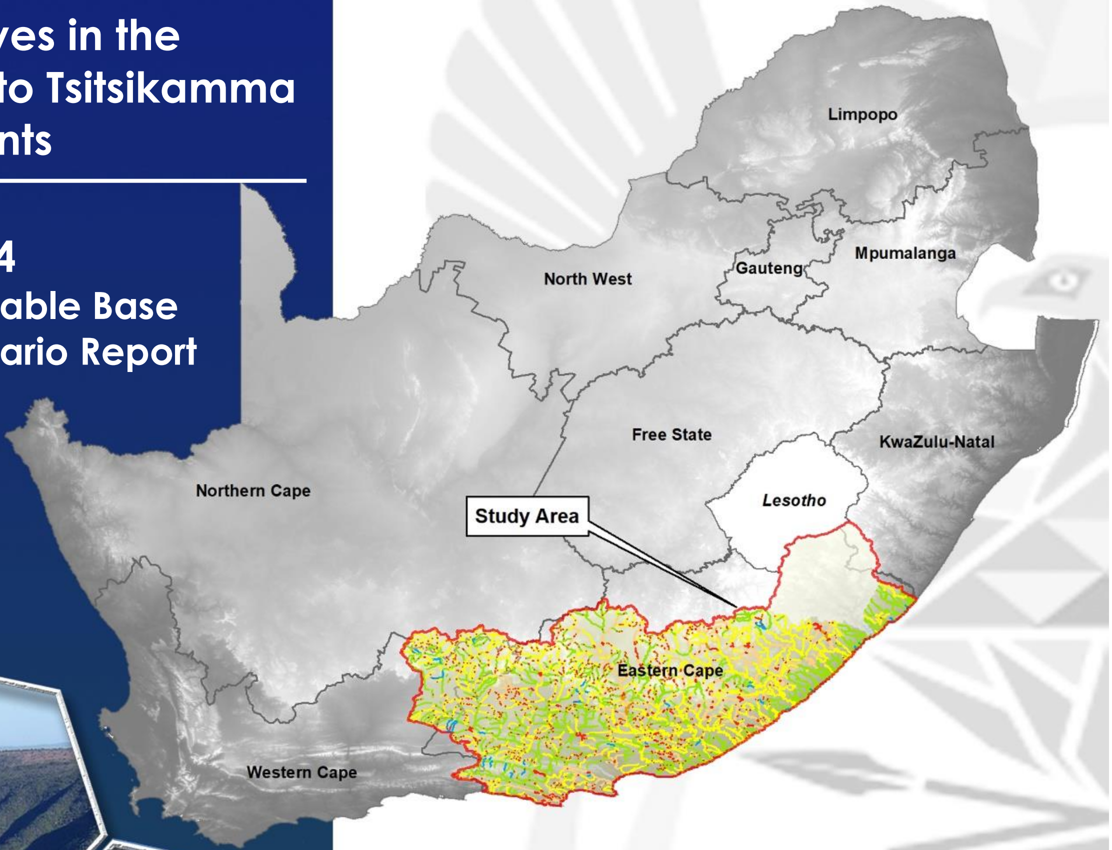
DEPARTMENT OF WATER AND SANITATION

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

WP11354
Ecological Sustainable Base Configuration Scenario Report



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Private Bag X313
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Tel: (012) 336 7500/ +27 12 336 7500
Fax: (012) 336 6731/ +27 12 336 6731

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GroundTruth

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Dr Mark Graham *Date*

Director, GroundTruth

Supported by:

……………………………………………………………… ………………………………………………………………

Project Manager *Scientific Manager*

Approved for the Department of Water and Sanitation by:

………………………………………………………………………..

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DOCUMENT INDEX

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Bold type indicates this report

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LIST OF ACRONYMS

BHN	Basic Human Needs
CD: WEM	Chief Directorate: Water Ecosystems Management
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ESBC	Ecological Base Configuration Scenario
EC	Ecological category
ESBC	Ecological Sustainable Base Configuration
EWR	Ecological Water Requirements
IUA	Integrated Units of Analysis
NWA	National Water Act
PES	Present Ecological State
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RoS	Reliability of Supply
RU	Resource Units
RQO	Resource Quality Objectives
WAAS	Water Availability Assessment Study
WMA	Water Management Area
WR2012	Water Resources 2012
WRCS	Water Resources Classification System
WRYM	Water Resource Yield Models

EXECUTIVE SUMMARY

Background and Purpose

The Ecological Sustainable Base Configuration (ESBC) Scenario Report documents the results of the ESBC assessment for the Keiskamma, Fish to Tsitsikamma study area, as part of Step 4 in the Water Resource Classification System (WRCS) process, aligning with the Department of Water and Sanitation (DWS) framework (DWS, 2017).

The goal of Step 4 is to determine the ESBC scenario and establish initial catchment configuration scenarios, which define the base ecological condition and the Ecological Water Requirements (EWRs) necessary to maintain it. A hydrological model is used to ensure the EWRs can be met for all sites. Key activities in Step 4 include:

- Determining an ESBC scenario that meets water quantity, quality, and ecological needs;
- Reviewing planning or reconciliation scenarios; and
- Establishing alternative catchment configuration starter scenarios.

The results from this study will guide the Department of Water and Sanitation (DWS) to meet the objectives of maintaining, and if attainable, improving the ecological state of the water resources to facilitate sustainable use of the water resources while maintaining ecological integrity. The primary deliverable will be the preparation of the templates with the final Water Resource Classes and RQOs for gazetting.

Study Area

The study area consists of the water resources of the Keiskamma, Fish to Tsitsikamma catchments and include large drainage areas as well as some smaller coastal systems, including:

- Mbhashe 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),
- Gamtoos River (drainage region L
- Mthatha River (drainage region T20),
- Small coastal rivers in the Pondoland area (drainage regions T60 to T90),
- Keiskamma, Buffalo, Nahoon and Gqunube Rivers (drainage region R),
- Kowie, Kariega and Bushmans Rivers (drainage region P),
- Koega and Swartkops Rivers (drainage region M),
- Krom and Seekoei Rivers (drainage region K90), and
- Tsitsikamma and small coastal rivers in drainage region K80.

Priority Resource Units (RUs) have been identified through an approach that considers both the water use, water quality impacts as well as ecological integrity and protection requirements for the rivers and estuaries. See Resource Units prioritisation report (WEM/WMA7/00/CON/RDM/0422) for more detail on the approach and the final RU priorities.

Three levels of **river priority RUs** were identified with associated level of detail required for the EWR assessment.

These priorities were:

- (i) priority 1 – intermediate level (at least 1 survey during high and low flow conditions);
- (ii) priority 2 – rapid level 3 (surveys during low flow conditions); and
- (iii) priority 3 – field verification or desktop level (on site, and extrapolation from high confidence sites and expert opinion).

Priority estuaries were identified as Intermediate, Rapid or Desktop estuaries depending on their sensitivities and availability of data.

Approach to the Ecological Base Configuration Scenario

The approach includes:

- Assessing the Present Ecological State (PES) to gauge ecological impacts.
- Establishing the ESBC scenario based on the identified Recommended Ecological Category (REC) for both rivers and estuaries;
- Considering current water use in the area; and
- Describing alternative scenarios for future assessments in Step 5.

Summary of ESBC scenario results

All EWR sites per IUA will be used during the yield modelling to evaluate the implementation of the Reserve and the resulting water balance for the Keiskamma, Fish to Tsitsikamma catchment areas. The REC to be used for modelling purposes per IUA is provided in **Table 1** below.

The hydrological modelling for the study used data and WRSM2000 models from the Water Resources of South Africa (WR2012) as a foundation. These models, covering hydrological years from 1920 to 2009, were updated and converted into Water Resource Yield Models (WRYM) where relevant. The models were created for individual river systems and combined where necessary.

For the Algoa (Nelson Mandela Bay) and Amathole (Buffalo City) systems, the modelling approach differed. The Algoa model combined WR2012's WRSM2000 models (Groot, Swartkops, and Coastal Catchments) with new models from the Water Availability Assessment Study (WAAS), while the Amathole model was developed as part of the Buffalo City Reconciliation Strategy.

Regarding the ESBC scenarios, two scenarios were considered:

- Scenario 1: Present-day water flows and supply without Environmental Water Requirements (EWR) (EWR OFF); and
- Scenario 1a: Present-day water flows and supply with EWR for rivers and estuaries (EWR ON).

Table 1 further summaries per IUA where the Reliability of Supply (RoS) for the EWR, are met or not. Cells highlighted in red (0 – 40% achievement of the ecological water requirements), orange (40% - 70% achievement of the ecological water requirements and green (70% - 100% achievement of the ecological water requirements). Although all the IUAs will be assessed during the trade-off assessment in the next phase of the study, this will aid the team to specifically focus on those IUAs where EWRs could not be met (0 – 40% and 40% - 70%) to determine the ecological consequences.

The sites of concern which are not meeting the EWR as a %nMAR for the given REC with the EWR turned off include the Black Kei, Kubusi (Lower), Keiskamma (Upper and Lower), Tyume, the Lower Buffalo, Tarka, Koonap, Kat (Lower), Kat (Upper), Gamtoos and Groot River. When the EWR is turned on, sites Tarka River is of major concern, with several other sites highlighted in orange where they only meet between 40 and 70% of the total EWR as a %nMAR for the REC.

Table 1: A summary of the rivers and estuaries REC per EWR site per IUA, along with a summary of where the Ecological Water Requirements are not met (red and orange highlights)

IUA	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)	Scenarios*		Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)
							EWR OFF	EWR ON					
	RIVERS								ESTUARIES				
IUA_T01	MBHA02_R	Mbhashe (Upper)	T11H	B/C	22.05	373.4	99%	99%	-				
	MTHA02_D	Mthatha (Upper)	T20A	C	21.49	122.5	92%	100%					
IUA_T02	MBAS01_I	Mbhashe (Middle)	T13C	C/D	38.02	673.8	100%	100%	Mbashe	T13E	B	108.5[1]	786.9
IUA_T03	MTHA01_I	Mthatha (Lower)	T20G	B/C	37.81	389.2	84%	100%					
IUA_T04	MNGA01_R	Mngazi	T70B	B/C	25.94	78.2	96%	100%%	Xora	T80D	B	77.3 + 5%	52.4
	NQAB01_R	Nqabarha	T90A	C	34.51	9.8	77%	*n/a*	Msikaba	T60G	A	93.8	212.4
	MTEN01_R	Mtentu	T60C	B/C	44.33	89.6	94%	*n/a*	Mngazi	T70B	B	95	87.3
	XORA01_D	Xora	T80D	B	30.53	83.0	67%	*n/a*					
IUA_S01	TSOM01_I	Tsomo	S50G	C/D	37.48	196.7	15%	72%	-				
	INDW01_R	Indwe	S20D	C/D	24.69	61.9	78%	100%					
	WKEI01_R	White Kei	S10J	C	26.16	155.7	57%	100%					
IUA_S02	BKEI01_I	Black Kei	S32K	D	32.03	187.9	22%	99%	-				
IUA_S03	GKEI01_I	Great Kei	S70A	C	24.97	897.2	44%	100%	Great Kei	S70F	B/C	74.1	1040.7

IUA	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	Scenarios*		Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
							EWR OFF	EWR ON					
	RIVERS								ESTUARIES				
	GCUW01_R	Gcuwa	S70D	D	14.86	67.6	46%	100%					
	KUBU03_R	Kubusi (Lower)	S60B	B/C	20.38	98.1	43%	99%					
	KEIS01_I	Keiskamma (Upper)	R10E	D	34.31	58.8	22%	99%					
IUA_R01	KEIS02_R	Keiskamma (Lower)	R10L	B/C	27.85	107.8	28%	100%	Keiskamm a	R10M	B	76.8	128.7
	TYUM01_R	Tyume	R10H	B/C	34.15	32.6	31%	98%					
IUA_R02	BUFF01_I	Buffalo (Middle)	R20F	D	34.46	83.8	46%	98%	Nahoon	R30F	C	62.8 + 5%	32.5
	BUFF02_FV	Buffalo (Lower)	R20G	D	32.83	91.9	6%	99%	Qinera	R30F	B	98.3	8.4
IUA_Q01	FISH01_FV	Great Fish (Upper)	Q21B	D	12.35	18.0	16%	96%	-				
	LFIS01_FV	Little Fish (Upper)	Q80B	B/C	23.72	24.3	85%	99%					
	FISH03_I	Great Fish (Lower)	Q91B	C	29.73	331.8	85%	100%					
IUA_Q02	LFIS02_FV	Little Fish (Lower)	Q80G	C	18.88	88.9	100%	100%	Great Fish	Q93D	B/C	90.3	496.3
	TARK01_FV	Tarka	Q44C	D	12.21	63.3	9%	12%					
	FISH02_FV	Great Fish (Middle)	Q50B	D	12.50	201.9	93%	100%					
IUA_Q03	KOON01_R	Koonap	Q92G	D	17.14	76.9	32%	100%					
	KAT02_R	Kat (Lower)	Q94F	C/D	15.16	61.8	30%	100%					

IUA	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	Scenarios*		Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
							EWR OFF	EWR ON					
	RIVERS								ESTUARIES				
	KAT01_I	Kat (Upper)	Q94B	B/C	43.53	23.9	27%	100%					
IUA_N01	SUND02_R	Sundays (Lower)	N40C	D	5.42	214.0	88%	100%	Sundays	N40F	B	95	263.1
IUA_M01	SWAR01_I	KwaZungu/ Swartkops	M10C	B/C	39.97	27.3	46%	100%	Swartkops	M10D	C	123.9[2]	56.9
IUA_P01	BOES01_FV	Bushmans	P10G	B	27.44	32.7	1%	82%	Kariega	P30C	C	60	21.9
									Bushmans	P20A	B	75.8 + 3%	43.1
									Kowie	P40C	B/C	89.1	31.4
IUA_KL01	GAMT01_I	Gamtoos	L90A	D	10.80	427.0	31%	97%	Gamtoos	L90C	C	51.8	404.2
									Kabeljous	K90G	B	89.3	5.3
									Kromme[3]	K90E	C	51	72.2
IUA_K01	KROM01_R	Kromme	K90A	C	36.66	27.6	85%	97%	Tsitsikamma	K80B	B	66.9 + 5%	19.9
	GROO01_FV	Groot (K80D)	K80D	B/C	29.09	47.6	57%	58%					
IUA_L01	KOUG01_R	Kouga	L82D	B/C	15.78	155.1	84%	100%	-				
	BAVI01_D	Baviaanskloof	L81D	B	28.58	48.1	79%	80%					

IUA	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	Scenarios* EWR OFF	Scenarios* EWR ON	Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
	RIVERS								ESTUARIES				
IUA_LN01	SUND01_FV	Sundays (Upper)	N22E	C	18.25	148.0	44%	83%	-				
	GRT01_D	Groot (L70G)	L70G	B	29.91	185.7	21%	42%					

**Following the assessment of the critical users per IUA, these columns illustrates where the RoS for the EWR, are not met (RoS is <75% i.e. it fails more than 25% of the time). This will aid the team to also focus on these during the trade-off assessment in the next phase of the study. The % achieved of the Ecological Water Requirements in relation to the Total EWR as %nMAR for REC for rivers and estuaries*

- *Red: 0 – 40% achievement of the ecological water requirements*
- *Orange: 40% - 70% achievement of the ecological water requirements*
- *Green: 70% - 100% achievement of the ecological water requirements*

[1]Mbashe is above natural due to transfer scheme.

[2]The REC MAR of Swartkops is above Natural due to the Motherwell Channel and the Chatty River stormwater input. The scenario is down from present as it requested all 3 WWTW to rese water and not discharge into or just above the estuary.

[3]Kromme: 51% of 97 x 106

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1. INTRODUCTION

1.1 Background

The National Water Act, 1998 (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 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 setting 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 provision of water required for the maintenance of the natural functionality of the ecosystem and provision of Basic Human Needs (BHN) is the only right to water in the National Water Act (No. 36 of 1998) (NWA). The other water users from a strategic use who are second in line to other water users are subject to formal gazetted General Authorization and water use authorization as per Section 21 of the NWA.

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 surface water (rivers, wetlands and estuaries) and groundwater. The Reserve determination include both the water quantity and quality of the Ecological Water Requirements (EWR) and BHN. This will assist the process of ensuring the availability of water required to protect aquatic systems and to secure water that is essential for the needs of individuals that are directly dependent on these water resources for their daily lifelihood.

1.2 Purpose of this study

The Keiskamma and Fish to Tsitsikamma catchments within the Mzimvubu to Tsitsikamma Water Management Area (WMA 7) 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 these catchments, especially around the major towns and cities. Water transfers into the study area from adjacent WMAs (i.e. transfer from Gariep Dam on Orange River to the Great Fish River) 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 the 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 (WRCS) (Regulation 810, 2010) to determine the Water Resource Classes;
- follow the integrated framework steps (DWS, 2017);
- undertake the 7-step process within the integrated framework context to determine and set RQOs; and
- determine the Reserve (EWR and BHN) for the selected water resources in the study area.

The above mentioned will ultimately assist the DWS in the management of the water resources in the study area from source to sea as far as practicably possible, to allow for the making of informed decisions regarding the authorisation of future water use and the magnitude of the impacts of current and proposed developments in the study area.

1.3 Purpose of this report

The purpose of this Ecological Sustainable Base Configuration (ESBC) scenario Report is to document the results of the ESBC scenario assessment within the study area (Keiskamma and Fish to Tsitsikamma). This forms part of step 4 of the Classification process and aligns with Step 4 of the integrated framework, DWS (2017) (see **Figure 1-1**).

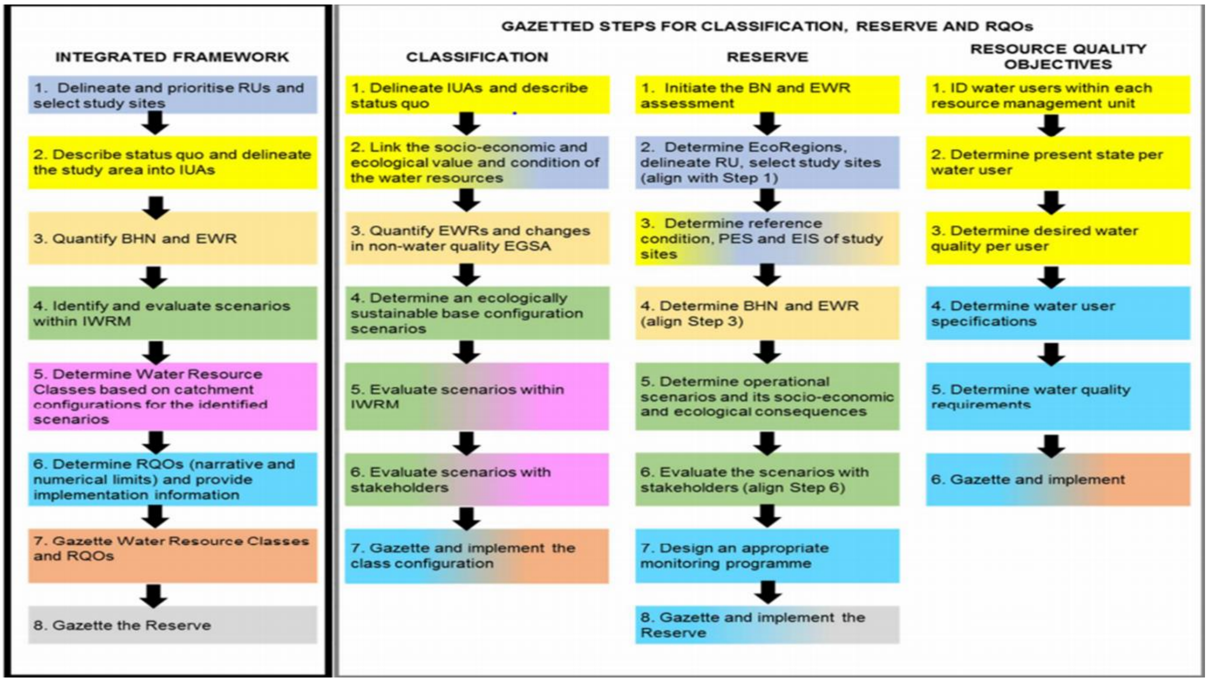

Figure 1-1: Integrated framework for the determination of Water Resource Classes, Reserve and RQOs.

An ESBC scenario is established to understand what the result would be in terms of system yield of implementing the minimum base level of ecological protection required to ensure sustainable use of the catchment's water resources (consideration of ecological, water quality and quantity needs).

The purpose of this report is therefore:

- To describe the process undertaken to establish the ESBC scenario;
- To describe the present ecological state of water resources per IUA at each of the identified EWR sites throughout the study area;
- To establish the ESBC for each IUA based on the Recommended Ecological Category (REC) for both the rivers and estuaries; and
- To define the ESBC scenario and present the results of the yield modelling.

2. OVERVIEW OF STUDY AREA

The study area forms part of the Mzimvubu to Tsitsikamma WMA7 with the main catchments and rivers indicated in **Table 2-1** and **Figure 2-1**. The water resources of the Mzimvubu River (T31 – T36) are not included as part of the study area as the resources have already been classified, RQOs determined and gazetted. Secondary catchments T40 (Mtamvuna) and T50 (Mzimkhulu) form part of WMA 4. 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 (Report Number: WEM/WMA7/00/CON/RDM/0322).

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. The study area consists of five large drainage basins with several smaller rivers in-between. The larger drainage basins are the:

- Mbhashe 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:

- Mthatha River (drainage region T20),
- Small coastal rivers in the Pondoland area (drainage regions T60 to T90),
- Keiskamma, Buffalo, Nahoon and Gqunube Rivers (drainage region R),
- Kowie, Kariega and Bushmans Rivers (drainage region P),
- Koega and Swartkops Rivers (drainage region M),
- Krom and Seekoei Rivers (drainage region K90), and
- Tsitsikamma and small coastal rivers in drainage region K80.

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, Bushmans 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	Mbhashe
T20	Mthatha
T60	Small coastal rivers (Mtentu, Msikaba, Mzintlava)
T70	Small coastal rivers (Mtakatye, Mngazi)
T80 & T90	Small coastal rivers

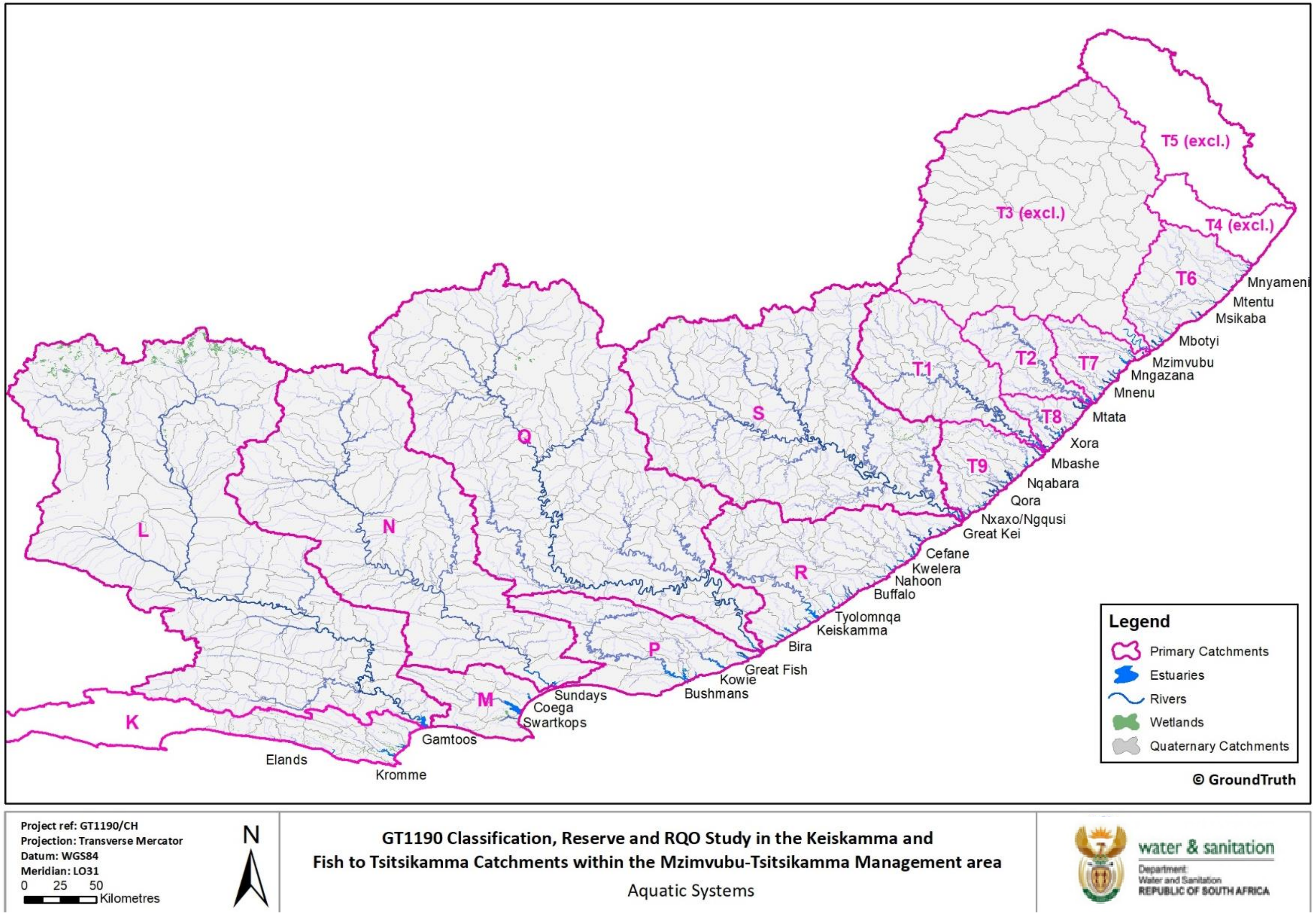

Figure 2-1: Map illustrating the study area for the Keiskam ma, Fish to Tsitsikamma.

3. INTEGRATED UNITS OF ANALYSIS AND RESOURCE UNITS DELINEATED WITHIN THE STUDY AREA

3.1 Integrated Units of Analysis

Integrated Units of Analysis (IUAs) are spatial units consisting of significant water resources for which Water Resource Classes will be determined. The delineation of the various catchment areas was 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 for this study will be 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 per IUA.

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 were identified for the study area. These are listed in **Table 3-1** with detailed descriptions and status quo per water resource component provided in DWS, 2022 and further illustrated in **Figure 3-1**.

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

IUA	IUA code	Description	Main rivers	Main estuaries	Quaternary Catchments
1	IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	Tsitsikamma, upper Kromme	Lottering Elandsbos Storms Elands Groot-East Tsitsikamma Klipdrift	K80A-F, K90A-B
2	IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	Kromme, Gamtoos	Kromme Seekoei Kabljous Gamtoos	K90C-G, L90A-C
3	IUA_L01	Kouga to Kouga Dam, Baviaanskloof	Kouga, Baviaanskloof	N/A	L81A-D, L82A-J
4	IUA_M01	M primary catchment	Swartkops, Coega	Van Stadens Maitland Baakens Papkuils Swartkops Coega	M10A-D, M20A-B, M30A-B
5	IUA_LN01	Groot to Kouga confluence, Upper	Sout, Kariega, Groot, Upper Sundays	N/A	L11A-G, L12A-D , L21A-F, L22A-D, L23A-D, L30A-D,

IUA	IUA code	Description	Main rivers	Main estuaries	Quaternary Catchments
		Sundays to Darlington Dam			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	Sundays	N40A-F
7	IUA_P01	P primary catchment	Bushmans, Kowie, Kariega	Bushmans Kasuka Kowie Riet	P10A-G, P20A-B, P30A-C, P40A-D
8	IUA_Q01	Upper Fish	Little Brak, Upper Great Fish, Upper Little Fish	N/A	Q11A-D, Q14A-E, Q21A-B, Q22A-B, Q30A-B, Q80A-C
9	IUA_Q02	Great Fish	Great Fish, Tarka, Baviaans, Lower Little Fish	Great Fish	Q12A-C, Q13A-C, Q30C-E, Q41A-D, Q42A-B, Q43A-B, Q44A-C, Q50A-C, Q60A-C, Q70A-C, Q80D-G, Q91A-C, Q93A-D
10	IUA_Q03	Koonap and Kat	Koonap, Kat	N/A	Q92A-G, Q94A-F
11	IUA_R01	Keiskamma	Keiskamma, Tylomnqa	Mpekweni Mtati Mgwalana Bira Mtana Keiskamma Ngqinisa Kiwane Tyolomnqa Ncera Mcantsi Gxulu	R10A-M, R40A-C, R50A-B
12	IUA_R02	Buffalo/ Nahoon	Baffalo, Nahoon, Kwelera, Gqunube	Buffalo Nahoon Qinira Gqunube Kwelera Bulura Cintsa Cefane	R20A-G , R30A-F

IUA	IUA code	Description	Main rivers	Main estuaries	Quaternary Catchments
				Nyara Haga-Haga Quko Morgan	
13	IUA_S01	Upper Great Kei	Indwe, White Kei, Tsomo, Great Kei	N/A	S10A-J, S20A-D, S40A-F, S50A-J
14	IUA_S02	Black Kei	Klipplaat, Klaas Smits, Black Kei	N/A	S31A-G, S32A-M
15	IUA_S03	Lower Great Kei	Kubusi, Great Kei	Great Kei	S60A-E, S70A-F
16	IUA_T01	Upper Mbashe, Upper Mthatha	Xuka, Mgwali, Upper Mbashe, Upper Mthatha	N/A	T11A-H, T12A-G, T20A
17	IUA_T02	Lower Mbashe	Lower Mbashe	Mbashe	T13A-E
18	IUA_T03	Lower Mthatha	Lower Mthatha	Mthatha	T20B-G
19	IUA_T04	Pondoland coastal	Mtentu, Msikaba, Mngazi, Mtakatye, Xora, Nqabara, Qhorha	Kobonqaba, Qora Shixini, Nqabara Mendu, Ntlonyane, Xora, Mncwasa, Mpako, Nenga, Mdumbi, Mtakatye, Mnenu, Mpande, Mngazana, Mngazi, Mntafufu, Mzintlava, Mbotyi, Lupatana, Msikaba, Mtentu, Sikombe, Kwanyana, Mzamba	T60A-K, T70A-G, T80A-D, T90A-G

The detailed descriptions and rationale for these IUAs are provided in Report No. WEM/WMA7/00/CON/RDM/0322.

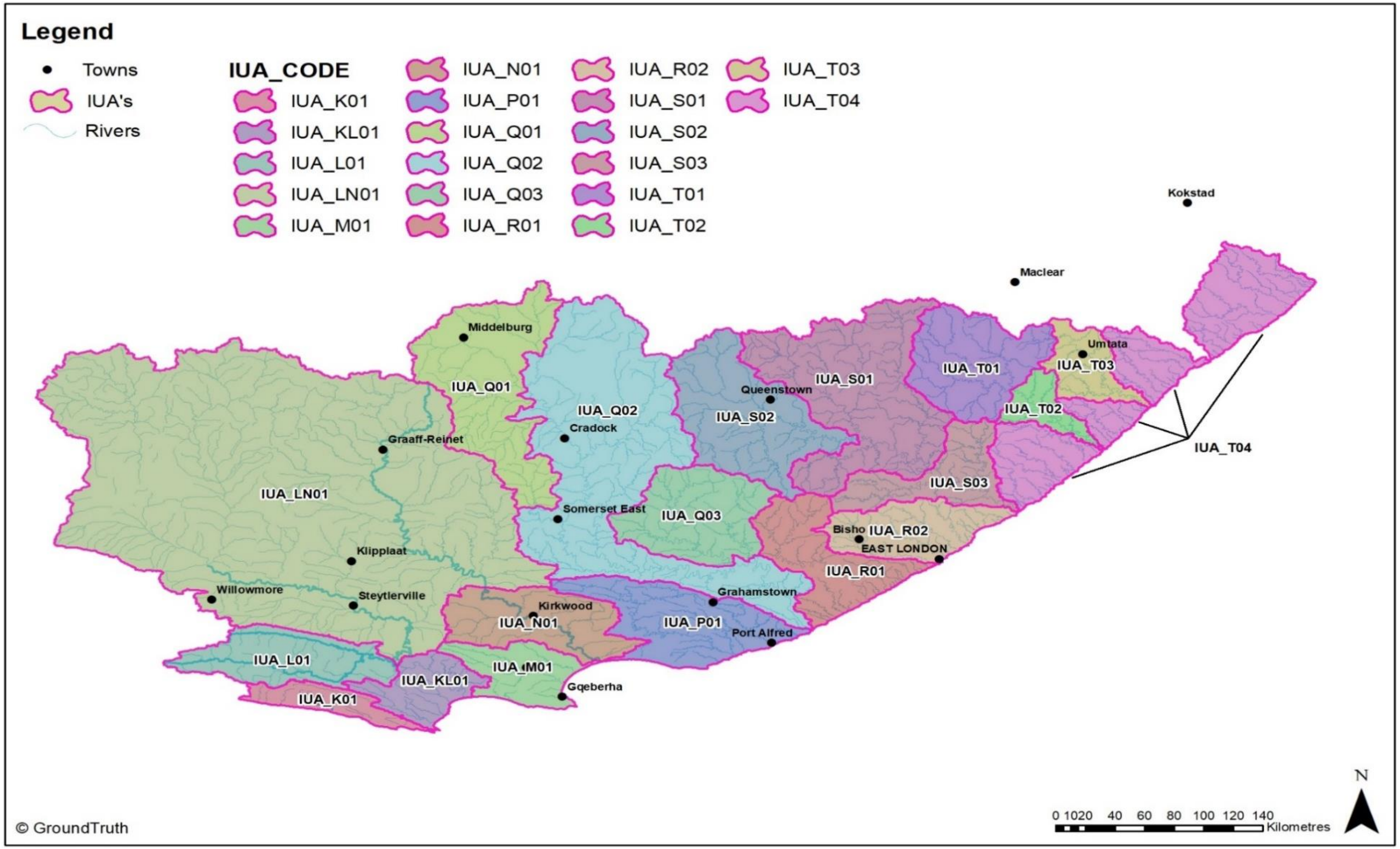

Figure 3-1: Integrated Units of Analysis

3.2 Priorities Resource Units for Rivers and Estuaries

Resource Units (RUs) were then delineated and prioritised within each of the 19 IUAs. The priority RUs (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 included the various Intermeidate and/or Rapid 3 EWR and field verification sites for rivers and selected prioritised wetlands and estuaries or groundwater areas. This was a key step as the gazetting of the Reserve and RQOs are based on these priority RUs where high confidence results are available. For further information, refer to Report No. WEM/WMA7/00/CON/RDM/0422.

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).

With regards to rivers and estuaries, the priority RUs identified are provided per water resource component and IUA in **Table 3-2** (rivers – including their initial EWR level and their revised EWR level going forward for this study – coupled with an explanation following the river surveys) and **Table 3-3** (estuaries). These are further illustrated in **Figure 3-2** (river RUs) and **Figure 3-3** (estuary RUs).

Table 3-2: Identified Resource Units for rivers in the study area (Intermeidate, Rapid 3 and field verification sites)

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
IUA_T01	Upper Mbashe, Upper Mthatha	R_RU27_R	Upper Mbhashe	T11H	Rapid 3	MBHA02_R	T11H	Rapid 3	No change
IUA_T02	Lower Mbashe	R_RU014_I	Lower Mbhashe	T13E	Intermediate	MBAS01_I	T13E	Intermediate	No change
IUA_T03	Lower Mthatha	R_RU015_I	Lower Mthatha	T20E	Intermediate	MTHA01_I	T20G	Intermediate	No change
IUA_T04	Pondoland coastal	R_RU29_R	Mtentu	T60D	Rapid 3	MTEN01_R	T60C	Rapid 3	No change
		R_RU31_R	Mngazi	T70B	Rapid 3	MNGA01_R	T70B	Rapid 3	No change
		R_RU33_R	Nqabarha	T90B	Rapid 3	NQAB01_R	T90A	Rapid 3	No change
IUA_S01	Upper Great Kei	R_RU011_I	Tsomo	S50G	Intermediate	TSOM01_I	S50G	Intermediate	No change
		R_RU20_R	White Kei	S10J	Rapid 3	WKEI01_R	S10J	Rapid 3	No change
		R_RU21_R	Indwe	S20D	Rapid 3	INDW01_R	S20D	Rapid 3	No change
IUA_S02	Black Kei	R_RU22_R	Klaas Smits	S31G[(1)]	Rapid 3	KSMI01_FV	S31G	Field Verification	Very low flows, mainly sewage from the Komani River (health hazard).

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
		R_RU24_R	Black Kei	S32M	Rapid 3	BKEI01_I	S32K	Intermediate	Numerous impacts observed in the upper catchment
IUA_S03	Lower Great Kei	R_RU012_I	Lower Kubusi	S60B	Intermediate	KUBU03_R	S60B	Rapid 3	No flow
		R_RU013_I	Great Kei	S70F	Intermediate	GKEI01_I	S70A	Intermediate	No change
		R_RU26_R	Gcuwa	S70D	Rapid 3	GCUW01_R	S70D	Rapid 3	A suitable site could not be identified. First site downstream of the town was associated with health hazards (sewage), downstream of the dam, there was no flow and upstream of the dam, was pooled. The site will be assessed in March 2023

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
									during the intermediate survey.
IUA_R01	Keiskamma	R_RU09_I	Upper Keiskamma	R10E	Intermediate	KEIS01_I	R10E	Intermediate	No change
		R_RU17_R	Tyume	R10G	Rapid 3	TYUM01_R	R10H	Rapid 3	No change
		R_RU18_R	Lower Keiskamma	R10L	Rapid 3	KEIS02_R	R10I	Rapid 3	No change
IUA_R02	Buffalo/ Nahoon	R_RU10_I	Middle Buffalo	R10E	Intermediate	BUFF01_I	R20F	Intermediate	No change
IUA_Q01	Upper Fish	R_RU11_R	Pauls	Q30B	Rapid 3	PAUL01_FV	Q30B	Field verification	Small ephemeral system with stagnant pools, very low flow and access limitations – Diatoms only.
		R_RU12_R	Upper Great Fish	Q21B	Rapid 3	FISH01_FV	Q30B	Field verification	Limited flow and habitat availability
		R_RU13_R	Little Fish	Q80C	Rapid 3	LFIS01_FV	Q80B	Field Verification	Site dry at the time of the survey, only puddles, no flow and stagnant as

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
									all water abstracted upstream of site
IUA_Q02	Great Fish	R_RU14_R	Tarka	Q44C	Rapid 3	TARK01_FV	Q44C	Field Verification	Limited flow and habitat availability
		R_RU06_I	Lower Great Fish	Q93A	Intermediate	FISH03_I	Q91B	Intermediate	No change
		R_RU07_I	Middle Great Fish	Q50B	Intermediate	FISH02_FV	Q50C	Field Verification	To high flows for access owing to interbasin transfer and safety risk.
IUA_Q03	Koonap and Kat	R_RU15_R	Lower Kat	Q94F	Rapid 3	KAT02_R	Q94F	Rapid 3	No change
		R_RU16_R	Koonap	Q92G	Rapid 3	KOON01_R	Q92G	Rapid 3	No change
		R_RU08_I	Upper Kat (d/s dam)	Q94B	Intermediate	KAT01_I	Q94B	Intermediate	No change
IUA_P01	P primary catchment	R_RU05_I	Kariega	P30B	Intermediate	-	P30B	-	Site was dry at the time of the survey owing to drought and dams upstream

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
									with no releases
		R_RU10_R	Boesmans	P10G	Rapid 3	BOES01_FV	P10G	Field Verification	Site dry and only desktop assessment will be undertaken
IUA_N01	Sundays downstream Darlington Dam	R_RU04_I	Lower Sundays	N40F	Intermediate	SUND02_R	N40C	Rapid 3	Due to the extensive water use, transfer of water from upstream weir and diversion into canals, a rapid 3 assessment for the river linked to the intermediate estuarine assessment will be used to evaluate scenarios for socio-economic trade-offs

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
		R_RU09_R	Upper Sundays	N21D	Rapid 3	-	N22C	-	Site dry and only desktop assessment will be undertaken
IUA_M01	M primary catchment	R_RU03_I	KwaZungu/ Swartkops	M10A	Intermediate	SWAR01_I	M10C	Intermediate	No change
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	R_RU05_R	Kouga	L82G	Rapid 3	KOUG01_R	L82E	Rapid 3	No change
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	R_RU02_I	Gamtoos	L90B	Intermediate	GAMT01_I	L90A	Intermediate	No change
		R_RU03_R	Kabeljous	K90G	Rapid 3	KABE01_FV	K90G	Field Verification	No flow, wetland conditions. No Suitable site along the system was identified. The EWR's will be specified following the rapid estuarine assessment on the Kabeljous Estuary.

IUA	IUA Description	RU No.	River	Proposed Quaternary catchment	Proposed Reserve Level	Following river survey – finalised levels			
						EWR site code	Surveyed Quaternary catchment	Upgrade and downgrade of Reserve Level	Reason
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	R_RU01_I	Upper Kromme	K90B	Intermediate	KROM01_R	K90B	Rapid 3	Site will be surveyed in March 2023
		R_RU01_R	Groot	K80D	Rapid 3	GROO01_FV	K80D	Field Verification	Site could not be surveyed owing to the river being in flood and a desktop assessment will be undertaken for the river link to the rapid estuarine assessment.
IUA_R02	Buffalo/ Nahoon	R_RU20_R	Lower Buffalo	R20G	Rapid 3	BUFF02_R	R20F	Rapid 3	Site not assessed – previous hydraulic data will be used and biological conducted in March 2023

Table 3-3: Identified priority Resource Units for estuaries in the study area

IUA No.	IUA Description	RU No.	Estuary System	Quaternary catchment	Priority
IUA_T02	Lower Mbashe	E_RU13	Mbashe	T13E	Intermediate
IUA_T03	Lower Mthatha	None			
IUA_T04	Pondoland coastal	E_RU14	Xora	T80D	Desktop
		E_RU21	Msikaba	T60G	Desktop**
		E_RU22	Mngazi	T70B	Rapid
IUA_S03	Lower Great Kei	E_RU12	Great Kei	S70F	Intermediate
IUA_R01	Keiskamma	E_RU10	Keiskamma	R10M	Intermediate
IUA_R02	Buffalo/ Nahoon	E_RU19	Nahoon	R30F	Desktop**
		E_RU20	Qinera	R30F	Desktop
IUA_Q02	Great Fish	E_RU18	Great Fish	Q93D	Rapid
IUA_N01	Sundays downstream Darlington Dam	E_RU08	Sundays	N40F	Desktop**
IUA_M01	M primary catchment	E_RU06	Swartskops	M10D	Intermediate
IUA_P01	P primary catchment	E_RU09	Kariega	P30C	Intermediate
		E_RU16	Bushmans	P20A	Desktop**
		E_RU17	Kowie	P40C	Desktop

IUA No.	IUA Description	RU No.	Estuary System	Quaternary catchment	Priority
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	E_RU04	Gamtoos	L90C	Intermediate
		E_RU05	Kabeljous	K90G	Rapid
		E_RU03	Kromme	K90E	Desktop**
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	E_RU15	Tsitsikamma	K80B	Desktop*

**Update of the PES*

*** Although not re-surveyed, results from previous studies to be used for interpretation*

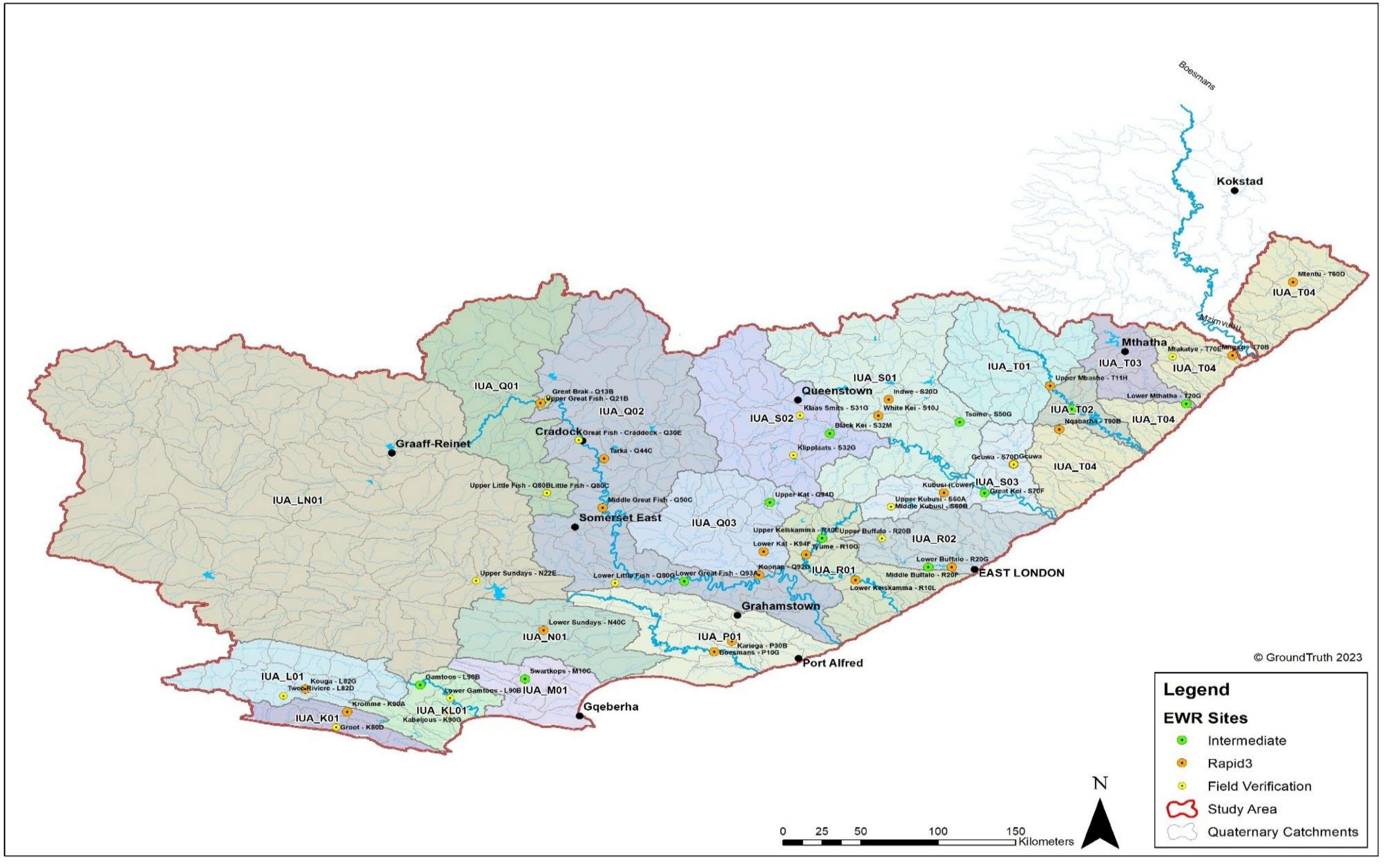

Figure 3-2: Map illustrating the final EWR sites assessed for the Keiskamma, Fish to Tsitsikamma catchment

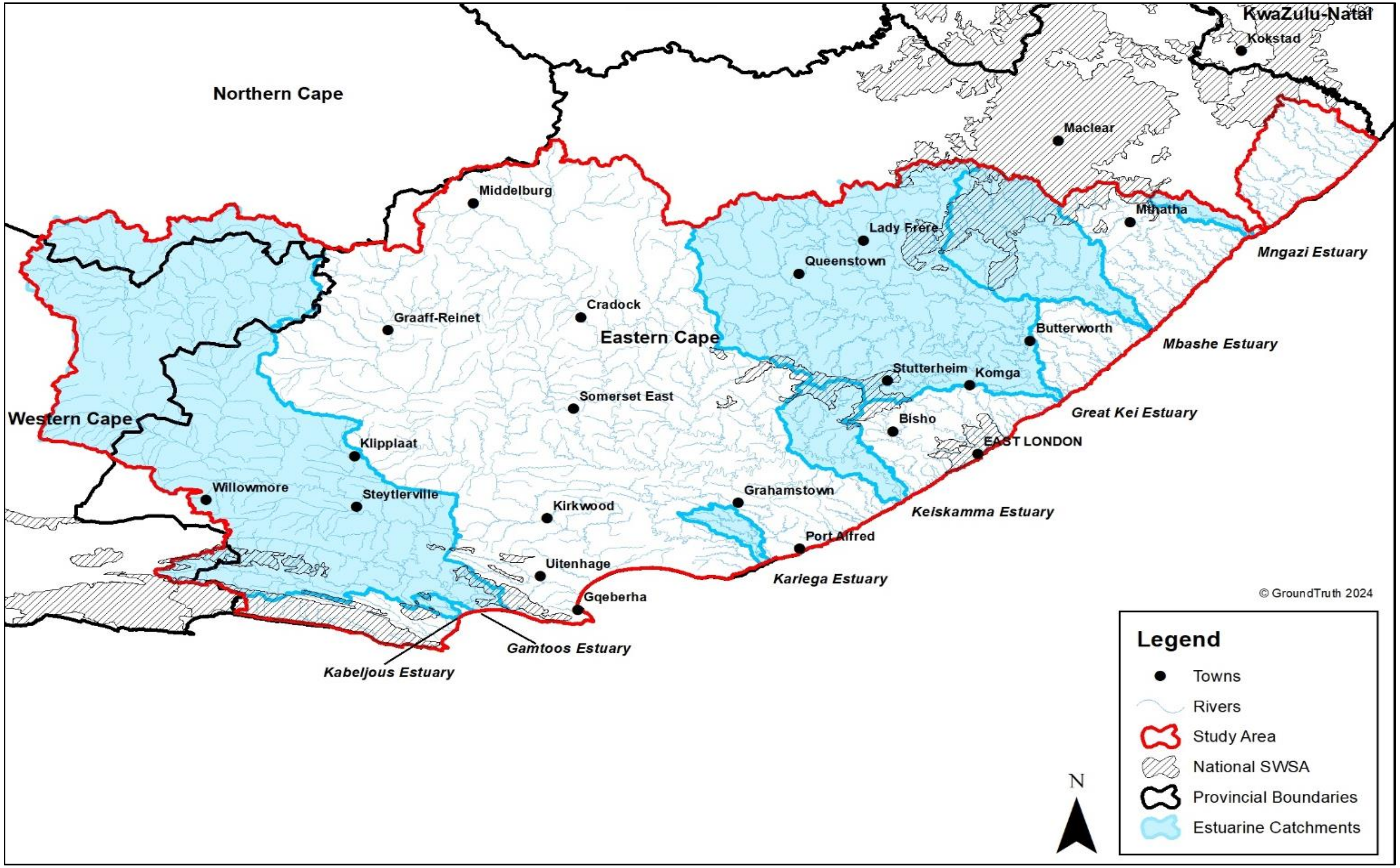

Figure 3-3: Priority estuaries in the study area

3.3 Prioritised Resource Units for Groundwater

As no specific IUA for groundwater was identified in this study, the EBSC primarily relied on the findings related to rivers and estuaries. However, **Table 3-4** below summarises the prioritised groundwater resources.

Table 3-4: Identified priority 1 and 2 groundwater Resource Units in the study area

IUA	IUA description	GW Description	RU No.	Quaternary catchment(s)	Priority level
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group Aquifer. The IUA is moderately to highly stressed.	GW_RU01	K80A, K80B, K80C, K80D, K80E, K80F	2
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group Aquifer. The IUA is moderately stressed in certain areas.	GW_RU02	K90F, K90G	2
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group Aquifer. The IUA is mildly stressed in certain areas.	GW_RU03	L82B, L82D	2
IUA_M01	M primary catchment	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group and Uitenhage Group. A small part of the IUA is also of an intergranular type, associated with Quaternary sands. The IUA is mildly stressed in certain areas.	GW_RU04	M10A, M10B	2
			GW_RU05	M10C, M10D	1
			GW_RU06	M20A, M20B. M30A	2
IUA_LN01	Groot to Kouga confluence, Upper	The aquifer is of a fractured type, mainly associated with the fractured Upper Cape Supergroup (Bokkeveld and Witteberg	GW_RU07	L11E, L11F	2
			GW_RU08	L12B, L12C, L12D	2

IUA	IUA description	GW Description	RU No.	Quaternary catchment(s)	Priority level
	Sundays to Darlington Dam	Groups) and Lower Karoo Supergroup. The IUA is mildly to moderately stressed in certain areas.	GW_RU09	L23C	2
			GW_RU10	L30A, L30C, L30D	2
IUA_N01	Sundays downstream Darlington Dam	The aquifer is mainly of a fractured type associated with the fractured Lower Karoo Supergroup and Uitenhage Group. A smaller part of the area is also of an intergranular type associated with Quaternary sand and alluvium. There are no stressed areas in the IUA.	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	The aquifer is mainly of a fractured type associated with the upper Cape Supergroup (Bokkeveld and Witteberg Groups) and Lower Karoo Supergroup. A smaller part of the area is also of an intergranular type associated with Quaternary sand and alluvium. There are no stressed areas in the IUA.	No priority 1 or 2 groundwater areas		
IUA_Q01	Upper Fish	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist, as well as localised intergranular aquifers associated with alluvial deposits. The IUA is mildly to highly stressed in certain areas.	GW_RU18	P20A	2
			GW_RU19	Q11C	2
			GW_RU20	Q14A, Q14B, Q14C, Q14D	1

IUA	IUA description	GW Description	RU No.	Quaternary catchment(s)	Priority level
			GW_RU21	Q14E	2
			GW_RU22	Q30A, Q30B	2
IUA_Q02	Great Fish	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. The IUA is mildly to highly stressed in certain areas.	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	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. There are no stressed areas in the IUA.	GW_RU28	Q92A	2
			GW_RU29	Q94A, Q94B, Q94C	2
IUA_R01	Keiskamma	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. There are no stressed areas in the IUA.	GW_RU30	R10A, R10B	2
			GW_RU31	R40A, R40C	2
IUA_R02	Buffalo/ Nahoon	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. The IUA is mildly stressed in certain areas.	GW_RU32	R20A, R20B, R20C	2
			GW_RU33	R30A, R30B, R30D	2
IUA_S01	Upper Great Kei		GW_RU34	S10H	2

IUA	IUA description	GW Description	RU No.	Quaternary catchment(s)	Priority level
		The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. There are no stressed areas in the IUA.	GW_RU35	S20C, S20D	2
			GW_RU36	S50D, S50E, S50F, S50G, S50H	2
IUA_S02	Black Kei	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is mildly to moderately stressed in certain areas.	GW_RU37	S31A, S31B, S31E	2
IUA_S03	Lower Great Kei	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is moderately stressed in certain areas.	GW_RU38	S60A	2
			GW_RU39	S70A, S70E, S70F	2
IUA_T01	Upper Mbashe, Upper Mthatha	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is mildly to highly stressed in certain areas.	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	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is mildly stressed in certain areas.	GW_RU43	T13A, T13B, T13C, T13D, T13E	2
IUA_T03	Lower Mthatha	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite	GW_RU44	T20A, T20B, T20C, T20D, T20E, T20F, T20G	2

IUA	IUA description	GW Description	RU No.	Quaternary catchment(s)	Priority level
		sills and dykes. The IUA is moderately stressed in certain areas.			
IUA_T04	Pondoland coastal	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. There are no stressed areas in the IUA	GW_RU45	T60A-T60K	2
			GW_RU46	T70A-T70G	2
			GW_RU47	T80A, T80B, T80C, T80D	2
			GW_RU48	T90A, T90D, T90G	2

3.4 Prioritised Resource Units for Wetlands

As no specific IUA for wetlands was identified in this study, the ESBC primarily relied on the findings related to rivers and estuaries. However, **Table 3-5** below summarises the prioritised wetland resources and results.

Table 3-5: Identified priority wetland Resource Units in the study area

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC	Degree of flow reliance
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam	K80A	W_RU01	Valley Bottom and Hillslope seep	C	C	While the wetlands rely predominantly on water inputs from the surrounding upstream catchment, the majority of their catchments are either plantation or natural forest and are unlikely to be developed or altered drastically.
				Valley Bottom and Hillslope seep	B	B	

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC	Degree of flow reliance
		K90A*	W_RU02	Valley-bottom	A	A	The Kromme wetland is reliant on both surface runoff and groundwater inputs. It is located in a catchment that could potentially be developed towards extensive agricultural use which may include the construction of dams and additional boreholes. It is also upstream of Churchill Dam which is an important irrigation and water supply dam.
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	N/A					
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	L82D	W_RU03	Valley-bottom	D	C/ D	The Krakeel wetland is reliant on surface runoff and may be reliant on groundwater inputs. It is in a catchment that is highly modified towards agricultural land uses, and most inflowing streams are extensively dammed. Additionally, there are several boreholes located within the catchment.
IUA_M01	M primary catchment	M10D	W_RU05	Floodplain	D	C	The Chatty River wetlands have been severely altered because of the urban development surrounding the wetlands – most of which cannot be undone. The most pressing and addressable issue for the Chatty River wetlands are related to water quality impacts to the wetlands.
				Channelled valley-bottom	D	C	
		M10B	W_RU04	Valley-bottom	C	B/ C	Whilst the wetlands rely predominantly on water inputs from the surrounding upstream catchment, most of their catchments are either plantation or natural forest and are unlikely to be developed or altered drastically. Additionally, the Longmore wetland complex

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC	Degree of flow reliance
							lies within the headwaters of the Van Stadens River and is therefore not reliant on extensive in-stream flows
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	L21D	W_RU06	Hillslope seep	B	B	This wetland complex is thought to rely on groundwater connection to a large degree. Multiple boreholes were observed near the Sneeuberg wetlands, or within their catchments and it would be useful to understand the relative reliance of these wetlands on groundwater inputs.
				Valley-bottom	C	C	
IUA_N01	Sundays downstream Darlington Dam	N/A					
IUA_P01	P primary catchment	N/A					
IUA_Q01	Upper Fish	Q22A	W_RU27	Hillslope seep	B	B	These wetlands are located within a remote catchment that is unlikely to receive intense and large-scale development.
				Valley-bottom	C	C	
IUA_Q02	Great Fish	Q43A, Q43B	W_RU10	Valley-bottom	B	A/ B	The water inputs into these systems are predominantly from the upstream catchment – as is evident by the sediment accumulation upstream of the interventions/structures which have led to the formation of ‘artificial’ wetland habitat. Based on a review of the historical imagery, the landscape has remained relatively unchanged over the last several decades.
IUA_Q03	Koonap and Kat	N/A					

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC	Degree of flow reliance
IUA_R01	Keiskamma	N/A					
IUA_R02	Buffalo/ Nahoon	R20E	W_RU15	Floodplain	C	C	The water inputs into this wetland are predominantly from the upstream catchment and would naturally have originated from overbank flooding. However, some incision of the channels within the floodplain has resulted in the loss of the ability to act as a floodplain and the wetland areas are now predominantly supported by lateral inputs. This floodplain wetland is located within a relatively rural area, and it is unlikely that there will be extensive development within the wetland or catchment.
		R20D	W_RU26	Valley-bottom and Hillslope seep	C	C	This wetland complex is fed by a combination of surface inflows and groundwater inputs. While it is unlikely that there will be significant development within the wetland or catchment, if there is a significant proliferation of groundwater abstraction within the region, there could be significant negative impacts on the hydrology of the wetland.
IUA_S01	Upper Great Kei	S50E	W_RU18	Valley-bottom	C	B	The seeps and valley-bottom wetlands are dominated by lateral inputs versus upstream flows. The likelihood of any substantial degradational development occurring within the catchment is considered to be unlikely. The likely anticipated changes to the catchment include the establish of a few more houses and the associated subsistence agricultural activities. These activities are
				Hillslope seep	C	B	

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC		Degree of flow reliance
								generally not considered to be massive flow reduction activities.
		S50C	W_RU21	Floodplain	D	C/	D	The hydrological inputs into the main floodplain system are largely from the catchment and are related to overbank flooding. There have been several modifications to the system including storage dams and diversion canals. It has been assumed that these activities have been authorised and that some level of quantification was considered during the application process. Any additional modifications to the flows within the system should be carefully considered into the future.
IUA_S02	Black Kei	S32D	W_RU13	Hillslope seep	C	B/	C	The wetland complex is located within active forestry and agricultural lands both of which have the potential to expand. The floodplain wetland is sensitive to changes in flood peaks and the seep wetlands are sensitive to changes in groundwater abstraction (and are home to the endangered Amathole Toad). However, extensive lateral hydrological inputs contribute a significant volume of water to the floodplain wetland. Additionally, this wetland is located in the headwaters of the Klipplaat River such that the wetlands do not rely extensively on river-related flows.
				Hillslope seep (degraded)	D	D		
				Channelled valley-bottom	C	B/	C	
				Floodplain	C	B/	C	
		S32E	W_RU12	Unchannelled valley-bottom and seep	B	B		The wetland complex is located on communally owned land that is predominantly used for grazing and small

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC	Degree of flow reliance
							subsistence agriculture. However, given the importance of these wetlands as being potential Amathole Toad breeding sites, any activities in the catchments of these wetlands would need to be carefully considered for authorisation.
IUA_S03	Lower Great Kei	N/A					
IUA_T01	Upper Mbashe, Upper Mthatha	T11A	W_RU22	Hillslope seep (tributaries)	D	C/ D	The seeps and valley-bottom wetlands are supported by lateral flows, whilst the main floodplain systems are maintained by both upstream inputs and lateral inputs. Unless there are substantial changes earmarked for the catchment, it is unlikely that a Reserve study would be required. The greatest threat to the wetlands is linked to water quality i.e., discharge of raw sewage into the wetlands
				Floodplain (east)	D	C/ D	
				Channelled valley-bottom (west)	D	C	
				Floodplain (upper)	E	D	
				Floodplain (lower)	C	B	
IUA_T02	Lower Mbashe	N/A					
IUA_T03	Lower Mthatha	N/A					
IUA_T04	Pondoland coastal	T60D	W_RU24	Channelled valley-bottom	B	B	Based on the evidence of the sediment inputs in the Sikombe wetland, a large portion of the flows are catchment related versus lateral, which stands true for the Xolobeni system, too. It is anticipated that the changes to the
				Channelled valley-bottom	C	B	

IUA	IUA Description	Quaternary catchment(s)	RU No.	HGM Unit Type	PES	REC		Degree of flow reliance
								catchment conditions will be mostly linked to increased number of households and the associated subsistence farming, and thus an EWR is not required. However, should there be a greater reliance on the systems in terms of the abstraction of water, an EWR may be considered.
		T60B	W_RU25	Valley-bottom and seep	D	C/	D	Both the seeps and valley-bottom wetlands are dominated by lateral inputs. The anticipated changes to the system in the short to medium term are associated with the expansion of the houses within the catchment and the associated agricultural activities. These activities are generally not considered to be massive flow reduction activities.

* Although not a wetland IUA, integration between the wetland, river and groundwater in quaternary catchment K90A will be undertaken to provide specific requirements for the wetland and to assess the ecological consequences of operational scenarios as part of socio-economic/ ecological trade-offs

4. ECOLOGICAL SUSTAINABLE BASE CONFIGURATION SCENARIO

Assessing the classification of a water resource in terms of its processes entails a comprehensive consideration of the social, economic, and ecological dynamics within a catchment. This evaluation aims to weigh the costs and benefits associated with the utilization versus protection of the water resource. Importantly, this classification is not conducted in isolation; instead, it is seamlessly integrated into the overarching planning for water resource protection, development, and utilisation, aligning with the broader objectives of the IUA and WMA. The foundation for determining the water resource class lies in establishing the ecologically sustainable level of protection required for water resources. This ecological consideration is then harmonized with economic and social goals. Therefore, it is crucial to define an appropriate ecological protection base level (base condition) for the water resources. From this baseline, an understanding is developed regarding the economic and social implications of achieving the minimal (sustainable) level of ecological protection. Once this sustainable ecological protection level is comprehended, various levels of resource-directed protection can be evaluated, considering their overall implications for the IUA and WMA. This holistic approach ensures that the classification process is embedded within a broader framework that addresses the interconnected goals of environmental sustainability, economic viability, and social well-being.

The ESBC defines this lowest theoretical level of protection required for the sustainable use of the water resources of a catchment. It is not the target scenario but informs the minimal protection level required as a starting point for the hydrological analysis of the water resource system.

This task has been undertaken in compliance with the requirements of the study terms of reference that specify that the classification process is required to build from existing and current initiatives undertaken in support of integrated water resource management.

4.1 Objective of Step 4 of the WRCS

The objective of step 4 of the WRCS is to determine the ESBC scenario and to establish starter catchment configuration scenarios. The ESBC scenario defines the base ecological condition for each water resource (and the EWRs required for maintaining that condition), and the water supply potential that can be achieved.

The establishment of the ESBC requires the running of a hydrological model using the base condition EWRs to test whether these EWRs for all EWR sites can be met.

The following activities have been undertaken as part of Step 4 of the WRCS, the:

- Determination of an ESBC scenario that meets feasibility criteria for water quantity, water quality, and ecological needs;
- Consideration of the planning or reconciliation scenarios for water resource developments; and
- Establishment of alternate catchment configuration scenarios.

Overall, the process followed in terms of the establishment of the ESBC is described in the WRCS Guidelines, Volumes 1 and 2 (Overview and the 7-step classification procedure; and Ecological, hydrological and water quality guidelines for the 7-step classification procedure) (DWAF, February 2007a and 2007b).

5. *ECOLOGICAL SUSTAINABLE BASE CONFIGURATION APPROACH*

The approach followed to determine the ESBC scenario for the Keiskamma, Fish to Tsitsikamma catchment areas, part of the Mzimvubu to Tsitsikamma WMA7 includes the following steps:

- Assessment of the Present Ecological State (PES) to determine the impacts on the drivers and subsequent responses of the biota and riparian vegetation at the identified EWR sites and selected priority estuaries;
- Establishment of the ESBC per IUA based on the REC for the protection of the water resources within these catchment areas;
- Consideration of the present water use in the study area; and
- Description of alternate catchment water use/ development scenarios to be assessed as part of Step 5 of the WRCS process.

The approach is discussed in more detail below.

5.1 Base Condition of Water Resources: Recommended Ecological Category

An ESBC scenario is established to understand what the result would be in terms of system yield of implementing a selected level of ecological protection required to ensure sustainable use of the catchment water resources (consideration of ecological, water quality and quantity needs). This involves the linking of the flow and resource condition using the REC in this study, ensuring that the river reaches and estuaries are maintained/ improved to a sustainable condition.

In terms of the WRCS, the base condition for each water resource is set at a minimum which is either a D ecological category or as whichever higher category is required to maintain all downstream EWR sites in at least a D category. However, where the ecological condition requires it, a higher ecological category (EC) needs to be set. Nonetheless, the D EC was not selected as the default for the ESBC. Rather, the selected EC was based on the assessment of the REC and ecological/conservation importance of water resources within the IUAs. Subsequently, the REC of the water resources is thus being used as the base ecological condition for the yield analysis.

The REC as determined for the Intermediate and/or Rapid 3 assessments at the selected EWR sites for rivers, and at the priority estuaries will be used for the ESBC ecological category as listed in **Table 5-1** for the study area. Important to note that the EWRs outlined in **Table 5-1** will be used during the yield modelling as part of the interpretation of the ESBC. Extrapolation/estimation techniques were used to determine the EWRs per site where no Reserve information was available.

For rivers, the quantified EWRs is provided in Report No. WEM/WMA7/00/CON/RDM/1923, 'Quantification of Ecological Water Requirements'. The Eco-categorisation Report, which includes all the detail of each EWR site and EcoStatus results is provided in Report No. WEM/WMA7/00/CON/RDM/1723 (Volume 1) and WEM/WMA7/00/CON/RDM/1823 (Volume 2).

For estuaries, the quantified EWRs is provided in Report No. WEM/WMA7/00/CON/RDM/2124, 'Quantification of Estuarine Ecological Water Requirements'. The Eco-categorisation Report, which includes all the detail of each priority estuary results is provided in Report No. WEM/WMA7/00/CON/RDM/2024.

Table 5-1: ESBC (REC) for the Keiskamma, Fish to Tsitsikamma catchment areas aggregate per IUA for all priority river and estuary sites

IUA	IUA Description	Rivers								Estuaries						
		EWR site code	Priority	River Name	Quaternary catchment	PES	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)	Estuary System	Quaternary catchment	Priority	PES	REC	Total EWR as %nMAR for REC[1]	nMAR ($10^6 m^3$)
IUA_T01	Upper Mbashe, Upper Mthatha	MBHA02_R	Rapid 3	Mbhashe (Upper)	T11H	B/C	B/C	22.05	373.4	-						
		MTHA02_D	Desktop	Mthatha (Upper)	R20A	C	C	21.49	122.5							
IUA_T02	Lower Mbashe	MBAS01_I	Intermediate	Mbhashe (Middle)	T13C	C/D	C/D	38.02	673.8	Mbashe[1]	T13E	Intermediate	B/C	B	108.5	786.9
IUA_T03	Lower Mthatha	MTHA01_I	Intermediate	Mthatha (Lower)	T20G	C	B/C	37.81	389.2							
IUA_T04	Pondoland coastal	MNGA01_R	Rapid 3	Mngazi	T70B	C	B/C	25.94	78.2	Xora	T80D	Desktop[2]	B/C	B	77.3 + 5%	52.4
		NQAB01_R	Rapid 3	Nqabarha	T90A	D	C	34.51	9.8	Msikaba	T60G	Desktop	A/B	A	93.8	212.4
		MTEN01_R	Rapid 3	Mtentu	T60C	C	B/C	44.33	89.6	Mngazi	T70B	Rapid	B	B	95	87.3
		XORA01_D	Desktop	Xora	T80D	B	B	30.53	83.0							
IUA_S01	Upper Great Kei	TSOM01_I	Intermediate	Tsomo	S50G	D	C/D	37.48	196.7	-						
		INDW01_R	Rapid 3	Indwe	S20D	C/D	C/D	24.69	61.9							
		WKEI01_R	Rapid 3	White Kei	S10J	C/D	C	26.16	155.7							
IUA_S02	Black Kei	BKEI01_I	Intermediate	Black Kei	S32K	D/E	D	32.03	187.9	-						
IUA_S03	Lower Great Kei	GKEI01_I	Intermediate	Great Kei	S70A	C/D	C	24.97	897.2	Great Kei	S70F	Intermediate	C	B/C	74.1	1040.7
		GCUW01_R	Rapid 3	Gcuwa	S70D	D	D	14.86	67.6							
		KUBU03_R	Rapid 3	Kubusi (Lower)	S60B	C	B/C	20.38	98.1							
IUA_R01	Keiskamma	KEIS01_I	Intermediate	Keiskamma (Upper)	R10E	D	D	34.31	58.8	Keiskamma	R10M	Intermediate	C	B	76.8	128.7
		KEIS02_R	Rapid 3	Keiskamma (Lower)	R10L	C	B/C	27.85	107.8							
		TYUM01_R	Rapid 3	Tyume	R10H	C	B/C	34.15	32.6							
IUA_R02	Buffalo/ Nahoon	BUFF01_I	Intermediate	Buffalo (Middle)	R20F	D	D	34.46	83.8	Nahoon	R30F	Desktop	C/D	C	62.8 + 5%	32.5
		BUFF02_FV	Field Verification	Buffalo (Lower)	R20G	D/E	D	32.83	91.9	Qinera	R30F	Desktop	B/C	B	98.3	8.4

IUA	IUA Description	Rivers								Estuaries						
		EWR site code	Priority	River Name	Quaternary catchment	PES	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	Estuary System	Quaternary catchment	Priority	PES	REC	Total EWR as %nMAR for REC[1]	nMAR (10^6m^3)
IUA_Q01	Upper Fish	FISH01_FV	Field Verification	Great Fish (Upper)	Q21B	D	D	12.35	18.0	-						
		LFIS01_FV	Field Verification	Little Fish (Upper)	Q80B	C	B/C	23.72	24.3							
IUA_Q02	Great Fish	FISH03_I	Intermediate	Great Fish (Lower)	Q91B	C	C	29.73	331.8	Great Fish	Q93D	Rapid	C	B/C	90.3	496.3
		LFIS02_FV	Field Verification	Little Fish (Lower)	Q80G	C	C	18.88	88.9							
		TARK01_FV	Field Verification	Tarka	Q44C	D	D	12.21	63.3							
		FISH02_FV	Field Verification	Great Fish (Middle)	Q50B	D	D	12.50	201.9							
IUA_Q03	Koonap and Kat	KOON01_R	Rapid 3	Koonap	Q92G	D	D	17.14	76.9							
		KAT02_R	Rapid 3	Kat (Lower)	Q94F	C/D	C/D	15.16	61.8							
		KAT01_I	Intermediate	Kat (Upper)	Q94B	C	B/C	43.53	23.9							
IUA_N01	Sundays downstream Darlington Dam	SUND02_R	Rapid 3	Sundays (Lower)	N40C	D	D	5.42	214.0	Sundays	N40F	Desktop	C/D	B	95	263.1
IUA_M01	M primary catchment	SWAR01_I	Intermediate	KwaZungu/ Swartkops	M10C	C	B/C	39.97	27.3	Swartkops[2]	M10D	Intermediate	D	C	123.93	56.9
IUA_P01	P primary catchment	BOES01_FV	Field Verification	Bushmans	P10G	B	B	27.44	32.7	Kariega	P30C	Intermediate	C	C	60	21.9
										Bushmans	P20A	Desktop	C	B	75.8 + 3%	43.1
										Kowie	P40C	Desktop	C	B/C	89.1	31.4
IUA_KL01	Kromme from Kromme Dam to estuary and Gamtoos	GAMT01_I	Intermediate	Gamtoos	L90A	D	D	10.80	427.0	Gamtoos	L90C	Intermediate	D	C	51.8	404.2
										Kabeljous	K90G	Rapid	B	B	89.3	5.3
										Kromme[3]	K90E	Desktop	D	C	51	72.2
IUA_K01	Tsitsikamma and headwaters of	KROM01_R	Rapid 3	Kromme	K90A	D	C	36.66	27.6	Tsitsikamma	K80B	Desktop	B/C	B	66.9+5%	19.9
		GROO01_FV	Field Verification	Groot (K80D)	K80D	C	B/C	29.09	47.6							

IUA	IUA Description	Rivers								Estuaries						
		EWR site code	Priority	River Name	Quaternary catchment	PES	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)	Estuary System	Quaternary catchment	Priority	PES	REC	Total EWR as %nMAR for REC[1]	nMAR ($10^6 m^3$)
	Kromme to Kromme Dam															
IUA_L01	Kouga to Kouga Dam, Baviaanskloof	KOUG01_R	Rapid 3	Kouga	L82D	C	B/C	15.78	155.1	-						
		BAVI01_D	Desktop	Baviaanskloof	L81D	B	B	28.58	48.1							
		KOUG02_D	Desktop	Kouga	L82H	C	B/C	15.86	229.3							
IUA_LN01	Groot to Kouga confluence, Upper Sundays to Darlington Dam	SUND01_FV	Field Verification	Sundays (Upper)	N22E	C	C	18.25	148.0	-						
		GRT01_D	Desktop	Groot (L70G)	L70G	B	B	29.91	185.7							

[1]*Mbashe is above natural due to transfer scheme.*
[2]*The REC MAR of Swartkops is above Natural due to the Motherwell Channel and the Chatty River stormwater input. The scenario is down from present as it requested all 3 WWTW to rese water and not discharge into or just above the estuary.*
[3]*Kromme: 51% of 97 x 106*

5.2 Summary and Overall ESBC per IUA

All EWR sites per IUA will be used during the yield modelling to evaluate the implementation of the Reserve and the resulting water balance for the Keiskamma, Fish to Tsitsikamma catchment areas. The summary of the rivers and estuaries REC per EWR site per IUA is listed in **Table 5-2.**

Table 5-2: A summary of the rivers and estuaries REC per EWR site per IUA

IUA	Rivers			Estuaries	
	EWR site code	River	REC	System	REC
IUA_T01	MBHA02_R	Mbhashe (Upper)	B/C	N/A	
	MTHA02_D	Mthatha (Upper)	C		
IUA_T02	MBAS01_I	Mbhashe (Middle)	C/D	Mbashe (Intermediate)	B
IUA_T03	MTHA01_I	Mthatha (Lower)	B/C	N/A	
IUA_T04	MNGA01_R	Mngazi	B/C	Mngazi (Rapid)	B
	NQAB01_R	Nqabarha	C	Xora (Desktop)	B
	MTEN01_R	Mtentu	B/C	Msikaba (Desktop)	A
	XORA01_D	Xora	B		
IUA_R01	KEIS01_I	Keiskamma (Upper)	D	Keiskamma (Intermediate)	B
	KEIS02_R	Keiskamma (Lower)	B/C		
	TYUM01_R	Tyume	B/C		
IUA_R02	BUFF01_I	Buffalo (Middle)	D	Nahoon (Desktop)	C
	BUFF02_FV	Buffalo (Lower)	D	Qinera (Desktop)	B
IUA_Q01	FISH01_FV	Great Fish (Upper)	D	N/A	
	LFIS01_FV	Little Fish (Upper)	B/C		
IUA_Q02	FISH03_I	Great Fish (Lower)	C	Great Fish (Rapid)	B/C
	LFIS02_FV	Little Fish (Lower)	C		
	TARK01_FV	Tarka	D		
	FISH02_FV	Great Fish (Middle)	D		
IUA_Q03	KAT01_I	Kat (Upper)	B/C	N/A	
	KOON01_R	Koonap	D		
	KAT02_R	Kat (Lower)	C/D		
IUA_M01	SWAR01_I	KwaZungu/ Swartkops	B/C	Swartkops (Intermediate)	C
IUA_S01	INDW01_R	Indwe	C/D	N/A	
	WKEI01_R	White Kei	C		
	TSOM01_I	Tsomo	C/D		
IUA_S02	BKEI01_I	Black Kei	C	N/A	
IUA_S03	KUBU03_R	Kubusi (Lower)	B/C	Great Kei (Intermediate)	B/C
	GCUW01_R	Gcuwa	D		
	GKEI01_I	Great Kei	C		
IUA_P01	BOES01_FV	Bushmans	B	Bushmans (Desktop)	B
				Kowie (Desktop)	B/C
				Kariega (Intermediate)	C

IUA	Rivers			Estuaries	
	EWR site code	**River**	**REC**	**System**	**REC**
IUA_N01	SUND02_R	Sundays (Lower)	D	Sundays (Desktop)	B
IUA_L01	KOUG01_R	Kouga	C	N/A	
	BAVI01_D	Baviaanskloof	B		
	KOUG02_D	Kouga	B/C		
IUA_LN01	SUND01_FV	Sundays (Upper)	C	N/A	
	GRT01_D	Groot (L70G)	B		
IUA_KL01	GAMT01_I	Gamtoos	D	Gamtoos (Intermediate)	C
				Kromme (Desktop)	C
				Kabeljous (Rapid)	B
IUA_K01	KROM01_R	Kromme	C	Tsistikamma (Desktop)	B
	GROO01_FV	Groot (K80D)	B/C		

6. HYDROLOGICAL MODELLING APPROACH

6.1 Background and setup

The hydrological modelling used the data and WRSM2000 models available from Water Resources of South Africa, 2012 Study (WR2012) as a foundation, which were then updated and converted to Water Resource Yield Models (WRYM), where applicable. This dataset covers the hydrology from 1920 to 2009 (hydrological years). The models were created per river system and joined where appropriate.

The models for the Algoa (Nelson Mandela Bay Metropolitan Municipality) and Amathole (Buffalo City Metropolitan Municipality) systems were handled slightly differently. The Algoa model is a combination of the WR2012's WRSM2000 models (Groot, Swartkops and Coastal Catchments) and new models developed as part of the Water Availability Assessment Study (WAAS). The Amathole model was created as part of the Buffalo City Reconciliation Strategy.

The final list of models includes:

- Algoa (WRYM);
- Amathole (WRYM);
- Great Kei with Mbashe (WRYM);
- Keiskamma (WRYM);
- Fish Sundays (WRYM);
- Mthatha (WRYM);
- Msikaba (WRYM);
- Mngazi (WRYM); and
- Bushmans, Kariega, Kowie, East Kleinemonde (WRYM).

6.2 System schematics

The models use a combination of nodes and links to represent a given river system. This allows for the the model to be expressed graphically. These graphically representations can grow to be large and complex, and for this reason are available electronically upon request.

6.3 Model runs and outputs

The models were used to simulate for the longest available hydrological flow records for the catchments / IUAs available. Thus the periods entailed the Amthole model (R02) 1920 to 2020; the Algoa model (K, L and M) the period was 1927 to 2009 and the remaining models were all from 1920 to 2009 in the study area. The time series of average monthly flows and water supply volumes were then processed to get the average annual volumes at all the key sites and abstractions.

This baseline present day scenario is for the current development levels. The future scenarios may require interventions to be able to achieve and maintain water supply and downstream flows. While there are reconciliation options for the larger systems these are currently in a state of being updated and there is some degree of uncertainty around the preferred medium to long term options to be selected. The timing of these interventions may also be affected by the trade-off process. As such, these have been handled as part of the Scenarios Report (WEM/WMA7/00/CON/RDM/2324).

6.4 The ESBC Scenario – Scenario 1 and scenario 1a

This scenario is based on the present-day flows and water supply (water use) without EWR (scenario 1) and with EWR for REC (rivers and estuaries, scenario 1a).

7. HYDROLOGICAL MODELLING RESULTS

The results of the hydrological modelling are presented per IUA in the tables below. The results include the outputs of the model as supply volumes for domestic, EWR, hydropower and irrigation channels. The water requirement is the mean annual volume and is based on the present-day best estimates, of actual volumes required (and not just licenced volumes). This assessment was done for two supply scenarios, i.e. the first scenario is the results of the model without EWR implementation (EWR OFF) and the second is the results with EWR implementation (EWR ON).

Furthermore, two EWR channels are given per EWR site. These are the EWR channel itself and the adjacent "overflow" channel. In the EWR OFF scenario the flow at the EWR site would be the flow through the adjacent "overflow" channel, however, during the EWR ON scenario the flow would be the sum of the two channels (as sometimes the flows exceed the EWR requirements).

Finally, the Reliability of Supply (RoS) is presented, which indicates how often the demand for a specific user/ EWR was met. This was calculated by comparing the monthly demand and monthly supply volumes per sequence and counting the number of months the supply did not match or exceed the demand to calculate a proxy for the risk of non-supply (failure). In other words, when supply was less than 95% of the demand for a given month, it was counted as a failure. This was then used to calculate the RoS. Thus, in summary, the calculations were as follows:

Risk of Failure (ROF) = Number of failures+1 / Number of Months.
RoS = 1 – ROF

For the EWR OFF scenario, the adjacent "overflow" channels do not have a demand associated with the channel. However, in this comparison their supply volumes were compared to their associated EWR channel's demand to give an estimation of the performance of the EWR site without the EWRs being implemented.

The above is summaried in **Table 7-1 to Table 7-19**. The detailed tables of the RoS per IUA are provided in **Appendix A (**

Table A-11-1 to **Table A-11-19).** Furthermore, refer to **Table 7-20** which lists and summaries the critical users per IUA where RoS for either the EWR, or other water users, are not met (RoS is <75% i.e. it fails more than 25% of the time). This will aid the team to also focus on these during the trade-off assessment in the next phase of the study.

Table 7-1: Summary results for IUA_K01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
K80D	Riverine EWR	GROO01_FV	13.41	0.00	12.13	NA	58%
K80D	Riverine EWR	GROO01_FV_EWR OFF	NA	27.44	15.53	57%	NA
K80D	Irrigation	RR Module 1024 Demands	0.41	0.39	0.14	97%	60%
K90A	Irrigation	RR Module 1119 Demands	0.38	0.30	0.16	84%	60%
K90A	Irrigation	RR Module 1109 Demands	0.41	0.38	0.18	94%	61%
K90B	Irrigation	RR Module 1110 Demands	0.63	0.56	0.33	90%	64%
K90C	Irrigation	RR Module 1114 Demands	0.95	0.68	0.68	73%	73%

Table 7-2: Summary results for IUA_KL01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
K90D	Riverine EWR	KROM02_I	8.33	0.00	8.34	NA	100%
K90D	Riverine EWR	KROM02_I_EWR OFF	NA	24.17	21.93	23%	NA
K90E	Riverine EWR	GEEL01_D	0.47	0.00	0.47	NA	86%
K90E	Riverine EWR	GEEL01_D_EWR OFF	NA	1.27	0.81	67%	NA
K90E	*Estuarine Site /Estuarine Driven*	KROMME	45.13	0.00	42.79	NA	71%
K90E	*Estuarine Site /Estuarine Driven*	KROMME_EWR OFF	NA	27.40	0.86	5%	NA
K90F	Riverine EWR	SEEK01_D	6.66	0.00	0.99	NA	68%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
K90F	Riverine EWR	SEEK01_D_EWR OFF	NA	2.17	1.50	19%	NA
K90F	Riverine EWR	SWRT01_D	0.60	0.00	0.58	NA	100%
K90F	Riverine EWR	SWRT01_D_EWR OFF	NA	1.66	1.06	34%	NA
L90A	Riverine EWR	GAMT01_I	49.26	0.00	48.35	NA	97%
L90A	Riverine EWR	GAMT01_I_EWR OFF	NA	164.06	126.51	31%	NA
K90D	Irrigation	RR Module 1117 Demands	1.61	1.05	1.04	68%	68%
K90D	Irrigation	Impofu Direct IRR	0.79	0.73	0.36	94%	44%
K90E	Irrigation	RR Module 1082 Demands	0.79	0.80	0.00	99%	17%
K90F	Irrigation	RR Module 1090 Demands	1.45	0.51	0.17	39%	18%
K90G	Irrigation	RR Module 1096 Demands	2.52	0.69	0.69	27%	27%
L90A	Irrigation	RR Module 282 Demands	20.10	13.22	11.05	73%	67%
L90B1	Irrigation	RR Module 286 Demands	1.55	1.15	1.15	74%	74%

Table 7-3: Summary results for IUA_L01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L82F	Irrigation	RR Module 506 Demands	0.28	0.22	0.22	74%	74%
L82J	Irrigation	RR Module 289 Demands	0.73	0.35	0.10	70%	63%

Table 7-4: Summary results for IUA_LN01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Kliplaat	Domestic	Kliplaat Abs	0.35	0.36	0.10	97%	47%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L70G	Riverine EWR	GRT01_D	36.92	0.00	30.03	NA	83%
L70G	Riverine EWR	GRT01_D_EWR OFF	NA	90.74	65.00	44%	NA
N22C	Riverine EWR	SUND01_FV	17.04	0.00	16.70	NA	87%
N22C	Riverine EWR	SUND01_FV_EWR OFF	NA	79.16	64.59	43%	NA
L11A	Irrigation	RR Module 3 Demands	1.99	0.75	0.75	20%	20%
L11E	Irrigation	RR Module 23 Demands	5.11	2.60	2.60	29%	29%
L12A	Irrigation	RR Module 37 Demands	7.07	2.01	2.01	11%	11%
L12B	Irrigation	RR Module 43 Demands	3.91	3.43	3.43	74%	74%
L12C	Irrigation	RR Module 48 Demands	2.93	2.08	2.08	61%	61%
L21D	Irrigation	RR Module 74 Demands	2.62	1.81	1.81	50%	50%
L21E	Irrigation	RR Module 81 Demands	2.84	2.13	2.13	68%	68%
L22A	Irrigation	RR Module 93 Demands	0.50	0.00	0.00	1%	1%
L22C	Irrigation	RR Module 105 Demands	5.21	2.56	2.56	19%	19%
L30A	Irrigation	RR Module 136 Demands	0.57	0.23	0.07	22%	18%
L30B	Irrigation	RR Module 142 Demands	0.63	0.23	0.09	24%	19%
L30C	Irrigation	RR Module 147 Demands	0.32	0.21	0.21	65%	65%
L30D	Irrigation	RR Module 153 Demands	2.40	0.84	0.37	90%	33%
L40A	Irrigation	RR Module 157 Demands	1.42	0.56	0.56	26%	26%
L40B	Irrigation	RR Module 163 Demands	1.17	0.46	0.16	21%	18%
L50A	Irrigation	RR Module 167 Demands	1.89	1.22	1.20	54%	54%
L60A	Irrigation	RR Module 177 Demands	0.22	0.17	0.06	67%	38%
L60B	Irrigation	RR Module 182 Demands	0.19	0.15	0.01	66%	30%
L70B	Irrigation	RR Module 188 Demands	4.70	1.91	0.68	79%	30%
L70C	Irrigation	RR Module 192 Demands	6.63	1.79	0.91	63%	25%
L70D	Irrigation	RR Module 196 Demands	5.02	0.97	0.97	11%	11%
N11A	Irrigation	RR Module 439 Demands	9.40	2.17	2.17	17%	17%
N11B	Irrigation	RR Module 441 Demands	13.44	2.22	2.22	11%	11%
N12A	Irrigation	RR Module 444 Demands	2.37	0.85	0.85	27%	27%
N13A	Irrigation	RR Module 448 Demands	16.73	2.62	2.62	8%	8%
N13B	Irrigation	RR Module 450 Demands	39.29	2.27	2.27	3%	3%
N13C	Irrigation	RR Module 453 Demands	47.90	6.26	6.09	9%	9%
N14A	Irrigation	RR Module 454 Demands	2.81	1.23	1.23	23%	23%
N14B	Irrigation	RR Module 455 Demands	15.72	2.65	2.65	9%	9%
N14C	Irrigation	RR Module 456 Demands	36.99	5.48	5.48	8%	8%
N14D	Irrigation	RR Module 458 Demands	18.15	10.92	10.92	52%	52%
N21A	Irrigation	RR Module 459 Demands	22.15	1.54	1.54	2%	2%
N21B	Irrigation	RR Module 462 Demands	3.50	2.07	1.89	39%	36%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
N21C	Irrigation	RR Module 464 Demands	5.71	2.45	2.11	31%	29%
N21D	Irrigation	RR Module 465 Demands	0.82	0.75	0.57	79%	66%
N22A	Irrigation	RR Module 474 Demands	3.06	1.42	1.03	29%	25%
N22B	Irrigation	RR Module 475 Demands	0.38	0.31	0.14	75%	41%
N22E	Irrigation	RR Module 478 Demands	2.78	2.00	2.56	54%	77%
N24A	Irrigation	RR Module 467 Demands	2.21	1.08	0.99	29%	28%
N24B	Irrigation	RR Module 468 Demands	12.34	1.76	1.76	6%	6%
N24C	Irrigation	RR Module 470 Demands	6.97	1.78	1.78	12%	12%
N24D	Irrigation	RR Module 472 Demands	2.68	1.96	1.30	54%	39%
N30A	Irrigation	RR Module 482 Demands	13.25	5.45	5.45	24%	24%
N30B	Irrigation	RR Module 483 Demands	4.48	2.32	2.32	31%	31%
N30C	Irrigation	RR Module 484 Demands	1.33	0.84	0.84	41%	41%

Table 7-5: Summary results for IUA_M01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
M10C	Riverine EWR	SWAR01_I	6.69	0.00	6.69	NA	100%
M10C	Riverine EWR	SWAR01_I_EWR OFF	NA	25.81	19.22	46%	NA

Table 7-6: Summary results for IUA_N01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
N40B	Irrigation	RR Module 487 Demands	8.87	3.60	3.60	48%	48%
N40C	Irrigation	RR Module 488 Demands	31.65	10.94	10.94	41%	41%
N40D	Irrigation	RR Module 489 Demands	33.45	16.87	16.87	52%	52%

Table 7-7: Summary results for IUA_P01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
P10F	Riverine EWR	BOES01_D	5.59	0.00	5.19	NA	82%
P10F	Riverine EWR	BOES01_D_EWR OFF	NA	26.17	21.35	1%	NA
P30B	Riverine EWR	KARI01_D	2.59	0.00	2.59	NA	97%
P30B	Riverine EWR	KARI01_D_EWR OFF	NA	12.00	9.46	1%	NA
P10A	Irrigation	Node 21	0.57	0.36	0.36	68%	68%
P10B	Irrigation	Node 23	2.18	1.09	1.09	43%	43%
P10C	Irrigation	Node 25	1.48	0.22	0.22	10%	10%
P10D	Irrigation	Node 27	2.78	0.57	0.57	14%	14%
P10E	Irrigation	Node 29	2.11	1.32	0.96	51%	38%
P10F	Irrigation	Node 30	2.02	1.54	1.54	71%	71%
P10G	Irrigation	Node 32	1.39	0.77	0.77	49%	49%

Table 7-8: Summary results for IUA_Q01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q21B	Riverine EWR	FISH01_R	1.80	0.00	1.77	NA	96%
Q21B	Riverine EWR	FISH01_R_EWR OFF	NA	8.95	8.00	16%	NA
Q80A	Irrigation	RR Module 215 Demands	6.41	3.98	3.92	39%	38%
Q80B	Irrigation	RR Module 220 Demands	6.00	3.94	4.00	44%	44%
Q80C	Irrigation	RR Module 225 Demands	2.68	2.12	2.12	61%	61%

Table 7-9: Summary results for IUA_Q02

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q44C	Riverine EWR	TARK01_R	6.31	0.00	3.48	NA	12%
Q44C	Riverine EWR	TARK01_R_EWR OFF	NA	24.16	21.85	9%	NA
Q11B	Irrigation	RR Module 7 Demands	2.59	1.68	1.68	44%	44%
Q11D	Irrigation	RR Module 15 Demands	9.34	3.74	3.74	25%	25%
Q12B	Irrigation	RR Module 23 Demands	7.64	2.55	2.55	20%	20%
Q14A	Irrigation	RR Module 37 Demands	16.19	3.36	3.36	9%	9%
Q14B	Irrigation	RR Module 41 Demands	14.86	4.21	4.20	13%	13%
Q14C	Irrigation	RR Module 45 Demands	8.17	2.89	2.89	19%	19%
Q14D	Irrigation	RR Module 50 Demands	5.11	1.38	1.38	17%	17%
Q14E	Irrigation	RR Module 54 Demands	5.55	1.33	1.33	15%	15%
Q21B	Irrigation	RR Module 71 Demands	21.11	5.41	4.64	14%	13%
Q22A	Irrigation	RR Module 58 Demands	4.26	1.95	1.91	26%	26%
Q22B	Irrigation	RR Module 62 Demands	4.51	1.39	1.34	20%	20%
Q30B	Irrigation	RR Module 89 Demands	7.35	3.64	3.63	29%	29%
Q41A	Irrigation	RR Module 113 Demands	3.66	1.75	1.75	33%	33%
Q41B	Irrigation	RR Module 119 Demands	6.06	2.54	2.54	29%	29%
Q41C	Irrigation	RR Module 124 Demands	0.69	0.56	0.56	71%	71%
Q43A	Irrigation	RR Module 138 Demands	4.58	2.42	2.42	32%	32%
Q43B	Irrigation	RR Module 144 Demands	2.78	1.64	1.64	37%	37%
Q44C	Irrigation	RR Module 164 Demands	22.28	3.23	2.02	10%	9%
Q60C	Irrigation	RR Module 193 Demands	0.69	0.55	0.55	72%	72%
Q80D	Irrigation	RR Module 230 Demands	20.20	9.73	9.74	35%	35%
Q80F	Irrigation	RR Module 242 Demands	10.48	3.06	2.99	16%	16%
Q91B	Irrigation	RR Module 256 Demands	2.75	1.83	1.83	54%	54%
Q91C	Irrigation	RR Module 260 Demands	3.35	1.75	1.75	41%	41%
Q93B	Irrigation	RR Module 349 Demands	3.98	0.66	0.66	13%	13%

Table 7-10: Summary results for IUA_Q03

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q92G	Riverine EWR	KOON01_R	12.78	0.00	12.77	NA	100%
Q92G	Riverine EWR	KOON01_R_EWR OFF	NA	61.47	51.60	32%	NA

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q94B	Riverine EWR	KAT01_I	9.28	0.00	9.25	NA	100%
Q94B	Riverine EWR	KAT01_I_EWR OFF	NA	15.89	6.72	27%	NA
Q94F	Riverine EWR	KAT02_R	10.16	0.00	10.12	NA	100%
Q94F	Riverine EWR	KAT02_R_EWR OFF	NA	42.83	35.17	30%	NA
Q92A	Irrigation	RR Module 265 Demands	7.51	4.89	4.65	51%	49%
Q92B	Irrigation	RR Module 272 Demands	8.90	3.48	3.10	35%	34%
Q92C	Irrigation	RR Module 277 Demands	8.30	3.89	2.33	32%	30%
Q92D	Irrigation	RR Module 285 Demands	2.75	1.91	1.11	57%	40%
Q94D	Irrigation	RR Module 329 Demands	10.22	6.97	6.16	54%	46%
Q94F	Irrigation	RR Module 339 Demands	11.93	5.57	3.94	38%	32%

Table 7-11: Summary results for IUA_R01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
R10D	Riverine EWR	KEIS01_I	23.86	0.00	23.73	NA	99%
R10D	Riverine EWR	KEIS01_I_EWR OFF	NA	34.12	12.08	22%	NA
R10H	Riverine EWR	TYUM01_R	10.63	0.00	10.60	NA	98%
R10H	Riverine EWR	TYUM01_R_EWR OFF	NA	19.25	8.89	31%	NA
R10L	Riverine EWR	KEIS02_R	29.35	0.00	29.28	NA	100%
R10L	Riverine EWR	KEIS02_R_EWR OFF	NA	57.72	30.78	28%	NA
R10A	Irrigation	RR Module 2 Demands	0.50	0.44	0.42	66%	64%
R10K	Irrigation	RR Module 61 Demands	1.83	1.60	1.21	82%	64%

Table 7-12: Summary results for IUA_R02

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Qonce (King Williams)	Domestic	Rooikrantz	19.88	15.23	13.30	67%	58%
R20F	Riverine EWR	BUFF01_I	27.61	0.00	26.65	NA	98%
R20F	Riverine EWR	BUFF01_I_EWR OFF	NA	52.59	33.06	46%	NA
R20G	Riverine EWR	BUFF02_R	29.03	0.00	28.77	NA	99%
R20G	Riverine EWR	BUFF02_R_EWR OFF	NA	21.69	4.95	6%	NA
R30F	Riverine EWR	NAHO01_FV	2.02	0.00	1.99	NA	100%
R30F	Riverine EWR	NAHO01_FV_EWR OFF	NA	16.26	14.06	40%	NA
R30F	Irrigation	RR Module 267 Demands	0.82	0.27	0.19	29%	27%

Table 7-13: Summary results for IUA_S01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Komani (Queenstown)	Domestic	Emergency Transfer to Queenstown	3.66	0.49	0.44	10%	10%
S50G	Riverine EWR	TSOM01_I	67.22	0.00	51.77	NA	72%
S50G	Riverine EWR	TSOM01_I_EWR OFF	NA	87.60	44.04	15%	NA
S10J	Riverine EWR	WKEI01_R	33.14	0.00	33.03	NA	100%
S10J	Riverine EWR	WKEI01_R_EWR OFF	NA	128.64	95.68	57%	NA
S10G	Irrigation	RR Module 121 Demands	1.51	1.12	1.12	66%	66%
S40A	Irrigation	RR Module 100 Demands	5.36	3.68	3.65	46%	46%
S40B	Irrigation	RR Module 101 Demands	5.27	3.37	3.34	44%	44%
S40C	Irrigation	RR Module 102 Demands	3.85	2.53	2.49	48%	47%

Table 7-14: Summary results for IUA_S02

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S32K	Riverine EWR	BKEI01_I	62.17	0.00	62.06	NA	99%
S32K	Riverine EWR	BKEI01_I_EWR OFF	NA	107.95	66.37	22%	NA
S31A	Irrigation	RR Module 95 Demands	3.12	2.71	0.90	70%	33%
S31B	Irrigation	RR Module 96 Demands	3.16	2.71	0.74	71%	30%
S31C	Irrigation	RR Module 97 Demands	5.90	4.26	1.26	55%	28%
S31D	Irrigation	RR Module 98 Demands	3.35	2.56	0.63	58%	28%
S31E	Irrigation	RR Module 99 Demands	17.45	3.50	2.43	24%	19%
S31G	Irrigation	RR Module 125 Demands	19.47	8.03	2.78	30%	20%
S31G	Irrigation	RR Module 126 Demands	2.40	0.83	0.28	25%	18%
S32A	Irrigation	RR Module 107 Demands	1.45	0.39	0.39	21%	21%
S32B	Irrigation	RR Module 108 Demands	4.10	1.67	0.72	45%	23%
S32C	Irrigation	RR Module 109 Demands	6.37	2.05	0.90	39%	22%
S32D	Irrigation	RR Module 103 Demands	12.62	8.78	8.78	50%	50%
S32F	Irrigation	RR Module 105 Demands	3.16	1.23	1.23	29%	29%
S32J	Irrigation	RR Module 127 Demands	1.70	1.27	0.21	52%	21%
S32K	Irrigation	RR Module 128 Demands	2.90	2.35	0.37	57%	21%
S32L	Irrigation	RR Module 129 Demands	2.15	1.59	2.11	55%	99%
S32M	Irrigation	RR Module 130 Demands	2.90	2.33	2.81	59%	98%

Table 7-15: Summary results for IUA_S03

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S60A	Riverine EWR	KUBU02_FV	6.41	0.00	6.37	NA	100%
S60A	Riverine EWR	KUBU02_FV_EWR OFF	NA	31.35	25.02	73%	NA
S60B	Riverine EWR	KUBU01_R	6.60	0.00	6.56	NA	99%
S60B	Riverine EWR	KUBU01_R_EWR OFF	NA	30.13	19.30	43%	NA
S60E	Riverine EWR	KUBU03_R	19.44	0.00	18.11	NA	53%
S60E	Riverine EWR	KUBU03_R_EWR OFF	NA	54.34	34.25	33%	NA
S70A	Riverine EWR	GKEI01_I	188.71	0.00	188.69	NA	100%
S70A	Riverine EWR	GKEI01_I_EWR OFF	NA	604.44	441.96	44%	NA

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S70D	Riverine EWR	GCUW01_R	9.53	0.00	9.53	NA	100%
S70D	Riverine EWR	GCUW01_R_EWR OFF	NA	51.50	42.14	46%	NA
S60B	Irrigation	RR Module 260 Demands	1.20	1.21	0.55	100%	42%
S60C	Irrigation	RR Module 144 Demands	2.43	1.62	0.75	53%	35%
S60D	Irrigation	RR Module 145 Demands	2.97	2.81	0.75	83%	32%

Table 7-16: Summary results for IUA_T01

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Elliot	Domestic	Eliot Abs	0.32	0.35	0.35	100%	100%
T11C	Bionode	XUKA01_D	NA	0.00	0.00	NA	NA
T11C	Bionode	XUKA01_D_EWR OFF	NA	113.80	113.80	NA	NA
T11H	Riverine EWR	MBHA02_R	73.84	0.00	73.82	NA	99%
T11H	Riverine EWR	MBHA02_R_EWR OFF	NA	354.25	280.43	99%	NA
T11A	Irrigation	RR Module 321 Demands	0.00	0.00	0.00	100%	100%
T11B	Irrigation	RR Module 322 Demands	0.00	0.00	0.00	100%	100%
T11C	Irrigation	RR Module 323 Demands	0.60	0.59	0.59	100%	100%
T11D	Irrigation	RR Module 324 Demands	0.00	0.00	0.00	100%	100%
T11E	Irrigation	RR Module 325 Demands	0.00	0.00	0.00	100%	100%
T11F	Irrigation	RR Module 326 Demands	0.00	0.00	0.00	100%	100%
T11G	Irrigation	RR Module 327 Demands	0.00	0.00	0.00	100%	100%
T11H	Irrigation	RR Module 328 Demands	0.00	0.00	0.00	100%	100%
T12A	Irrigation	RR Module 317 Demands	0.00	0.00	0.00	100%	100%
T12B	Irrigation	RR Module 318 Demands	0.00	0.00	0.00	100%	100%
T12C	Irrigation	RR Module 319 Demands	3.50	3.29	3.10	95%	90%
T12D	Irrigation	RR Module 320 Demands	1.29	1.30	1.30	100%	100%

Table 7-17: Summary results for IUA_T02

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
T13C	Riverine EWR	MBAS01_I	245.52	0.00	244.87	NA	100%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
T13C	Riverine EWR	MBAS01_I_EWR OFF	NA	739.74	489.09	100%	NA
T13E	Estuarine Site/ Estuarine Driven	MBASHE	NA	0.00	0.00	NA	NA
T13E	Estuarine Site/ Estuarine Driven	MBASHE_EWR OFF	NA	853.11	847.35	NA	NA
Eskom	Hydropower	Colleywobbles Hydropower	84.89	84.83	84.83	100%	100%

Table 7-18: Summary results for IUA_T03

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Mthatha	Domestic	Mtata Abs	19.00	18.93	18.77	99%	98%
T20A	Riverine EWR	MTHA02_D	25.59	0.00	25.61	NA	100%
T20A	Riverine EWR	MTHA02_D_EWR OFF	NA	81.99	56.41	92%	NA
T20G	Estuarine Site/ Estuarine Driven	MTATA	NA	0.00	0.00	NA	NA
T20G	Estuarine Site/ Estuarine Driven	MTATA_EWR OFF	NA	321.57	322.09	NA	NA
T20G	Riverine EWR	MTHA01_I	150.53	0.00	150.13	NA	100%
T20G	Riverine EWR	MTHA01_I_EWR OFF	NA	321.57	171.96	84%	NA
Mthatha	Hydropower	Mthatha Hydropwer	132.51	132.19	131.36	100%	98%

Table 7-19: Summary results for IUA_T04

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Lusikisiki	Domestic	Lusikisiki Abs	5.84	5.84	5.84	100%	99%
Port Saint Johns	Domestic	Port St. Johns	3.00	2.87	2.87	79%	79%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
T60C	Riverine EWR	MTEN01_R	37.08	NA	NA	NA	NA
T60C	Riverine EWR	MTEN01_R_OFF	NA	88.63	NA	94%	NA
T60F	Riverine EWR	XURA01_D	5.24	0.00	5.23	NA	100%
T60F	Riverine EWR	XURA01_D_EWR OFF	NA	15.77	10.53	100%	NA
T60G	Riverine EWR	MSIK01_D	29.51	0.00	29.57	NA	100%
T60G	Riverine EWR	MSIK01_D_EWR OFF	NA	135.25	105.70	99%	NA
T60G	Estuarine Site/ Estuarine Driven	MSIKABA	NA	0.00	0.00	NA	NA
T60G	Estuarine Site/ Estuarine Driven	MSIKABA_EWR OFF	NA	216.18	216.19	NA	NA
T70B	Estuarine Site/ Estuarine Driven	BULO01_D	NA	0.00	0.00	NA	NA
T70B	Estuarine Site/ Estuarine Driven	BULO01_D_EWR OFF	NA	1.05	1.05	NA	NA
T70B	Riverine EWR	MNGA01_R	20.45	0.00	20.42	NA	100%
T70B	Riverine EWR	MNGA01_R_EWR OFF	NA	75.00	54.60	96%	NA
T70B	Estuarine Site/ Estuarine Driven	MNGAZI	NA	0.00	0.00	NA	NA
T70B	Estuarine Site/ Estuarine Driven	MNGAZI_EWR OFF	NA	82.56	82.56	NA	NA
T90A	Riverine EWR	XORA01_D	22.82	NA	NA	NA	NA
T90A	Riverine EWR	XORA01_D_OFF	NA	51.86	NA	67%	NA
T90A	Riverine EWR	NQUB01_R	3.19	NA	NA	NA	NA
T90A	Riverine EWR	NQUB01_R_OFF	NA	9.12	NA	77%	NA

Table 7-20: Summary of the critical users per IUA where RoS for either the EWR, or other water users, are not met

IUA	Scenario	RoS (Months fully supplied)			
		EWR	IRR	Domestic	Hydropower
K01	EWR OFF	71%	97%	NA	NA
	EWR ON	78%	91%	NA	NA
KL01	EWR OFF	20%	87%	99%	NA
	EWR ON	80%	79%	92%	NA
L01	EWR OFF	81%	95%	NA	NA
	EWR ON	90%	95%	NA	NA
LN01	EWR OFF	43%	72%	99%	NA
	EWR ON	85%	70%	82%	NA
M01	EWR OFF	46%	95%	100%	NA
	EWR ON	100%	95%	98%	NA
N01	EWR OFF	88%	82%	100%	NA
	EWR ON	100%	82%	100%	NA
P01	EWR OFF	1%	83%	91%	NA
	EWR ON	90%	83%	90%	NA
Q01	EWR OFF	51%	61%	100%	NA
	EWR ON	97%	61%	100%	NA
Q02	EWR OFF	72%	74%	93%	NA
	EWR ON	78%	74%	93%	NA
Q03	EWR OFF	30%	82%	100%	NA
	EWR ON	100%	80%	100%	NA
R01	EWR OFF	27%	94%	98%	NA
	EWR ON	99%	91%	96%	NA
R02	EWR OFF	42%	66%	77%	NA
	EWR ON	84%	66%	73%	NA
S01	EWR OFF	50%	91%	85%	94%
	EWR ON	91%	90%	85%	90%
S02	EWR OFF	22%	56%	100%	NA
	EWR ON	99%	47%	99%	NA
S03	EWR OFF	48%	91%	100%	NA
	EWR ON	90%	81%	100%	NA
T01	EWR OFF	99%	99%	100%	NA
	EWR ON	99%	99%	100%	NA

IUA	Scenario	RoS (Months fully supplied)			
		EWR	IRR	Domestic	Hydropower
T02	EWR OFF	100%	NA	NA	100%
	EWR ON	100%	NA	NA	100%
T03	EWR OFF	0%	0%	0%	0%
	EWR ON	88%	NA	99%	100%
T04	EWR OFF	0%	0%	0%	0%
	EWR ON	100%	NA	98%	98%

8. THE ALTERNATE CATCHMENT CONFIGURATION SCENARIOS

Below in **Table 8-1** and **Table 8-2** is a summary and outline of the proposed operational and flow scenarios that will be used to compare the ESBC with, and to evaluate both ecological and socio-economic consequences, coupled with undertaking trade-offs to inform the water resource class per IUA. Further detail on the identification, approach, methodolgoy and assessment of these scenarios, please refer to the Scenarios Report (Report No. WEM/WMA7/00/CON/RDM/2324).

Table 8-1: Summary of operational scenarios for the study

Scenario	Scenario descriptions	
Scenario 1 (Sc1)	Present Day Demands	• Sc1a (without EWR) – "modelling flows in rivers/ estuaries and supply to users without EWR"
		• Sc1b (with EWR - rivers) – "the EWR for REC for rivers will be included into the models and prioritised to ensure the flows are provided to meet the ecological needs – will need to assess whether meets the socio-economic needs/potential trade-offs?"
		• Sc1c (with EWR – REC for rivers and estuaries)
Scenario 2 (Sc2)	Medium Term (2030)	• Sc2a (without EWR)
		• Sc2b (with EWR - rivers)
		• Sc2c (with EWR – rivers and estuaries)
Scenario 3 (Sc3)	Long Term (2050)	• Sc3a (without EWR) • Sc3.1a (intervention alternative scenario without EWR)
		• Sc3b (with EWR - rivers) • Sc3.1b (intervention alternative scenario with EWR for rivers)
		• Sc3c (with EWR – rivers and estuaries) • Sc3.1c (intervention alternative scenario with EWR for rivers and estuaries)
Scenario 4	Water quality (considered and predicted)	• Only selected IUAs were assessed where water quality was identified to be of a concern. The future water quality status (either deterioration or improvement) is based on Sc1b – the present day status of the water quality, along with the EWR for the set REC for rivers and/or estuaries.
Scenario 5	Climate Change (considered and predicted)	• Models were run stochastically; • Selected a drier time series (that correlated with the anticipated changes) and used that as the historical alternative sequence;

Scenario	Scenario descriptions	
		• Algoa reduced availability although were not reflected within the models; • Amatola – projections were not sufficiently clear whether there was an increase/decrease, thus no change in the water balance was made; • The range of flows were assessed; • Only one climate change scenario was assessed and for specific IUAs where most impact expected

Table 8-2: Proposed catchment scenarios per IUA

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m³/year)	Augmentation Interventions	Model Used for Assessment
IUA_T01	Upper Mbashe, Upper Mthatha	Linked to: IUA_T02, IUA_S01, S02, S03	MBHA02_R: Mbhashe (Upper) MTHA02_D: Mthatha XUKA01_D: Xuka	N/A	None	No	Sc1	Forestry & Invasives (40.6) Irrigation (5.4) **Mbashe:** Elliot (0.305) Collywobbles Hydropower (84.88)		WRYM**
							Sc2	**Mbashe:** Elliot (0.333) 50% utilisation of irrigation allocation from Ncora Dam (11 MCM/a) Collywobbles Hydropower (84.88)		
							Sc3	**Mbashe:** Elliot (0.355) Full utilisation of irrigation allocation from Ncora Dam (21.9 MCM/a) Collywobbles Hydropower (84.88)		
IUA_T02	Lower Mbashe	Linked to: IUA_T01, IUA_S01, S02, S03 Upstream water transfer from Ncora Dam (Tsomo River in S5) to Collywobbles hydropower Thus, impact on Great Kei, will have an impact on Mbashe	MBAS01_I: Mbhashe (Middle)	Mbashe (Intermediate)		No	Sc1	Forestry & Invasives (0.3) Irrigation (0)		WRYM
							Sc2			
							Sc3			
IUA_T03	Lower Mthatha	Linked to IUA_T01 (upper Mthatha) Hydropower (modified flows)	MTHA01_I: Mthatha (Lower)	Mthatha (although will rely on rivers as the EWR site is approximately 1km upstream from the estuary)	Mthatha (T2R001)	No	Sc1	Forestry & Invasives (5) Irrigation (0) **Mthatha:** Mthatha (22.332)		WRYM

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m^3/year)	Augmentation Interventions	Model Used for Assessment
		Growth scenario for Mthatha Re-use included/excluded					Sc2	**<u>Mthatha:</u>** Mthatha (23.126)	**<u>Mthatha:</u>** Groundwater development Re-use of water (2.795 MCM/a)	
							Sc3a	**<u>Mthatha:</u>** Mthatha (24.393) Hydropower (132)	**<u>Mthatha:</u>** Groundwater development Re-use of water (2.795 MCM/a)	
							Sc3b	**<u>Mthatha:</u>** Mthatha (55.08) Hydropower (90)	**<u>Mthatha:</u>** Groundwater development Re-use of water (2.795 MCM/a)	
IUA_T04[3]	Pondoland coastal	Mngazi (off-channel dam - increased demands) Potential new license applications (projected growth for domestic water use – limited information on irrigation growth and license applications constituting water use in the given sector) Will use existing info for Msikaba River No developments on Mngazana, is this correct?	MNGA01_R: Mngazi NQAB01_R: Nqabarha MTEN01_R: Mtentu MTAK01_FV: Mtakatye BULO01_D: Bulolo MNTA01_D: Mntafufu MZIN01_D: Mzizangwa XURA01_D: Xura MSIK01_D: Msikaba	Mngazi (Rapid) Xora (Desktop) Msikaba (Desktop) *Mngazana (Lara to advise owing to ecological importance/ mangroves)*		No	Sc1	Forestry & Invasives (13.1) Irrigation (0) **<u>Msikaba:</u>** Lusikisiki (5.837) **<u>Mngazi:</u>** Port St. Johns (7.95)		WRYM (Mngazi) WRSM 2000 (Remainder)
							Sc2	Irrigation (1.45) **<u>Msikaba:</u>** Lusikisiki (5.901) **<u>Mngazi:</u>** Port St. Johns (*need to investigate)*	**<u>Msikaba:</u>** Construction of Zalu Dam (on Xura River) (5.84 MCM/a) Additional abstractions from Magwa Dam and to meet the growing water requirements (1 MCM/a) **<u>Mngazi:</u>** Abstraction from the Mzimvubu/Mzintlava River (1 MCM/a) Development of the Mngazana Regional Water Supply Scheme (RWSS) (1 MCM/a) Identifying and addressing unlawful irrigation[2]	
							Sc3	Irrigation (1.45) **<u>Msikaba:</u>** Lusikisiki (5.901) **<u>Mngazi:</u>** Port St. Johns [1]	Identifying and addressing unlawful irrigation[2]	

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m³/year)	Augmentation Interventions	Model Used for Assessment
IUA_R01	Keiskamma	Consider scenario (demand as a medium term, alternative scenario – abstractions – greater/less domestic growth).	CATA01_D: Cata KEIS01_I: Keiskamma (Upper) KEIS02_R: Keiskamma (Lower) TYUM01_R: Tyume	Keiskamma (Rapid) Gxulu *(potentially re-look at flows from scenarios) This was identified as possible groundwater-estuary integration. If no additional information available from estuary we can exclude*	Sandile (R1R002) Binfield (R1R003)	Yes	Sc1	Forestry & Invasives (15.6) Irrigation (16.4) **Keiskamma:** Peddie (2.68) Dimbaza (7.29) Debe (0.78) ADM (2.33)	Identifying and addressing unlawful irrigation, especially on Keiskamma[2]	WRYM
							Sc2	**Keiskamma:** Peddie (3.72) Dimbaza (10.39) Debe (1.37) ADM (2.83)	Identifying and addressing unlawful irrigation, especially on Keiskamma[2]	
							Sc3	**Keiskamma:** Peddie (-) Dimbaza (-) Debe (-) ADM (3.39)		
IUA_R02	Buffalo / Nahoon	Linked to IUA_S03 Intervention scenarios Growth scenarios	BUFF03_FV: Buffalo YELL01_D: Yellowwoods BUFF01_I: Buffalo (Middle) BUFF02_R: Buffalo NAHO01_FV: Nahoon KWEN01_FV: Kwenxura	Nahoon (Desktop) Qinera (Desktop) Kwelera *(potentially re-look at flows from scenarios)* Bulura *(potentially re-look at flows from scenarios)* Cintsa *(potentially re-look at flows from scenarios)*	Laing (R2R001) Bridledrift (R2R003) Nahoon (R3R001)	Yes	Sc1	Forestry & Invasives (9.7) Irrigation (2.9) **Amathole:** Buffalo City (91.41) Amathole District (3.35)		WRYM
							Sc2	**Amathole:** Buffalo City (102.05) Amathole District (3.96)	**Buffalo City:** Water Reuse (20 million m³/a) **Amathole:** Groundwater (3.3 million m³/a	
							Sc3	**Amathole:** Buffalo City (120.66) Amathole District (4.71)	**Buffalo City:** Water Reuse (26 million m³/a) Wesselshoek Dam (10.9 million m³/a) **Amathole:** Groundwater (3.3 million m³/a	
IUA_Q01	Fish	Run as one model Linked to: IUA_Q02, Q03, LN01, N01	FISH01_R: Great Fish PAUL01_D: Pauls LFIH01_FV: Klein Fish	N/A		No	Sc1	Forestry & Invasives (0) Irrigation (15.1) **Fish:** Inxuba (Cradock) (1.715)		WRYM

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m^3/year)	Augmentation Interventions	Model Used for Assessment
		Major transfer from Gariep Dam (Upper Orange catchment) to Grassridge Dam to Elandsdrift Dam to the Great Fish (Fish catchment), then transfer to Sundays system to Gqeberha (see **Figure 1** below).					Sc2	**Fish:** Inxuba (Cradock) (1.9335)	**Fish:** Groundwater development (0.7 MCM/a)	
IUA_Q02	Great Fish		GBRA01_FV: Groot Brak FISH04_FV: Great Fish TARK01_R: Tarka FISH02_R: Great Fish FISH05_D: Great Fish LFIS02_FV: Klein Fish FISH03_I: Great Fish (Lower)	Great Fish (Desktop)		Provisionally Yes (downstream of Nxuba (Craddock) – WWTW, irrigation, agriculture)	Sc1	Forestry & Invasives (1.4) Irrigation (600.1) **Fish:** Cookhouse & Sommerset East (2.447)	**Fish:** Partial supply to Makhanda (Grahamstown) (6.57)	WRYM
							Sc2	**Fish:** Cookhouse & Sommerset East (2.824)	**Fish:** Groundwater development (0.7 MCM/a) Partial supply to Makhanda (Grahamstown) (7.62)	
							Sc3		**Fish:** Groundwater development (0.7 MCM/a) Partial supply to Makhanda (Grahamstown) (8.03)	
IUA_Q03	Koonap and Kat		KAT01_I: Kat (Upper) KAT03_D: Kat KAT02_R: Kat (Lower) KOON01_R: Koonap	N/A	Katriver (Q9R001)	No	Sc1	Forestry & Invasives (1.3) Irrigation (50.4) **Kat:** KwaMaqoma (Fort Beaufort), Seymour, Balfour (3.113) **Koonap:** Adelaide, Bedford (1.306)		WRYM
							Sc2	**Kat:** KwaMaqoma (Fort Beaufort), Seymour, Balfour (3.113) **Koonap:** Adelaide, Bedford (1.306)	**Kat:** Groundwater development (0.7 MCM/a) **Koonap:** Foxwood Dam	
IUA_M01	M primary catchment	Linked to: IUA_KL01, LN01	SWAR01_I: Swartkops SAND01_D: Sand ELAN01_D: Elands CHAT01_D: Chatty	Swartkops (Desktop)	Groendal (M1R001)	Estuary only (Swartkop estuary)	Sc1	Forestry & Invasives (32.5) Irrigation (8) **Swartkops:**	**Coega:** Nooitgedagt / Coega Low Level Scheme (Up to 160 Ml/d)	WRYM

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m³/year)	Augmentation Interventions	Model Used for Assessment
								Nelson Mandela Bay Metro (126.38 MCM)		
							Sc2	**Swartkops:** Nelson Mandela Bay Metro (126.2[4])	**Swartkops:** Groundwater development (0.4 million m³/a) **Coega:** Nooitgedagt / Coega Low Level Scheme	
							Sc3	**Swartkops:** Nelson Mandela Bay Metro (151.6)	Schoenmakerskop Desalination (60 Ml/d)	
IUA_S01	Upper Great Kei	Run as one model Linked to: IUA_T01, T02, R02 (Kubusi in S03) Ncora Dam (on Tsomo River – irrigation and license allocation update)	TSOM01_I: Tsomo INDW01_R: Indwe WKEI01_R: White Kei	N/A	Xonxo (S1R001) Lubisi (S2R001) Ncora (S5R001)	Yes (rivers only)	Sc1	Forestry & Invasives (7.2) Irrigation (36.1) **White Kei:** Emalahleni LM (2.42) **Tsomo:** Intsika LM (4.833)		WRYM
							Sc2	**White Kei:** Emalahleni LM (2.51) **Tsomo:** Intsika LM (4.84)	**Tsomo [5]:** Groundwater development (0.1 MCM/a) Extension of the Tsojana Scheme (0.12 MCM/a)	
							Sc3	**White Kei:** Emalahleni LM (2.61) **Tsomo:** Intsika LM (4.86)		
IUA_S02	Black Kei		KOMA01_D: Komani KSIM01_FV: Klaas Smits KLIP01_FV: Klipplaat BKEI01_I: Black Kei	N/A	Waterdown (S3R001)	Yes (rivers only)	Sc1	Forestry & Invasives (2.1) Irrigation (120.9) **Black Kei:** Komani (Queenstown) (13.8)		
							Sc2	**Black Kei:** Komani (Queenstown) (13.282)	**Black Kei:** Additional abstractions from Xonxa and Lubisi Dams (2 MCM/a). *This is assumed that the emergency transfer is formalised.*	

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m³/year)	Augmentation Interventions	Model Used for Assessment
									Re-use of water in Komani Queenstown (4.391 MCM/a)	
							Sc3	**<u>Black Kei:</u>** Komani (Queenstown) (14.67)		
IUA_S03	Lower Great Kei		GKEI01_I: Great Kei GCUW01_R: Gcuwa KUBU01_R: Kubusi KUBU02_FV: Kubusi KUBU03_R: Kubusi (Lower)	Great Kei (Intermediate)	Gcuwa (S7R001) Wriggleswade (S6R002)	Yes (Rivers and Great Kei estuary – WWTW located on estuary system)	Sc1	Forestry & Invasives (29.6) Irrigation (21.9) **<u>Gubu:</u>** Stutterheim (1.02) **<u>Gcuwa:</u>** Butterworth (8.54)		
							Sc2	Forestry & Invasives or irrigation growth? **<u>Gubu:</u>** Stutterheim (1.13) **<u>Gcuwa:</u>** Butterworth (8.22)	**<u>Kubu:</u>** Groundwater development (2 MCM/) **<u>Gcuwa:</u>** Extension of Qolora Scheme (0.5 MCM/a) Extension of Butterworth scheme (0.5 MCM/a) Groundwater development in Butterworth & Idutwa Additional allocation from Xilinxa Dam (2.9 MCM/a) Re-use of water in Butterworth (3.877 MCM/a) Raising of Gcuwa dam Mbashe North Scheme on Nqbara River (dam on Nqabara River) Qora/Cufatweni RWSS Sundwana RWSS[6]	
							Sc3	**<u>Gubu:</u>** Stutterheim (1.32) **<u>Gcuwa:</u>** Butterworth (9.08)	**<u>Gubu:</u>** Groundwater development (2 million m³/a)	

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m^3/year)	Augmentation Interventions	Model Used for Assessment
IUA_P01	P primary catchment	Driven by estuary requirements - rivers dry	BLOU01_D: Bloukrans KARI01_D: Kariega (Dry) BOES01_FV: Bushmans (Dry)	Kariega (Rapid) Bushmans (Desktop) Kowie (Desktop) East-Kleinemode		Yes rivers and estuaries (Kariega and Kowie estuary - WWTW located on estuary system)	Sc1	Forestry & Invasives (10.3) Irrigation (21.2) **Kariega:** Makhanda (Grahamstown) (8.87) Port Alfred (2.23)	**Fish:** Allocation from Glen Melville Dam (6.57 MCM/a)	WRYM
							Sc2	Forestry & Invasives or irrigation growth? **Kariega:** Makhanda (Grahamstown) (9.92) Port Alfred (2.0)	**Kariega:** **Fish:** Increased allocation from Glen Melville Dam (7.62 MCM/a)	
							Sc3a	**Kariega:** Makhanda Grahamstown (10.33) Port Alfred (2.506)	**Kariega:** **Fish:** Increased allocation from Glen Melville Dam (8.03 MCM/a)	
IUA_N01	Sundays downstream of Darlington Dam	Linked to: IUA_LN01, Q01, Q02, Q03	SUND02_R: Sundays (lower) COER01_D: Coerney	Sundays (Desktop)	Darlington (N2R001)	No[7]	Sc1	Forestry & Invasives (0.3) Irrigation (154.6) **Sundays:** Kirkwood, Addo, Enon (4.0025)	Supply to Nelson Mandela Bay (58.5)	WRYM
							Sc2	**Sundays:** Kirkwood, Addo, Enon (4.88)	Supply to Nelson Mandela Bay (76.55)	
							Sc3	**Sundays:** Kirkwood, Addo, Enon (5.947)	Supply to Nelson Mandela Bay (76.55)	
IUA_L01	Kouga to Kouga Dam and Baviaanskloof	Linked to: IUA_K01, KL01, LN01, M01	KOUG01_R: Kouga LOUT01_D: Louterwater TWEE01_FV: Twee Riviere[9] NABO01_D: Nabooms BAVI01_D: Baviaanskloof	N/A		No	Sc1	Forestry & Invasives (0) Irrigation (36.8)		WRYM
							Sc2	[8]		
							Sc3		Proposed Guernakop Dam on Kouga River to supply (33.945 million m3/a)	

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m³/year)	Augmentation Interventions	Model Used for Assessment
IUA_LN01	Groot to Kouga confluence and Upper Sundays to Darlington Dam	Groot linked to: IUA_K01, KL01, L01, M01 Sundays linked to: IUA_N01 & IUA_Q01,02,03	BFL01_D: Buffels KARI01_D: Kariega GRT01_D: Groot SUND01_FV: Sundays	N/A		No	Sc1	Forestry & Invasives (1.5) Irrigation (367.7) **Groot:** Klipplaat (0.678) **Sundays:** Robert Sobukwe (Graaff-Reinet) (5.2)		WRYM
							Sc2	**Groot:** Klipplaat (0.779) **Sundays:** Robert Sobukwe Graaff-Reinet (5.802)	**Groot:** Groundwater development (0.2 MCM/a) **Sundays:** Groundwater development (0.82 MCM/a) Re-use of water in Robert Sobukwe (Graaf-Reinet) (1.91 MCM/a)	
							Sc3	**Groot:** Klipplaat (0.960) **Sundays:** Robert Sobukwe (Graaf-Reinet) (6.836)	**Sundays:** Re-use of water in Robert Sobukwe (Graaf-Reinet) (2.2 MCM/	
IUA_KL01	Kromme from Kromme Dam (Churchill) to estuary and Gamtoos	Linked to: IUA_K01, LN01, L01, M01 Kromme has no further interventions and is over-utilised Reallocation (Sc2) Augmentation of this integrated system Some scenarios may have more consequences to each system (Kromme, Gamtoos, Kabeljous rivers and estuaries)	GAMT01_I: Gamtoos GAMT02_FV: Gamtoos KROM02_I: Kromme KROM03_R: Kromme DIEP01_D: Diep GEEL01_D: Geelhoutboom SEEK01_D: Seekoei SWRT01_D: Swart	Gamtoos (Intermediate) Kabeljous (Rapid) Seekoei *(potentially re-look at flows from scenarios)* Kromme (Desktop, use information from 2006 study where applicable)	Kromme River Dam (Churchill) (K9R001) Impofu (K9R002) Kouga (L8R001)	No	Sc1	Forestry & Invasives (6.8) Irrigation (64.5) **Kromme:** Kareedouw (0.26) Coastal Towns(8.08) **Gamtoos** Hankey/Patenise(2.01)	Kouga LM additional groundwater development to augment and supplement existing surface water allocations from Churchill & Kouga Dams. (2.2 million m³/a) **Kromme:** Supply to Nelson Mandela Bay (-) **Gamtoos:** Supply to Nelson Mandela Bay (-)	WRYM
							Sc2	**Kromme:** Kareedouw (0.301) Coastal Towns(8.08) **Gamtoos** Hankey/Patenise(2.01)	Groundwater development for Kouga LM **Kromme:** Supply to Nelson Mandela Bay (-) **Gamtoos:** Supply to Nelson Mandela Bay (-)	

IUA	Description	IUA Linkages*/ Comments	Rivers (EWR sites)	Estuaries	Dam releases constraints	Water Quality Scenario required (Rivers / Estuaries)***	Scenario No.	Water Requirements (million m^3/year)	Augmentation Interventions	Model Used for Assessment
									Kabeljous: Removal of illegal dams (10%) and associated irrigators. Removal of IAP	
							Sc3	**Kromme:** Kareedouw (-) Coastal Towns(8.08) **Gamtoos** Hankey/Patenise(2.01)	**Kromme:** Supply to Nelson Mandela Bay (-) **Gamtoos:** Supply to Nelson Mandela Bay (-)	
IUA_K01	Tsitsikamma and headwaters of Kromme to Kromme Dam (Churchill)	Linked to: IUA_KL01, LN01, L01, M01 No specific interventions, no trade-offs, run scenarios to include the river / estuary requirements to assess the effects from demands upstream	ELND01_D: Elandbos GROO01_FV: Groot (East) TSIT01_D: Tsitsikamma KROM01_R: Kromme	Elands *(potentially re-look at flows from scenarios)* Groot Oos *(potentially re-look at flows from scenarios)* Tsitsikamma (Desktop)		No	Sc1a Sc1c *Hypothetical scenario (?) – if necessary based on the present day results (forestation, irrigation)*	Forestry & Invasives (35.3) Irrigation (9.7) [10]		WRYM

[1] *Assumed future requirements for Pst Johns would be supplied from outside the Mngazi. Mngazi supplying (3.025)*

[2] *Possible volumes to be confirmed with DWS*

[3] *In previous studies - Extensive sand mining and possibility of further abstraction and water requirements for mining operation: Xobeleni River systems previously targeted for mining abstraction: Mtentu, Mnyameni, Mzamba & Mtamvuna. Are these still a reality, can it be removed?*

[4] *Recon has proposed to use the high growth scenario for the Aloga water requirements. However, current monitoring is more in line with the unconstrained high requirements. A discussion with DWS and key stakeholders is required to determine the approach moving forward.*

[5] *Proposed: 15.3 million m^3/a from Ncora to CHDM. Additional abstraction to ADM; Eskom 80 million m^3/a ; Irrigators 22 million m^3/a (80% AOS); Domestic 10 million m^3/a (98% AOS)*

[6] *More information required to model*

[7] *Significant sewage pollution from Sundays River Valley LM, Addo & Kirkwood & Enon wwtw, totally dysfunctional and vandalised.*

[8 *Possible scenario could be the reduced flows from WAAS calibration that river team could interpret if no other scenarios.*

[9] *Significant sewage pollution coming from Koukamma LM. To such an extent that Gamtoos Water initiated independent water quality monitoring. E.coli is picked up on Kouga Dam.*

[10] *Possible scenario for upper Kromme could be the reduced flows from WAAS calibration that river team could interpret if no other scenarios. We are also looking at integration between rivers, wetlands and groundwater for upper Krom, so important to have some scenarios.*

9. CONCLUSIONS

This ESBC Report summarises the assessment for the Keiskamma, Fish to Tsitsikamma area as part of Step 4 in the WRCS process, following the DWS framework (2017).

Step 4 aims to determine the ESBC, which defines the base ecological condition and the EWRs needed to maintain it. A hydrological model is then used to assess if these EWRs are met.

Key activities included:

- Developing an ESBC scenario that meets water quantity, quality, and ecological needs;
- Reviewing planning or reconciliation scenarios; and
- Establishing alternative catchment configuration scenarios to be used during trade-offs.

All EWR sites and priority estuaries per IUA will be used during the yield modelling to evaluate the implementation of the Reserve and the resulting water balance for the Keiskamma, Fish to Tsitsikamma catchment areas. The REC to be used for modelling purposes per IUA is provided in **Table 9-1** below.

The hydrological modelling for the study used data and WRSM2000 models from the Water Resources of South Africa (WR2012) as a foundation. These models, covering hydrological years from 1920 to 2009, were updated and converted into Water Resource Yield Models (WRYM) where relevant. The models were created for individual river systems and combined where necessary.

For the Algoa (Nelson Mandela Bay) and Amathole (Buffalo City) systems, the modelling approach differed. The Algoa model combined WR2012's WRSM2000 models (Groot, Swartkops, and Coastal Catchments) with new models from the Water Availability Assessment Study (WAAS), while the Amathole model was developed as part of the Buffalo City Reconciliation Strategy.

Regarding the ESBC Scenarios, two scenarios were considered:

- Scenario 1: Present-day water flows and supply without Ecological Water Requirements (EWR) (EWR OFF); and
- Scenario 1a: Present-day water flows and supply with EWR for rivers and estuaries (EWR ON).

Table 9-1 further summaries per IUA where RoS for the EWR, are met or not. Cells highlighted in red (0 – 40% achievement of the ecological water requirements), orange (40% - 70% achievement of the ecological water requirements and green (70% - 100% achievement of the ecological water requirements). Although all the IUAs will be assessed during the trade-off assessment in the next phase of the study, this will aid the team to specifically focus on those IUAs where EWRs could not be met (0 – 40% and 40% - 70%) to determine the ecological consequences.

The sites of concern which are not meeting the EWR as a %nMAR for the given REC with the EWR turned off include the Black Kei, Kubusi (Lower), Keiskamma (Upper and Lower), Tyume, the Lower Buffalo, Tarka, Koonap, Kat (Lower), Kat (Upper), Gamtoos and Groot River. When the EWR is turned on, sites Tarka River is of major concern, with several other sites highlighted in orange where they only meet between 40 and 70% of the total EWR as a %nMAR for the REC.

Table 9-1: A summary of the rivers and estuaries REC per EWR site per IUA, along with a summary of where the Ecological Water Requirements are not met (red and orange highlights)

IUA	RIVERS						Scenarios*		ESTUARIES				
	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	EWR OFF	EWR ON	Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
IUA_T01	MBHA02_R	Mbhashe (Upper)	T11H	B/C	22.05	373.4	99%	99%	-				
	MTHA02_D	Mthatha (Upper)	T20A	C	21.49	122.5	92%	100%					
IUA_T02	MBAS01_I	Mbhashe (Middle)	T13C	C/D	38.02	673.8	100%	100%	Mbashe	T13E	B	108.5[1]	786.9
IUA_T03	MTHA01_I	Mthatha (Lower)	T20G	B/C	37.81	389.2	84%	100%					
IUA_T04	MNGA01_R	Mngazi	T70B	B/C	25.94	78.2	96%	100%%	Xora	T80D	B	77.3 + 5%	52.4
	NQAB01_R	Nqabarha	T90A	C	34.51	9.8	77%	*n/a*	Msikaba	T60G	A	93.8	212.4
	MTEN01_R	Mtentu	T60C	B/C	44.33	89.6	94%	*n/a*	Mngazi	T70B	B	95	87.3
	XORA01_D	Xora	T80D	B	30.53	83.0	67%	*n/a*					
IUA_S01	TSOM01_I	Tsomo	S50G	C/D	37.48	196.7	15%	72%	-				
	INDW01_R	Indwe	S20D	C/D	24.69	61.9	78%	100%					
	WKEI01_R	White Kei	S10J	C	26.16	155.7	57%	100%					
IUA_S02	BKEI01_I	Black Kei	S32K	D	32.03	187.9	22%	99%	-				

IUA	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)	Scenarios* EWR OFF	Scenarios* EWR ON	Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)
	RIVERS								ESTUARIES				
IUA_S03	GKEI01_I	Great Kei	S70A	C	24.97	897.2	44%	100%	Great Kei	S70F	B/C	74.1	1040.7
	GCUW01_R	Gcuwa	S70D	D	14.86	67.6	46%	100%					
	KUBU03_R	Kubusi (Lower)	S60B	B/C	20.38	98.1	43%	99%					
IUA_R01	KEIS01_I	Keiskamma (Upper)	R10E	D	34.31	58.8	22%	99%	Keiskamma	R10M	B	76.8	128.7
	KEIS02_R	Keiskamma (Lower)	R10L	B/C	27.85	107.8	28%	100%					
	TYUM01_R	Tyume	R10H	B/C	34.15	32.6	31%	98%					
IUA_R02	BUFF01_I	Buffalo (Middle)	R20F	D	34.46	83.8	46%	98%	Nahoon	R30F	C	62.8 + 5%	32.5
	BUFF02_FV	Buffalo (Lower)	R20G	D	32.83	91.9	6%	99%	Qinera	R30F	B	98.3	8.4
IUA_Q01	FISH01_FV	Great Fish (Upper)	Q21B	D	12.35	18.0	16%	96%	-				
	LFIS01_FV	Little Fish (Upper)	Q80B	B/C	23.72	24.3	85%	99%					
IUA_Q02	FISH03_I	Great Fish (Lower)	Q91B	C	29.73	331.8	85%	100%	Great Fish	Q93D	B/C	90.3	496.3
	LFIS02_FV	Little Fish (Lower)	Q80G	C	18.88	88.9	100%	100%					
	TARK01_FV	Tarka	Q44C	D	12.21	63.3	9%	12%					

IUA	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	Scenarios*		Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
							EWR OFF	EWR ON					
	RIVERS								ESTUARIES				
	FISH02_FV	Great Fish (Middle)	Q50B	D	12.50	201.9	93%	100%					
IUA_Q03	KOON01_R	Koonap	Q92G	D	17.14	76.9	32%	100%					
	KAT02_R	Kat (Lower)	Q94F	C/D	15.16	61.8	30%	100%					
	KAT01_I	Kat (Upper)	Q94B	B/C	43.53	23.9	27%	100%					
IUA_N01	SUND02_R	Sundays (Lower)	N40C	D	5.42	214.0	88%	100%	Sundays	N40F	B	95	263.1
IUA_M01	SWAR01_I	KwaZungu/ Swartkops	M10C	B/C	39.97	27.3	46%	100%	Swartkops	M10D	C	123.9[2]	56.9
IUA_P01	BOES01_FV	Bushmans	P10G	B	27.44	32.7	1%	82%	Kariega	P30C	C	60	21.9
									Bushmans	P20A	B	75.8 + 3%	43.1
									Kowie	P40C	B/C	89.1	31.4
IUA_KL01	GAMT01_I	Gamtoos	L90A	D	10.80	427.0	31%	97%	Gamtoos	L90C	C	51.8	404.2
									Kabeljous	K90G	B	89.3	5.3
									Kromme[3]	K90E	C	51	72.2
IUA_K01	KROM01_R	Kromme	K90A	C	36.66	27.6	85%	97%		K80B	B	66.9 + 5%	19.9

IUA	RIVERS								ESTUARIES				
	EWR site code	River Name	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)	Scenarios*		Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
							EWR OFF	EWR ON					
	GROO01_FV	Groot (K80D)	K80D	B/C	29.09	47.6	57%	58%	Tsitsikamma				
IUA_L01	KOUG01_R	Kouga	L82D	B/C	15.78	155.1	84%	100%	-				
	BAVI01_D	Baviaanskloof	L81D	B	28.58	48.1	79%	80%					
IUA_LN01	SUND01_FV	Sundays (Upper)	N22E	C	18.25	148.0	44%	83%	-				
	GRT01_D	Groot (L70G)	L70G	B	29.91	185.7	21%	42%					

**Following the assessment of the critical users per IUA, these columns illustrates where RoS for the EWR, are not met (RoS is <75% i.e. it fails more than 25% of the time). This will aid the team to also focus on these during the trade-off assessment in the next phase of the study. The % achieved of the Ecological Water Requirements in relation to the Total EWR as %nMAR for REC for rivers and estuaries*

- *Red: 0 – 40% achievement of the ecological water requirements*
- *Orange: 40% - 70% achievement of the ecological water requirements*
- *Green: 70% - 100% achievement of the ecological water requirements*

[1]Mbashe is above natural due to transfer scheme.

[2]The REC MAR of Swartkops is above Natural due to the Motherwell Channel and the Chatty River stormwater input. The scenario is down from present as it requested all 3 WWTW to rese water and not discharge into or just above the estuary.

[3]Kromme: 51% of 97 x 106

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11. APPENDICES

Appendix A

***Note**: abbreviations within below tables are as follows:*

BIO: Biodnode; EST: Estuarine Site/Estuarine Driven, EWR: Riverine EWR; IRR: Irrigation

Table A-11-1: Results for IUA_K01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
K80A	BIO[1]	ELND01_D	NA	0.00	0.00	NA	NA
K80A	BIO	ELND01_D_EWR OFF	NA	30.42	30.42	NA	NA
K80C	EST[2]	ELANDS	NA	0.00	0.00	NA	NA
K80C	EST	ELANDS_EWR OFF	NA	83.01	83.01	NA	NA
K80D	EWR	GROO01_FV	13.41	0.00	12.13	NA	58%
K80D	EWR	GROO01_FV_EWR OFF	NA	27.44	15.53	57%	NA
K80D	EST	GROOT_E	NA	0.00	0.00	NA	NA
K80D	EST	GROOT_E_EWR OFF	NA	36.86	37.07	NA	NA
K80E	EST	TSIT01_D	NA	0.00	0.00	NA	NA
K80E	EST	TSIT01_D_EWR OFF	NA	10.24	10.24	NA	NA
K80E	EST	TSITSIKAM	NA	0.00	0.00	NA	NA
K80E	EST	TSITSIKAM_EWR OFF	NA	17.71	17.71	NA	NA
K90A	EWR[3]	KROM01_I	8.33	0.00	8.36	NA	97%
K90A	EWR	KROM01_I_EWR OFF	NA	23.55	15.57	85%	NA
K80A	IRR[4]	RR Module 1018 Demands	0.35	0.36	0.36	100%	100%
K80B	IRR	RR Module 1019 Demands	0.00	0.00	0.00	100%	100%
K80B	IRR	RR Module 1020 Demands	1.07	1.07	1.07	100%	100%
K80C	IRR	RR Module 1021 Demands	0.60	0.58	0.58	100%	100%
K80C	IRR	RR Module 1022 Demands	0.60	0.58	0.58	100%	100%
K80D	IRR	RR Module 1023 Demands	0.41	0.39	0.39	100%	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
K80D	IRR	RR Module 1024 Demands	0.41	0.39	0.14	97%	60%
K80E	IRR	RR Module 1025 Demands	0.32	0.30	0.30	100%	100%
K80E	IRR	RR Module 1026 Demands	0.32	0.30	0.30	97%	97%
K80F	IRR	RR Module 1027 Demands	0.00	0.00	0.00	100%	100%
K80F	IRR	RR Module 1028 Demands	0.00	0.00	0.00	100%	100%
K90A	IRR	RR Module 1108 Demands	0.32	0.28	0.28	100%	100%
K90A	IRR	RR Module 1119 Demands	0.38	0.30	0.16	84%	60%
K90A	IRR	RR Module 1109 Demands	0.41	0.38	0.18	94%	61%
K90A	IRR	RR Module 1113 Demands	0.47	0.48	0.48	100%	100%
K90A	IRR	RR Module 1118 Demands	0.69	0.70	0.70	100%	100%
K90B	IRR	RR Module 1111 Demands	0.22	0.22	0.22	100%	100%
K90B	IRR	RR Module 1110 Demands	0.63	0.56	0.33	90%	64%
K90C	IRR	RR Module 1115 Demands	0.09	0.07	0.07	100%	97%
K90C	IRR	RR Module 1116 Demands	0.50	0.52	0.52	100%	100%
K90C	IRR	RR Module 1114 Demands	0.95	0.68	0.68	73%	73%
K90C	IRR	RR Module 1120 Demands	2.49	2.46	2.46	100%	100%

[1]*BIO – Bionode*
[2]*EST – Estuarine Site/ Estuarine Driven*
[3]*EWR – Riverine EWR*
[4]*IRR – Irrigation*

Table A-11-2: Results for IUA_KL01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Kareedouw	Domestic	Kareedouw Abs	0.35	0.36	0.36	100%	100%
Kouga LM	Domestic	Coastal Towns	8.08	8.05	7.44	99%	83%
Kouga LM	Domestic	Hankey/Patensie/Loerie	1.99	1.96	1.76	99%	92%
K90D	BIO	DIEP01_D	NA	0.00	0.00	NA	NA
K90D	BIO	DIEP01_D_EWR OFF	NA	10.73	10.76	NA	NA
K90D	EWR	KROM02_I	8.33	0.00	8.34	NA	100%
K90D	EWR	KROM02_I_EWR OFF	NA	24.17	21.93	23%	NA
K90D	EST	KROM03_D	NA	0.00	0.00	NA	NA
K90D	EST	KROM03_D_EWR OFF	NA	24.15	39.70	NA	NA
K90E	EWR	GEEL01_D	0.47	0.00	0.47	NA	86%
K90E	EWR	GEEL01_D_EWR OFF	NA	1.27	0.81	67%	NA
K90E	EST	KROMME	45.13	0.00	42.79	NA	71%
K90E	EST	KROMME_EWR OFF	NA	27.40	0.86	5%	NA
K90F	EWR	SEEK01_D	6.66	0.00	0.99	NA	68%
K90F	EWR	SEEK01_D_EWR OFF	NA	2.17	1.50	19%	NA
K90F	EST	SEEKOEI	NA	0.00	0.00	NA	NA
K90F	EST	SEEKOEI_EWR OFF	NA	6.73	7.08	NA	NA
K90F	EWR	SWRT01_D	0.60	0.00	0.58	NA	100%
K90F	EWR	SWRT01_D_EWR OFF	NA	1.66	1.06	34%	NA
K90G	EST	KABE01_FV	NA	0.00	0.00	NA	NA
K90G	EST	KABE01_FV_EWR OFF	NA	2.04	2.04	NA	NA

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
K90G	EST	KABELJOUS	NA	0.00	0.00	NA	NA
K90G	EST	KABELJOUS_EWR OFF	NA	4.68	4.68	NA	NA
L90A	EWR	GAMT01_I	49.26	0.00	48.35	NA	97%
L90A	EWR	GAMT01_I_EWR OFF	NA	164.06	126.51	31%	NA
L90B	QUA[5]	GAMT02_FV	NA	0.00	0.00	NA	NA
L90B	QUA	GAMT02_FV_EWR OFF	NA	191.03	201.19	NA	NA
L90C	EST	GAMTOOS	NA	0.00	0.00	NA	NA
L90C	EST	GAMTOOS_EWR OFF	NA	205.32	213.57	NA	NA
K90D	IRR	RR Module 1117 Demands	1.61	1.05	1.04	68%	68%
K90D	IRR	Impofu Direct IRR	0.79	0.73	0.36	94%	44%
K90E	IRR	RR Module 1081 Demands	0.00	0.00	0.00	100%	100%
K90E	IRR	RR Module 1082 Demands	0.79	0.80	0.00	99%	17%
K90F	IRR	RR Module 1089 Demands	0.00	0.00	0.00	100%	100%
K90F	IRR	RR Module 1090 Demands	1.45	0.51	0.17	39%	18%
K90G	IRR	RR Module 1096 Demands	2.52	0.69	0.69	27%	27%
K90G	IRR	RR Module 1097 Demands	0.00	0.00	0.00	100%	100%
L90A	IRR	RR Module 294 Demands	0.13	0.11	0.11	93%	93%
L90A	IRR	RR Module 282 Demands	20.10	13.22	11.05	73%	67%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L90B1	IRR	RR Module 285 Demands	0.00	0.00	0.00	100%	100%
L90B1	IRR	RR Module 286 Demands	1.55	1.15	1.15	74%	74%
L90B2	IRR	RR Module 287 Demands	0.16	0.17	0.17	100%	100%
L90B2	IRR	RR Module 288 Demands	0.03	0.04	0.04	98%	98%
L90B3	IRR	RR Module 301 Demands	0.03	0.02	0.02	100%	100%
L90B3	IRR	RR Module 283 Demands	17.42	16.72	14.14	94%	86%
L90C	IRR	RR Module 406 Demands	0.69	0.66	0.66	94%	94%
L90C1	IRR	RR Module 405 Demands	0.28	0.25	0.23	87%	82%
L90C1	IRR	RR Module 403 Demands	0.50	0.38	0.35	80%	75%
L90C1	IRR	RR Module 404 Demands	0.69	0.69	0.69	100%	100%
L90C2	IRR	RR Module 308 Demands	0.09	0.09	0.09	97%	97%
L90C2	IRR	RR Module 284 Demands	27.80	27.34	23.32	98%	90%

[5]*QUA - Quality node*

Table A-11-3: Results for IUA_L01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L81D	EWR	BAVI01_D	6.06	0.00	6.06	NA	80%
L81D	EWR	BAVI01_D_EWR OFF	NA	19.98	13.93	79%	NA
L82C	BIO	LOUT01_D	NA	0.00	0.00	NA	NA
L82C	BIO	LOUT01_D_EWR OFF	NA	15.90	15.99	NA	NA
L82D	EWR	KOUG01_R	20.10	0.00	20.17	NA	100%
L82D	EWR	KOUG01_R_EWR OFF	NA	103.04	82.89	84%	NA
L82D	QUA	NABO01_D	NA	0.00	0.00	NA	NA
L82D	QUA	NABO01_D_EWR OFF	NA	21.17	21.12	NA	NA
L82D	QUA	TWEE01_FV	NA	0.00	0.00	NA	NA
L82D	QUA	TWEE01_FV_EWR OFF	NA	3.19	3.19	NA	NA
L81A	IRR	RR Module 510 Demands	0.00	0.00	0.00	100%	100%
L81B	IRR	RR Module 515 Demands	0.00	0.00	0.00	100%	100%
L81C	IRR	RR Module 520 Demands	0.00	0.00	0.00	100%	100%
L81D	IRR	RR Module 524 Demands	0.00	0.00	0.00	100%	100%
L82A2	IRR	RR Module 621 Demands	1.51	1.52	1.52	100%	100%
L82A2	IRR	RR Module 614 Demands	1.64	1.63	1.63	100%	100%
L82A2	IRR	RR Module 612 Demands	1.01	0.98	0.98	100%	100%
L82A4	IRR	RR Module 616 Demands	0.69	0.67	0.67	100%	100%
L82B2	IRR	RR Module 644 Demands	0.35	0.35	0.35	100%	100%
L82B2	IRR	RR Module 646 Demands	11.14	9.56	9.55	89%	89%
L82B3	IRR	RR Module 648 Demands	0.25	0.21	0.21	91%	91%
L82C1	IRR	RR Module 654 Demands	1.20	1.17	1.17	100%	100%
L82C1	IRR	RR Module 652 Demands	3.22	3.18	3.18	100%	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L82C2	IRR	RR Module 657 Demands	5.14	5.10	5.10	100%	100%
L82D1	IRR	RR Module 665 Demands	0.06	0.07	0.07	100%	100%
L82D1	IRR	RR Module 673 Demands	4.58	4.49	4.49	98%	98%
L82D2	IRR	RR Module 662 Demands	0.57	0.57	0.57	100%	100%
L82D2	IRR	RR Module 670 Demands	7.83	6.39	6.39	83%	83%
L82D2	IRR	RR Module 677 Demands	3.72	3.49	3.49	95%	95%
L82D3	IRR	RR Module 679 Demands	0.19	0.13	0.13	86%	86%
L82E	IRR	RR Module 502 Demands	0.13	0.12	0.12	100%	100%
L82F	IRR	RR Module 506 Demands	0.28	0.22	0.22	74%	74%
L82J	IRR	RR Module 289 Demands	0.73	0.35	0.10	70%	63%
L82J	IRR	RR Module 270 Demands	0.47	0.47	0.42	100%	96%

Table A-11-4: Results for IUA_LN01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Kliplaat	Domestic	Beervlei Abs	0.00	0.00	0.00	100%	100%
Kliplaat	Domestic	Kliplaat Abs	0.35	0.36	0.10	97%	47%
Robert Sobukwe (Graaf-Reinet)	Domestic	Graafreneit Abstraction	4.10	4.08	4.08	100%	100%
L22A	BIO	BFL01_D	NA	0.00	0.00	NA	NA
L22A	BIO	BFL01_D_EWR OFF	NA	37.99	37.99	NA	NA
L23D	BIO	KARI01_D	NA	0.00	0.00	NA	NA

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L23D	BIO	KARI01_D_EWR OFF	NA	58.96	58.96	NA	NA
L70G	EWR	GRT01_D	36.92	0.00	30.03	NA	83%
L70G	EWR	GRT01_D_EWR OFF	NA	90.74	65.00	44%	NA
N22C	EWR	SUND01_FV	17.04	0.00	16.70	NA	87%
N22C	EWR	SUND01_FV_EWR OFF	NA	79.16	64.59	43%	NA
L11A	IRR	RR Module 2 Demands	0.00	0.00	0.00	100%	100%
L11A	IRR	RR Module 3 Demands	1.99	0.75	0.75	20%	20%
L11B	IRR	RR Module 8 Demands	0.60	0.58	0.58	99%	99%
L11B	IRR	RR Module 9 Demands	0.00	0.00	0.00	100%	100%
L11C	IRR	RR Module 14 Demands	1.89	1.73	1.73	90%	90%
L11C	IRR	RR Module 15 Demands	0.00	0.00	0.00	100%	100%
L11E	IRR	RR Module 23 Demands	5.11	2.60	2.60	29%	29%
L11F	IRR	RR Module 27 Demands	1.01	0.98	0.98	99%	99%
L11F	IRR	RR Module 28 Demands	0.00	0.00	0.00	100%	100%
L11G	IRR	RR Module 33 Demands	0.13	0.14	0.14	100%	100%
L12A	IRR	RR Module 37 Demands	7.07	2.01	2.01	11%	11%
L12A	IRR	RR Module 38 Demands	0.00	0.00	0.00	100%	100%
L12B	IRR	RR Module 43 Demands	3.91	3.43	3.43	74%	74%
L12C	IRR	RR Module 47 Demands	0.00	0.00	0.00	100%	100%
L12C	IRR	RR Module 48 Demands	2.93	2.08	2.08	61%	61%
L21A	IRR	RR Module 56 Demands	1.23	1.23	1.23	100%	100%
L21A	IRR	RR Module 57 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L21B	IRR	RR Module 63 Demands	2.46	2.39	2.39	92%	92%
L21C	IRR	RR Module 68 Demands	0.00	0.00	0.00	100%	100%
L21C	IRR	RR Module 67 Demands	3.47	3.14	3.14	87%	87%
L21D	IRR	RR Module 73 Demands	0.00	0.00	0.00	100%	100%
L21D	IRR	RR Module 74 Demands	2.62	1.81	1.81	50%	50%
L21E	IRR	RR Module 81 Demands	2.84	2.13	2.13	68%	68%
L21E	IRR	RR Module 82 Demands	0.00	0.00	0.00	100%	100%
L21F	IRR	RR Module 87 Demands	1.33	1.33	1.33	100%	100%
L21F	IRR	RR Module 88 Demands	0.00	0.00	0.00	100%	100%
L22A	IRR	RR Module 93 Demands	0.50	0.00	0.00	1%	1%
L22A	IRR	RR Module 94 Demands	0.00	0.00	0.00	100%	100%
L22B	IRR	RR Module 99 Demands	0.92	0.89	0.89	98%	98%
L22B	IRR	RR Module 100 Demands	0.00	0.00	0.00	100%	100%
L22C	IRR	RR Module 105 Demands	5.21	2.56	2.56	19%	19%
L23A	IRR	RR Module 112 Demands	0.35	0.36	0.36	100%	100%
L23A	IRR	RR Module 113 Demands	0.00	0.00	0.00	100%	100%
L23B	IRR	RR Module 118 Demands	0.92	0.92	0.92	100%	100%
L23B	IRR	RR Module 119 Demands	0.00	0.00	0.00	100%	100%
L23C	IRR	RR Module 125 Demands	3.85	3.78	3.78	93%	93%
L23D	IRR	RR Module 130 Demands	0.32	0.32	0.32	100%	100%
L30A	IRR	RR Module 135 Demands	0.00	0.00	0.00	100%	100%
L30A	IRR	RR Module 136 Demands	0.57	0.23	0.07	22%	18%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
L30B	IRR	RR Module 141 Demands	0.00	0.00	0.00	100%	100%
L30B	IRR	RR Module 142 Demands	0.63	0.23	0.09	24%	19%
L30C	IRR	RR Module 147 Demands	0.32	0.21	0.21	65%	65%
L30C	IRR	RR Module 148 Demands	0.00	0.00	0.00	100%	100%
L30D	IRR	RR Module 153 Demands	2.40	0.84	0.37	90%	33%
L40A	IRR	RR Module 157 Demands	1.42	0.56	0.56	26%	26%
L40A	IRR	RR Module 158 Demands	0.00	0.00	0.00	100%	100%
L40B	IRR	RR Module 163 Demands	1.17	0.46	0.16	21%	18%
L50A	IRR	RR Module 167 Demands	1.89	1.22	1.20	54%	54%
L50A	IRR	RR Module 168 Demands	0.00	0.00	0.00	100%	100%
L60A	IRR	RR Module 176 Demands	0.00	0.00	0.00	100%	100%
L60A	IRR	RR Module 177 Demands	0.22	0.17	0.06	67%	38%
L60B	IRR	RR Module 182 Demands	0.19	0.15	0.01	66%	30%
L70B	IRR	RR Module 188 Demands	4.70	1.91	0.68	79%	30%
L70C	IRR	RR Module 192 Demands	6.63	1.79	0.91	63%	25%
L70D	IRR	RR Module 196 Demands	5.02	0.97	0.97	11%	11%
L70D	IRR	RR Module 197 Demands	0.00	0.00	0.00	100%	100%
L70E	IRR	RR Module 202 Demands	0.00	0.00	0.00	100%	100%
L70E	IRR	RR Module 203 Demands	0.00	0.00	0.00	100%	100%
L70F	IRR	RR Module 208 Demands	0.00	0.00	0.00	100%	100%
N11A	IRR	RR Module 439 Demands	9.40	2.17	2.17	17%	17%
N11A	IRR	RR Module 440 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
N11B	IRR	RR Module 441 Demands	13.44	2.22	2.22	11%	11%
N11B	IRR	RR Module 442 Demands	0.00	0.00	0.00	100%	100%
N12A	IRR	RR Module 443 Demands	0.00	0.00	0.00	100%	100%
N12A	IRR	RR Module 444 Demands	2.37	0.85	0.85	27%	27%
N12B	IRR	RR Module 445 Demands	0.00	0.00	0.00	100%	100%
N12C	IRR	RR Module 446 Demands	0.00	0.00	0.00	100%	100%
N12C	IRR	RR Module 447 Demands	0.00	0.00	0.00	100%	100%
N13A	IRR	RR Module 448 Demands	16.73	2.62	2.62	8%	8%
N13A	IRR	RR Module 449 Demands	0.00	0.00	0.00	100%	100%
N13B	IRR	RR Module 450 Demands	39.29	2.27	2.27	3%	3%
N13B	IRR	RR Module 451 Demands	0.00	0.00	0.00	100%	100%
N13B	IRR	RR Module 452 Demands	0.00	0.00	0.00	100%	100%
N13C	IRR	RR Module 453 Demands	47.90	6.26	6.09	9%	9%
N14A	IRR	RR Module 454 Demands	2.81	1.23	1.23	23%	23%
N14B	IRR	RR Module 455 Demands	15.72	2.65	2.65	9%	9%
N14C	IRR	RR Module 456 Demands	36.99	5.48	5.48	8%	8%
N14C	IRR	RR Module 457 Demands	0.00	0.00	0.00	100%	100%
N14D	IRR	RR Module 458 Demands	18.15	10.92	10.92	52%	52%
N21A	IRR	RR Module 459 Demands	22.15	1.54	1.54	2%	2%
N21A	IRR	RR Module 460 Demands	0.00	0.00	0.00	100%	100%
N21B	IRR	RR Module 461 Demands	0.00	0.00	0.00	100%	100%
N21B	IRR	RR Module 462 Demands	3.50	2.07	1.89	39%	36%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
N21C	IRR	RR Module 463 Demands	0.00	0.00	0.00	100%	100%
N21C	IRR	RR Module 464 Demands	5.71	2.45	2.11	31%	29%
N21D	IRR	RR Module 465 Demands	0.82	0.75	0.57	79%	66%
N22A	IRR	RR Module 473 Demands	0.00	0.00	0.00	100%	100%
N22A	IRR	RR Module 474 Demands	3.06	1.42	1.03	29%	25%
N22B	IRR	RR Module 475 Demands	0.38	0.31	0.14	75%	41%
N22C	IRR	RR Module 476 Demands	0.00	0.00	0.00	100%	100%
N22D	IRR	RR Module 477 Demands	0.00	0.00	0.00	100%	100%
N22E	IRR	RR Module 478 Demands	2.78	2.00	2.56	54%	77%
N23A	IRR	RR Module 479 Demands	3.94	3.94	3.94	100%	100%
N23B	IRR	RR Module 480 Demands	3.53	3.53	3.53	100%	100%
N24A	IRR	RR Module 466 Demands	0.00	0.00	0.00	100%	100%
N24A	IRR	RR Module 467 Demands	2.21	1.08	0.99	29%	28%
N24B	IRR	RR Module 468 Demands	12.34	1.76	1.76	6%	6%
N24B	IRR	RR Module 469 Demands	0.00	0.00	0.00	100%	100%
N24C	IRR	RR Module 470 Demands	6.97	1.78	1.78	12%	12%
N24C	IRR	RR Module 471 Demands	0.00	0.00	0.00	100%	100%
N24D	IRR	RR Module 472 Demands	2.68	1.96	1.30	54%	39%
N30A	IRR	RR Module 481 Demands	0.00	0.00	0.00	100%	100%
N30A	IRR	RR Module 482 Demands	13.25	5.45	5.45	24%	24%
N30B	IRR	RR Module 483 Demands	4.48	2.32	2.32	31%	31%
N30C	IRR	RR Module 485 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
N30C	IRR	RR Module 484 Demands	1.33	0.84	0.84	41%	41%

Table A-11-5: Results for IUA_M01

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
NMBM	Domestic	North 1	68.20	68.20	68.20	100%	100%
NMBM	Domestic	North 2	4.29	4.25	4.25	100%	100%
NMBM	Domestic	South	53.90	53.72	51.22	99%	93%
M10B	BIO	SAND01_D	NA	0.00	0.00	NA	NA
M10B	BIO	SAND01_D_EWR OFF	NA	1.58	1.28	NA	NA
M10C	BIO	ELAN01_D	NA	0.00	0.00	NA	NA
M10C	BIO	ELAN01_D_EWR OFF	NA	31.13	30.76	NA	NA
M10C	EWR	SWAR01_I	6.69	0.00	6.69	NA	100%
M10C	EWR	SWAR01_I_EWR OFF	NA	25.81	19.22	46%	NA
M10D	QUA	CHAT01_D	NA	0.00	0.00	NA	NA
M10D	QUA	CHAT01_D_EWR OFF	NA	7.47	7.47	NA	NA
M10D	EST	SWARTKOPS	NA	0.00	0.00	NA	NA
M10D	EST	SWARTKOPS_EWR OFF	NA	113.25	112.98	NA	NA
M20A	EST	PAPKUILS	NA	0.00	0.00	NA	NA
M20A	EST	PAPKUILS_EWR OFF	NA	21.06	21.06	NA	NA
M10B	IRR	RR Module 704 Demands	2.43	2.41	2.41	100%	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
M10B	IRR	RR Module 705 Demands	0.00	0.00	0.00	100%	100%
M10C	IRR	RR Module 721 Demands	2.49	2.49	2.49	100%	100%
M10D	IRR	RR Module 726 Demands	1.36	1.19	1.19	83%	83%
M10D	IRR	RR Module 727 Demands	0.00	0.00	0.00	100%	100%
M20A	IRR	RR Module 734 Demands	0.03	0.00	0.00	94%	94%
M20B	IRR	RR Module 740 Demands	1.61	1.31	1.28	79%	78%
M20B	IRR	RR Module 741 Demands	0.00	0.00	0.00	100%	100%
M30A	IRR	RR Module 747 Demands	0.03	0.00	0.00	97%	97%
M30B	IRR	RR Module 752 Demands	0.00	0.00	0.00	100%	100%

Table A-11-6: Results for IUA_N01

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
NMBM	Domestic	Sundays to NMBM	58.38	58.36	58.36	100%	100%
Sundays Domestic	Domestic	Sundays Domestic	4.00	4.01	4.01	100%	100%
N40C	EWR	SUND02_R	9.81	0.00	9.77	NA	100%
N40C	EWR	SUND02_R_EWR OFF	NA	192.76	184.51	88%	NA
N40D	BIO	COER01_D	NA	0.00	0.00	NA	NA
N40D	BIO	COER01_D_EWR OFF	NA	14.60	14.60	NA	NA
N40F	EST	SUNDAYS	NA	0.00	0.00	NA	NA

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
N40F	EST	SUNDAYS_EWR OFF	NA	246.22	247.74	NA	NA
N40A	IRR	RR Module 486 Demands	0.00	0.00	0.00	100%	100%
N40B	IRR	RR Module 492 Demands	0.00	0.00	0.00	100%	100%
N40B	IRR	RR Module 487 Demands	8.87	3.60	3.60	48%	48%
N40C	IRR	RR Module 493 Demands	0.00	0.00	0.00	100%	100%
N40C	IRR	RR Module 488 Demands	31.65	10.94	10.94	41%	41%
N40D	IRR	RR Module 494 Demands	0.00	0.00	0.00	100%	100%
N40D	IRR	RR Module 489 Demands	33.45	16.87	16.87	52%	52%
N40E	IRR	RR Module 495 Demands	0.00	0.00	0.00	100%	100%
N40E	IRR	RR Module 490 Demands	54.88	51.38	51.38	77%	77%
N40F	IRR	RR Module 491 Demands	25.78	25.71	25.71	100%	100%

Table A-11-7: Results for IUA_P01

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Grahamstown	Domestic	Jameson_ABS	0.22	0.19	0.19	77%	77%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Grahamstown	Domestic	Settlers_ABS	2.08	2.02	2.00	97%	95%
P40C	Domestic	PortAlfred_ABS	0.73	0.72	0.72	100%	100%
P10F	EWR	BOES01_D	5.59	0.00	5.19	NA	82%
P10F	EWR	BOES01_D_EWR OFF	NA	26.17	21.35	1%	NA
P10G	EST	BUSHMANS	NA	0.00	0.00	NA	NA
P10G	EST	BUSHMANS_EWR OFF	NA	35.82	36.16	NA	NA
P30B	EWR	KARI01_D	2.59	0.00	2.59	NA	97%
P30B	EWR	KARI01_D_EWR OFF	NA	12.00	9.46	1%	NA
P30C	EST	KARIEGA	NA	0.00	0.00	NA	NA
P30C	EST	KARIEGA_EWR OFF	NA	13.32	13.33	NA	NA
P40A	QUA	BLOU01_D	NA	0.00	0.00	NA	NA
P40A	QUA	BLOU01_D_EWR OFF	NA	15.57	15.57	NA	NA
P40C	EST	KOWIE	NA	0.00	0.00	NA	NA
P40C	EST	KOWIE_EWR OFF	NA	30.19	30.19	NA	NA
P40D	EST	EAST KLEINEMONDE	NA	0.00	0.00	NA	NA
P40D	EST	EAST KLEINEMONDE_EWR OFF	NA	9.55	9.55	NA	NA
P10A	IRR	Node 21	0.57	0.36	0.36	68%	68%
P10A	IRR	Node 22	0.00	0.00	0.00	100%	100%
P10B	IRR	Node 23	2.18	1.09	1.09	43%	43%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
P10B	IRR	Node 24	0.00	0.00	0.00	100%	100%
P10C	IRR	Node 25	1.48	0.22	0.22	10%	10%
P10C	IRR	Node 26	0.00	0.00	0.00	100%	100%
P10D	IRR	Node 27	2.78	0.57	0.57	14%	14%
P10D	IRR	Node 28	0.00	0.00	0.00	100%	100%
P10E	IRR	Node 29	2.11	1.32	0.96	51%	38%
P10F	IRR	Node 30	2.02	1.54	1.54	71%	71%
P10F	IRR	Node 31	0.00	0.00	0.00	100%	100%
P10G	IRR	Node 32	1.39	0.77	0.77	49%	49%
P10G	IRR	Node 33	0.00	0.00	0.00	100%	100%
P30A	IRR	Node 34	1.29	1.16	1.16	88%	88%
P30A	IRR	Node 35	0.00	0.00	0.00	100%	100%
P30B	IRR	Node 36	2.97	2.61	2.61	88%	88%
P30B	IRR	Node 37	0.00	0.00	0.00	100%	100%
P30C	IRR	Node 38	0.50	0.45	0.45	84%	86%
P40A	IRR	Node 39	0.13	0.13	0.13	100%	100%
P40A	IRR	Node 40	0.00	0.00	0.00	100%	100%
P40B	IRR	Node 41	0.06	0.06	0.06	100%	100%
P40B	IRR	Node 42	0.00	0.00	0.00	100%	100%
P40C	IRR	Node 43	0.13	0.13	0.13	98%	98%
P40C	IRR	Node 44	0.00	0.00	0.00	100%	100%
P40D	IRR	Node 45	0.06	0.05	0.05	100%	100%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
P40D	IRR	Node 46	0.00	0.00	0.00	100%	100%

Table A-11-8: Results for IUA_Q01

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Inxuba (Cradock)	Domestic	Cradock	1.70	1.67	1.67	100%	100%
Q21B	EWR	FISH01_R	1.80	0.00	1.77	NA	96%
Q21B	EWR	FISH01_R_EWR OFF	NA	8.95	8.00	16%	NA
Q80B	EWR	LFIH01_FV	4.04	0.00	4.02	NA	99%
Q80B	EWR	LFIH01_FV_EWR OFF	NA	18.71	14.77	85%	NA
Q80A	IRR	RR Module 215 Demands	6.41	3.98	3.92	39%	38%
Q80B	IRR	RR Module 219 Demands	0.00	0.00	0.00	100%	100%
Q80B	IRR	RR Module 220 Demands	6.00	3.94	4.00	44%	44%
Q80C	IRR	RR Module 225 Demands	2.68	2.12	2.12	61%	61%

TableA-11-9: Results for IUA_Q02

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Makhanda (Grahamstown)	Domestic	Grahamstown Transfer	6.56	6.47	6.47	86%	86%
Cookhouse	Domestic	Cookhouse	2.50	2.46	2.46	100%	100%
Q13B	TRN	GBRA01_FV	NA	0.00	0.00	NA	NA
Q13B	TRN	GBRA01_FV_EWR OFF	NA	718.81	718.84	NA	NA
Q30B	BIO	PAUL01_D	NA	0.00	0.00	NA	NA
Q30B	BIO	PAUL01_D_EWR OFF	NA	7.08	7.09	NA	NA
Q30D	TRN	FISH04_FV	NA	0.00	0.00	NA	NA
Q30D	TRN	FISH04_FV_EWR OFF	NA	675.86	676.69	NA	NA
Q44C	EWR	TARK01_R	6.31	0.00	3.48	NA	12%
Q44C	EWR	TARK01_R_EWR OFF	NA	24.16	21.85	9%	NA
Q50B	EWR	FISH02_FV	21.05	0.00	21.04	NA	100%
Q50B	EWR	FISH02_FV_EWR OFF	NA	274.80	255.80	93%	NA
Q70C	BIO	FISH05_D	NA	0.00	0.00	NA	NA
Q70C	BIO	FISH05_D_EWR OFF	NA	228.06	229.95	NA	NA
Q80G	EWR	LFIS02_FV	12.09	0.00	12.09	NA	100%
Q80G	EWR	LFIS02_FV_EWR OFF	NA	87.21	75.33	100%	NA
Q91B	EWR	FISH03_I	73.84	0.00	73.74	NA	100%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q91B	EWR	FISH03_I_EWR OFF	NA	311.53	240.87	85%	NA
Q93D	EST	GREAT FISH	NA	0.00	0.00	NA	NA
Q93D	EST	GREATFISH_EWR OFF	NA	450.99	459.22	NA	NA
Q11A	IRR	RR Module 2 Demands	0.00	0.00	0.00	100%	100%
Q11B	IRR	RR Module 7 Demands	2.59	1.68	1.68	44%	44%
Q11C	IRR	RR Module 11 Demands	0.00	0.00	0.00	100%	100%
Q11D	IRR	RR Module 15 Demands	9.34	3.74	3.74	25%	25%
Q12A	IRR	RR Module 19 Demands	1.10	1.08	1.08	97%	97%
Q12B	IRR	RR Module 23 Demands	7.64	2.55	2.55	20%	20%
Q12C	IRR	RR Module 27 Demands	45.19	45.14	45.14	100%	100%
Q13A	IRR	RR Module 31 Demands	0.00	0.00	0.00	100%	100%
Q13B	IRR	RR Module 76 Demands	17.45	16.86	16.84	93%	93%
Q13C	IRR	RR Module 80 Demands	0.00	0.00	0.00	100%	100%
Q13C	IRR	RR Module 81 Demands	47.62	45.57	45.58	92%	92%
Q14A	IRR	RR Module 37 Demands	16.19	3.36	3.36	9%	9%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q14B	IRR	RR Module 41 Demands	14.86	4.21	4.20	13%	13%
Q14C	IRR	RR Module 45 Demands	8.17	2.89	2.89	19%	19%
Q14D	IRR	RR Module 50 Demands	5.11	1.38	1.38	17%	17%
Q14E	IRR	RR Module 54 Demands	5.55	1.33	1.33	15%	15%
Q21A	IRR	RR Module 66 Demands	0.28	0.27	0.27	100%	100%
Q21B	IRR	RR Module 70 Demands	0.00	0.00	0.00	100%	100%
Q21B	IRR	RR Module 71 Demands	21.11	5.41	4.64	14%	13%
Q22A	IRR	RR Module 58 Demands	4.26	1.95	1.91	26%	26%
Q22B	IRR	RR Module 62 Demands	4.51	1.39	1.34	20%	20%
Q30B	IRR	RR Module 88 Demands	0.00	0.00	0.00	100%	100%
Q30B	IRR	RR Module 89 Demands	7.35	3.64	3.63	29%	29%
Q30C	IRR	RR Module 95 Demands	0.00	0.00	0.00	100%	100%
Q30C	IRR	RR Module 94 Demands	17.29	16.63	16.63	92%	92%
Q30D	IRR	RR Module 100 Demands	0.00	0.00	0.00	100%	100%
Q30D	IRR	RR Module 101 Demands	10.48	10.02	10.02	92%	92%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q30E	IRR	RR Module 106 Demands	0.00	0.00	0.00	100%	100%
Q30E	IRR	RR Module 107 Demands	49.55	47.41	47.41	92%	92%
Q41A	IRR	RR Module 112 Demands	0.00	0.00	0.00	100%	100%
Q41A	IRR	RR Module 113 Demands	3.66	1.75	1.75	33%	33%
Q41B	IRR	RR Module 118 Demands	0.00	0.00	0.00	100%	100%
Q41B	IRR	RR Module 119 Demands	6.06	2.54	2.54	29%	29%
Q41C	IRR	RR Module 125 Demands	0.00	0.00	0.00	100%	100%
Q41C	IRR	RR Module 124 Demands	0.69	0.56	0.56	71%	71%
Q41D	IRR	RR Module 151 Demands	9.44	9.40	9.40	100%	100%
Q42A	IRR	RR Module 130 Demands	0.54	0.52	0.52	99%	99%
Q42B	IRR	RR Module 134 Demands	0.69	0.66	0.66	88%	88%
Q43A	IRR	RR Module 139 Demands	0.00	0.00	0.00	100%	100%
Q43A	IRR	RR Module 138 Demands	4.58	2.42	2.42	32%	32%
Q43B	IRR	RR Module 145 Demands	0.00	0.00	0.00	100%	100%
Q43B	IRR	RR Module 144 Demands	2.78	1.64	1.64	37%	37%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q44A	IRR	RR Module 155 Demands	0.00	0.00	0.00	100%	100%
Q44B	IRR	RR Module 159 Demands	6.53	5.67	5.67	83%	83%
Q44C	IRR	RR Module 164 Demands	22.28	3.23	2.02	10%	9%
Q50A	IRR	RR Module 169 Demands	57.50	55.00	55.00	92%	92%
Q50B	IRR	RR Module 176 Demands	0.00	0.00	0.00	100%	100%
Q50B	IRR	RR Module 175 Demands	22.91	22.33	22.23	95%	93%
Q50C	IRR	RR Module 181 Demands	28.05	26.91	27.19	92%	92%
Q60A	IRR	RR Module 185 Demands	0.66	0.58	0.58	85%	85%
Q60B	IRR	RR Module 189 Demands	0.00	0.00	0.00	100%	100%
Q60C	IRR	RR Module 193 Demands	0.69	0.55	0.55	72%	72%
Q70A	IRR	RR Module 198 Demands	0.00	0.00	0.00	100%	100%
Q70A	IRR	RR Module 197 Demands	18.02	17.32	17.33	92%	92%
Q70B	IRR	RR Module 204 Demands	0.00	0.00	0.00	100%	100%
Q70B	IRR	RR Module 203 Demands	31.12	29.25	29.28	91%	91%
Q70C	IRR	RR Module 210 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q70C	IRR	RR Module 209 Demands	5.14	4.25	4.09	79%	78%
Q80D	IRR	RR Module 230 Demands	20.20	9.73	9.74	35%	35%
Q80E	IRR	RR Module 235 Demands	0.00	0.00	0.00	100%	100%
Q80E	IRR	RR Module 236 Demands	21.74	21.70	21.70	100%	100%
Q80F	IRR	RR Module 242 Demands	10.48	3.06	2.99	16%	16%
Q80G	IRR	RR Module 247 Demands	0.00	0.00	0.00	100%	100%
Q80G	IRR	RR Module 246 Demands	10.79	10.51	9.49	94%	86%
Q91A	IRR	RR Module 252 Demands	1.48	1.26	1.26	79%	79%
Q91B	IRR	RR Module 256 Demands	2.75	1.83	1.83	54%	54%
Q91C	IRR	RR Module 260 Demands	3.35	1.75	1.75	41%	41%
Q93A	IRR	RR Module 345 Demands	1.01	1.03	1.03	100%	100%
Q93B	IRR	RR Module 349 Demands	3.98	0.66	0.66	13%	13%
Q93B	IRR	RR Module 350 Demands	0.00	0.00	0.00	100%	100%
Q93C	IRR	RR Module 356 Demands	6.28	6.12	6.26	95%	100%
Q93D	IRR	RR Module 363 Demands	1.01	0.95	0.95	89%	89%

Table A-11-10: Results for IUA_Q03

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Fort Beaufort, Seymour, Balfour	Domestic	Beaufort Abstraction	2.40	2.40	2.40	100%	100%
KwaMagoma (Fort Beaufort, Seymour, Balfour)	Domestic	Seymour Abstraction	0.19	0.23	0.23	100%	100%
Q92C	Domestic	Bedford Demands	0.54	0.55	0.55	100%	100%
Q92F	Domestic	Adelaide Demands	0.79	0.83	0.83	100%	100%
Q92G	EWR	KOON01_R	12.78	0.00	12.77	NA	100%
Q92G	EWR	KOON01_R_EWR OFF	NA	61.47	51.60	32%	NA
Q94B	EWR	KAT01_I	9.28	0.00	9.25	NA	100%
Q94B	EWR	KAT01_I_EWR OFF	NA	15.89	6.72	27%	NA
Q94D	BIO	KAT03_D	NA	0.00	0.00	NA	NA
Q94D	BIO	KAT03_D_EWR OFF	NA	40.20	40.27	NA	NA
Q94F	EWR	KAT02_R	10.16	0.00	10.12	NA	100%
Q94F	EWR	KAT02_R_EWR OFF	NA	42.83	35.17	30%	NA
Q92A	IRR	RR Module 266 Demands	0.00	0.00	0.00	100%	100%
Q92A	IRR	RR Module 265 Demands	7.51	4.89	4.65	51%	49%
Q92B	IRR	RR Module 272 Demands	8.90	3.48	3.10	35%	34%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q92C	IRR	RR Module 278 Demands	0.00	0.00	0.00	100%	100%
Q92C	IRR	RR Module 277 Demands	8.30	3.89	2.33	32%	30%
Q92D	IRR	RR Module 286 Demands	0.00	0.00	0.00	100%	100%
Q92D	IRR	RR Module 285 Demands	2.75	1.91	1.11	57%	40%
Q92D	IRR	RR Module 291 Demands	0.00	0.00	0.00	100%	100%
Q92F	IRR	RR Module 296 Demands	0.00	0.00	0.00	100%	100%
Q92F	IRR	RR Module 295 Demands	0.00	0.00	0.00	100%	100%
Q92G	IRR	RR Module 302 Demands	0.00	0.00	0.00	100%	100%
Q92G	IRR	RR Module 301 Demands	0.00	0.00	0.00	100%	100%
Q94A	IRR	RR Module 309 Demands	0.13	0.13	0.13	100%	100%
Q94A	IRR	RR Module 317 Demands	0.00	0.00	0.00	100%	100%
Q94C	IRR	RR Module 324 Demands	0.69	0.67	0.67	96%	96%
Q94D	IRR	RR Module 329 Demands	10.22	6.97	6.16	54%	46%
Q94E	IRR	RR Module 335 Demands	0.00	0.00	0.00	100%	100%
Q94F	IRR	RR Module 340 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Q94F	IRR	RR Module 339 Demands	11.93	5.57	3.94	38%	32%

Table A-11-11: Results for IUA_R01

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
ADM	Domestic	Tyume	1.20	1.20	1.20	100%	100%
ADM	Domestic	MasInc	1.45	1.41	1.36	93%	86%
Debe	Domestic	Debe	1.20	1.20	1.20	96%	96%
Peddie	Domestic	Peddle	3.00	3.00	3.00	100%	100%
Peddie	Domestic	Domestic	0.03	0.00	0.00	100%	100%
Sandile/Dimbaza	Domestic	Dimbaza	7.83	7.80	7.57	100%	95%
R10B	BIO	CATA01_D	NA	0.00	0.00	NA	NA
R10B	BIO	CATA01_D_EWR OFF	NA	11.68	11.92	NA	NA
R10D	EWR	KEIS01_I	23.86	0.00	23.73	NA	99%
R10D	EWR	KEIS01_I_EWR OFF	NA	34.12	12.08	22%	NA
R10H	EWR	TYUM01_R	10.63	0.00	10.60	NA	98%
R10H	EWR	TYUM01_R_EWR OFF	NA	19.25	8.89	31%	NA
R10L	EWR	KEIS02_R	29.35	0.00	29.28	NA	100%
R10L	EWR	KEIS02_R_EWR OFF	NA	57.72	30.78	28%	NA

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
R10M	EST	KEISKAMMA	NA	0.00	0.00	NA	NA
R10M	EST	KEISKAMMA_EWR OFF	NA	79.57	81.88	NA	NA
R10A	IRR	RR Module 2 Demands	0.50	0.44	0.42	66%	64%
R10B	IRR	RR Module 3 Demands	4.99	4.99	4.68	100%	94%
R10C	IRR	RR Module 14 Demands	0.57	0.57	0.54	100%	95%
R10D	IRR	RR Module 26 Demands	5.14	5.12	4.79	100%	94%
R10E	IRR	RR Module 27 Demands	0.19	0.18	0.18	96%	96%
R10F	IRR	RR Module 39 Demands	1.55	1.47	1.47	90%	90%
R10G	IRR	RR Module 40 Demands	1.20	1.21	1.18	100%	97%
R10H	IRR	RR Module 41 Demands	0.00	0.00	0.00	100%	100%
R10J	IRR	RR Module 60 Demands	0.00	0.00	0.00	100%	100%
R10K	IRR	RR Module 61 Demands	1.83	1.60	1.21	82%	64%
R10L	IRR	RR Module 62 Demands	0.03	0.00	0.00	100%	100%
R10M	IRR	RR Module 63 Demands	0.35	0.37	0.37	100%	100%

Table A-11-12: Results for IUA_R02

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Buffalo City	Domestic	Total	71.64	71.27	67.14	98%	83%
Buffalo City	Domestic	Bridle Drift	46.55	46.25	42.24	82%	44%
Buffalo City	Domestic	Nahoon	14.20	14.14	14.07	41%	69%
Buffalo City	Domestic	Laing Dam	9.50	9.52	9.44	100%	99%
Buffalo City	Domestic	Wriggleswade	1.42	1.43	1.42	76%	85%
Qonce (King Williams)	Domestic	Rooikrantz	19.88	15.23	13.31	67%	58%
R20B	EWR	BUFF03_FV	4.45	0.00	4.44	NA	100%
R20B	EWR	BUFF03_FV_EWR OFF	NA	20.21	17.68	82%	NA
R20E	BIO	YELL01_D	NA	0.00	0.00	NA	NA
R20E	BIO	YELL01_D_EWR OFF	NA	12.99	17.78	NA	NA
R20F	EWR	BUFF01_I	27.61	0.00	26.65	NA	98%
R20F	EWR	BUFF01_I_EWR OFF	NA	52.58	33.05	46%	NA
R20G	EWR	BUFF02_R	29.03	0.00	28.77	NA	99%
R20G	EWR	BUFF02_R_EWR OFF	NA	21.70	4.95	6%	NA
R30F	EWR	NAHO01_FV	2.02	0.00	1.99	NA	100%
R30F	EWR	NAHO01_FV_EWR OFF	NA	16.26	14.06	40%	NA
R30F	EST	NAHOON	NA	0.00	0.00	41%	0.69

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
R30F	EST	NAHOON_EWR OFF	NA	19.33	19.13	NA	NA
R20E	IRR	RR Module 247 Demands	1.33	1.22	1.22	86%	86%
R30E	IRR	RR Module 262 Demands	0.79	0.72	0.72	84%	84%
R30F	IRR	RR Module 267 Demands	0.82	0.27	0.18	29%	27%

Table A-11-13: Results for IUA_S01

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Emalahleni LM	Domestic	Indwe Domestic	0.57	0.59	0.59	100%	100%
Emalahleni LM	Domestic	Chris Hani Domestic	2.49	2.46	2.46	100%	100%
Intsika LM	Domestic	Chris Hani Domestic	2.49	2.46	2.46	100%	100%
Intsika LM	Domestic	Cofimvaba Domestic	0.00	0.00	0.00	100%	100%
Intsika LM	Domestic	Cluster 9 Domestic	3.06	3.00	3.00	100%	99%
Komani (Queenstown)	Domestic	Emergency Transfer to Queenstown	3.66	0.49	0.44	10%	10%
S10J	EWR	WKEI01_R	33.14	0.00	33.03	NA	100%
S10J	EWR	WKEI01_R_EWR OFF	NA	128.64	95.68	57%	NA

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S20D	EWR	INDW01_R	13.57	0.00	13.53	NA	100%
S20D	EWR	INDW01_R_EWR OFF	NA	49.30	35.79	78%	NA
S50G	EWR	TSOM01_I	67.22	0.00	51.77	NA	72%
S50G	EWR	TSOM01_I_EWR OFF	NA	87.60	44.04	15%	NA
S50E	Hydropower	Ncora Hydropower	84.89	81.55	77.81	94%	90%
S10A	IRR	RR Module 115 Demands	0.79	0.76	0.76	88%	88%
S10B	IRR	RR Module 116 Demands	1.14	1.12	1.12	93%	93%
S10C	IRR	RR Module 117 Demands	0.69	0.68	0.68	93%	93%
S10D	IRR	RR Module 118 Demands	0.92	0.90	0.90	95%	95%
S10E	IRR	RR Module 119 Demands	0.69	0.68	0.68	97%	97%
S10F	IRR	RR Module 120 Demands	0.60	0.55	0.55	89%	89%
S10G	IRR	RR Module 121 Demands	1.51	1.12	1.12	66%	66%
S10H	IRR	RR Module 122 Demands	0.38	0.38	0.38	100%	100%
S10J	IRR	RR Module 123 Demands	0.06	0.03	0.03	100%	100%
S20A	IRR	RR Module 111 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S20B	IRR	RR Module 112 Demands	0.00	0.00	0.00	100%	100%
S20C	IRR	RR Module 113 Demands	0.00	0.00	0.00	100%	100%
S20D	IRR	RR Module 114 Demands	6.00	6.01	6.01	100%	100%
S40A	IRR	RR Module 100 Demands	5.36	3.68	3.65	46%	46%
S40B	IRR	RR Module 101 Demands	5.27	3.37	3.34	44%	44%
S40C	IRR	RR Module 102 Demands	3.85	2.53	2.49	48%	47%
S40D	IRR	RR Module 131 Demands	1.20	1.21	1.16	100%	97%
S40E	IRR	RR Module 132 Demands	2.49	2.50	2.40	99%	95%
S40F	IRR	RR Module 133 Demands	3.25	3.19	3.02	97%	93%
S50A	IRR	RR Module 134 Demands	0.25	0.26	0.26	100%	100%
S50B	IRR	RR Module 135 Demands	0.35	0.36	0.36	100%	100%
S50C	IRR	RR Module 136 Demands	0.47	0.46	0.46	100%	100%
S50D	IRR	RR Module 137 Demands	0.41	0.39	0.39	100%	100%
S50F	IRR	RR Module 138 Demands	0.00	0.00	0.00	100%	100%
S50G	IRR	RR Module 139 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S50H	IRR	RR Module 140 Demands	0.38	0.37	0.36	100%	97%
S50J	IRR	RR Module 141 Demands	0.00	0.00	0.00	100%	100%

Table A-11-14: Results for IUA_S02

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Komani (Queenstown)	Domestic	Queenstown Domestic	7.20	7.20	7.18	100%	99%
S31G	QUA	KOMA01_D	NA	0.00	0.00	NA	NA
S31G	QUA	KOMA01_D_EWR OFF	NA	3.13	3.00	NA	NA
S31G	BIO	KSIM01_FV	NA	0.00	0.00	NA	NA
S31G	BIO	KSIM01_FV_EWR OFF	NA	28.08	42.65	NA	NA
S32G		KLIP01_FV	NA	0.00	0.00	NA	NA
S32G		KLIP01_FV_EWR OFF	NA	38.07	38.38	NA	NA
S32K	EWR	BKEI01_I	62.17	0.00	62.06	NA	99%
S32K	EWR	BKEI01_I_EWR OFF	NA	107.95	66.37	22%	NA
S31A	IRR	RR Module 95 Demands	3.12	2.71	0.90	70%	33%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S31B	IRR	RR Module 96 Demands	3.16	2.71	0.74	71%	30%
S31C	IRR	RR Module 97 Demands	5.90	4.26	1.26	55%	28%
S31D	IRR	RR Module 98 Demands	3.35	2.56	0.63	58%	28%
S31E	IRR	RR Module 99 Demands	17.45	3.50	2.43	24%	19%
S31F	IRR	RR Module 124 Demands	0.00	0.00	0.00	100%	100%
S31G	IRR	RR Module 125 Demands	19.47	8.03	2.78	30%	20%
S31G	IRR	RR Module 126 Demands	2.40	0.83	0.28	25%	18%
S32A	IRR	RR Module 107 Demands	1.45	0.39	0.39	21%	21%
S32B	IRR	RR Module 108 Demands	4.10	1.67	0.72	45%	23%
S32C	IRR	RR Module 109 Demands	6.37	2.05	0.90	39%	22%
S32D	IRR	RR Module 103 Demands	12.62	8.78	8.78	50%	50%
S32E	IRR	RR Module 104 Demands	5.30	4.96	4.96	83%	83%
S32F	IRR	RR Module 105 Demands	3.16	1.23	1.23	29%	29%
S32G	IRR	RR Module 106 Demands	11.74	11.78	11.62	100%	99%
S32H	IRR	RR Module 110 Demands	11.71	11.73	11.55	100%	98%

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S32J	IRR	RR Module 127 Demands	1.70	1.27	0.21	52%	21%
S32K	IRR	RR Module 128 Demands	2.90	2.35	0.37	57%	21%
S32L	IRR	RR Module 129 Demands	2.15	1.59	2.11	55%	99%
S32M	IRR	RR Module 130 Demands	2.90	2.33	2.81	59%	98%

Table A-11-15: Results for IUA_S03

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Butterworth system	Domestic	Butterworth Domestic	5.78	5.76	5.76	100%	100%
Butterworth system	Domestic	Small Villages Domestic	2.40	2.40	2.40	100%	100%
Gubu	Domestic	Gubu Domestic	0.95	0.95	0.95	100%	100%
S60A	EWR	KUBU02_FV	6.41	0.00	6.37	NA	100%
S60A	EWR	KUBU02_FV_EWR OFF	NA	31.35	25.02	73%	NA
S60B	EWR	KUBU01_R	6.60	0.00	6.56	NA	99%
S60B	EWR	KUBU01_R_EWR OFF	NA	30.13	19.30	43%	NA
S60E	EWR	KUBU03_R	19.44	0.00	18.11	NA	53%
S60E	EWR	KUBU03_R_EWR OFF	NA	54.34	34.25	33%	NA

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S70A	EWR	GKEI01_I	188.71	0.00	188.69	NA	100%
S70A	EWR	GKEI01_I_EWR OFF	NA	604.44	441.96	44%	NA
S70D	EWR	GCUW01_R	9.53	0.00	9.53	NA	100%
S70D	EWR	GCUW01_R_EWR OFF	NA	51.50	42.14	46%	NA
S70F	EST	GREATKEI	NA	0.00	0.00	NA	NA
S70F	EST	GREATKEI_EWR OFF	NA	734.69	761.06	NA	NA
S60A	IRR	RR Module 255 Demands	0.95	0.88	0.88	91%	91%
S60B	IRR	RR Module 256 Demands	3.38	3.04	3.16	84%	90%
S60B	IRR	RR Module 260 Demands	1.20	1.21	0.55	100%	42%
S60C	IRR	RR Module 144 Demands	2.43	1.62	0.75	53%	35%
S60D	IRR	RR Module 145 Demands	2.97	2.81	0.75	83%	32%
S60E	IRR	RR Module 146 Demands	1.99	1.93	1.77	85%	91%
S70A	IRR	RR Module 150 Demands	1.42	1.43	1.28	100%	92%
S70B	IRR	RR Module 151 Demands	0.25	0.28	0.28	100%	100%
S70C	IRR	RR Module 147 Demands	0.19	0.18	0.18	100%	100%
S70D	IRR	RR Module 148 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
S70E	IRR	RR Module 149 Demands	0.41	0.42	0.42	100%	100%
S70F	IRR	RR Module 152 Demands	1.04	1.04	1.04	100%	100%

Table A-11-16: Results for IUA_T01

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Elliot	Domestic	Eliot Abs	0.32	0.35	0.35	100%	100%
T11C	BIO	XUKA01_D	NA	0.00	0.00	NA	NA
T11C	BIO	XUKA01_D_EWR OFF	NA	113.80	113.80	NA	NA
T11H	EWR	MBHA02_R	73.84	0.00	73.82	NA	99%
T11H	EWR	MBHA02_R_EWR OFF	NA	354.25	280.43	99%	NA
T11A	IRR	RR Module 321 Demands	0.00	0.00	0.00	100%	100%
T11B	IRR	RR Module 322 Demands	0.00	0.00	0.00	100%	100%
T11C	IRR	RR Module 323 Demands	0.60	0.59	0.59	100%	100%
T11D	IRR	RR Module 324 Demands	0.00	0.00	0.00	100%	100%
T11E	IRR	RR Module 325 Demands	0.00	0.00	0.00	100%	100%

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
T11F	IRR	RR Module 326 Demands	0.00	0.00	0.00	100%	100%
T11G	IRR	RR Module 327 Demands	0.00	0.00	0.00	100%	100%
T11H	IRR	RR Module 328 Demands	0.00	0.00	0.00	100%	100%
T12A	IRR	RR Module 317 Demands	0.00	0.00	0.00	100%	100%
T12B	IRR	RR Module 318 Demands	0.00	0.00	0.00	100%	100%
T12C	IRR	RR Module 319 Demands	3.50	3.29	3.10	95%	90%
T12D	IRR	RR Module 320 Demands	1.29	1.30	1.30	100%	100%

Table A-11-17: Results for IUA_T02

User	User Type	Supplied by	Demand (million m³/year)	Supply (million m³/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
T13C	EWR	MBAS01_I	245.52	0.00	244.87	NA	100%
T13C	EWR	MBAS01_I_EWR OFF	NA	739.74	489.09	100%	NA
T13E	EST	MBASHE	NA	0.00	0.00	NA	NA
T13E	EST	MBASHE_EWR OFF	NA	853.11	847.35	NA	NA
Eskom	Hydropower	Colleywobbles Hydropower	84.89	84.83	84.83	100%	100%

Table A-11-18: Results for IUA_T03

User	User Type	Supplied by	Demand (million m^3/year)	Supply (million m^3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Mthatha	Domestic	Mtata Abs	19.00	18.93	18.77	99%	98%
T20A	EWR	MTHA02_D	25.59	0.00	25.61	NA	100%
T20A	EWR	MTHA02_D_EWR OFF	NA	81.99	56.41	92%	NA
T20G	EST	MTATA	NA	0.00	0.00	NA	NA
T20G	EST	MTATA_EWR OFF	NA	321.57	322.09	NA	NA
T20G	EWR	MTHA01_I	150.53	0.00	150.13	NA	100%
T20G	EWR	MTHA01_I_EWR OFF	NA	321.57	171.96	84%	NA
Mthatha	Hydropower	Mthatha Hydropwer	132.51	132.19	131.36	100%	98%

Table A-11-19: Results for IUA_T04

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
Lusikisiki	Domestic	Lusikisiki Abs	5.84	5.84	5.84	100%	99%
Port Saint Johns	Domestic	Port St. Johns	3.00	2.87	2.87	79%	79%
T60C	EWR	MTEN01_R	37.08	NA	NA	NA	NA
T60C	EWR	MTEN01_R_OFF	NA	88.63	NA	94%	NA
T60F	EWR	XURA01_D	5.24	0.00	5.23	NA	100%

User	User Type	Supplied by	Demand (million m3/year)	Supply (million m3/year)		RoS (Months fully supplied)	
			2020	EWR OFF	EWR ON	EWR OFF	EWR ON
T60F	EWR	XURA01_D_EWR OFF	NA	15.77	10.53	100%	NA
T60G	EWR	MSIK01_D	29.51	0.00	29.57	NA	100%
T60G	EWR	MSIK01_D_EWR OFF	NA	135.25	105.70	99%	NA
T60G	EST	MSIKABA	NA	0.00	0.00	NA	NA
T60G	EST	MSIKABA_EWR OFF	NA	216.18	216.19	NA	NA
T70B	EST	BULO01_D	NA	0.00	0.00	NA	NA
T70B	EST	BULO01_D_EWR OFF	NA	1.05	1.05	NA	NA
T70B	EWR	MNGA01_R	20.45	0.00	20.42	NA	100%
T70B	EWR	MNGA01_R_EWR OFF	NA	75.00	54.60	96%	NA
T70B	EST	MNGAZI	NA	0.00	0.00	NA	NA
T70B	EST	MNGAZI_EWR OFF	NA	82.56	82.56	NA	NA
T90A	EWR	XORA01_D	22.82	NA	NA	NA	NA
T90A	EWR	XORA01_D_OFF	NA	51.86	NA	67%	NA
T90A	EWR	NQUB01_R	3.19	NA	NA	NA	NA
T90A	EWR	NQUB01_R_OFF	NA	9.12	NA	77%	NA