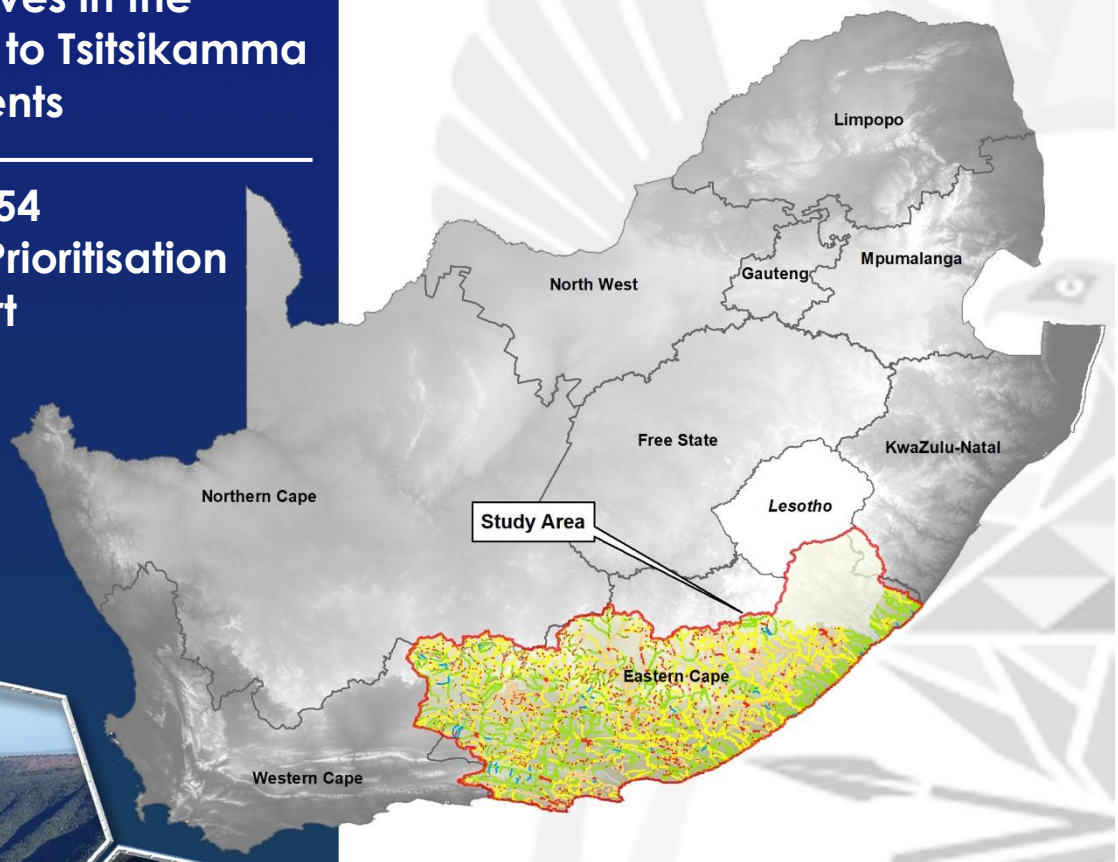
DEPARTMENT OF WATER AND SANITATION

Determination of Water Resource Classes, Reserve and the Resource Quality Objectives in the Keiskamma and Fish to Tsitsikamma Catchments

WP11354
Resource Units Prioritisation Report



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EXECUTIVE SUMMARY

The Department of Water and Sanitation, through the Chief Directorate: Water Ecosystems Management (CD: WEM), has initiated a study for the determination of Water Resource Classes, Reserve and associated Resource Quality Objectives for the identified significant water resources in the Keiskamma and Fish to Tsitsikamma catchments. The water resource components included for this study are rivers, wetlands, groundwater and estuaries. The Reserve determination include both the water quantity and quality of the Ecological Water Requirements (EWR) and Basic Human Needs (BHN). This will ensure the availability of water required to protect aquatic systems and that the essential needs of individuals that are directly dependent on these water resources.

The Keiskamma and Fish to Tsitsikamma catchments (study area) within the Mzimvubu to Tsitsikamma Water Management Area (WMA7) are amongst many waters stressed catchments in South Africa (high water use from surface and groundwater, primarily for agricultural and domestic, ultimately impacting on the availability of water resources for the protection of the aquatic ecosystems. Industrial practices and domestic water use are on the rise in some of these catchments, especially around the major towns and cities. Water transfers into the study area from adjacent WMAs and within the study area and numerous storage dams changes the flow patterns, impacting on the aquatic biota. Furthermore, the study is also important from a conservation perspective, including protected areas, natural heritage, cultural and historical sites that require protection.

The determination of the Water Resource Classes is necessary to facilitate a balance between protection and use of water resources. In determining the class, it is important to recognise that different water resources will require different levels of protection which requires the consideration of the social and economic needs. The Water Resource Classification System (WRCS) is applied taking account of the local conditions, socio-economic imperatives and system dynamics within the context of the catchment. The process also requires a wide range of complex trade-offs to be assessed and evaluated at a number of scales. The first step of the Classification process is to assess the status quo of all water resources in the study area, and delineate the Integrated Units of Analysis (IUA) *i.e.* homogenous areas consisting of significant water resources for which Water Resource Classes are determined.

This report forms part of step 1 of the integrated framework as developed by the DWS (DWS, 2017). The purpose of this report is to document the data, information, approaches followed and the results of the identification of stressed areas (hotspots), delineation and prioritisation of RUs, selection of biophysical and/ or hydronodes within each of the 19 selected IUAs. Ecological, socio-cultural and water resource use (quantity and quality) was considered for the identification of the RUs. These results will assist in the determination of the Water Resource Classes, Reserve requirements and the setting of the associated RQOs. The EWRs will be determined for these priority river, estuarine and groundwater Resource Units and ecological specifications provided for the priority wetlands on various levels of detail (e.g. intermediate, rapid or desktop for rivers). Integration between the various components, where applicable, will be assessed and the linkages between the components will be defined.

Based on (i) the assessment of information and data available, (ii) the status quo or current developments and impacts per IUA and (iii) any proposed new developments that will impact on the water resources, three levels of priority were identified for each component, namely:

- Priority 1, where rivers and estuaries will be assessed on an intermediate level and detailed considerations for wetlands and groundwater. RQOs will also be determined for the selected sub-components;
- Priority 2, with rapid assessments for rivers and estuaries and less detailed studies for the wetlands and groundwater (desktop with limited field verifications). Some of these will also be used as hydro and/ or biophisical nodes at the outlets of RUs or IUAs or where specific protection considerations are required; and
- Priority 3, desktop assessments using existing information and data for all the components.

Overall, the following preliminary priority 1 and 2 RUs for rivers, wetlands, estuaries, and groundwater were identified (see table below). These will be refined and finalised following consultation with the DWS and key stakeholders during the first Project Steering Committee (PSC) meeting.

Summary of priority sites identified

Component	Priority 1	Priority 2
Rivers	15	33
Wetlands	7	9
Estuaries	3	11
Groundwater	2	46

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LIST OF ACRONYMS

BHN	Basic Human Needs
CD: WEM	Chief Directorate: Water Ecosystems Management
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
ECSECC	Eastern Cape Socio Economic Consultative Council
EFZ	Estuarine Functional Zone
EI	Ecological Importance
EIS	Ecological Importance and Sensitivity
ES	Ecological Sensitivity
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
FSA	Fish Support Area
GDP	Gross domestic product
GW	Groundwater
GRU	Groundwater Resource Unit
HGM	Hydro-geomorphic
GRDM	Groundwater Resource Directed Measures
IBA	Important Bird Areas
IUA	Integrated Unit of Analysis
IWUI	Integrated water use index
IEI	Integrated Ecological Index
MPA	Marine Protected Areas
NBA	National Biodiversity Assessment
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
NWM5	National Wetland Map 5
PES	Present Ecological State
PES A	Natural/pristine
PES B	Largely natural
PES C	Moderately modified
PES D	Largely modified
PES E - F	Critically modified
POSA	Plants of Southern Africa

PSC	Project Steering Committee
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RQO	Resource Quality Objectives
RU	Resource Units
SANBI	South African National Biodiversity Institute
SCI	Social Cultural Importance
SFR	Stream flow response
SWSA	Strategic Water Source Areas
SQ	Sub-quaternary
WMA	Water Management Area
WARMS	Water use Authorization and Registration Management System
WR2012	Water Resources 2012

1. INTRODUCTION

1.1 Background

The National Water 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 without seriously affecting the functioning of water resource systems. To achieve this objective, Chapter 3 of the NWA provides for the protection of water resources through the implementation of Resource Directed Measures (RDM). These measures are protection-based and include Water Resource Classification, determination of the Reserve and the associated Resource Quality Objectives (RQOs). These measures collectively aim to ensure that a balance is reached between the need to protect and sustain water resources, while allowing economic development.

The Chief Directorate: Water Ecosystems Management (CD: WEM) has initiated a study for the determination of Water Resource Classes, Reserve and associated Resource Quality Objectives for the significant water resources in the Keiskamma, Fish to Tsitsikamma catchments. The water resource components included for this study are rivers, dams, wetlands, groundwater and estuaries. The Reserve determination include both the water quantity and quality of the Ecological Water Requirements (EWR) and Basic Human Needs (BHN). This will ensure the availability of water required to protect aquatic systems and that the essential needs of individuals served by these water resources are provided for.

1.2 Purpose of this study

The Keiskamma and Fish to Tsitsikamma catchments within the Mzimvubu to Tsitsikamma Water Management Area (WMA7) are amongst many waters stressed catchments in South Africa. These areas are important for conservation and have recognisable protected areas, natural heritage, cultural and historical sites that require protection. However, water use from surface as well as groundwater for agricultural and domestic purposes are high, especially in the more arid catchments, impacting on the availability of water resources for the protection of the aquatic ecosystems. Industrial practices and domestic water use are on the rise in some of the above-mentioned catchments, especially around the major towns and cities (East London, Gqeberha). Water transfers into the study area from adjacent WMAs and within the study area and numerous storage dams changes the flow patterns, impacting on the aquatic biota.

Thus, the main purpose of the study is to determine appropriate Water Resource Classes, the Reserve and associated RQOs for all significant water resources in the study area to facilitate sustainable use of the water resources while maintaining ecological integrity.

The aim is to:

- implement the Water Resource Classification System (Regulation 810, 2010) by determining water resource classes using the procedure prescribed in the integrated framework (2017);

- undertake the 7-step process of determining and setting RQOs; and
- determine the Reserve for the water resources in the study area.

This will ultimately assist the DWS in the management of the water resources in the study area and making informed decisions regarding the authorisation of future water use and the magnitude of the impacts of proposed developments.

1.3 Purpose of this report

This report forms part of step 1 of the integrated framework as developed by the DWS (DWS, 2017). The purpose of this report is to document the data, information, approaches followed and the results of the identification of stressed areas (hotspots), delineation and prioritisation of Resource Units (RU). In addition, a selection of biophysical and/ or hydronodes will be identified within each of the selected Integrated Units of Analysis (IUA). Ecological, socio-cultural and water resource use (quantity and quality) will be considered for the identification of the RUs. These results will assist in the determination of the Water Resource Classes, Reserve requirements and the setting of the associated RQOs.

The ecological water requirements will be determined for these priority river, estuarine and groundwater Resource Units and ecological specifications provided for the priority wetlands on various levels of detail (e.g. intermediate rapid or desktop level for rivers). Integration between the various components, where applicable, will be assessed and the linkages between the components will be defined.

2. OVERVIEW OF STUDY AREA

2.1 Rivers, wetlands, groundwater and estuaries

The study area forms part of the Mzimvubu to Tsitsikamma WMA7 as indicated in Table 2-1. The water resources of the Mzimvubu River (T31 – T36) are not included as part of the study area for the purposes of this study. Secondary catchments T40 (Mtamvuna) and T50 (Mzimkhulu) form part of WMA4 (Appendix A, Figure 9-1). A detailed overview and status quo of the study area in terms of the rivers, wetlands, estuaries and groundwater, water resource infrastructure and socio-economics has been presented in the delineation of IUAs report (DWS, 2022).

A brief overview of each of the water resources components, namely rivers, wetlands, groundwater and estuaries, are provided below.

The rivers in the study area ranges from large perennial to semi-ephemeral systems and there are also small coastal rivers that all drains towards the Indian Ocean (Appendix A: Figure 9-1). The study area consists of five large drainage basins with several smaller rivers in-between. The larger drainage basins are the:

- Mbashe River (part of drainage region T which includes T11, T12 and T13),
- Great Kei River (drainage region S),
- Great Fish (drainage region Q),
- Sundays (drainage region N), and
- Gamtoos River (drainage region L).

The small drainage regions include the:

i. Mthatha River (drainage region T20),
ii. Small coastal rivers in the Pondoland area (drainage regions T60 to T90),
iii. Keiskamma, Buffalo, Nahoon and Gqunube Rivers (drainage region R),
iv. Kowie, Kariega and Boesmans Rivers (drainage region P),
v. Koega and Swartkops Rivers (drainage region M),
vi. Krom and Seekoei Rivers (drainage region K90), and
vii. Tsitsikamma and small coastal rivers in drainage region K80.

The study area has been divided into 11 sub-catchments to provide broad management units within which wetland prioritisation and assessments have been undertaken. The sub-catchments are as follows:

- Gamtoos (L catchment, channelled/ unchannelled valley bottom, depression, seepage-slope wetlands rare)
- Sundays (N catchment, depression and combination of channelled valley bottom and depression, seepage-slope wetlands rare)

- Fish (Q catchment, depression or channelled valley bottom)
- Tsitsikamma and Krom (K8 and K9 catchments, depression and channelled valley bottom)
- Algoa (M catchment, depression and channelled valley bottom)
- Bushmans (P catchment, depression)
- Kei (S catchment, seepage-slope, channelled valley bottom)
- Amatola (R catchment, channelled valley bottom and seepage)
- Mbashe (T11, T12, T13 catchment, seepage and channelled valley bottom)
- Mthatha (T2 catchment, channelled valley bottom)
- Wild Coast (T6, T7, T8, T9 catchments, channelled valley bottom and unchannelled valley bottom)

The major aquifer systems associated with the Cape and Karoo Supergroups are mainly of a fractured type, where groundwater occurrence, is due to secondary deformation relating to faults, fissures, fractures, bedding planes and joints. The Karoo Supergroup also constitutes a fractured and intergranular aquifer over widespread areas associated with intrusive and extrusive igneous rocks, i.e. dolerite sills and dykes as well as basalt. The quaternary sand and alluvium constitute limited intergranular aquifers in the project area where groundwater occurrence is because of pore spaces between sand particles. Borehole yields in the fractured aquifers vary greatly depending on the lithological unit intersected during drilling and the arenacous: argillaceous ratio within the respective lithological units.

There are 251 coastal drainage systems within the study area, comprising 154 estuaries and a further 97 microsystems. Most of the estuaries in the study area are within the warm temperate marine bioregion (>60%) with the rest within the subtropical bioregion. A large number of estuaries are adjacent to Marine Protected Areas (MPA), including 25 systems in the warm temperature bioregion, such as the Tsitsikamma, the Great Kei and the Pondoland MPAs (Van Niekerk, *et al.,* 2020). Five of the nine different types of estuaries are present in the study area. These include:

i. Small temporarily closed systems,
ii. Large temporarily closed systems,
iii. Small fluvially dominated systems,
iv. Large fluvially dominated systems, and
v. Predominantly open estuaries.

Table 2-1: Main catchments and rivers in the study area

Catchment	Major Rivers
K80	Tsitsikamma and small coastal rivers
K90	Krom and small coastal rivers
L10 - L90	Gamtoos with main tributaries Groot, Baviaanskloof and Kouga
M10 - M30	Koega, Swartkops and small coastal rivers
N10 - N40	Sundays
P10 - P40	Kowie, Kariega, Boesmans and small coastal rivers
Q10 - Q90	Fish River with main tributaries of Little Fish, Koonap and Kat
R10 - R50	Keiskamma and small coastal rivers
S10 - S70	Great Kei River with main tributaries of Klipplaats, Indwe, White Kei, Black Kei
T10	Mbashe
T20	Mthatha
T60	Small coastal rivers (Mtentu, Msikaba, Mzintlava)
T70	Small coastal rivers (Mtakatye, Mngazi)
T80 & T90	Small coastal rivers

2.2 Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) in accordance with Le Maitre *et al.,* 2018 are described as areas of land that either:

a. Supply relatively large quantity of mean annual surface water runoff, being cognisant of their size and thus considered nationally important;
b. Have high groundwater recharge and where the groundwater forms a nationally important resource/ hotspot; or
c. Areas where surface and groundwater importance are integrated and whereby, they include transboundary Water Source Areas that extend into Lesotho and Swaziland (Eswatini).

An update of the 2018 SWSAs have been undertaken in 2021 (Lötter & Maitre, 2021). This updated information has been used and the SWSAs within the study area were identified (see map in Appendix A, Figure 9-2). The SWSAs are provided for surface water, groundwater and surface water-groundwater interaction. Most of the surface water SWSAs are present along the coast, especially in the Tsitsikamma (K80), Kromme (K90), Upper reaches of R10 (Keiskamma) and R20 (Buffalo), S60

(Kubusi) and the rivers in the T catchments (Mbashe, Mthatha, Pondoland Coastal Rivers). The groundwater SWSAs are scattered throughout the study area, with some inland in the drier Karoo area (upper reaches of Groot, Sundays and Fish Rivers) and along the coast.

2.3 Socio-Cultural Importance

The population of the catchment was 5.87 million in 2021 (2011 Stas SA census adjustments) and the population is predominately Xhosa speaking. The catchment is mainly rural with a few urban areas in East London, Gqeberha (Port Elizabeth), and Makhanda (Grahamstown). According to Stats SA 2021, the Eastern Cape had the highest unemployment rate, at 47.1% and nationally it was at 34.9%.

The Eastern Cape contributed a gross domestic product (GDP) of approximately R230.3 billion in the last quarter of 2020, which is a contribution of 7.7% to the total national GDP (ECSECC, 2020). The economy of the Eastern Cape is mainly supported by the tertiary sector (wholesale and retail trade, tourism and communications), followed by the sectors of manufacturing (large proportion by the automotive sub-sector), agriculture and agro-processing.

Key sensitive ecosystem services in the catchment are preliminarily identified as the following:

- Water Provisioning Services provided by the network of rivers, dams and impoundments and SWSA along the T and S drainage regions.
- Cultural services as indicated by the distribution of protected areas, tourism and community demographics.

3. INTEGRATED UNITS OF ANALYSIS

IUAs are spatial units consisting of significant water resources for which Water Resource Classes are determined. The delineation of a larger catchment into IUAs is done primarily according to a number of socio-economic criteria and the boundaries of water resource components or catchments, taking into consideration ecological information and biophysical characteristics. These IUAs are then used for the assessment of the ecological and socio-economic implications and/ or consequences of the different scenarios with the ultimate objective to determine Water Resource Classes.

Due to the large number of catchments and the diversity in the water resources (aquatic ecosystems, groundwater systems, estuaries, wetlands, water infrastructure) and socio-economic aspects, 19 IUAs have been identified for the study area. These are listed in Table 3-1 (see map in Appendix A, Figure 9-3) with detailed descriptions and status quo per water resource component provided in DWS, 2022.

Table 3-1: Integrated Units of Assessment for the study area

IUA	IUA code	Description	Main rivers	Quaternary Catchments
1	IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	Tsitsikamma, upper Kromme	K80A-F, K90A-B
2	IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	Kromme, Gamtoos	K90C-G, L90A-C
3	IUA_L01	Kouga to Kouga Dam, Baviaanskloof	Kouga, Baviaanskloof	L81A-D, L82A-J
4	IUA_M01	M primary catchment	Swartkops, Coega	M10A-D, M20A-B, M30A-B
5	IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	Sout, Kariega, Groot, Upper Sundays	L11A-G, L12A-D , L21A-F, L22A-D, L23A-D, L30A-D, L40A-B, L50A-B, L60A-B, L70A-G, N11A-B, N12A-C, N13A-C, N14A-D, N21A-D, N22A-E, N23A-B, N24A-D, N30A-C
6	IUA_N01	Sundays downstream Darlington Dam	Lower Sundays	N40A-F
7	IUA_P01	P primary catchment	Boesmans, Kowie, Kariega	P10A-G, P20A-B, P30A-C, P40A-D
8	IUA_Q01	Upper Fish	Little Brak, Upper Great Fish, Upper Little Fish	Q11A-D, Q14A-E, Q21A-B, Q22A-B, Q30A-B, Q80A-C
9	IUA_Q02	Great Fish	Great Fish, Tarka, Baviaans, Lower Little Fish	Q12A-C, Q13A-C, Q30C-E, Q41A-D, Q42A-B, Q43A-B, Q44A-C, Q50A-C, Q60A-C,

IUA	IUA code	Description	Main rivers	Quaternary Catchments
				Q70A-C, Q80D-G, Q91A-C, Q93A-D
10	IUA_Q03	Koonap and Kat	Koonap, Kat	Q92A-G, Q94A-F
11	IUA_R01	Keiskamma	Keiskamma, Tylomnqa	R10A-M, R40A-C, R50A-B
12	IUA_R02	Buffalo/ Nahoon	Baffalo, Nahoon, Kwelera, Gqunube	R20A-G , R30A-F
13	IUA_S01	Upper Great Kei	Indwe, White Kei, Tsomo, Great Kei	S10A-J, S20A-D, S40A-F, S50A-J
14	IUA_S02	Black Kei	Klipplaat, Klaas Smits, Black Kei	S31A-G, S32A-M
15	IUA_S03	Lower Great Kei	Kubusi, Great Kei	S60A-E , S70A-F
16	IUA_T01	Upper Mbashe, Upper Mthatha	Xuka, Mgwali, Upper Mbashe, Upper Mthatha	T11A-H, T12A-G, T20A
17	IUA_T02	Lower Mbashe	Lower Mbashe	T13A-E
18	IUA_T03	Lower Mthatha	Lower Mthatha	T20B-G
19	IUA_T04	Pondoland coastal	Mtentu, Msikaba, Mngazi, Mtakatye, Xora, Nqabara, Qhorha	T60A-K, T70A-G, T80A-D, T90A-G

4. RESOURCE UNIT DELINEATION AND PRIORITISATION

The next step is to select, delineate and prioritise the Resource Units within each of these IUAs where more detailed assessments will be undertaken and RQOs determined.

A priority RU (previously hotspots) represents a river reach, estuary, wetland or groundwater area with (i) a high ecological importance and/ or sensitivity which could be under threat due to its importance for water use or (ii) where the water use is high or (iii) where there are water quality impacts or (iv) future water resource developments are planned that will impact on the water resource quantity and/ or quality. Thus, these priority RUs represent reaches or areas that are already stressed or will be stressed in future (Louw and Huggins, 2007; Louw *et al*., 2010).

The priority RUs further provides an indication where EWR sites (rivers), specific wetlands and estuaries or groundwater areas should be selected and the level of assessment required for scenario evaluation and the undertaking of socio-economic trade-offs. This is a key step as the gazetting of the Reserve and RQOs are based on these priority RUs where high confidence results are available.

The overall approach that was followed is based on the approach as presented in step 1 of the study for the Development of procedures to operationalise Resource Directed Measures (DWS, 2017). See also the diagramme below. The approaches per water resource component (rivers, wetlands, groundwater and estuaries) and the Socio-Cultural Importance are presented in this section (Section 4) and the final priority RUs are presented in Section 5. The detailed results per sub-quaternary reach/ quaternary catchment are available as excel spreadsheets.

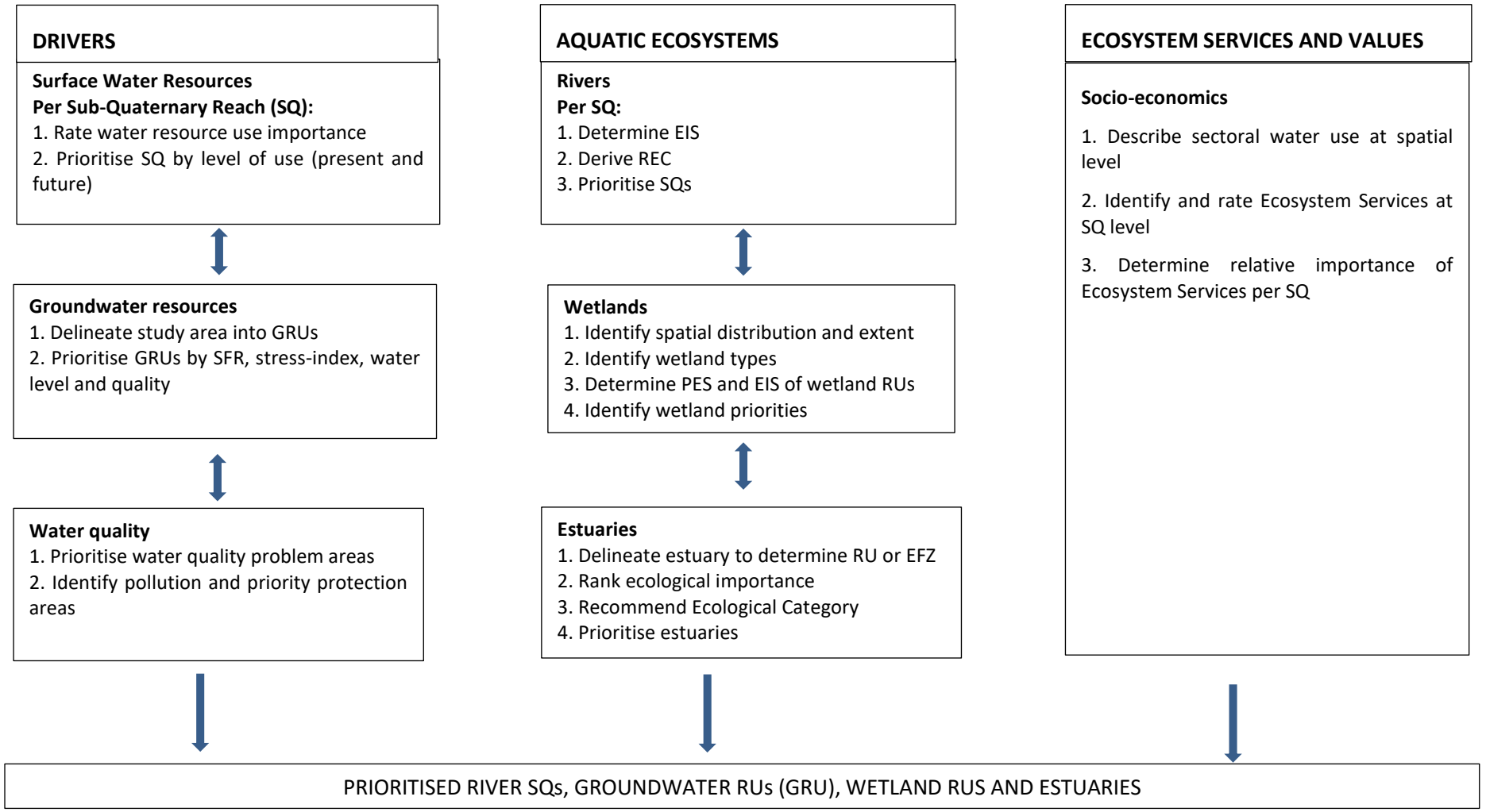


Figure 4-1: Integrated step 1: Delineate and prioritise Resource Units (DWS, 2017)

4.1 River RU prioritisation approach and rationale

Approximately 1 600 sub-quaternary (SQ) reaches are nested throughout the Keiskamma, Fish to Tsitsikamma study area, all which have been assessed in the Desktop PES/EI/ES study (DWS, 2014). This large number of sub-reaches makes it unfeasible to determine EWRs for all of these, especially for the large number of reaches being ephemeral to episodic with little or no water use.

The 2017 DWS study to develop procedures for the operationalisation of Resource Directed Measures provided the guidance for the identification and prioritisation of Resource Units (RUs) in integrated step 1. The methods and tools listed refers to both the DWA 2011 RQO guidelines and the approach followed for the Mvoti Classification study (DWS, 2013). Although the RU prioritisation tool, developed by the DWS (2011) was considered, it was not a practical approach for this study due to the large number of sub-quaternary reaches (~1 600). A similar approach was adopted, of which has been applied for previous Classification studies to assess a large number of RUs/SQ reaches (DWA, 2013 – Mvoti and Inkomati studies). This prioritisation procedure excluded ephemeral to episodic rivers in drier interior parts with little/ no water use. There was a focus on sub-reaches with a very high/ high EI, ES, Social Cultural Importance (SCI) and water use impacts (quantity and quality) and which formed part of a Strategic Water Source Area (SWSA) which are already stressed (or future stressed due to water resource developments/quality impacts). EWR sites will be selected for these priority sub-reaches and based on the level of stress and the PES will indicate the level of Reserve determination required.

The criterion and sub-criteria identified in the RU prioritisation tool (DWS, 2011) versus the adapted approach and criterion identified from DWS, 2017 (Mvoti & Inkomati 2013) is illustrated in Table 4-1 below.

Table 4-1: Prioritisation tool 2011 verses adopted approach for this study

Prioritisation Tool, 2011		**Approach, adapted from DWS 2017 (Mvoti & Inkomati 2013)**
Criterion	**Sub-criteria**	**Criteria**
Position of resource unit within IUA	Resource units located on a large mainstem river at the downstream end of an IUA (IUA outlet node)	Additional consideration and lowest RU included where EWR site will be selected, especially for IUAs with more than one major river at outlet
Importance for users (Current & anticipated future use)	Resource units which provide important **cultural services** to society	Included recreational use, aesthetic appreciation, cultural and spiritual/ ritual practices, tourism and educational value as part of SCI scoring
	Resource units which are important in **supporting livelihoods of significant vulnerable communities**	Included as part of SCI scoring - resource dependency score (reliance on water and resource dependency)
	Resource units which are important in meeting **strategic requirements and international obligations**	Additional consideration - only hydropower generation in the study area
	Resource units that provide **supporting and regulating services**	Included as part of the wetlands scoring and dams Water use score (0 - no use to 4/5 - high use)
	Resource units most important in supporting activities **contributing to the economy** (GDP & job creation) in the catchment (e.g. commercial agriculture, industrial abstractions and bulk abstractions by water authorities)	Water use score (0 - no use to 4/5 - high use)
Threat posed to users	Level of **threat posed to users**	Additional considerations - sedimentation, RUs downstream of dams, large abstractions or transfers in or out of the study area
Ecological Importance	Resource units with a **high or very high EIS category**	EI and ES with integrated EIS

Prioritisation Tool, 2011		Approach, adapted from DWS 2017 (Mvoti & Inkomati 2013)
Criterion	**Sub-criteria**	**Criteria**
	Resource units which have an **A/B NEC and / or PES**	PES of largely natural A, A/B or B categories considered, linked to FEPA rivers, fish sanctuaries, sensitive macroinvertebrates and endemic riparian vegetation
	Resource units identified as N**ational Freshwater Ecosystem Priority Areas**	Considered in detail with 1 - no FEPA, 2 - Phase 2 FEPA/ Upstream, 3 - Fish Support Area/ Corridor/ free flowing, 4 - FEPA/ flagship/ IUCN listed fish species
	Resource units identified as a **priority in provincial / fine scale aquatic biodiversity plans**	Additional considerations: • FEPA (upstream / within) • Ecological regions (Ecoregions) • Impacts on the geomorphology / sediment – areas prone to erosion • Conservation sensitivities (specifically conservation targets set by the DEFF (previously known as DEA) • Flagship and/or free flowing rivers (important for ecosystem processes/ biodiversity value) • Threatened or sensitive vegetation ecosystems • Alien vegetation infestation was assessed and considered if a problem • Sensitive aquatic macroinvertebrates (water quality, flow, habitat) • Fish support areas, fish sanctuaries, fish corridors with IUCN red listed fish species (threatened and near-threatened)
Threat faced by ecological component of the RU	Level of **threat posed to ecological components of the resource unit**	Integrated Water Use Index (IWUI) or resource stress based on water quantity and quality impacts
Management Considerations	Resource units with **PES lower than a D Category or lower than the accepted gazetted category (NEC)**	Additional considerations, highlighted those systems that are currently <D category

Prioritisation Tool, 2011		Approach, adapted from DWS 2017 (Mvoti & Inkomati 2013)
Criterion	**Sub-criteria**	**Criteria**
Practical Considerations	Availability of **EWR site data or other monitoring data** (RHP, DWAF gauging weirs etc) located within reach?	Will be considered when EWR sites are selected
	Accessibility of resource unit for monitoring	Will be considered when EWR sites are selected
	Safety risk associated with monitoring resource units.	Will be considered when EWR sites are selected
		Additional considerations:
		Strategic Water Source Areas (SWSA) for surface water, groundwater and surface-groundwater interaction
		Ecoregions - selecting priority RUs per ecoregion of larger river systems
		Alien vegetation infestation - large areas impacting on the systems
		Integration/ linkages between the various water resource components (i.e. priority wetlands or groundwater areas, contributing to baseflows of rivers were identified and thus more detailed assessments required)
		Any planned future large-scale water resource developments that will impact on the downstream water resource and degrade the PES

Consequent, this approach was used in the current study based on the results of the DWS, 2014 Desktop PES/EI/ES study and includes the assessment of:

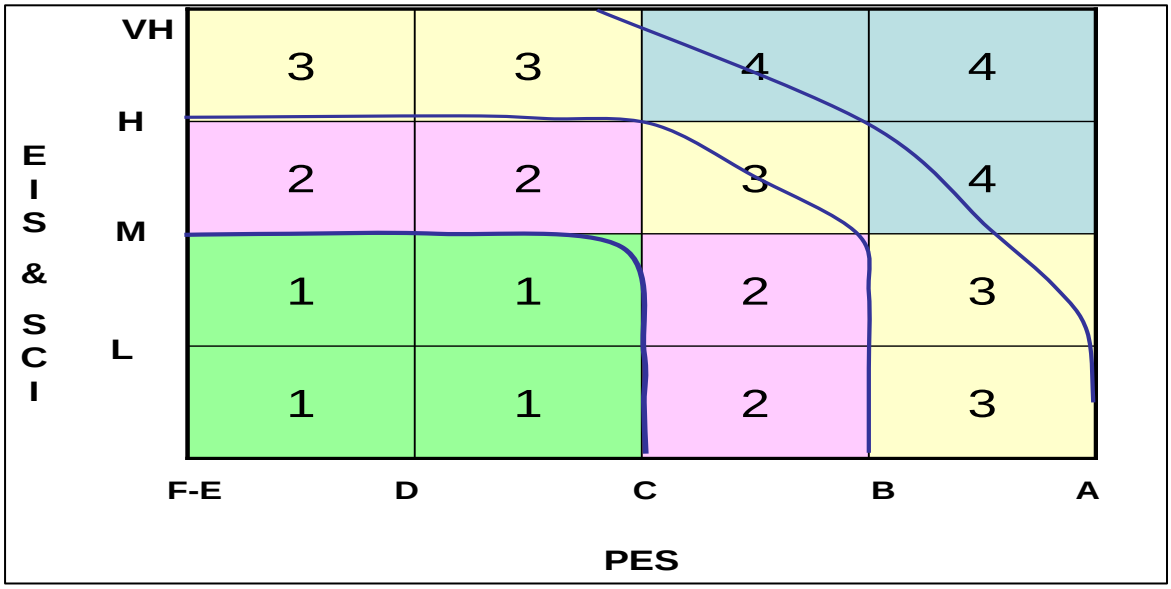
(i) The water use impacts (quantity and quality) to determine the integrated water use index (IWUI) or water stress;
(ii) The highest rating of the EI, ES, SCI and SWSA is used and integrated with the PES for each sub-quaternary reach to provide an Integrated Ecological Index (IEI); and
(iii) The level of EWR determination required is obtained by integrating the IWUI and IEI.

The following steps were followed:

Step 1:
Determine IWUI per sub-quaternary reach using the flow and quantity modification metric scores from the desktop PES/EI/ES study. These were scored from 0 (no modification) to 4 (critical modification). The highest score of the two metrics was used as the IWUI per sub-quaternary reach. If any water use developments between 2012 and 2022 were undertaken that changed the water availability or quality in a specific area/ reach, these were considered, and the original score changed to reflect it.

Step 2:
Determine the EIS (very low to very high) by selecting the highest score of EI, ES, SCI and SWSA.

Step 3:
Integrate the EIS with the PES, using the following matrix to determine the Integrated Ecological Index (IEI) (Figure 4-2). The EIS and SCI are scored from Low (L), Moderate (M), High (H) and Very High (VH) and the PES in terms of categories A (natural) to E-F (critically modified). The integrated scores (IEI) is from 1 (low importance) to 4 (high importance) based on ecological considerations, thus indicating where the focus should be, i.e. river reaches with very high EIS and SCI, even if the PES is in a modified state or where the PES is in an A or B category, even with a low EIS.



EIS and SCI indicates Very High (VH), High (H), Medium (M), Low (L)
PES indicates natural/pristine (Category A), largely natural (Category B), moderately modified (Category C), largely modified (Category D) and critically modified (Category E-F)

Figure 4-2: Matrix to integrate PES and EIS/ SCI to derive IEI (from DWA, 2013)

Step 4:
The IEI and IWUI/ Resource Stress scores are integrated in this step to determine the level of Reserve study (desktop, rapid 3, intermediate or comprehensive) and is guided by the matrix below (Figure 4-3). For example, if the IEI score is 2 (moderate important) and the IWUI score is a 3 (high impact), then the resultant level is a rapid 3.

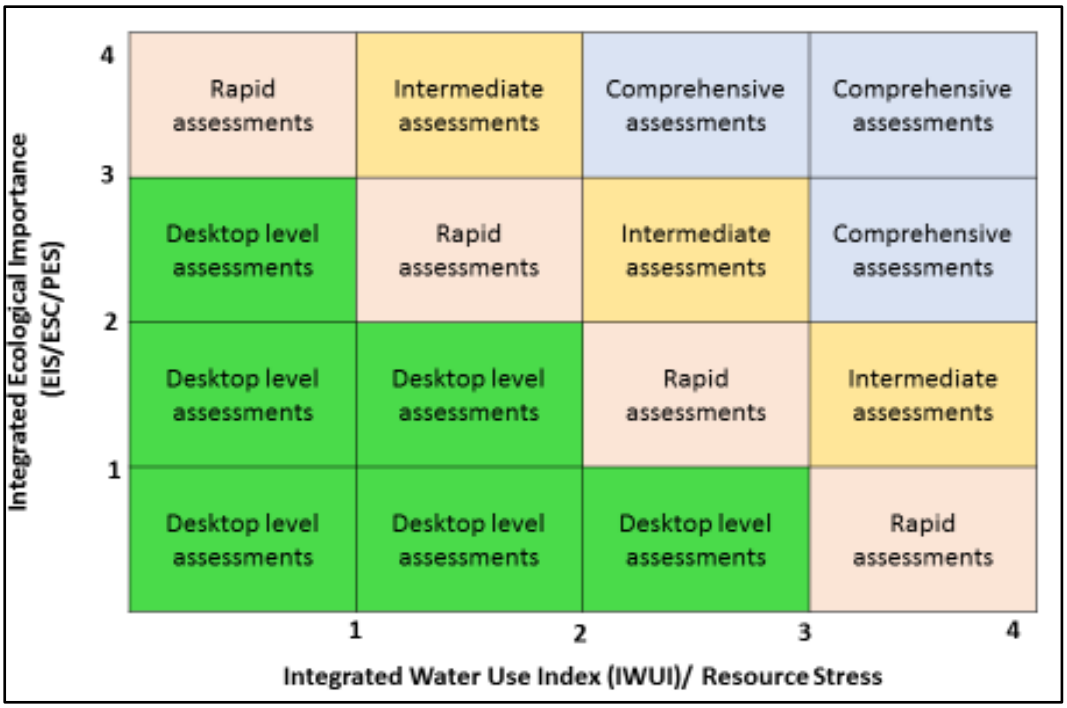


Figure 4-3: Matrix to integrate the Integrated Ecological Importance (IEI) and the Resource Stress (IWUI) and to derive the level of Reserve assessment (from DWAF, 2008)

Step 5:

The final step was to check the following and to adjust the level of Reserve assessment to provide higher confidence in the final results:

i. Possible impacts of sediment on the sub-reach, especially in areas prone to erosion resulting in high silt loads. The likely sediment input was calculated based on the water erosion risk output from Le Roux *et al.* (2008). The average erosion risk (tonnes/ha/year) value was calculated per RU and categorised into 5 classes so that 0 to 3 tonnes/ha/year was assigned a score of 1 (very low), 3 to 10 tonnes/ha/year was assigned a score of 2 (low), 10 to 30 tonnes/ha/year was assigned a score of 3 (moderate), 30 to 50 tonnes/ha/year received a score of 4 (high) and > 50 tonnes/ha/year received a score of 5 (very high);
ii. FEPA rivers, especially the reaches that were identified as Fish Support Areas (FSA), fish corridors, flagship rivers and free flowing rivers. Highest prioritisation was given to river reaches associated with FEPA sub-catchments (particularly those associated with Fish Sanctuaries for Threatened Fish Species) or classified as Flagship Free-flowing rivers. Fish sanctuaries are river reaches that are essential for protecting threatened and near-threatened freshwater fish that are indigenous to South Africa, while flagship free-flowing rivers are considered important based on their representativeness of free-flowing rivers across the country as well as their importance for ecosystem processes and biodiversity value (Driver *et al.,* 2011). Additional considerations were given in the RU prioritisation for river reaches classified as fish support areas (i.e. fish sanctuaries in lower than an A or B ecological condition and also include sub-quaternary catchments that are important for migration of threatened or near-threatened fish species) or other designated free-flowing rivers (rivers without dams that flow undisturbed from their source to the confluence with a larger river or to the sea). A lower priority was given to those reaches designated as Phase 2 FEPAs (i.e. moderately modified rivers, only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition) or Upstream Management Areas (sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and FSA; Driver *et al.,* 2011);
iii. Reaches inhabited by sensitive aquatic macroinvertebrates, which are sensitive to varying habitat conditions namely unmodified water quality, high flow conditions and specific biotopes;
iv. Areas with threatened or sensitive vegetation, ecosystems or where alien vegetation infestation is a problem (data included the remaining extent of natural vegetation (SANBI, 2011), vegetation Biomes and Bioregions (Mucina & Rutherford (2006, 2018), Centres of plant endemism (Van Wyk & Smith (2001) and threatened or sensitive riparian / wetland plant species occur in the study area (SANBI (POSA), 2016));
v. Any planned future large-scale water resource developments that will impact on the downstream water resource and degrade the PES;
vi. Specific conservation targets as set by the Department of Environmental Affairs were considered and the level of assessment was adjusted;
vii. All Un-named tributaries and small non-perennial rivers with little or no water use have been excluded from the priorities;
viii. Estuaries, where wetlands or groundwater are important to the contribution of baseflows; and
ix. If any priority wetlands or groundwater areas, contributing to baseflows of rivers have been identified in specific sub-quaternary reaches, these were included for more detailed assessments.

The results of the identified priority 1 and 2 rivers are presented in Chapter 0 and a summary provided in Table 6-1 and Table 6-2. A graphical illustration is provided in Appendix B (Figure 9-4).

4.2 Wetlands RU prioritisation approach

The identification, prioritisation and inclusion of priority wetland RUs as part of this study has been recognised as necessary for the implementation of a holistic approach to ensure that all water resources are accounted for within the broader study area.

The identification of wetland RUs is focused on identifying those systems at an ecosystem level, and is strongly reliant on knowing where important and/or priority wetland systems are within the landscape. Therefore, the methods used to identify these priority wetlands was reliant on existing wetland coverages and available information.

Additional spatial layers that were viewed as important for consideration throughout this process were incorporated into the approach. The sections below provide an overview of the steps taken to identify the priority wetland RUs in the study area.

Step 1: Identification of potential priority wetland areas

The reliance of the process on existing wetland coverages was of particular concern as it was recognised at the outset that the available wetland coverage had significant gaps with certain areas identified as being underrepresented in terms of wetland extent. It was thus assumed that additional wetlands may be scattered across the study area. Where possible a brief review of the National Freshwater Ecosystem Priority Area (NFEPA) wetland spatial layer was undertaken at a desktop level to identify any obvious differences in the wetland coverages that may identify additional areas for consideration i.e. the NWM5 and NFEPA datasets. This applied particularly to the western portions of the study area, where NWM5 was identified as having had very little field verification and as being particularly problematic.

The following information was used for the scoring to identify the priority wetlands for consideration in this study:

- National Wetland Map 5 spatial dataset (supplemented, especially in the western portions, with desktop review and local knowledge);
- National Freshwater Ecosystem Priority Areas (NFEPAs) wetland shapefile;
- Important Bird Areas (IBAs);
- Crane sightings and nest sites;
- Wetlands that interacted with the surface and groundwater SWSAs (Lötter & Maitre, 2021);
- Hydrogeomorphic (HGM) unit type, which was used to determine the level to which each system may provide services associated with:
    - Flood attenuation;
    - Stream flow regulation;
    - Erosion control;
    - Sediment trapping; and
    - Water quality enhancements (assimilation of nutrients).

- Wetlands that fall within Aquatic Critical Biodiversity Areas;
- Those systems that were classified as Critically Endangered or Endangered;
- Wetlands located upstream of important water supply dams; and
- Identified water-stressed catchments/basins from the river RU process.

Since the majority of these spatial layers have been created at a national scale, the extent and associated attributes may not be accurate at a fine scale and field verification of the selected wetlands will be necessary to review the characteristics of the wetlands that have been prioritised.

Following the review of the relevant national spatial datasets, the wetland gaps were noted across specific areas. A desktop review was then undertaken for those areas that were not accounted for in any of the wetland datasets and these were indicated with a point shapefile. These areas were typically recognized through vegetation signatures in the landscape and evidence of the movement of water through the landscape. These points, in combination with the wetland coverages and base layers, were then used to identify the priority wetlands and/or wetland complexes. It is however recognised that this approach favoured larger-scale systems and that smaller systems might be excluded.

Step 2: Identification of criteria and scoring

As part of the initial wetland prioritisation process, specific criteria was identified for scoring on a sub-quaternary level (same sub-reaches as for the rivers). These criteria included the following:

i. Present Ecological State (PES) – From A (largely natural) to E/F (serious/ critically modified);
ii. Threat Status Score (based on National Biodiversity Assessment 2011), with 4 = Critically Endangered, 3 = Endangered, 2 = Vulnerable, 1 = Least Concern;
iii. Proximity to a known crane breeding or feeding site or if site falls within an Important Bird Area, with 4 = Crane Breeding Site, 3 = IBA, 2 = Crane Feeding Site, 1 = Crane sighting within 350m of wetland;
iv. Critical Biodiversity Areas (CBA), with 4 = High Priority CBA, 2 = Low Priority CBA, 0 = No CBA;
v. Wetland Upstream of Water Supply Dams, with 4 = Wetland in same quaternary catchment, 2 = Wetland in quaternary catchment directly upstream of dam, 1 = Wetland in upstream quaternary catchment separated by one quaternary catchment;
vi. Ability to supply ecosystem services based on HGM Unit type, with 4 = Unchannelled valley-bottoms, 3 = Channelled valley-bottoms, floodplains, 2 = Seep wetlands, 1 = Flats and depressions; and
vii. FEPA Wetlands, with 4 = FEPA Wetland and 2 = Low priority FEPA Wetland (Note: Due to inherent problems with the NFEPA wetland coverage, only FEPA wetlands that overlap with wetlands mapped in the NWM5 have been considered).

The overall score per sub-reach was calculated by adding the five highest criteria and then adjusted to indicate the priority of the wetlands per sub-reach. Through this process, a large number of priority wetlands were flagged as potentially being important within the study area. The final step was to

interpret the scores and select the final priority wetlands where field surveys will be undertaken on various levels of detail to determine RQOs.

Step 3: Final selected priority wetland RUs

Using the data that was derived from Step 2, a manual review of the entire study area was undertaken, focussing on the initially prioritised wetland sites. The project team also considered the following to inform the final desktop prioritisation process:

- Presence of surface and/or groundwater SWSAs;
- Preliminary priority River RU quaternary catchments;
- Specific important wetland areas identified by individual stakeholders; and
- Quaternary catchments identified with the highest recorded water uses (water quantity).

Through this largely iterative process, the final wetland RUs and their respective priorities (1, 2 and 3) were derived. This involved the project team workshopping the prioritised sites, newly identified areas, and identifying those wetland systems that were considered important in terms of conservation and the protection of the water resource.

The results of the identified priority 1 and 2 wetlands are presented in Chapter 0 and a summary provided in Table 6-3. An illustration is provided in Appendix B (Figure 9-5). Although, Priority 3 Wetland RUs were identified during the initial prioritisation, these were excluded from further assessment and RQO development to allow the project team to focus on Priority 1 and 2 RUs.

4.3 Estuaries RU prioritisation approach

Estuaries are defined as single resource units (RUs) based on their Estuarine Functional Zone[1] (EFZ) delineation. The delineation of these resource units has recently been undertaken on a national scale (van Niekerk *et al.* 2019) and this delineation was used to define these areas for prioritisation.

Prioritization of the estuaries aims to identify important areas (previously referred to as estuary hotspots) as these would be the areas where more detailed and focussed work for the rest of the integrated steps would occur. These high priority RUs are selected based on the ecological and water resource use importance and are often areas of high ecological importance where water resources are stressed or may be stressed in future. This is a key step as the Resource Units (RUs) information is gazetted with measured information and potentially higher confidence output. The prioritisation

[1] In 2010, the concept of the Estuarine Functional Zone (EFZ) was adopted in South Africa's environmental legislation, more specifically in Notice 3 (repealed GN R 546; now GN R 985 of 2014) under the National Environmental Management Act (NEMA), Environmental Impact Assessment (EIA) Regulations (2010) (Van Niekerk and Turpie, 2012). This notice stipulates that estuaries - as defined by the spatial delineation of the estuarine functional zone – are 'sensitive areas' that require environmental authorisation before developments within this zone may proceed. Where previously the 'geographical boundaries' of an estuary was assumed to be the 'open water body', the EFZ encapsulates additional area that support physical and biological processes and habitats necessary for that estuarine function and health (Van Niekerk and Turpie, 2012).

therefore acts as a filter to allow one to focus on specific areas in various ecosystems. Study sites where more detailed field work is undertaken are selected within high priority RUs (priority 1), i.e. sites can only be selected after the prioritisation process.

The approach followed for the estuary prioritisation is similar to the approach for the rivers as described in section 4.1. The following steps were followed:

Step 1:
Each estuary is selected as an individual RU and delineated as defined by the 2018 Estuary Functional Zone (EFZ) (van Niekerk *et al.* 2019).

Step 2:
The PES determined recently for each estuary in the study area by the National Biodiversity Assessment has been used to define the current ecological health of each estuary. An Integrated Estuary Score (IES) is determined from the maximum of the Biodiversity or Conservation Importance Score (SANBI 2018) and a 'Linkages' score which rates the linkages of these estuaries to Marine Protected Areas or other terrestrial formal Protected Areas, NFEPA rivers, particularly the lower reaches and Important Bird Areas or Fish Nursery Areas. If there are combinations of these criteria, then the Linkages score increases.

Step 3:
Together the two scores from Step 2, the PES and IES have been used (see matrix Figure 4-2) to determine the Integrated Ecological Index (IEI). The IES is scored on the y-axis and ranges from Low (L), Moderate (M), High (H) and Very High (VH) and on the x-axis the PES in terms of categories A (natural) to E-F (critically modified). The integrated score (IEI) that results is in the range from 1 (low importance) to 4 (high importance) based on ecological considerations, thus indicating where the study focus areas should be, *i.e.* selection of estuaries could range from those estuaries with a very high IES, even if the PES is in a low or highly modified state to those with a PES of an A or B category, but which have a low IES.

Step 4:
In this step the level of the Reserve for each estuary is determined by using the IEI score from Step 3 and the Estuary Pressure Scores which have been determined for each estuary nationally (SANBI 2018). This determination is based on Figure 4-3 and indicates whether a desktop (priority 3), rapid (priority 2), intermediate/ comprehensive (priority 1) Reserve is to be carried out.

The results of the identified priority 1 and 2 estuaries are presented in Chapter 0 and a summary provided in Table 6-3. A graphical illustration is provided in Appendix B (Figure 9-6).

4.4 Groundwater RU prioritisation approach

The approach for the prioritisation of the priority groundwater areas (RUs) used the WRC (2012), delineation of groundwater resource units that is based on quaternary catchment boundaries, aquifer type (primary aquifer, secondary aquifer, karst aquifer) and other physical, management and/or functional criteria. Quaternary catchments form the basic unit for a Groundwater Resource Directed Measures (GRDM) assessment. However, these units can be further subdivided (or grouped into larger areas). Typically, areas of similar character can be mapped into distinct units using expert judgement

and interpretation. A key outcome is a map showing the extent of the groundwater resource GRDM assessment data sheet, in which the name of each unit and its aerial extent is recorded.

Using the WRC (2012) datasets, groundwater resource unit delineation for the study area used aquifer type, borehole yields, groundwater quality and groundwater recharge. Additionally, the following criteria was scored per sub-reach (same as river sub-quaternary reaches) and used to identify the priority groundwater areas:

i. Groundwater use, based mainly on WARMS data, with 1= no/ low use to 5 = high use;
ii. Strategic Groundwater Source Areas, based on area coverage with 1 = no groundwater SWSA to 5 = entire catchment part of SWSA;
iii. Groundwater dependency, based on number of people dependant on groundwater with 1 = low dependency to 5 = high dependency;
iv. Stressed areas, with 1 = no stress to 5 = high stress (stressed is where recharge is less than water use);
v. Government Control Areas, based on the area that is part of a Government Control Area, with 1 = none to 5 = entire catchment part of Government Control Area; and
vi. Groundwater Quality, based on WR (2012) spatial data of Electrical Conductivity (EC), with 1 = poor quality (EC > 520mS/m) to 5 = good quality (EC < 70mS/m)

The results of the identified priority 1 and 2 groundwater areas are presented in Chapter 0 and a summary is provided in Table 6-5. A graphical illustration is provided in Appendix B (Figure 9-7).

4.5 Socio-Cultural Importance RU prioritisation approach

The SCI was generated by scoring each quaternary catchment based on the features (Huggins *et al.,* 2010) as shown in the Table 4-2 below. The features included: resource dependence, aesthetic value, recreational value, historical/ cultural value, and ritual use.

The features were then scored from 0-4, with 0 indicating no socio-cultural importance and 4 indicating extreme importance. Scores were then modified to reflect the adjudged importance of each component relative to the other. Ritual Use" has a weighting of 40 points, "Aesthetic Value" a weighting of 20 points, "Resource Dependence" a weighting of 100 points, "Recreational Use" a weighting of 50 points, and "Historical Cultural" Value a weighting of 75 points. The final scores were then combined to generate an overall score between 0 and 4 (Table 4-3).

Table 4-2: Socio-Cultural analysis of Fish-keiskamma study area

features	Description	Analysis	Data source	Weighting points
Resource dependence	Goods and services delivered by the river system and people dependence on	Extent of subsistence agriculture (please note that commercial farming is excluded). Percentage of population dependent on water resource (i.e., borehole, riverine stream and they do not	2011 Stats SA census data, google earth, agricultural land cover	100

features	Description	Analysis	Data source	Weighting points
	these components	have access to water services from municipalities)		
Aesthetic Value	Value of the natural beauty to people's lives due to the presence of the water resource.	Intensity and significance of appreciation are both valued. Intensity relates to the number of people likely to view the river and appreciate its aesthetic value and significance relates to the degree to which the river is of critical aesthetic importance to people. (e.g., presence of forest, nature reserve, and coastal area)	Land cover, google earth	20
Recreational Use	Presence of recreational facilities due to the presence of natural resources	Intensity and significance of use are both valued. Intensity relates to the number of people likely to make use of the river for recreational purposes and significance relates to the degree to which the river is of critical importance to people (e.g., Lodges and tourism activities due to the presence of nature reserves, and coastal areas)	Land cover, google earth	50
Historical/Cultural Value:	Historical value due to the presence of the river and ecological infrastructure as a result	Intensity and significance of use are both valued. Intensity relates to the Xhosa people likely to appreciate the river and ecological infrastructure for its historical or cultural significance and significance relates to the degree to which the river is of critical importance to people	Land cover, Lit review	75
Ritual Use	Ritual use from the river. This would be for ceremonial purposes or for spiritual/religious activities	intensity and significance of use are both valued. Intensity relates to the number of people likely to make use of the river for ritual use and significance relates to the degree to which the river is of	Land cover, Lit review	40

features	Description	Analysis	Data source	Weighting points
		critical importance to people (presence of forest and nature reserve is analysed as their presence has ritual use).		

Table 4-3: SCI rating scores

	Category	Comment
0 - 0.99	Very low	Of little or no socio-cultural importance.
1 - 1.99	Moderate	Of moderate importance. PES should not be allowed to be negative affected without strong motivation.
2 - 2.99	High	Of high importance. A score in this range motivates for maintain or potentially positive change to PES.
3 - 3.99	Very high	Of extreme importance. A score in this range motivates for positive change to PES.

5. IDENTIFIED PRIORITY RESOURCE UNITS PER INTEGRATED UNIT OF ANALYSIS

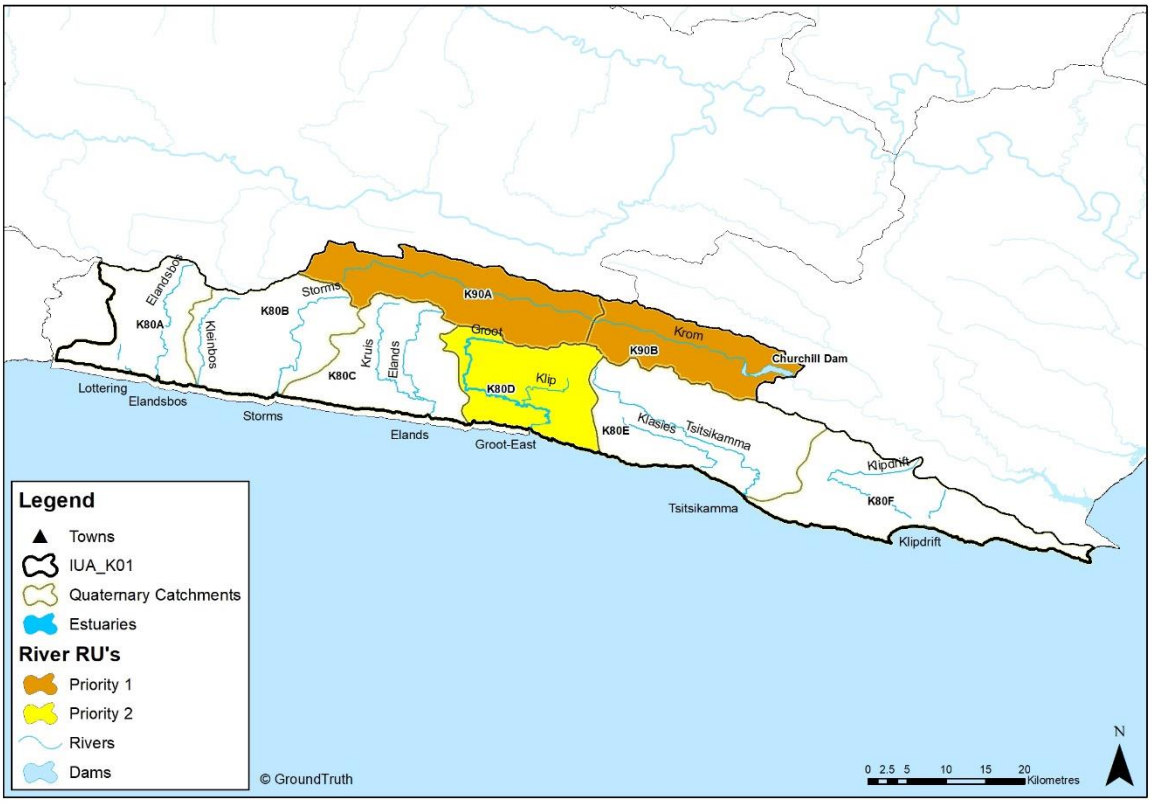
Based on (i) the assessment of information and data available, (ii) the status quo or current developments and impacts per IUA and (iii) any proposed new developments that will impact on the water resources, three levels of priority have been identified, namely:

- Priority 1, where rivers and estuaries will be assessed on an intermediate level and detailed considerations for wetlands and groundwater. RQOs will also be determined for the selected sub-components;
- Priority 2, with rapid assessments for rivers and estuaries and less detailed studies for the wetlands and groundwater (desktop with limited field verifications). Some of these will also be used as hydro and/ or biophysical nodes at the outlets of RUs or IUAs or where specific protection considerations are required; and
- Priority 3, desktop assessments using existing information and data for all the components.

The priority 1 and 2 RUs identified for each component per IUA is illustrated below from Section 5.1 to 5.19, coupled with the rationale.

5.1 IUA_K01: Tsitsikamma and headwaters of Kromme to Kromme Dam

IUA_K01: Tsitsikamma and headwaters of Kromme to Kromme Dam



This IUA covers the Tsitsikamma and smaller coastal rivers and the headwaters of Kromme River to Kromme Dam. The IUA delineation was based on biophysical characteristics, ecoregion, associated sensitivities which include the Tsitsikamma Nature Reserve and Formosa Provincial Nature Reserve. Owing to the vast land use activities and impacts (commercial farming, forestry, and high reliance on water resources from the municipality) it is a highly stressed catchment, although categorised as a SWSA for surface water (SW), groundwater (GW) and integrated SW-GW. The IUA includes various fish sanctuaries in the form of fish support areas (FSA).

RESOURCE UNITS

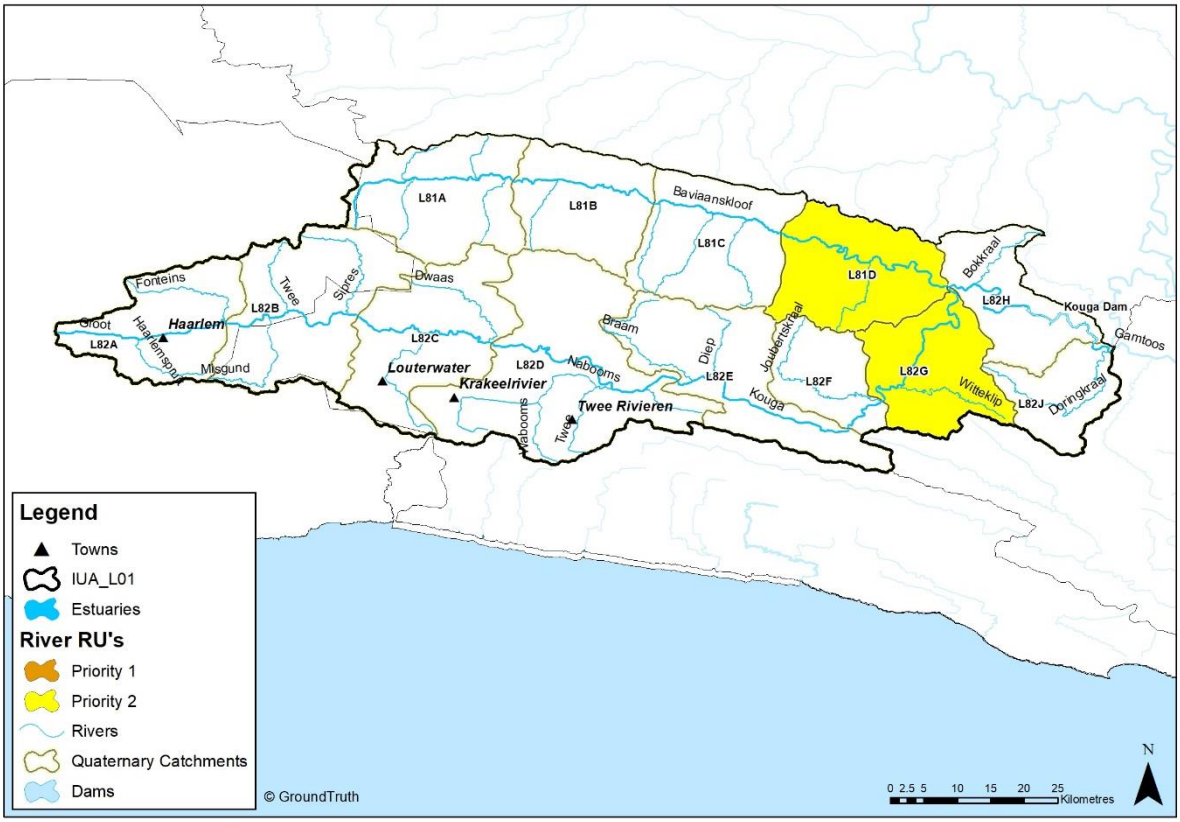
Dams

Level	Quaternary	System	Purpose
1	K90B	Kromme (Churchill)	• Domestic, industrial and irrigation

Rivers ***(illustrated in figure above)***			
1	K90A K90B	Krom	• Very high-water use (domestic, irrigation, forestry) • Compromised water quality • High EIS • Sensitive biota to water quality, flow • FSA (*Galaxias sp. "Joubertina"*:EN, *Pseudobarbus Krom* (now *P. senticeps:* Cr) • Previous EWR done in 2006 (EWR1 in K90A). • Part of wetland in upper Krom
2	K80D	Groot	• Low water use • Limited water quality issues • PES – B • High EIS • Sensitive biota to water quality, flow • FSA (*P. afer cf. Forest* (NT))
Estuaries			
2	K80D	Groot	• River Mouth estuary in excellent condition • Low pressures • Located on eastern boundary of the Tsitsikamma National Park • Good linkages to terrestrial and MPA • Linkages with Groot River
	K80C	Elands	• Small deeply incised system • River Mouth Estuary • Minor human impact • Adjacent to the Tsitsikamma MPA • Good linkages to terrestrial and MPA • Contributes to biodiversity and EFZ
Groundwater			
2	K80A - K80F K90B and K90D		• GW use ranges from low to very high • GW dependency (K80C – K80F) • Good groundwater quality • Very high stress on GW (K80A – K80D), remainder of the sub catchment is mildly stressed
Wetlands			
1	K80A		• (Tsitsikamma Plains). Part of the Tsitsikamma plains wetlands Predominantly valley bottom wetlands • High extent and diversity of wetlands; a high importance in terms wetland-dependent, Red-listed species and habitat; an important ecological link between the mountains and coastal strip.
	K90F		• (Kromme River). Large wetlands. Mostly valley bottom wetland • Large palmiet peatland wetland; extensive rehabilitation by WfWetlands. High regulating services value for downstream urban areas.

5.2 IUA_L01: Kouga to Kouga Dam, Baviaanskloof

IUA_L01: Kouga to Kouga Dam, Baviaanskloof



This IUA covers the Kouga River to Kouga Dam and Baviaanskloof. The IUA delineation is based on biophysical characteristics, ecoregion and sensitive land use (Baviaanskloof Nature Reserve and numerous fish sanctuaries, including priority areas and FSA). It is a highly stressed IUA with impacts including irrigation from SW and GW and poor water quality in some tributaries, e.g. Nabooms River. This IUA is further linked to the Algoa system although parts of the quaternary catchments are categorized as SWSA for both SW, GW and integrated SW-GW.

RESOURCE UNITS

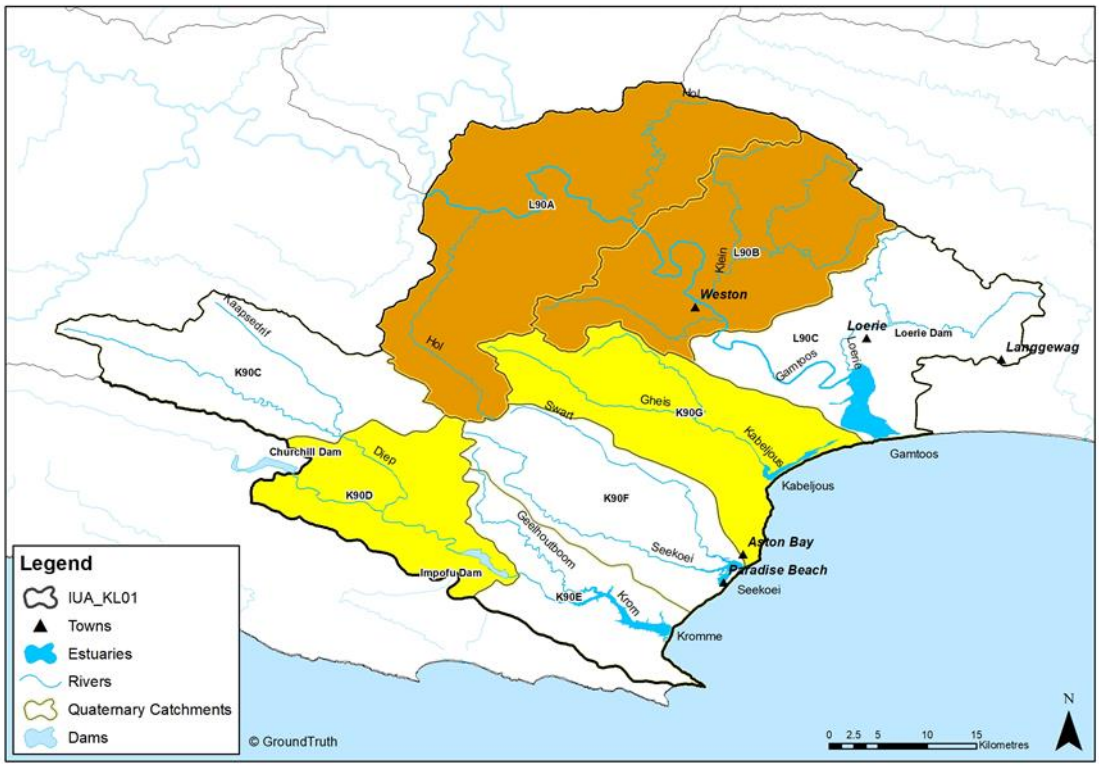
Dams

Level	Quaternary	System	Purpose
1	L82H	Kouga	• Irrigation • Domestic
1	L82A	Haarlem	• Irrigation
Rivers *(illustrated in figure above)*			
2	L81D	Baviaanskloof	• Not a resource stress issue • Ecological sensitivities • FEPA • Fish sanctuary (*Pseudobarbus swartzi:* EN) • Sensitive biomes • Sensitive macroinvertebrates to water quality, flow
2	L82G	Kouga	• Not a resource stress issue • Localised water quality impacts on tributaries • Ecological sensitivities • Sensitive riparian vegetation species due to declining populations • Sensitive macroinvertebrates to water quality, flow

IUA_L01: Kouga to Kouga Dam, Baviaanskloof			
Estuaries			
None			
Groundwater			
2	L82A–L82F L81A–L81C		• GW SWSA • Very high water use (Langkloof Valley) • Mildly stressed • Excellent groundwater quality
Wetlands			
2	L82D	Krakeel wetland	• One of the largest wetlands in the overall study area, and of a type which has been subject to very high levels of cumulative loss, and while much of the wetland itself has been transformed, it still contains remnant reasonably intact natural areas and is important in terms of regulating services

5.3 IUA_KL01: Kromme from Kromriver Dam to Estuary and Gamtoos

IUA_KL01: Kromme from Kromriver Dam to Estuary and Gamtoos



This IUA covers the Kromme River flowing downstream from the Kromme Dam to the estuary and the Gamtoos River and is linked directly to the Algoa system. The IUA delineation was based on similar biophysical characteristics as per IUA1 (IUA_K01), ecoregion and economic activities. The land use and impacts within this IUA includes commercial farming and high reliance on water resources from the municipality. There are two (2) large dams (Kromme and Mpofu) in this IUA. Parts of some quaternary catchments include SWSA for SW and integrated SW-GW. Various fish sanctuaries occur throughout, both priority areas and FSA.

RESOURCE UNITS

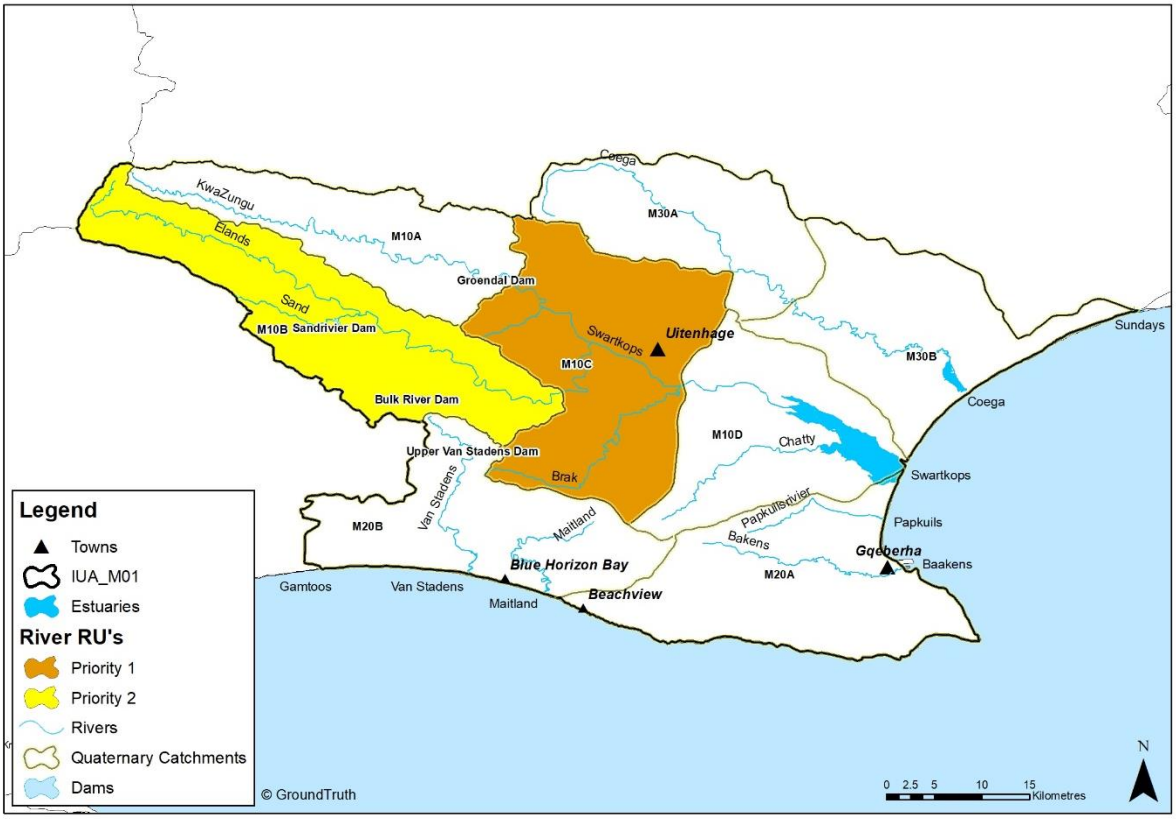
Dams

Level	Quaternary	System	Purpose
1	K90D	Mpofu	• Domestic, industrial, irrigation
1	L90C	Loerie	• Domestic
1	K90F	Zalverige Valley	• Irrigation
Rivers *(illustrated in figure above)*			
1	L90A, B	Gamtoos	• High water use (irrigation, domestic) • water quality issues • Add Gamtoos d/s Groot and Kouga confluence at intermediate level. • Use EWR2 and EWR3 from 2006 Kromriver study
2	K90D	Krom	• Very high water use (irrigation, domestic, forestry) • water quality issues • FSA • River categorised as seriously modified (PES D)

IUA_KL01: Kromme from Kromriver Dam to Estuary and Gamtoos			
2	K90G	Kabeljous	• Although moderate water use and water quality issues, it has been flagged by a stakeholder owing to increased citrus farming so additional pressures on the water source. – connected with the rapid that will be undertaken on the Kabeljous estuary • Kabeljous Nature Reserve (as per the Eastern Cape Biodiversity Plan)
Estuaries			
2	K90E	Kromme	• Classified as a Permanently Open estuary with a severely impounded catchment which has a strong anthropogenic impact on the estuary. • The mounting pressures on this estuary in combination with its category and PES result in selection for further study to determine management class and set RQOs to avoid further degradation.
1	L90C	Gamtoos	• A Permanently Open Estuary with a clear degradation in the catchment resulting in water quantity and quality declines. • The water pressures and the available historical information make this a good candidate for an intermediate level assessment. • The declining condition of this very important estuary add weight to this selection for intermediate assessment.
2	K90G	Kabeljous	• Good conditions • Classified as a large temporary closed estuary. • This estuary was raised as a concern from a key stakeholder due to high anthropogenic impacts (increased abstraction for irrigation, numerous small dams).
Groundwater			
2	K90E - K90G		• High groundwater use and dependency • Good groundwater quality
2	L90B, L90C		• Mildly stressed catchments • Moderate to good groundwater quality
Wetlands			
None			

5.4 IUA_M01: M primary catchment

IUA_M01: M primary catchment



This IUA covers the entire M primary catchment and is based on a mixture of land uses and land use impacts, which include towns, settlements, high population numbers and industrial activities. There are SWSA for both SW and GW, as well as integrated SW-GW, with a few fish sanctuaries with both priority areas and FSA.

RESOURCE UNITS

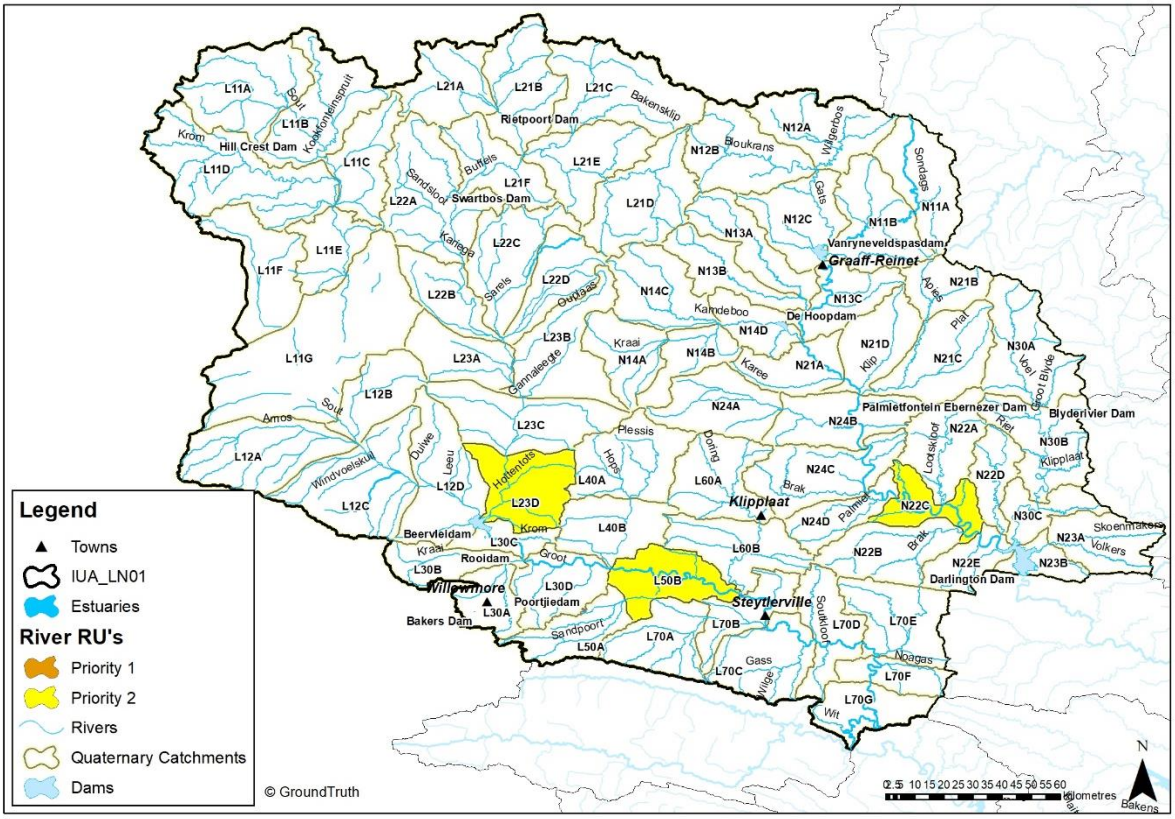
Dams

Level	Quaternary	System	Purpose
1	M10A	Groendal	• Domestic, industrial
1	M10B	Bulkrivier	• Domestic, industrial
1	M10B	Sand River	• Domestic, industrial
1	M20B	Upper and Lower Van Stadens	• Domestic, industrial
Rivers ***(illustrated in figure above)***			
1	M10C	KwaZungu/ Swartkops	• Very high water use and quality impacts due to town developments (highly stressed resource) • High EIS • FEPA • Fish sanctuary (*Pseudobarbus afer s.s.*: EN)
2	M10B	Elands	• SWSA for both SW and GW • FSA (*Pseudobarbus afer s.s.:* EN)

Estuaries			
2	M10D	Swartkops	• A Predominantly Open estuary which is heavily impacted. Upper estuary associated with the Swartkops Valley Local Authority Nature Reserve, also an IBA and Highly important fish nursery • High biodiversity importance but with a low PES and high pressures mean that there must be a focus to set the class and RQOs for this system.
2	M20A	Papkuilsrivier	• A small temporarily closed estuary which is highly modified to a canalised system with major degradation.
Groundwater			
2	M10A, M10B		• GW SWSA • Subterranean Government Water Control Area • Increasing private groundwater use due to recent drought • Good groundwater quality
1	M10C, M10D M30A, M30B		• GW SWSA • Very high GW use and dependency • Subterranean Government Water Control Area • Increasing private groundwater use due to recent drought • Good groundwater quality
2	M20A, M20B		• GW SWSA • Increasing private groundwater use due to recent drought • Good groundwater quality
Wetlands			
2	M10B	Longmore State Forest wetlands	• Predominantly valley bottom wetlands. Moderately extensive largely intact wetland with widespread forest plantations in the catchment. Demand for the wetlands' regulatory services is relatively high given a downstream water supply dam.
1	M10D	Gqeberha	• While wetlands are generally small and many are transformed, a diversity of types are represented (with many depressions) and several are important for regulating services, particularly in terms of buffering water quality impacts on the Swartkops Estuary.

5.5 IUA_LN01: Groot to Kouga confluence, Upper Sundays to Darlington Dam

IUA_LN01: Groot to Kouga confluence, Upper Sundays to Darlington Dam



This IUA covers the Groot River to the confluence with the Kouga, including the upper Sundays River to Darlington Dam. This large IUA is based on the fact that it is a highly stressed catchment, with agricultural activities, high irrigation demand, as well as important conservation areas requiring protection, namely Camdeboo National Park. Some fish sanctuaries which include priority areas, corridors and FSA. The IUA is groundwater driven (northern part of N and L drainage regions where the dynamics of water use is similar and used for town supply). Some SWSA for groundwater.

RESOURCE UNITS

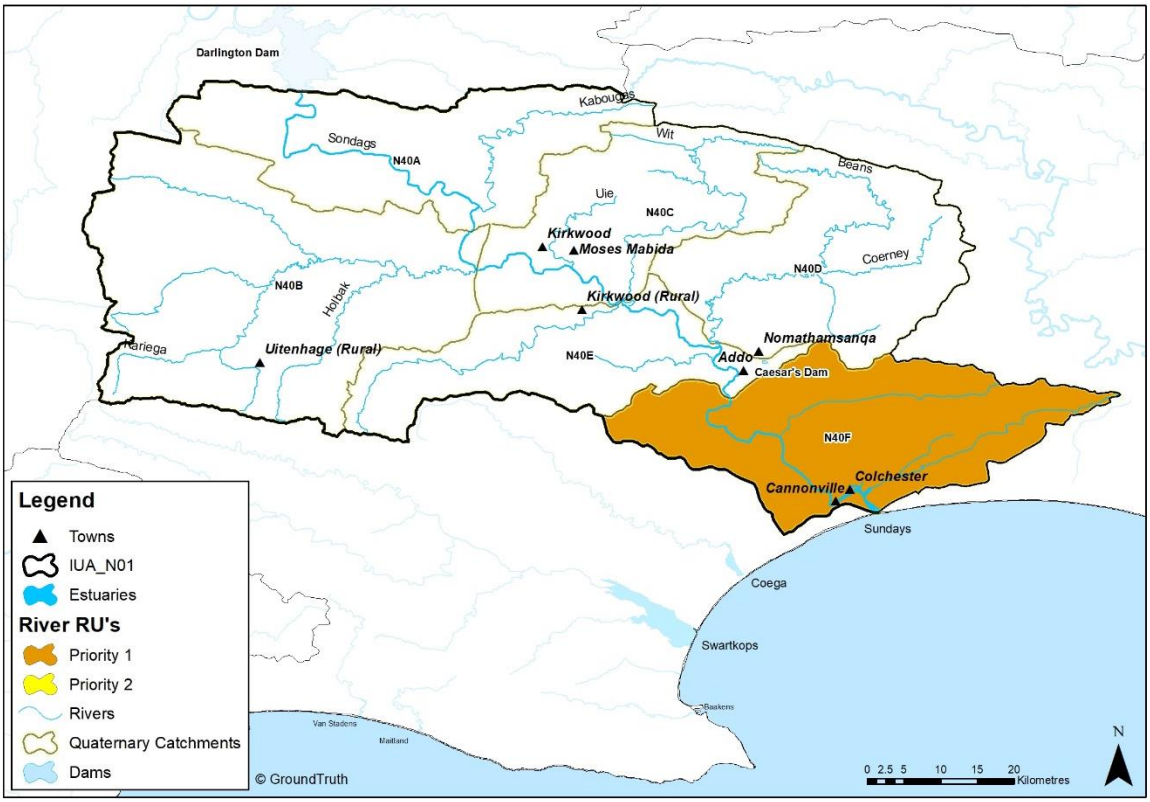
Dams

Level	Quaternary	System	Purpose
1	L30C	Beervlei	• Flood control
1	L60A	Klipfontein	• Irrigation
1	N13C	Nqweba	• Irrigation
1	N23B	Darlington	• Water is transferred from the Great Fish to Darlington Dam • Primarily irrigation and transfer to Gqeberha
1	N11B	Bloemhof	• Irrigation
1	N14D	De Hoop	• Irrigation
Rivers *(illustrated in figure above)*			
2	L23D	Kariega	• Not a resource stress issue • FSA (*Pseudobarbus asper*, VU) • Fish corridor
2	L50B	Groot	• Not a resource stress issue • FSA (*Pseudobarbus asper*, VU)
2	N22C	Sondags	• High water use

IUA_LN01: Groot to Kouga confluence, Upper Sundays to Darlington Dam			
			• High EIS
Estuaries			
None			
Groundwater			
2	L11E, L11F		• GW SWSA (L11E) • High GW use (L11F) • Good groundwater quality • Mildly stressed • High dependency on groundwater
2	L12A - L12D		• High GW use • Marginal groundwater quality • Mildly stressed • High dependency on groundwater
2	L23B, L23C		• High GW use • Good groundwater quality • Mildly stressed • High dependency on groundwater
2	L21B		• High GW use • Good groundwater quality • High dependency on groundwater
2	L30A, L30D		• GW SWSA (L30A) • High GW use • Good to moderate groundwater quality • High dependency on groundwater
2	N11A–N11B N12A – N12C N13A – N13C		• GW SWSA • High GW use • Good to excellent groundwater quality • High dependency on groundwater
2	N14A – N14C		• High GW use • Excellent groundwater quality • Mildly to Moderately stressed • High dependency on groundwater
2	N21B – N21C N30A – N30B		• High GW use • Good groundwater quality • High dependency on groundwater
2	N24C		• High GW use • Good groundwater quality • Mildly stressed • High dependency on groundwater
Wetlands			
2	L21D		• Extensive seep and valley bottom wetlands in the Western Sneeuberg, especially important because in much of the surrounding lower-lying landscape, which is predominantly arid, wetlands are naturally scarce.

5.6 IUA_N01: Sundays downstream Darlington Dam

IUA_N01: Sundays downstream Darlington Dam



This IUA covers the Sundays River downstream of Darlington Dam. The IUA delineation is based on biophysical characteristics, ecoregion and the associated sensitivity of these catchments i.e. Addo Elephant National Park, as well as land use and impacts namely commercial and irrigation. Several fish sanctuaries within priority areas and FSA.

RESOURCE UNITS

Dams

Level	Quaternary	System	Purpose
1	N40C	Slagboom	• Irrigation

Rivers ***(illustrated in figure above)***

1	N40F	Sundays	• High water resource stress from flow and quality (mostly irrigation) • Very high-water use • Compromised water quality • Site downstream of Darlington Dam • Transfer from the lower Sundays to the Algoa WSS

Estuaries

1	N40F	Sundays	• Predominantly Open estuary in fair condition with a significant mosaic of Addo Elephant National Park and Addo Elephant Marine Protected Area and an important fish area/NFEPA

Groundwater

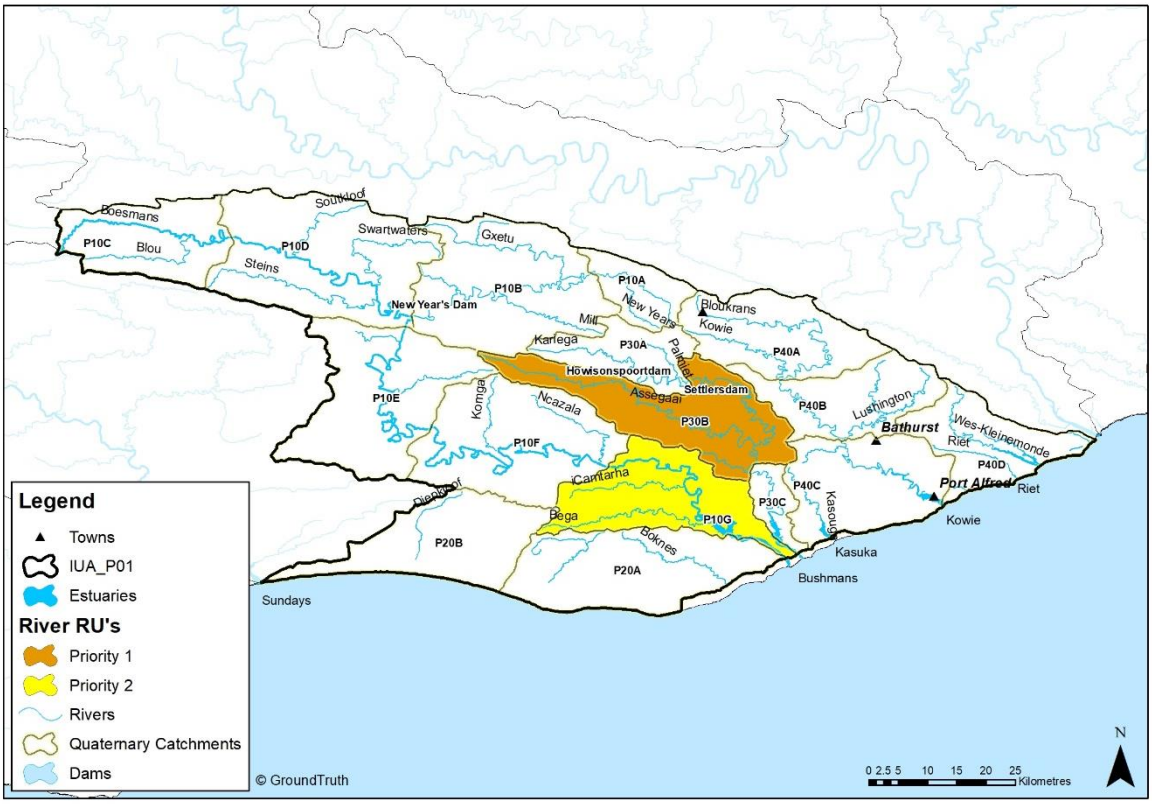
None, however possible saltwater intrusion due to municipal bulk water supply from groundwater

Wetlands

None

5.7 IUA_P01: P primary catchment

IUA_P01: P primary catchment



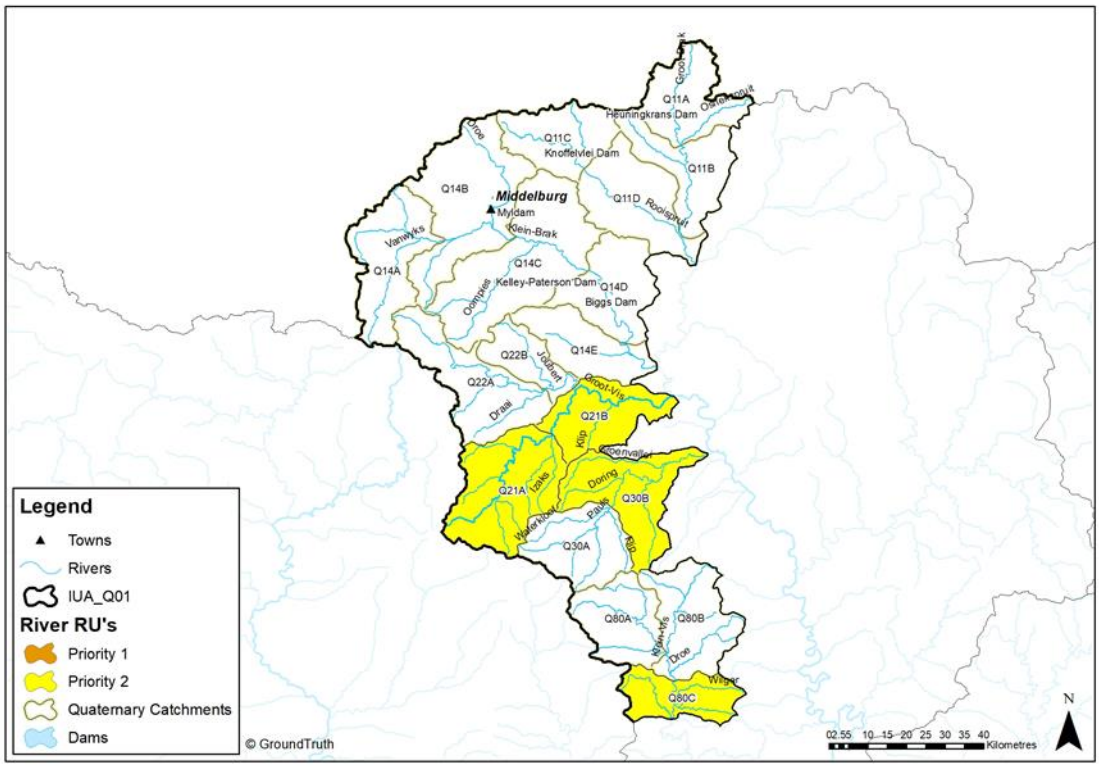
This IUA covers the entire P primary catchment and is based on land use and social activities taking place, including important conservation areas, coupled with SWSA for both SW and integrated SW-GW.

RESOURCE UNITS			
Dams			
Level	**Quaternary**	**System**	**Purpose**
1	P10A	Jameson	• Domestic
1	P10A	Milner	• Domestic
1	P10B	Nuwejaars	• Domestic
1	P30A	Howisonpoort	• Domestic
1	P30B	Settlers	• Domestic
Rivers *(illustrated in figure above)*			
1	P30B	Kariega	• High water use (alien vegetation, only some irrigation and forestry) • FEPA • Fish sanctuary • Site on lower reaches d/s Settlers Dam
2	P10G	Bushmans	• Not a water resource stress issue • High EIS • FSA
Estuaries			
2	P30C	Kariega	• Reduced freshwater inputs due to agricultural cultural demands
2	P10G	Bushmans	• Emlanjeni Private Game Reserve is associated with the upper reaches of the estuary

IUA_P01: P primary catchment			
			• High fishing efforts and alien fish
Groundwater			
2	P20A, P10G, P30C, P40C, P40D		• Increasing dependency on groundwater • Sensitive coastal aquifers, vulnerable to seawater intrusion • Good to moderate groundwater quality
Wetlands			
None			

5.8 IUA_Q01: Fish

IUA_Q01: Fish



This IUA covers the main stem Fish River before the transfer of water from the Orange River to the Great Fish River and some of the smaller tributaries of the upper Fish River. It is rural in nature throughout the catchments, and associated dry, ephemeral rivers. There are numerous fish sanctuaries, including priority areas and FSA.

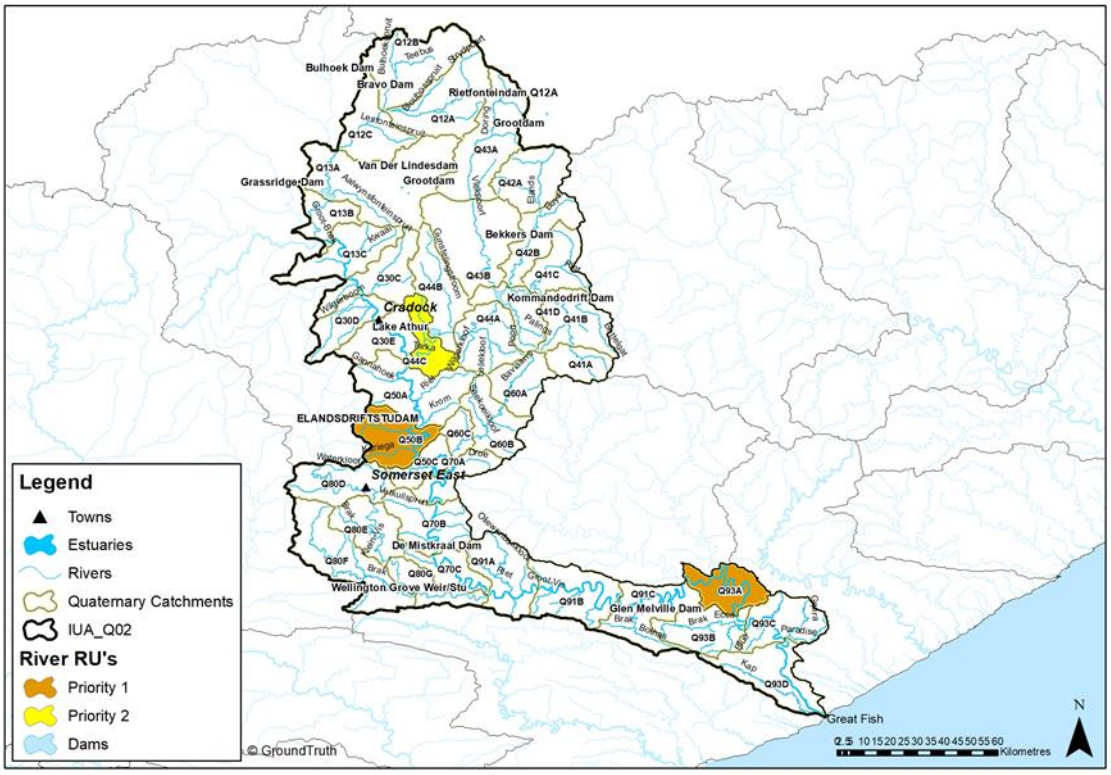
RESOURCE UNITS

Level	Quaternary	System	Purpose
Dams			
1	Q13A	Grassridge	• Water transferred from Gariep Dam to the upper reaches of the Great Fish River into Grassridge Dam • Mostly for irrigation
1	Q14C	Kelly-Patterson	• Irrigation
Rivers *(illustrated in figure above)*			
2	Q21B	Great Fish	• Upstream of transfer. PES=D, outlet of IUA
2	Q30B	Pauls	• Some water use in lower reaches (irrigation) • Lower reaches river changes from a PES B to a PES D
2	Q80C	Little Fish	• Upstream of transfer of water from Great Fish to Little Fish • Limited irrigation • Outlet of IUA
Estuaries			
None			

Groundwater			
2	Q11B, Q11C		• GW SWSA • High GW use • High GW dependency • Excellent groundwater quality
1	Q14A, Q14B		• GW SWSA • High GW use • High GW dependency • Mildly stressed • High yielding aquifers • Excellent groundwater quality
2	Q14C, Q14D, Q14E		• GW use • High GW dependency • Excellent groundwater quality
2	Q21A, Q21B, Q22A, Q22B		• GW use • High GW dependency • Moderately stressed • Good to excellent groundwater quality
2	Q30A, Q30B, Q80A		• Considerable GW use • GW use • High GW dependency • Good groundwater quality
Wetlands			
1	Q21A		• Portion of Sneeuberg East wetland cluster; seep and valley bottom wetlands in a broader landscape with very little wetland.
	Q22A		• Portion of the Loodsberg wetland cluster seep and valley bottom wetlands in a broader landscape with very little wetland
	Q30A, Q30B		• Portion of Sneeuberg East wetland cluster, seep and valley bottom wetlands in a broader landscape with very little wetland
	Q80A, Q80B		• Portion of Sneeuberg East wetland cluster, seep and valley bottom wetlands in a broader landscape with very little wetland

5.9 IUA_Q02: Great Fish

IUA_Q02: Great Fish



This IUA was delineated owing to it being highly stressed and highly utilised catchments based on the transfer scheme from Gariep Dam to the Great Fish and lower Little Fish Rivers, and irrigation in the catchment, especially along the Great Fish River. However, it is an important IUA in terms of conservation areas namely the Mountain Zebra National Park and the Great Fish Nature Reserve. There are parts categorized as GW SWSAs.

RESOURCE UNTIS

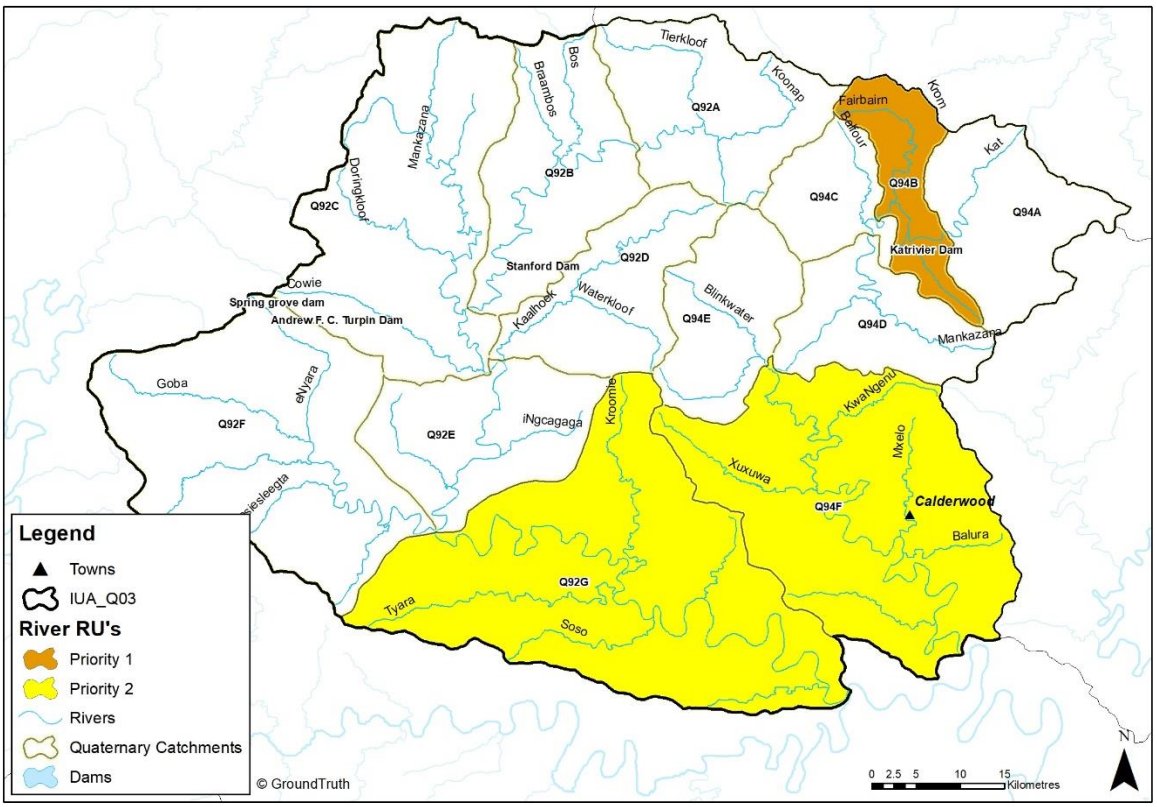
Dams

Level	Quaternary	System	Purpose
1	Q41B	Nettle Grove	• Irrigation
1	Q44B	Lake Arthur	• Irrigation
1	Q41D	Kommandodrift	• Irrigation
1	Q50A	Elandsdrift	• Irrigation
1	Q80E	De Mistkraal	• Irrigation
1	Q93B	Glen Melville	• Water from Great Fish River • Mostly domestic and irrigation
Rivers *(illustrated in figure above)*			
1	Q50B	Great Fish	• Downstream Elandsdrift Weir with transfers to Little Fish • High irrigation demand
1	Q93A	Great Fish	• Water use • Great Fish d/s Kat confluence
2	Q44C	Tarka	• High water resource use • High water use • Water quality issues

Estuaries			
None			
Groundwater			
2	Q12A, Q12B, Q12C		• High GW use and dependency • Excellent groundwater quality
2	Q13A, Q13B, Q13C		• High GW use • Very high GW stress • Good groundwater quality
2	Q30C-Q30E, Q50A		• High GW use and dependency • Very high GW stress • Good groundwater quality
2	Q41A, Q41B, Q41C		• High GW use and dependency • Excellent groundwater quality
2	Q80D		• High GW use • GS SWSA • Excellent groundwater quality
Wetlands			
2	Q43A, Q43B	Arthur's seat	• Very long channelled valley bottom wetland with several major erosion-control works resulting in major erosion control and sediment trapping outcomes, with some limited field verification already having been undertaken.

5.10 IUA_Q03: Koonap and Kat

IUA_Q03: Koonap and Kat

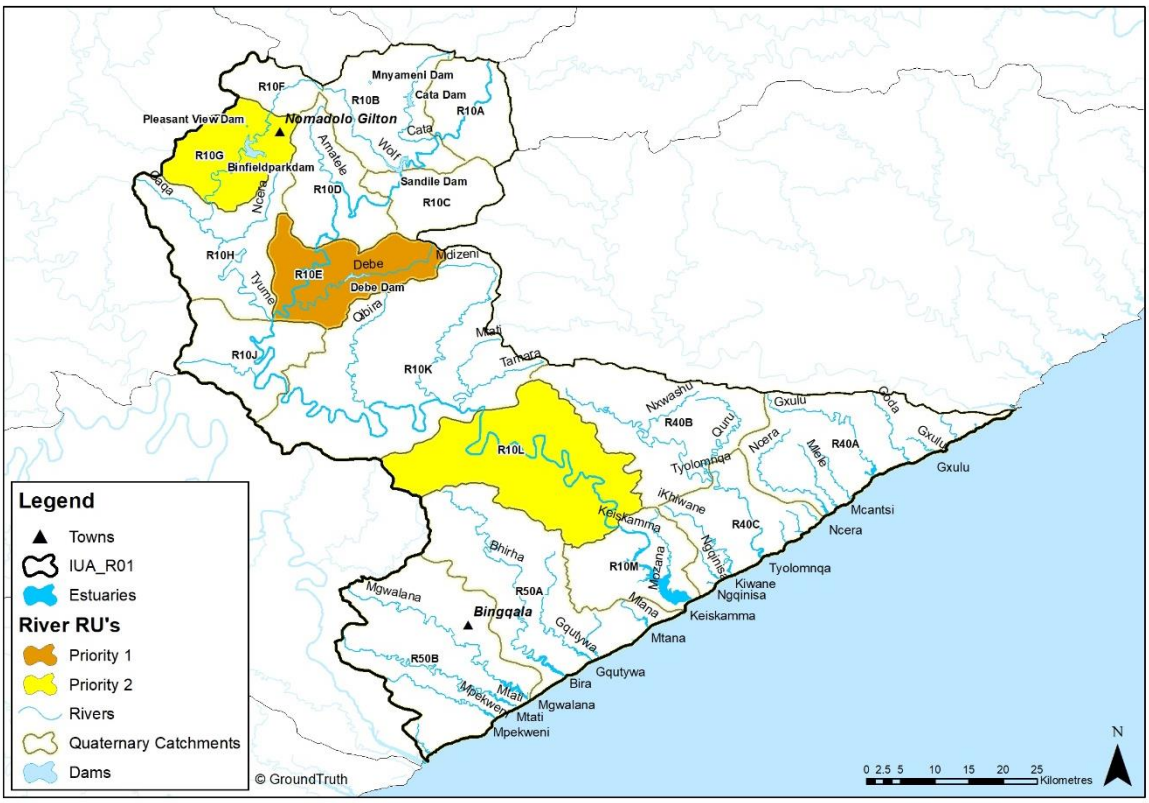


The IUA was delineated based on the area being wetter, with more local sources for irrigation down the entire Koonap and Kat Rivers.

RESOURCE UNITS			
Dams			
Level	**Quaternary**	**System**	**Purpose**
1	Q94A	Kat River	• Irrigation
Rivers *(illustrated in figure above)*			
1	Q94B	Kat (d/s dam)	• High water use and quality issues • FSA (*Sandelia bainsii*, EN)
2	Q94F	Kat	• Upper reaches water quality issues
2	Q92G	Koonap	• FSA (*Sandelia bainsii*, EN) • Outlet of IUA
Estuaries			
None			
Groundwater			
2	Q92A		• High GW use • Excellent groundwater quality
2	Q92E, Q92F		• High groundwater use and dependency • Good to excellent groundwater quality • High yielding aquifers
Wetlands			
None			

5.11 IUA_R01: Keiskamma

IUA_R01: Keiskamma



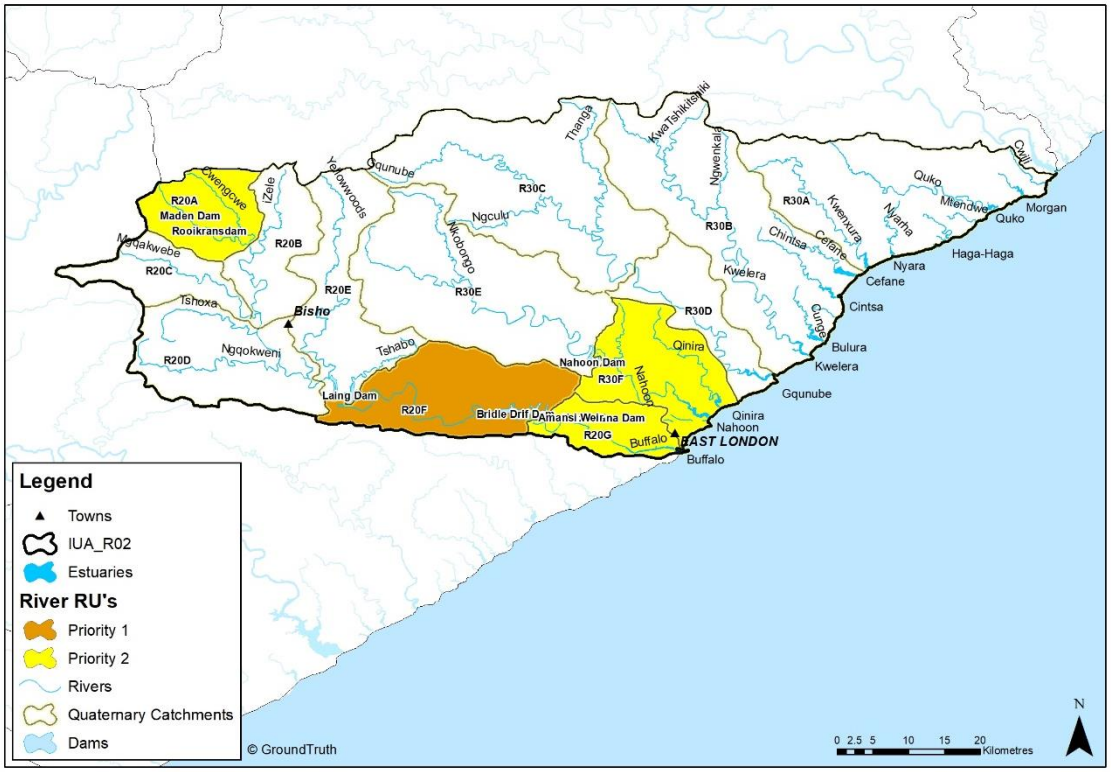
This IUA covers the Keiskamma and is mostly based on ecoregion and catchment impacts namely subsistence farming, forestry and relatively rural and a number of large dams in the upper reaches of this system.

RESOURCE UNITS			
Dams			
Level	**Quaternary**	**System**	**Purpose**
1	R10B	Sandile	• Irrigation
1	R10B	Cata	• Irrigation
1	R10G	Binfield	• Domestic
Rivers *(illustrated in figure above)*			
1	R10E	Keiskamma	• High water use (irrigation, domestic) • Keiskamma d/s Sandile Dam
2	R10G	Tyume	• Very high water use (irrigation, domestic) • FSA (*Amatolacypris trevelyani*, EN), *Sandelia bainsii*, EN)
2	R10L	Keiskamma	• Water use, linked to estuary
Estuaries			
2	R10M	Keiskamma	• An estuary in good condition with low pressures and important linkages with Protected Area network suggest that this system be assessed with a rapid assessment
2	R40A	Gxulu	• A large temporarily open estuary in near natural condition with low pressures result in this estuaries selection for a rapid assessment.

Groundwater			
2	R10A, R10B		• High GW use • Good to excellent groundwater quality
Wetlands			
None			

5.12 IUA_R02: Buffalo/ Nahoon

IUA_R02: Buffalo/ Nahoon



This IUA covers the Buffalo and Nahoon Rivers and a few smaller coastal systems. The IUA delineation was based similarly on ecoregion and catchment impacts, which include commercial and subsistence farming, highly developed area around East London, with a high reliance of water resources from municipality – thus various catchments are stressed. These stresses further include the water transfers from the Kubusi River (Wriggleswade Dam) in the Kei system (S60) to the Amatola system.

RESOURCE UNITS

Dams

Level	Quaternary	System	Purpose
1	R20E	Laing	• Domestic and industrial, receives transfer from Wriggleswade Dam on Kubusi River
1	R20A	Rooikrantz	• Domestic and industrial
1	R20F	Bridledrift	• Domestic and industrial
1	R30E	Nahoon	• Domestic and industrial, receives transfer from Wriggleswade Dam on Kubusi River
1	R20A	Maden	• Domestic and industrial

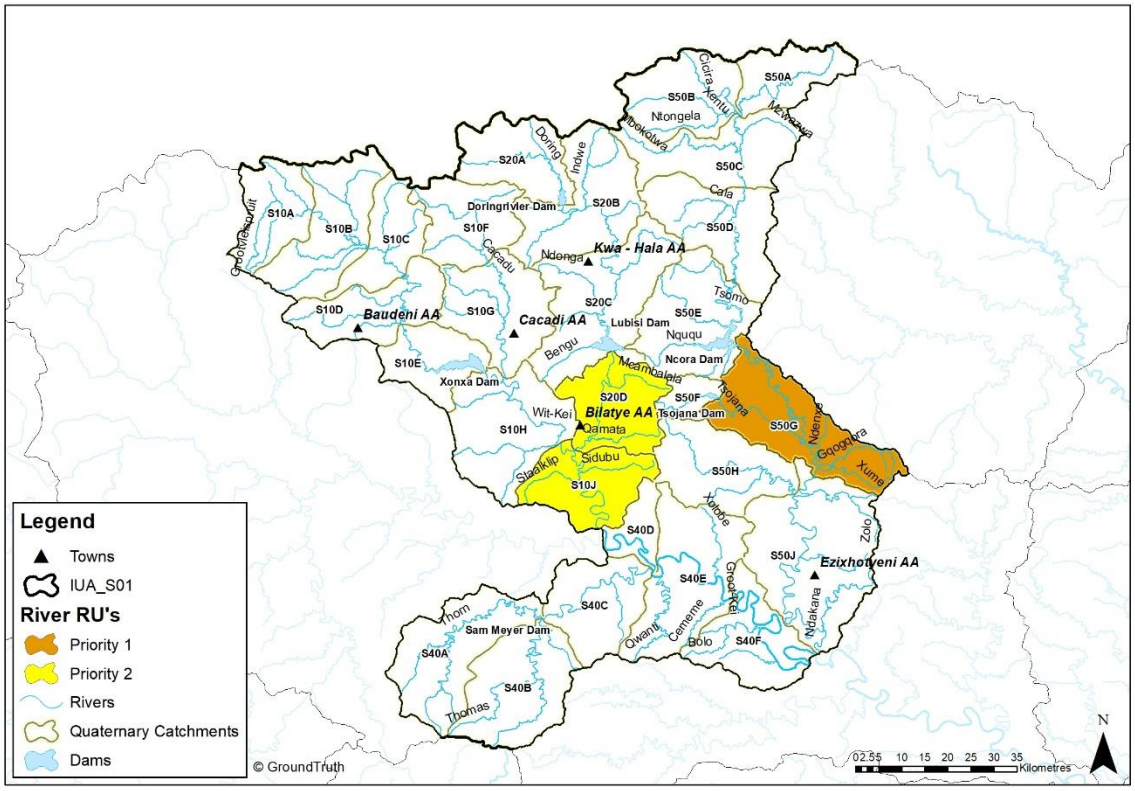
Rivers ***(illustrated in figure above)***

1	R20F	Buffalo	• High water resource stress – quantity and quality • Very high water use • Water quality impacts • D/s Laing Dam (existing EWR2, 2003)
2	R20A	Buffalo	• High water use (Maden and Rooikrantz Dams, forestry and irrigation) • FSA (*Barbus trevelyani*, EN), *Sandelia bainsii*, EN) • Sensitive macroinvertebrates to water quality and flow • Maputaland-Pondoland Region of plant endemism

IUA_R02: Buffalo/ Nahoon			
2	R20G	Buffalo	•
2	R30F	Nahoon	• Water use (domestic) • Water quality impacts • Water is transferred from Wriggleswade Dam (Kei system) to the Nahoon Rivers
Estuaries			
None			
Groundwater			
2	R20A, R20C		• Moderate to high GW use • Mildly stressed • Good to excellent groundwater quality •
2	R30A, R30B, R30D		• GW SWSA • Moderate to high GW use • Variable groundwater quality
Wetlands			
1	R20D, R20E	kwaMasele	• Hillslope and valley bottom wetland with extensive micro-topographical features characteristic of the Kommetjievlakte. Likely one of the largest Kommetjievlakte wetlands, a unique wetland type confined to the greater Bisho/Qonce area.
2	R20E	Hanover/ eDrayini	• Floodplain of medium size subject to a relatively high level of cultivation. Important from a management planning and regulation perspective given its location on the edge of an expanding urban area.

5.13 IUA_S01: Upper Great Kei

IUA_S01: Upper Great Kei



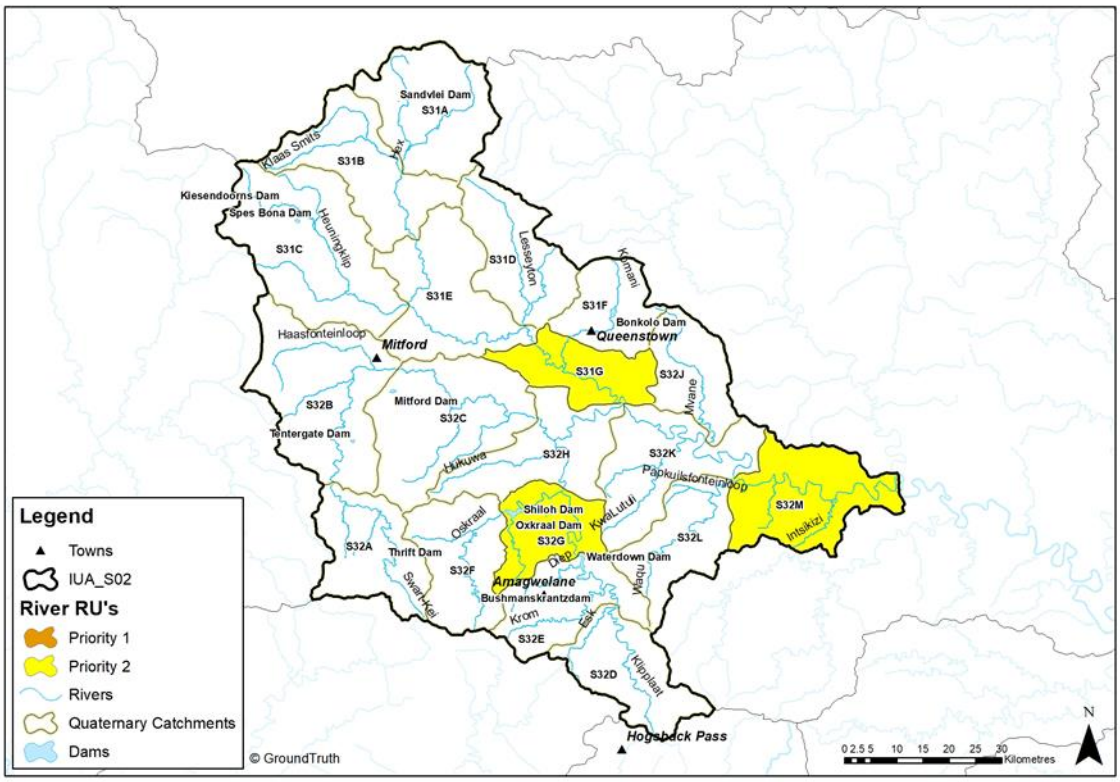
This IUA covers the Upper reaches of the Great Kei and the delineation was primary based on impacts to the catchment including rural development, irrigation and large dams for water supply.

RESOURCE UNITS			
Dams			
Level	**Quaternary**	**System**	**Purpose**
1	S10E	Xonxa	• Irrigation
1	S20C	Lubisi	• Irrigation
1	S20A	Doringrivier/ Indwe	• Domestic
1	S50E	Ncora	• Main purpose is irrigation • Ncora Hydropower and transfers to Mbashe River (IUA_T02)
1	S50F	Tsojana	• Domestic
Rivers *(illustrated in figure above)*			
1	S50G	Tsomo	• High water use (domestic, irrigation, forestry) • Maputaland-Pondoland Region of plant endemism • D/s Ncora Dam
2	S10J	White-Kei	• Some water use • Maputaland-Pondoland Region of plant endemism
2	S20D	Indwe	• High water use (domestic) • Maputaland-Pondoland Region of plant endemism

Estuaries			
None			
Groundwater			
2	S10C-S10F, S10H		• High GW use and dependency • Excellent groundwater quality
2	S20A, S20B, S20C, S20D		• High GW use and dependency • Excellent groundwater quality
2	S50C-S50H, S40E		• High GW use and dependency • Excellent groundwater quality
Wetlands			
2	S50C	Deochandoris	• Floodplain (probably the largest in the overall study area); extensive cultivation within the wetland
2	S50E, S50F,	Cala NU and Maya wetlands	• Valley bottom wetlands, with the largest of these concentrated in the northern portion of S50E, including an extensive unchannelled valley bottom, still largely intact but with extensive cultivation and human settlement in the catchment.

5.14 IUA_S02: Black Kei

IUA_S02: Black Kei



The IUA includes the Klipplaat, Klaas, Smits and Black Kei River systems, which are highly stressed. The catchment pressures include irrigation and a few small dams.

RESOURCE UNITS

Dams

Level	Quaternary	System	Purpose
1	S32E	Waterdown	• Irrigation
1	S31F	Bonkolo	• Domestic
1	S32G	Oxkraal	• Irrigation,

Rivers ***(illustrated in figure above)***

2	S31G	Klaas Smits	• High water use (irrigation) • Water quality impacts from irrigation and WWTW
2	S32G	Klipplaat	• High water use (irrigation, forestry in upper reaches) • Linked to wetlands
2	S32M	Black Kei	• Irrigation

Estuaries

None

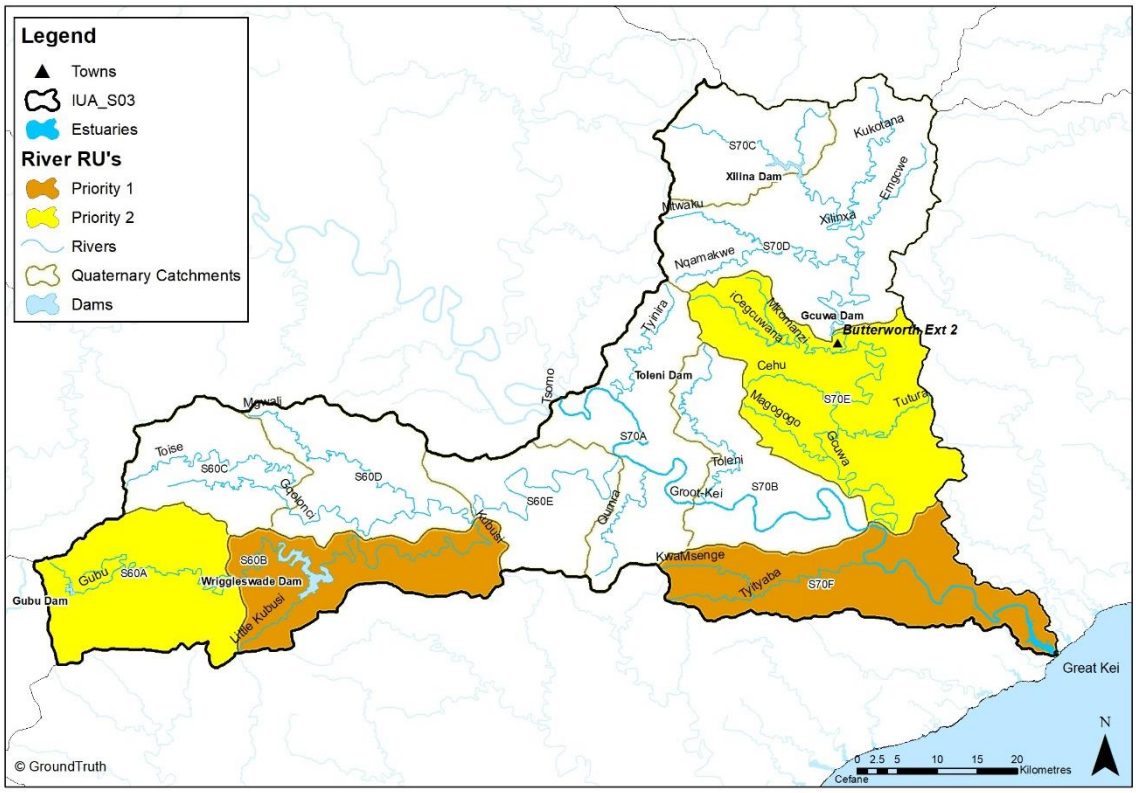
Groundwater

2	S31A, S31B, S31D, S31E, S31F		• Very high GW use • Mildly stressed at places (S31E) • Good to excellent groundwater quality
2	S32E, S32F, S32H, S32L		• Considerable GW use • Mildly stressed at places (S32H) • Good to excellent groundwater quality

IUA_S02: Black Kei			
Wetlands			
1	S32D	Hogsback	• Significant wetland complex, including the much of the Hogsback wetlands. Extensive wetlands of a high diversity of types, including one of the largest unchanneled valley bottoms in the overall study area, as well as wetland habitat supporting Red-listed species and some wetlands which have been rehabilitated by WfWetlands. Wetlands range from minimally impacted to high impacts from forestry and agriculture.
2		Cairns/ Kolomane	• A large and very diverse wetland, including unchannelled valley bottom wetland, floodplain wetland (minor) and extensive hillslope and valley bottom wetland with microtopographical features characteristic of the Kommetjievlakte. Much of the wetland and its catchment still under intact natural vegetation, with what appears to be limited human impacts.

5.15 IUA_S03: Lower Great Kei

IUA_S03: Lower Great Kei



This IUA delineation was based on catchment impacts namely irrigation, rural development, and the transfers from Wrigglewade Dam to the Buffalo (part of the integrated Amatola system).

RESOURCE UNITS

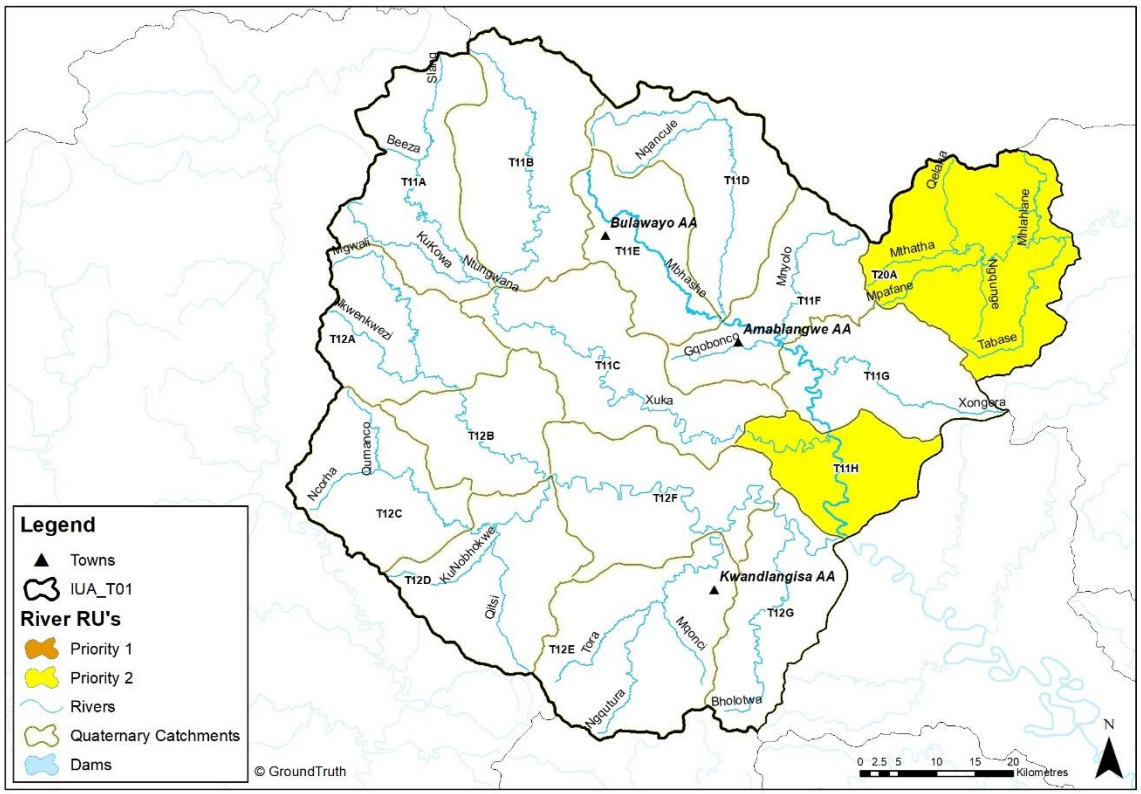
Dams

Level	Quaternary	System	Purpose
1	S60A	Gubu	• Domestic
1	S60B	Wriggleswade	• Transfer of water from Wriggleswade Dam to R20 (Buffalo) catchment for domestic use • Irrigation
1	S70D	Gcuwa	• Domestic • Study being undertaken for dam wall expansion
1	S70C	Xilinxa	• Domestic
1	S70B	Toleni	• Domestic
Rivers *(illustrated in figure above)*			
1	S60B	Kubusi	• High water use (irrigation, transfers) • D/s Wriggleswade Dam (existing Kubusi_EWR5, 2006)
1	S70F	Great Kei	• Outlet of IUA
2	S60A	Kubusi	• FSA (*Pseudobarbus capensis*, EN)
2	S70D	Gcuwa	• High water use (dams, domestic, irrigation) • Study being undertaken for dam wall expansion (therefore future changes to drivers, major implications on the downstream EWR and biotic responses)

Estuaries			
1	S70F	Great Kei	• A large Fluvially dominated Estuary • Fair condition with a noticeable degree of ecological degradation in both the catchment and the estuary. • Heavy siltation noted for this system. • It is noted to have very high flow modification pressures as well as high fishing pressure. • This in combination with its high biodiversity or conservation importance and its selection to satisfy national biodiversity targets provides this estuary's rationale for intermediate assessment.
Groundwater			
2	S60A		• Considerable GW use and dependence • Moderately stressed • GW SWSA • Good to excellent groundwater quality
2	S70A, S70E, S70F		• GW SWSA (S70E, S70F) • Good to excellent groundwater quality
Wetlands			
None			

5.16 IUA_T01: Upper Mbashe, Upper Mthatha

IUA_T01: Upper Mbashe, Upper Mthatha



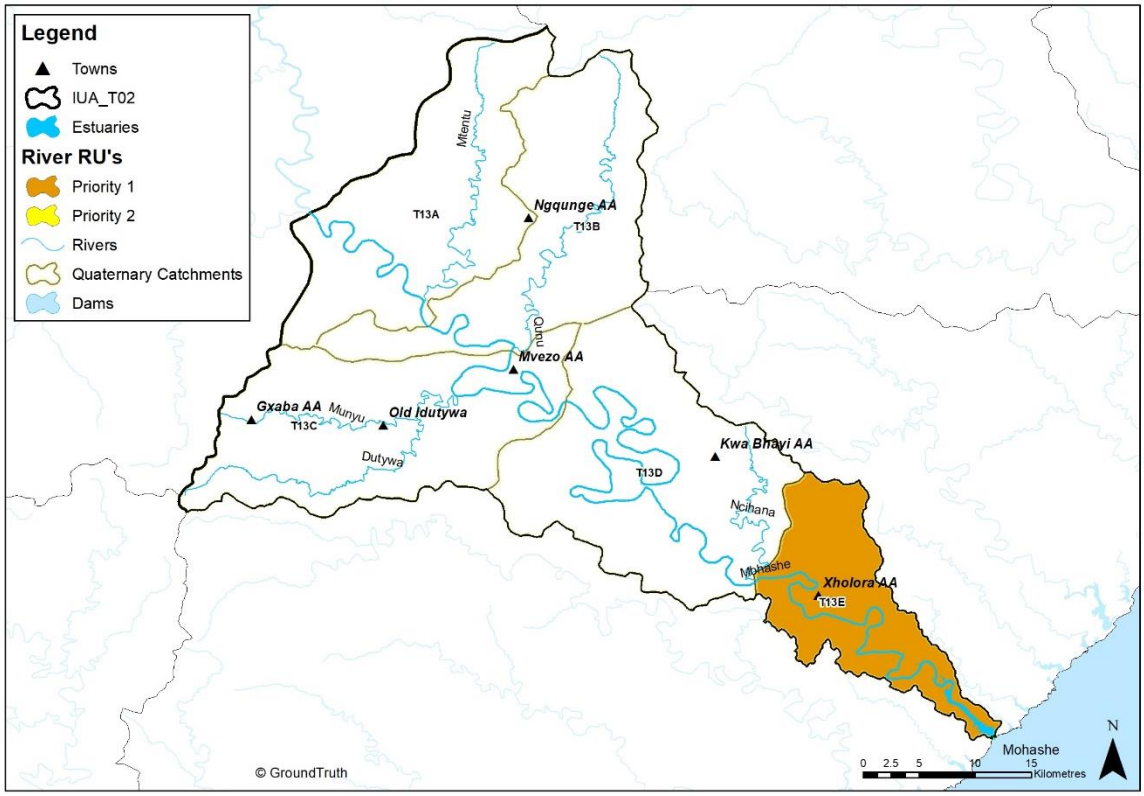
This IUA covers the Upper Mbashe and Mthatha River systems. Much of the catchments are stressed with impacts associated with extensive subsistence agriculture. Many of the systems are degraded, indicating seriously to critically modified ecological conditions, although with a few fish sanctuaries present within FSA and corridors.

RESOURCE UNITS			
Dams			
Level	**Quaternary**	**System**	**Purpose**
1	T20A	Mabeleni	• Forestry
Rivers *(illustrated in figure above)*			
2	T11H	Mbhashe	• Ecological sensitivities • Fish corridor (*Pseudobarbus capensis*, EN) • Sensitive macroinvertebrates • Maputaland-Pondoland Region of plant endemism
2	T20A	Mthatha	• Ecological sensitivities • Sensitive macroinvertebrates • Maputaland-Pondoland Region of plant endemism
Estuaries			
None			
Groundwater			
2	T11A, T11C, T11D, T11E, T11F, T11G, T11H		• Some quats with high water use • GW SWSA • Mildly stressed • Good to excellent groundwater quality

IUA_T01: Upper Mbashe, Upper Mthatha			
2	T12A, T12B, T12C, T12D T12E		• Some quats with high water use • Mildly stressed • Good to excellent groundwater quality
2	T20A		• High water use • GW SWSA • Moderately stressed • Good to excellent groundwater quality
Wetlands			
1	T11A		• One of the largest floodplains in the overall study area, and if taken together with all of the tributary arms connected to the floodplain, it could well be the largest wetland complex in the entire study area. While large portions of the floodplain have been developed, much is still intact and an active floodplain. Also, it supports breeding Crowned Crane and has a high ecosystem services value, both in terms of provisioning services as well as in terms of regulating services, particularly water quality enhancement.

5.17 IUA_T02: Lower Mbashe

IUA_T02: Lower Mbashe



The IUA delineation was based on biophysical characteristics, ecoregion, sensitive land uses namely the Pondoland Coastline, Dwesa-Cwebe Wildlife Reserve, and the important Mbhashe estuarine system. SW SWSA and integrated SW-GW SWSA,

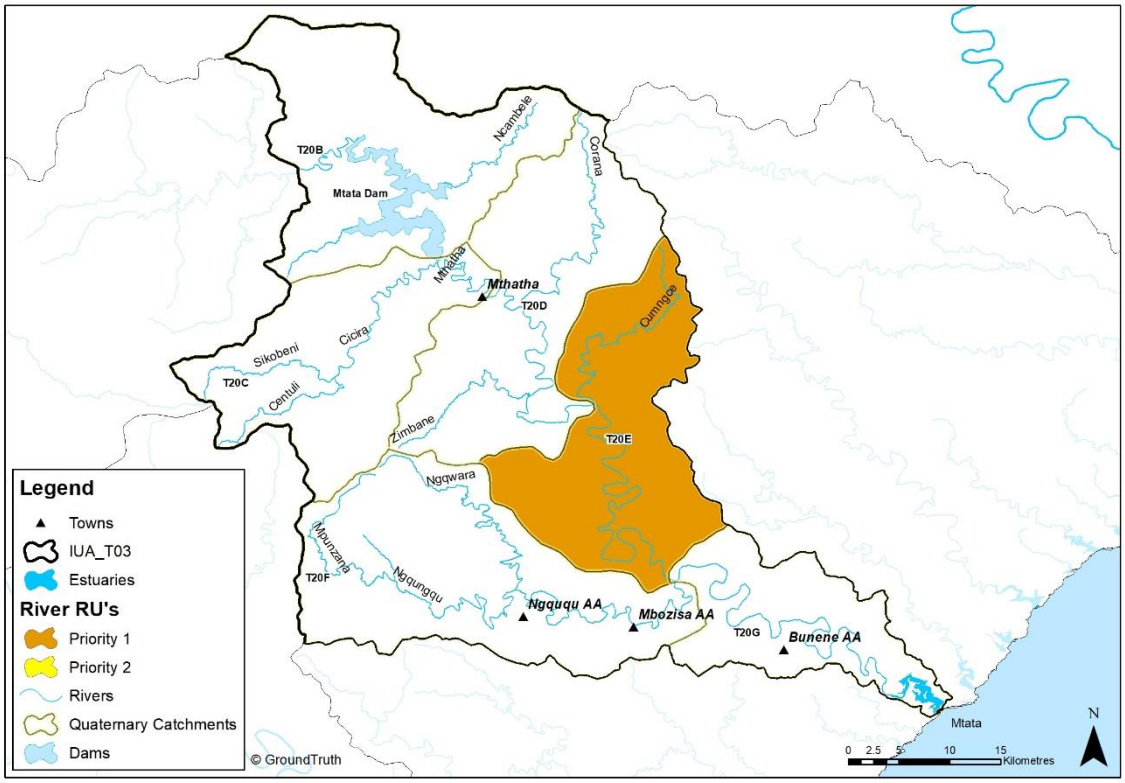
RESOURCE UNITS

Rivers ***(illustrated in figure above)***

Level	Quaternary	System	Purpose
1	T13E	Mbhashe	• Outlet of IUA, linked to estuary • Flows in the Mbashe are supported through releases from the Ncora Dam (that are transferred from the Kei system to the Mbashe catchment). • Colly Wobbles Hydropower Scheme
Estuaries			
2	T13E	Mbashe	• A large Fluvially dominated Estuary • High biodiversity or conservation importance and selected to satisfy national biodiversity targets. • In MPA (Dwesa-Cwebe Marine Protected Area), PA - Dwesa-Cwebe Nature Reserve • Recognised key estuary on the boundary of two biogeographic zones
Groundwater			
2	T13A, T13B, T13D, T13E		• Some quaternaries with high water use (T13B) • Mildly stressed (T13A) • Good to excellent groundwater quality
Wetlands			
None			

5.18 IUA_T03: Lower Mthatha

IUA_T03: Lower Mthatha

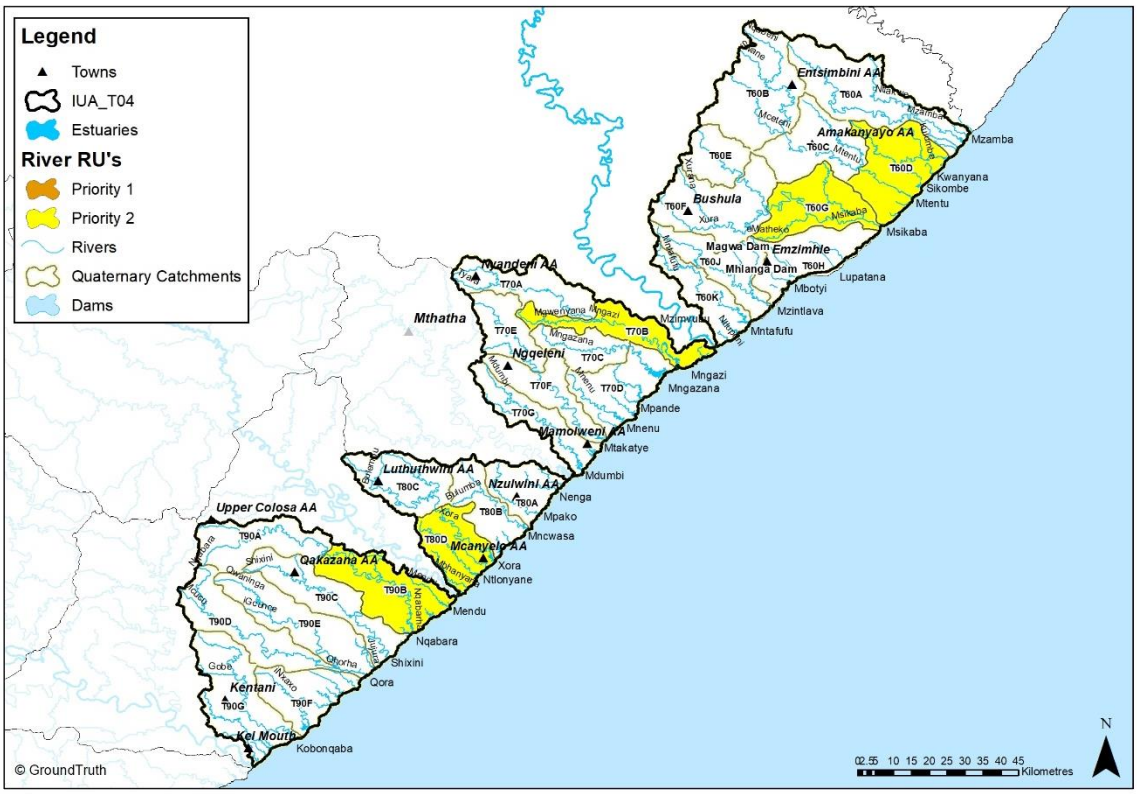


This IUA includes the lower Mthatha River reach from Mthatha Dam to the Mthata Estuary. It is highly stressed in the upper parts of the catchment area with the Mthatha Dam (T20B) and releases for the hydropower scheme. This IUA has been identified as the most developed and stressed in the T drainage region from a quality and quantity perspective. Artificial flows occur during the winter periods, because of the hydropower scheme, having a knock-on effect on all aquatic biota.

RESOURCE UNITS			
Dams			
Level	**Quaternary**	**System**	**Purpose**
1	T20B	Mthatha	• Domestic, industrial • Hydropower releases (1st and 2nd Falls) • High invasive plant encroachment
1	T20D	Corana	• Domestic
Rivers ***(illustrated in figure above)***			
1	T20G	Mthatha	• D/s Mthatha and Corana Dams. • Linked to estuary for outlet of IUA • High water use and quality impacts
Estuaries			
None			
Groundwater			
2	T20B, T20C, T20D, T20E, T20F		• High GW use in certain places • Moderately stressed in upper catchments (T20B, T20C) • GW SWSA (T20B)
Wetlands			
None			

5.19 IUA_T04: Pondaland Coastal

IUA_T04: Pondaland Coastal



This IUA covers the characteristics, ecoregion and sensitive land use (Pondoland marine protected area, Mkambati Nature Reserve). There are various ecological sensitive rivers and estuaries which have been categorized as endangered in this IUA (namely Ntlonyane, Nkanya, Xora, Bulungula and Nmcwasa estuaries (T80D), Mdumbi, Lwandile, Mtakatye, Mnenu, Mtonga, Mpande, Mngazana, Mngazi (T70B, D, F, G), Nkodusweni, Mntafufu, Mzintlava, Mtentu, Mnyameni and Mzamba (T60A, D, J, K). The IUA further includes free-flowing flagship rivers.

RESOURCE UNITS

Dams

Level	Quaternary	System	Purpose
1	T60H	Magwa	• Irrigation
1	T70A	Mhlanga	• Irrigation, domestic
1	T70A	Bulolo	• Domestic
Rivers *(illustrated in figure above)*			
2	T60D	Mtentu	• FEPA • Flagship river • Fish sanctuary • Sensitive macroinvertebrates to water quality and flow • Maputaland-Pondoland Region of plant endemism • SW SWSA
2	T60G	Msikaba	• FEPA • Free flowing river • Fish sanctuary • Sensitive macroinvertebrates to water quality and flow • Maputaland-Pondoland Region of plant endemism

IUA_T04: Pondaland Coastal			
			• SW SWSA
2	T70B	Mngazi	• FEPA • Fish sanctuary • SW SWSA • Possible intermediate – vegetation (Msikaba natural forests – still assessing)
2	T80D	Xora	• FEPA • Free flowing river • Maputaland-Pondoland Region of plant endemism • SW SWSA
2	T90B	Nqabara	• FEPA • Flagship river • Fish sanctuary • Maputaland-Pondoland Region of plant endemism • SW SWSA
Estuaries			
2	T80D	Xora	• A Subtropical Predominantly Open estuary which is considered extremely important and in need of further study (rapid)
Groundwater			
2	T60A-T60K		• GW use • GW SWSA in certain catchments • Excellent groundwater quality
2	T70A-T70G (excl. T70D)		• Rudimentary supply in villages, strategic importance • GW SWSA in certain catchments • Excellent groundwater quality
2	T80A, T80B, T80C, T80D		• Rudimentary supply in villages, strategic importance • Excellent groundwater quality
2	T90A, T90B, T90C, T90D, T90F, T90G		• Rudimentary supply in villages, strategic importance • GW SWSA in certain catchments • Excellent groundwater quality
Wetlands			
2	T60B	Kusiwisa halt	• Extensive, albeit mainly narrow, wetlands; predominantly valley bottom; moderately impacted.
1	T60D	Mkambathi to Xolobeni	• A very high diversity of wetland types located in an important centre of endemism, resulting in a very high biodiversity value. The wetlands are also important for provisioning services, including water supply.

6. SUMMARY OF PRIORITY RESOURCE UNITS

The priority 1 and 2 RUs identified for rivers, wetlands and estuaries and priority 1 groundwater areas are provided per water resource component and IUA in the following tables. See also the maps in Appendix B indicating the priority RUs per water resource component.

Table 6-1: Identified priority 1 Resource Units for rivers in the study area (proposed intermediate sites)

IUA	IUA Description	RU No.	River	Quaternary catchment
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	R_RU01_I	Krom	K90A, B
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	R_RU02_I	Gamtoos	L90A, B
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	No priority 1 (intermediate sites) selected		
IUA_M01	M primary catchment	R_RU03_I	KwaZungu/ Swartkops	M10A
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	No priority 1 (intermediate sites) selected		
IUA_N01	Sundays downstream Darlington Dam	R_RU04_I	Sundays	N40F
IUA_P01	P primary catchment	R_RU05_I	Kariega	P30B
IUA_Q01	Upper Fish	No priority 1 (intermediate sites) selected		
IUA_Q02	Great Fish	R_RU06_I	Great Fish	Q93A
		R_RU07_I	Great Fish	Q50B
IUA_Q03	Koonap and Kat	R_RU08_I	Kat (d/s dam)	Q94B
IUA_R01	Keiskamma	R_RU09_I	Keiskamma	R10E
IUA_R02	Buffalo/ Nahoon	R_RU10_I	Buffalo	R10E
IUA_S01	Upper Great Kei	R_RU011_I	Tsomo	S50G
IUA_S02	Black Kei	No priority 1 (intermediate sites) selected		
IUA_S03	Lower Great Kei	R_RU012_I	Kubusi	S60B
		R_RU013_I	Great Kei	S70F
IUA_T01	Upper Mbashe, Upper Mthatha	No priority 1 (intermediate sites) selected		
IUA_T02	Lower Mbashe	R_RU014_I	Mbhashe	T13E
IUA_T03	Lower Mthatha	R_RU015_I	Mthatha	T20E
IUA_T04	Pondoland coastal	No priority 1 (intermediate sites) selected		

Table 6-2: Identified priority 2 Resource Units for rivers in the study area (proposed rapid 3 sites)

IUA	IUA Description	RU No.	River	Quaternary catchment(s)
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	R_RU01_R	Groot	K80D
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	R_RU02_R	Krom	K90D
		R_RU03_R	Kabeljous	K90G
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	R_RU04_R	Baviaanskloof	L81D
		R_RU05_R	Kouga	L82G
IUA_M01	M primary catchment	R_RU06_R	Elands	M10B
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	R_RU07_R	Kariega	L23D
		R_RU08_R	Groot	L50B
		R_RU09_R	Sondags	N21D
IUA_N01	Sundays downstream Darlington Dam	No priority 2 (rapid 3 sites) selected		
IUA_P01	P primary catchment	R_RU10_R	Boesmans	P10G
IUA_Q01	Upper Fish	R_RU11_R	Pauls	Q30B
		R_RU12_R	Great Fish	Q21B
		R_RU13_R	Little Fish	Q80C
IUA_Q02	Great Fish	R_RU14_R	Tarka	Q44C
IUA_Q03	Koonap and Kat	R_RU15_R	Kat	Q94F
		R_RU16_R	Koonap	Q92G
IUA_R01	Keiskamma	R_RU17_R	Tyume	R10G
		R_RU18_R	Keiskamma	R10L
IUA_R02	Buffalo/ Nahoon	R_RU19_R	Buffalo	R20A
		R_RU20_R	Buffalo	R20G
		R_RU21_R	Nahoon	R30F

IUA	IUA Description	RU No.	River	Quaternary catchment(s)
IUA_S01	Upper Great Kei	R_RU20_R	White Kei	S10J
		R_RU21_R	Indwe	S20D
IUA_S02	Black Kei	R_RU22_R	Klaas Smits	S31G
		R_RU23_R	Klipplaat	S32G
		R_RU24_R	Black Kei	S32M
IUA_S03	Lower Great Kei	R_RU25_R	Kubusi	S60A
		R_RU26_R	Gcuwa	S70D
IUA_T01	Upper Mbashe, Upper Mthatha	R_RU27_R	Mbhashe	T11H
		R_RU28_R	Mthatha	T20A
IUA_T02	Lower Mbashe	No priority 2 (rapid 3 sites) selected		
IUA_T03	Lower Mthatha	No priority 2 (rapid 3 sites) selected		
IUA_T04	Pondoland coastal	R_RU29_R	Mtentu	T60D
		R_RU30_R	Mzintlava	T60J
		R_RU31_R	Mngazi	T70B
		R_RU32_R	Xora	T80D
		R_RU33_R	Nqabara	T90B

Table 6-3: Identified priority 1 Resource Units for wetlands in the study area

IUA	IUA Description	RU No.	Quaternary catchment(s)
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	W_RU01	K80A
		W_RU02	K90A
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	No priority 1 wetlands	
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	No priority 1 wetlands	
IUA_M01	M primary catchment	W_RU03	M10D

IUA	IUA Description	RU No.	Quaternary catchment(s)
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	No priority 1 wetlands	
IUA_N01	Sundays downstream Darlington Dam	No priority 1 wetlands	
IUA_P01	P primary catchment	No priority 1 wetlands	
IUA_Q01	Upper Fish	No priority 1 wetlands	
IUA_Q02	Great Fish	No priority 1 wetlands	
IUA_Q03	Koonap and Kat	No priority 1 wetlands	
IUA_R01	Keiskamma	No priority 1 wetlands	
IUA_R02	Buffalo/ Nahoon	W_RU4	R20D
IUA_S01	Upper Great Kei	No priority 1 wetlands	
IUA_S02	Black Kei	W_RU5	S32D
IUA_S03	Lower Great Kei	No priority 1 wetlands	
IUA_T01	Upper Mbashe, Upper Mthatha	W_RU6	T11A
IUA_T02	Lower Mbashe	No priority 1 wetlands	
IUA_T03	Lower Mthatha	No priority 1 wetlands	
IUA_T04	Pondoland coastal	W_RU7	T60D

Table 6-4: Identified priority 2 Resource Units for wetlands in the study area

IUA	IUA Description	RU No.	Quaternary catchment(s)
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	No priority 2 wetlands	
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	No priority 2 wetlands	
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	No priority 2 wetlands	
IUA_M01	M primary catchment	W_RU08	M10B
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	W_RU09	L21D

IUA	IUA Description	RU No.	Quaternary catchment(s)
IUA_N01	Sundays downstream Darlington Dam	No priority 2 wetlands	
IUA_P01	P primary catchment	No priority 2 wetlands	
IUA_Q01	Upper Fish	W_RU10	Q22A
		W_RU11	Q80A
IUA_Q02	Great Fish	W_RU12	Q43A, Q43B
IUA_Q03	Koonap and Kat	No priority 2 wetlands	
IUA_R01	Keiskamma	No priority 2 wetlands	
IUA_R02	Buffalo/ Nahoon	W_RU13	R20E
IUA_S01	Upper Great Kei	W_RU14	S50C
		W_RU15	S50E, S50F
IUA_S02	Black Kei	No priority 2 wetlands	
IUA_S03	Lower Great Kei	No priority 2 wetlands	
IUA_T01	Upper Mbashe, Upper Mthatha	No priority 2 wetlands	
IUA_T02	Lower Mbashe	No priority 2 wetlands	
IUA_T03	Lower Mthatha	No priority 2 wetlands	
IUA_T04	Pondoland coastal	W_RU16	T60B

Table 6-5: Identified priority 1 and 2 Resource Units for estuaries in the study area

IUA	IUA description	RU No.	Estuary	Quaternary catchment	Priority level
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	E_RU01	Groot	K80D	2
		E_RU02	Elands	K80C	2
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	E_RU03	Kromme	K90E	2
		E_RU04	Gamtoos	L90C	1
		E_RU05	Kabeljous	K90G	2

IUA	IUA description	RU No.	Estuary	Quaternary catchment	Priority level
IUA_M01	M primary catchment	E_RU06	Swartkops	M10D	2
		E_RU07	Papkuilsrivier	M20A	2
IUA_N01	Sundays downstream Darlington Dam	E_RU08	Sundays	N40F	1
IUA_P01	P primary catchment	E_RU09	Kariega	P30C	2
IUA_R01	Keiskamma	E_RU10	Keiskamma	R10M	2
		E_RU11	Gxulu	R40A	2
IUA_S03	Lower Great Kei	E_RU12	Groot Kei	S70F	1
IUA_T02	Lower Mbashe	E_RU13	Mbashe	T13E	2
IUA_T04	Pondoland coastal	E_RU14	Xora	T80D	2

Table 6-6: Identified priority 1 and 2 groundwater Resource Units in the study area

IUA	IUA description	RU No.	Quaternary catchment(s)	Priority level
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	GW_RU01	K80A, K80B, K80C, K80D, K80E, K80F	2
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	GW_RU02	K90F, K90G	2
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	GW_RU03	L82B, L82D	2
IUA_M01	M primary catchment	GW_RU04	M10A, M10B	2
		GW_RU05	M10C, M10D	1
		GW_RU06	M20A, M20B. M30A	2
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	GW_RU07	L11E, L11F	2
		GW_RU08	L12B, L12C, L12D	2
		GW_RU09	L23C	2
		GW_RU10	L30A, L30C, L30D	2

IUA	IUA description	RU No.	Quaternary catchment(s)	Priority level
IUA_N01	Sundays downstream Darlington Dam	GW_RU11	N11A, N11B	2
		GW_RU12	N12A, N12B, N12C	2
		GW_RU13	N13A, N13B, N13C	2
		GW_RU14	N14A, N14B, N14C	2
		GW_RU15	N21B, N21C	2
		GW_RU16	N24C	2
		GW_RU17	N30A, N30B	2
IUA_P01	P primary catchment	No priority 1 or 2 groundwater areas		
IUA_Q01	Upper Fish	GW_RU18	P20A	2
		GW_RU19	Q11C	2
		GW_RU20	Q14A, Q14B, Q14C, Q14D	1
		GW_RU21	Q14E	2
		GW_RU22	Q30A, Q30B	2
IUA_Q02	Great Fish	GW_RU23	Q13A, Q13C	2
		GW_RU24	Q30C	2
		GW_RU25	Q41A, Q41B, Q41C	2
		GW_RU26	Q50A	2
		GW_RU27	Q80D	2
IUA_Q03	Koonap and Kat	GW_RU28	Q92A	2
		GW_RU29	Q94A, Q94B, Q94C	2
IUA_R01	Keiskamma	GW_RU30	R10A, R10B	2
		GW_RU31	R40A, R40C	2
IUA_R02	Buffalo/ Nahoon	GW_RU32	R20A, R20B, R20C	2
		GW_RU33	R30A, R30B, R30D	2
IUA_S01	Upper Great Kei	GW_RU34	S10H	2

IUA	IUA description	RU No.	Quaternary catchment(s)	Priority level
		GW_RU35	S20C, S20D	2
		GW_RU36	S50D, S50E, S50F, S50G, S50H	2
IUA_S02	Black Kei	GW_RU37	S31A, S31B, S31E	2
IUA_S03	Lower Great Kei	GW_RU38	S60A	2
		GW_RU39	S70A, S70E, S70F	2
IUA_T01	Upper Mbashe, Upper Mthatha	GW_RU40	T11A, T11C, T11D, T11E, T11F, T11G, T11H	2
		GW_RU41	T12A, T12B, T12C, T12D T12E	2
		GW_RU42	T20A	2
IUA_T02	Lower Mbashe	GW_RU43	T13A, T13B, T13C, T13D, T13E	2
IUA_T03	Lower Mthatha	GW_RU44	T20A, T20B, T20C, T20D, T20E, T20F, T20G	2
IUA_T04	Pondoland coastal	GW_RU45	T60A-T60K	2
		GW_RU46	T70A-T70G	2
		GW_RU47	T80A, T80B, T80C, T80D	2
		GW_RU48	T90A, T90D, T90G	2

7. CONCLUSIONS

This report forms part of step 1 of the integrated framework as developed by the DWS (DWS, 2017). The purpose of this report is to document the data, information, approaches followed and the results of the identification of stressed areas (hotspots), delineation and prioritisation of RUs, selection of biophysical and/ or hydronodes within each of the 19 selected IUAs. Ecological, socio-cultural and water resource use (quantity and quality) was considered for the identification of the RUs. These results will assist in the determination of the Water Resource Classes, Reserve requirements and the setting of the associated RQOs. The EWRs will be determined for these priority river, estuarine and groundwater Resource Units and ecological specifications provided for the priority wetlands on various level of detail (e.g. intermediate, rapid or desktop level for rivers). Integration between the various components, where applicable, will be assessed and the linkages between the components will be defined.

Based on (i) the assessment of information and data available, (ii) the status quo or current developments and impacts per IUA and (iii) any proposed new developments that will impact on the water resources, three levels of priority were identified for each component, namely:

- Priority 1, where rivers and estuaries will be assessed on an intermediate level and detailed considerations for wetlands and groundwater. RQOs will also be determined for the selected sub-components;
- Priority 2, with rapid assessments for rivers and estuaries and less detailed studies for the wetlands and groundwater (desktop with limited field verifications). Some of these will also be used as hydro and/ or biophisical nodes at the outlets of RUs or IUAs or where specific protection considerations are required; and
- Priority 3, desktop assessments using existing information and data for all the components.

Overall, the following preliminary priority 1 and 2 RUs for rivers, wetlands, estuaries, and groundwater were identified (Table 7-1). These will be refined and finalised following consultation with the DWS and key stakeholders during the first Project Steering Committee (PSC) meeting.

Table 7-1: Summary of priority sites identified

Component	Priority 1	Priority 2
Rivers	15	33
Wetlands	7	9
Estuaries	3	11
Groundwater	2	46

8. REFERENCES

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9. APPENDICES

Appendix A: Figures for the study area

Appendix B: Priority 1 and 2 RUs per water resource component

Appendix A: Study area

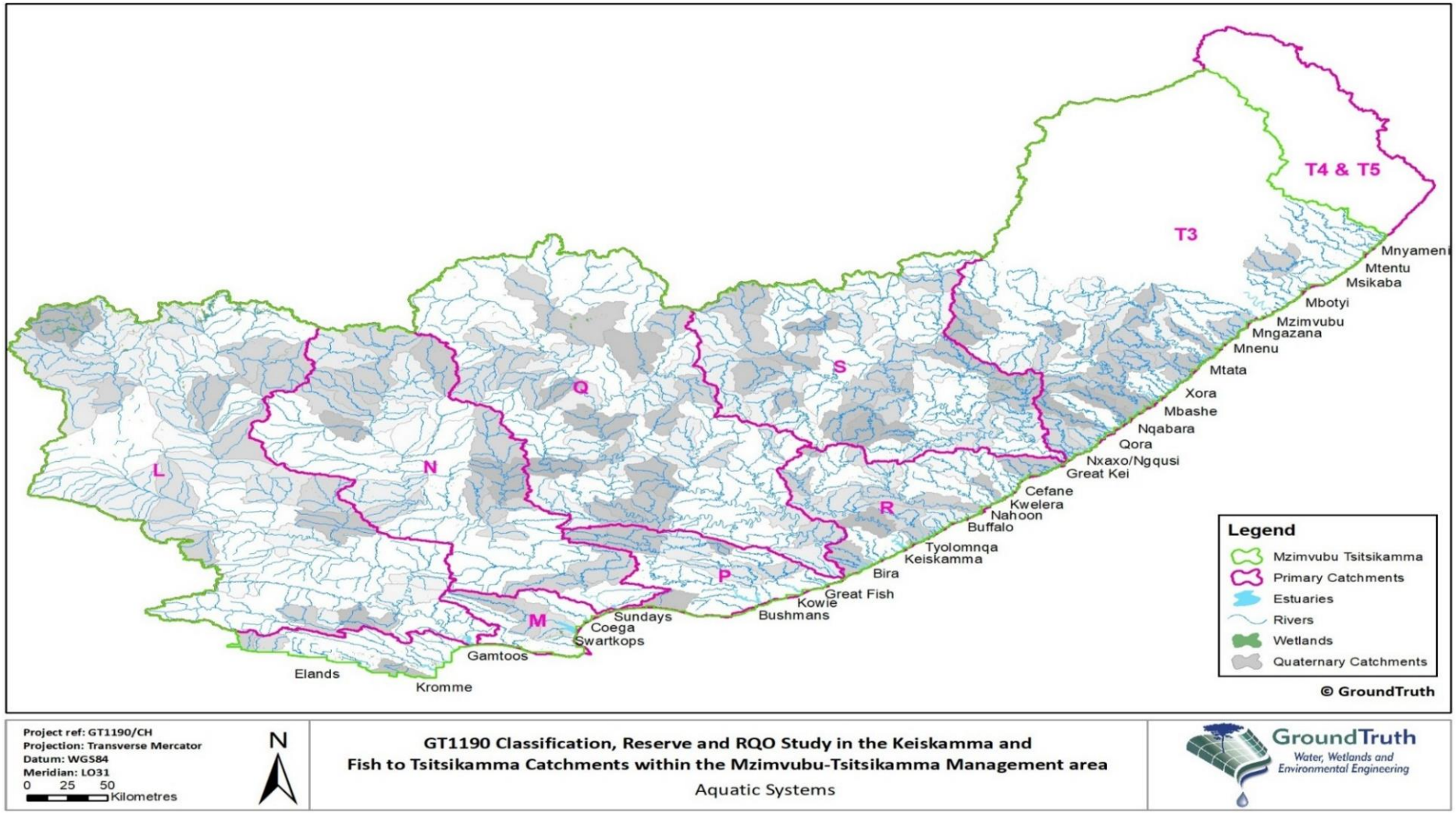

Figure 9-1: Study area of the Keiskamma, Fish to Tsitsikamma

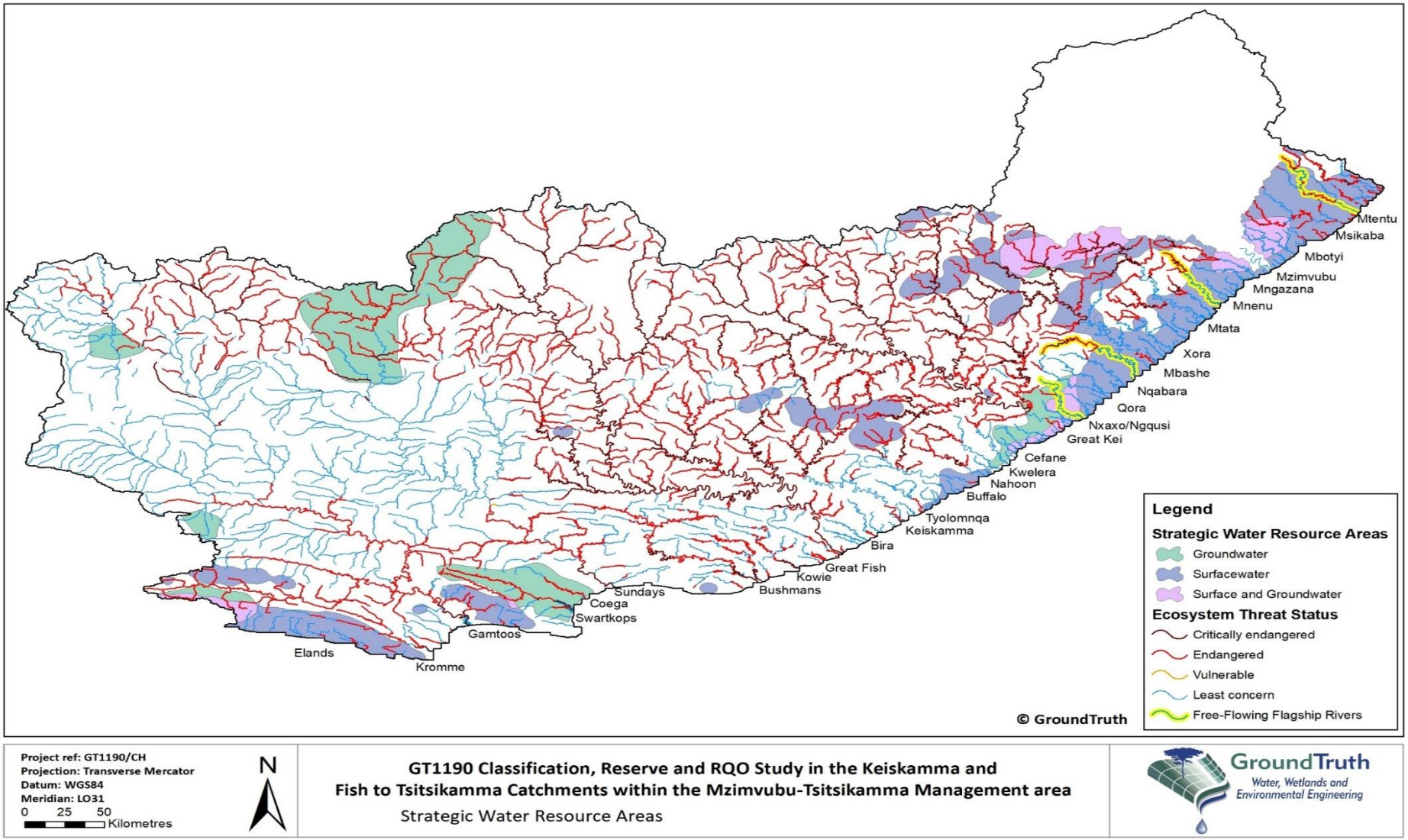

Figure 9-2: Strategic Water Source Areas (Lötter & Maitre, 2021)

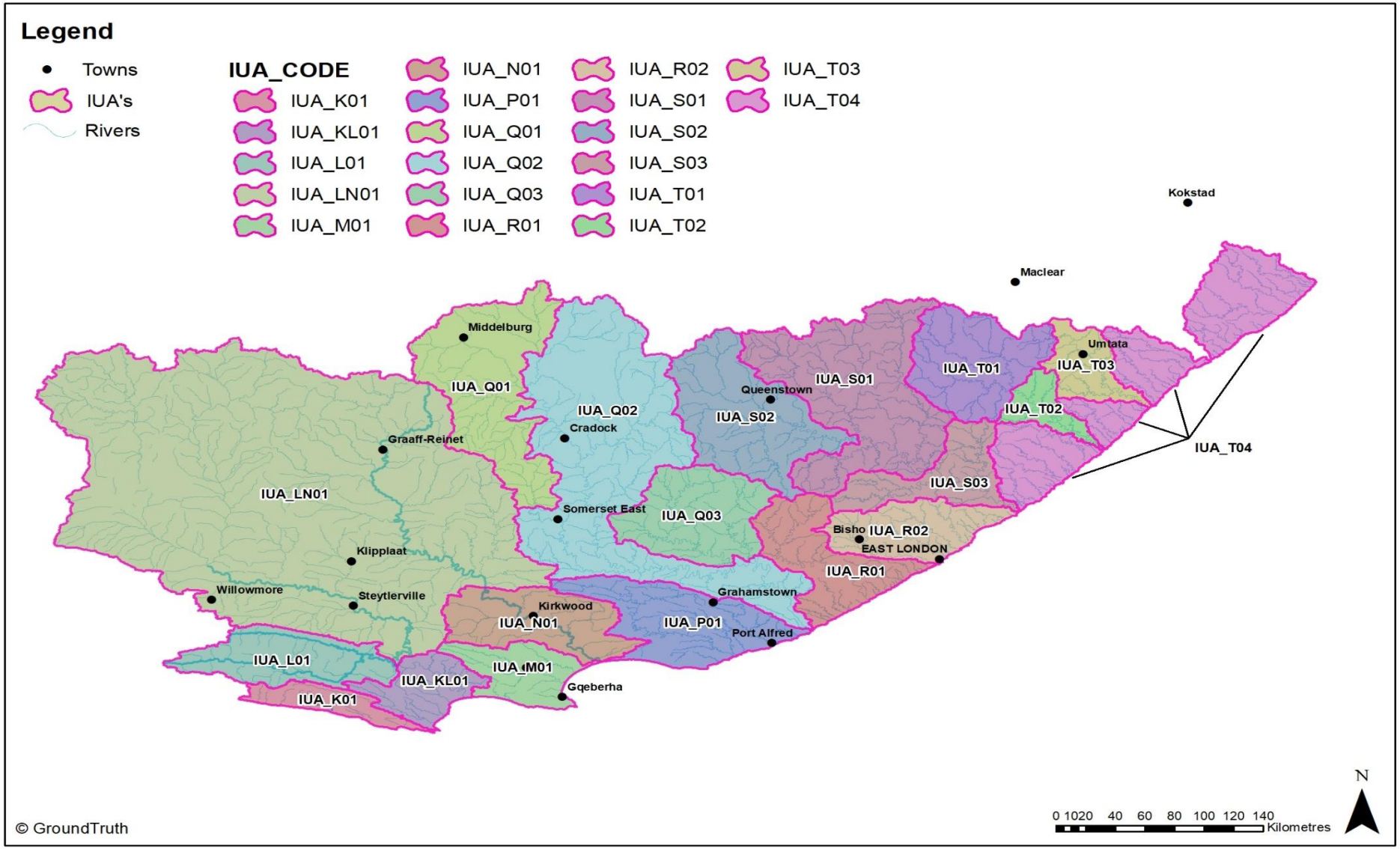

Figure 9-3: Integrated Units of Analysis

Appendix B Priority 1 and 2 RUs per water resource component

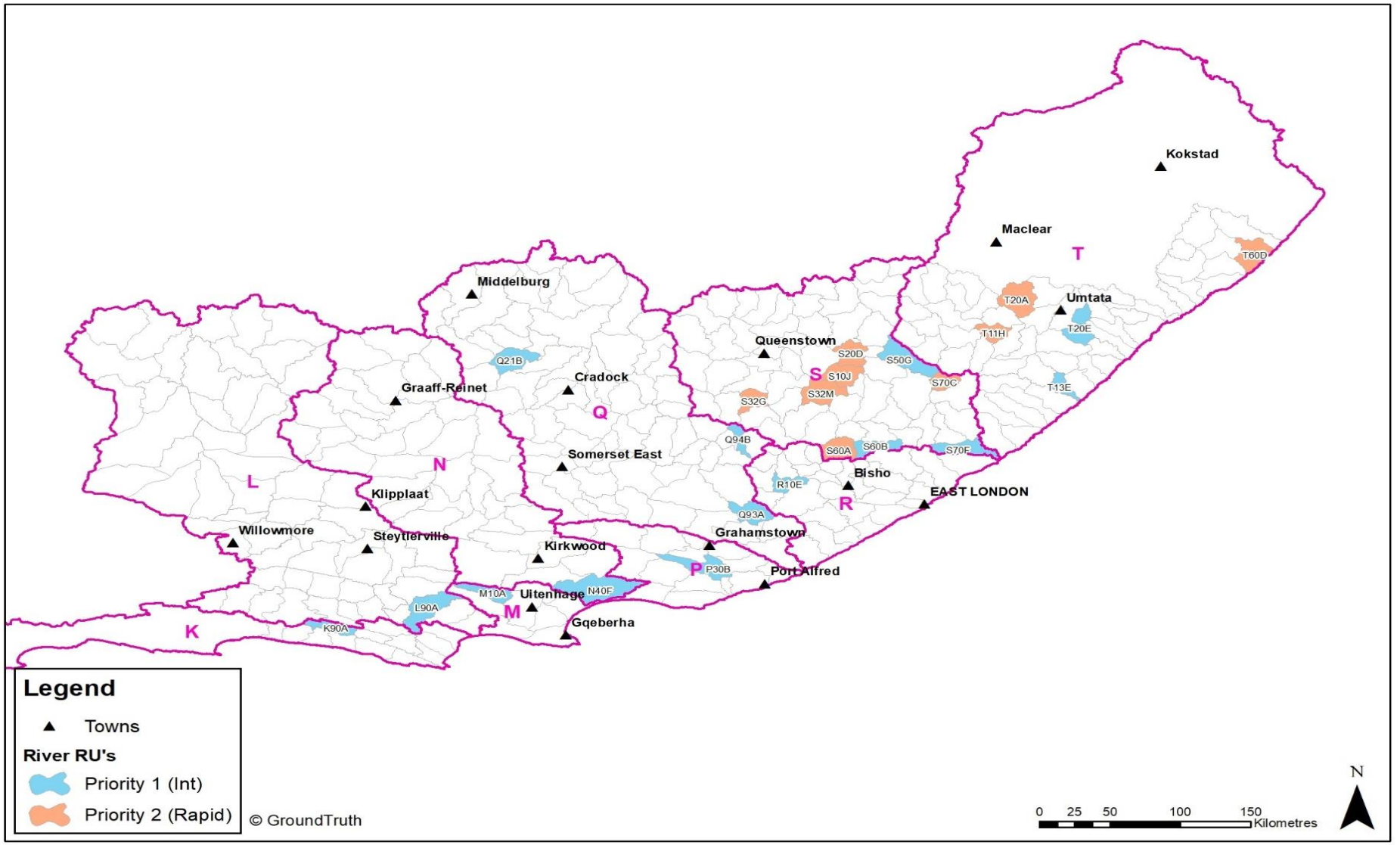

Figure 9-4: Priority 1 and 2 RUs for rivers in the study area

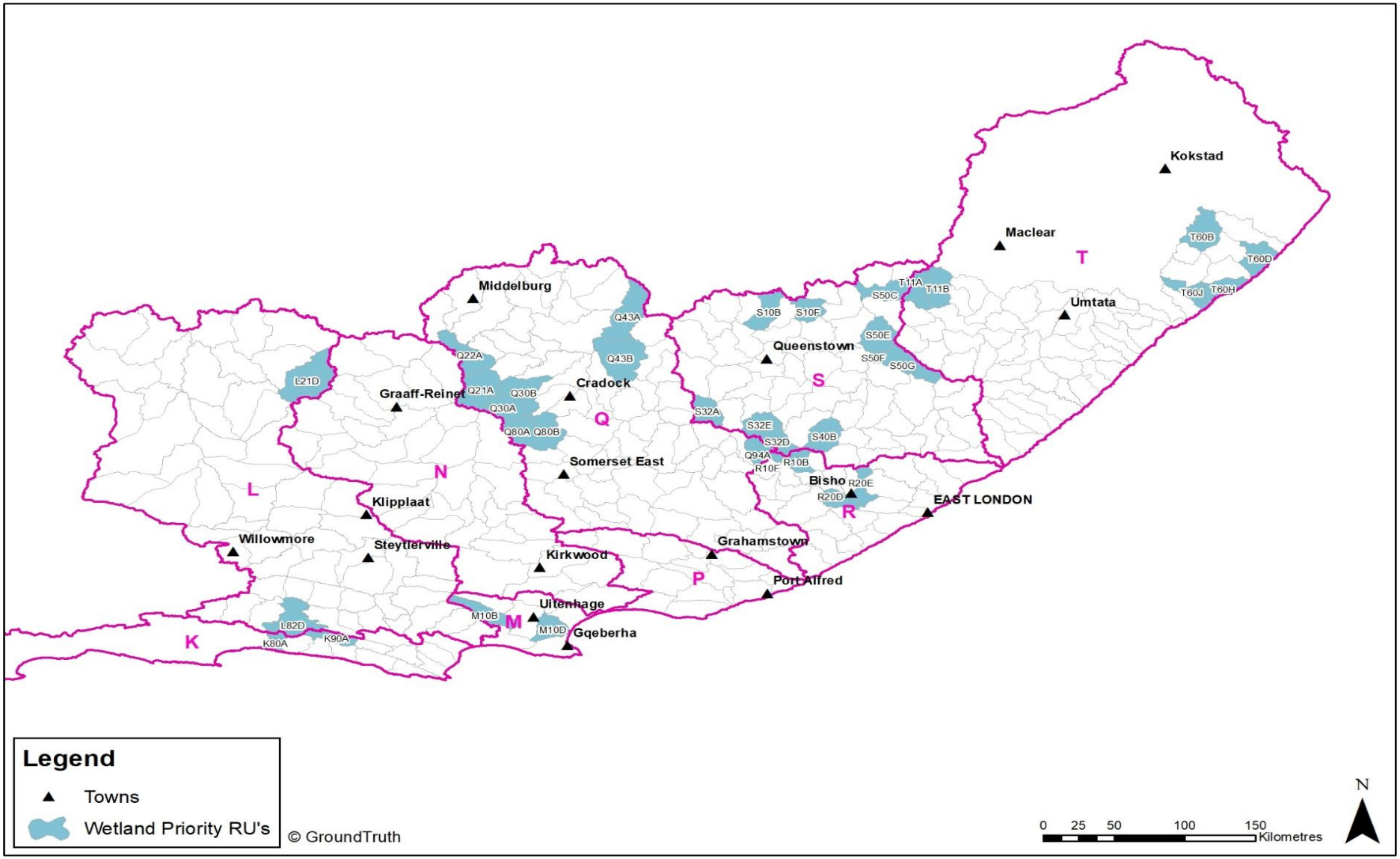

Figure 9-5: Priority 1 and 2 wetland RUs in the study area

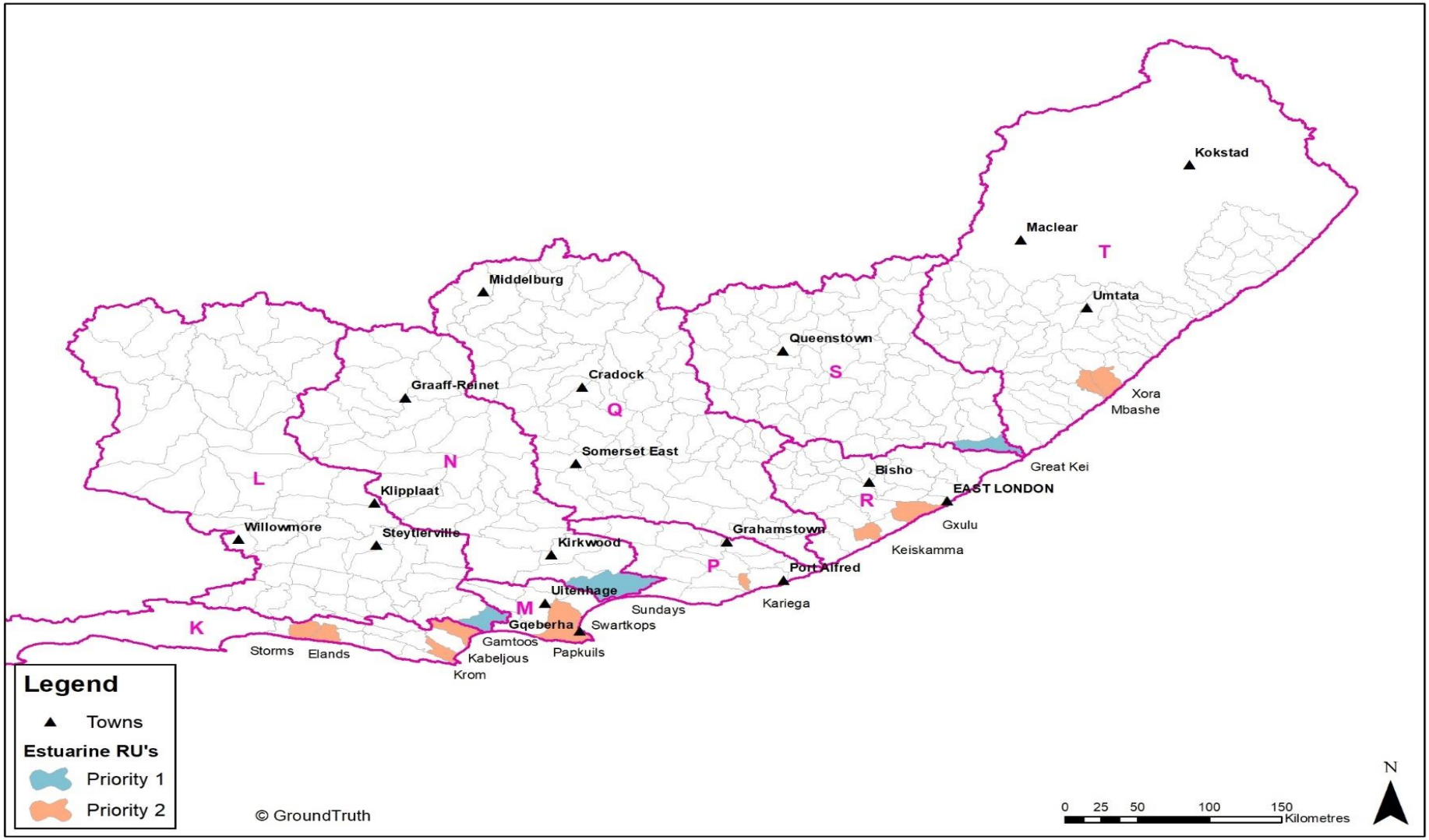

Figure 9-6: Priority 1 and 2 estuaries in the study area

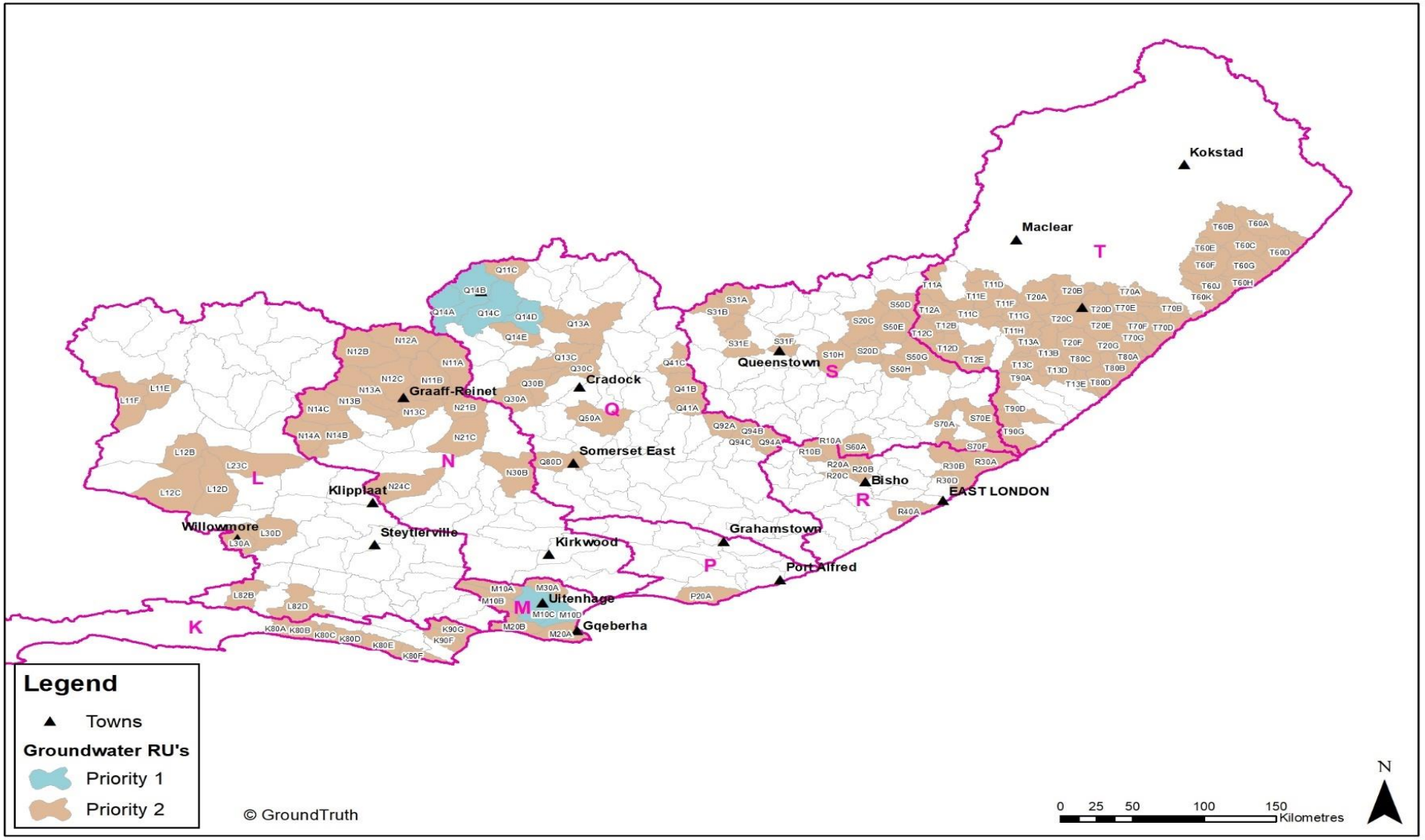

Figure 9-7: Priority 1 and 2 groundwater RUs in the study area