

DETERMINATION OF WATER RESOURCE CLASSES, RESERVE AND RQOs IN THE KEISKAMMA AND FISH TO TSITSIKAMMA CATCHMENTS WITHIN THE MZIMVUBU-TSITSIKAMMA WATER MANAGEMENT AREA (WP11354)

RQO Capacity Building: Rivers

14 May 2025



1

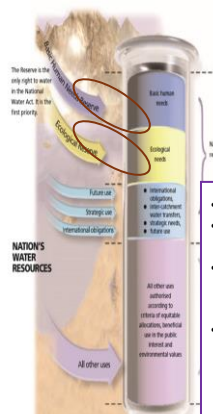
Protection of Water Resources

National system for classifying resources

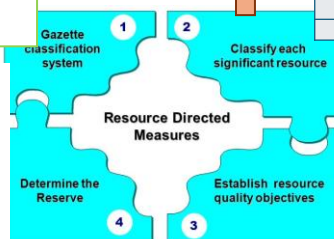
- Gazetted on 17 September 2010, Gazette No. 33541, Regulation 810

Rivers, groundwater, wetlands and estuaries.

Defines and specifies the procedures for determining the classes of water resources (7 steps), the Reserve (8 steps) and resource quality objectives (6 steps).



- Only right in NWA
- The Reserve is an integral part of the RQO
- The Reserve is part of the water resource that is under the direct control of the Minister.
- It has priority over all other water use. Reserve must be met before water resources can be allocated to other water users



Class	Description of use	Ecological Category	Description of resource
I	Minimally used	A-B	Minimally altered
II	Moderately used	C	Moderately altered
III	Heavily used	D	Heavily altered

Each class represents:

- a different **level of protection** that is required for the water resource, and the extent to which the water can be used.

Classification is used in two ways:

- To define the **present status** of the water resource
- To define the state towards which the water resource needs to be **managed** sustainably (**future state**).

Targets or objectives/ management goals that provide statements about:

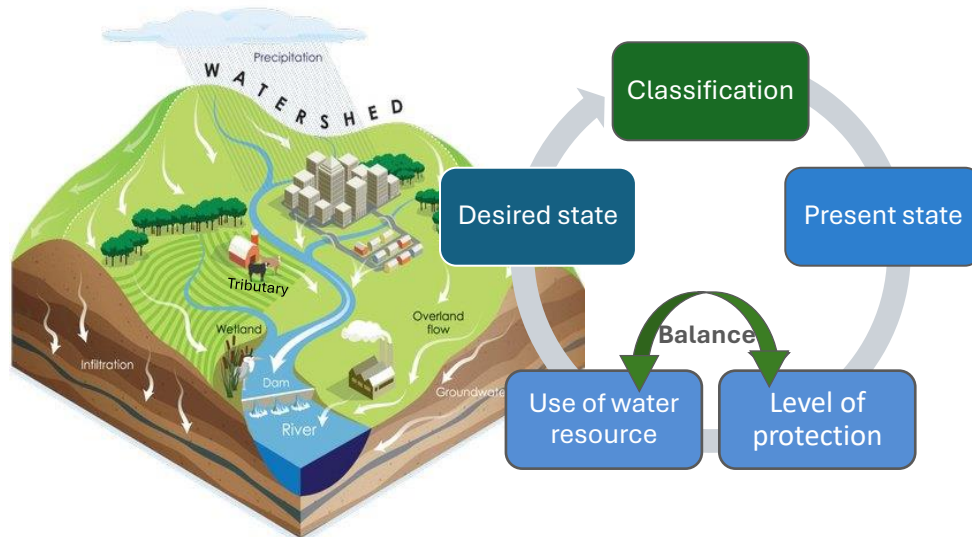
- what the **quantity** of the water should be (water level, pattern, timing)
- what the water **quality** should be (physical, chemical and biological)
- what the **condition of the instream and riparian** (riverbank) habitat should be
- what the **condition of the aquatic** (water) animal and plant life should be.



2

Classification of Water Resources

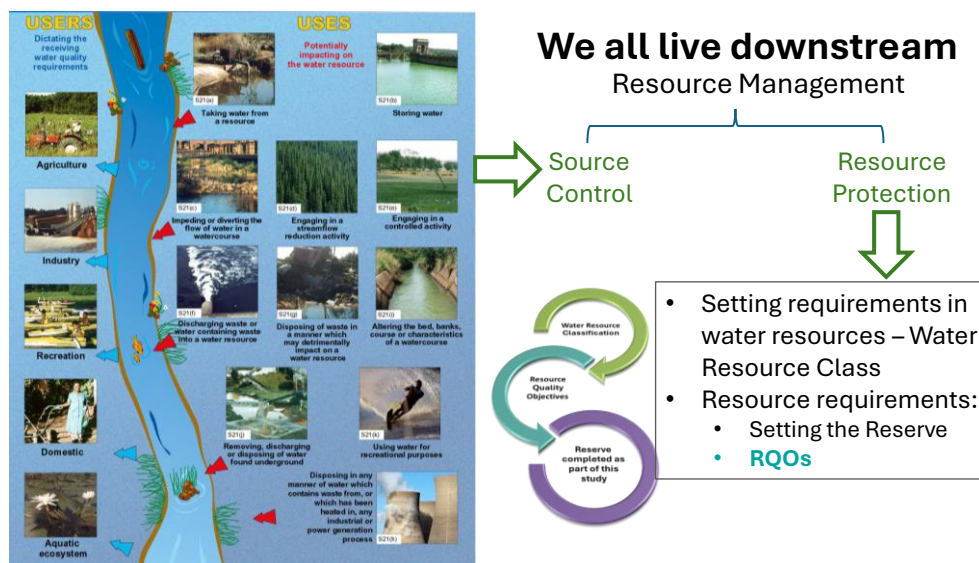
Integrated Water Resources Management (IWRM)



3

Balancing Use and Protection

Integrated Water Resources Management (IWRM)



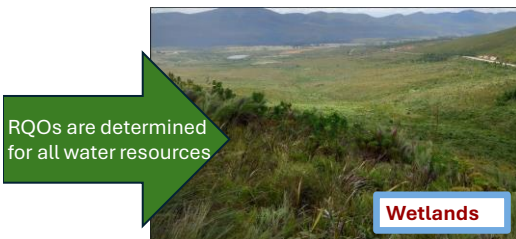
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RESOURCE QUALITY OBJECTIVES

- Purpose is to establish clear goals relating to the quality of the relevant water resources
- Provide limits or boundaries for the sustainable use of water resources
- In determining RQOs, a balance must be sought between the need to protect and sustain water resources and the need to use them
- Must take account of user requirements and the class of the resource
- Legally binding
- The RQOs may inform decision-making relating to the use of the water in a specific water resource.

RQOs can be numerical and/or descriptive statements and may relate to the:

- **Quantity of water** (water level, pattern, timing)
- **Water quality** (physical, chemical, biological)
- **Instream and riparian (riverbank) habitat condition**
- **Aquatic (water) animal and plant life**

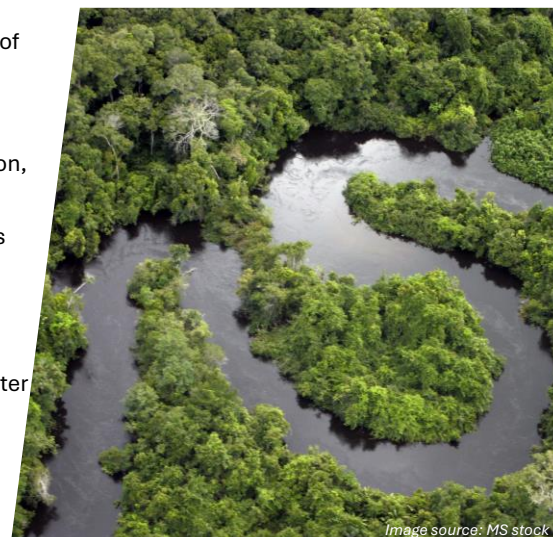


5

Resource Quality Objectives

• RQOs closely aligned with Sustainable Development Goals (SDG)

- Particularly, SDG 6
- Aims to ensure the availability and sustainable management of water and sanitation for all
- The alignment can be summarised as follows:
 - **Water Quality (SDG 6.3):** Sets benchmarks to reduce pollution, manage chemicals, and reuse treated wastewater.
 - **Water Quantity (SDG 6.4):** Supports sustainable withdrawals and prevents water scarcity.
 - **Ecosystem Protection (SDG 6.6):** Safeguards and restores aquatic ecosystems.
 - **Integrated Management (SDG 6.5):** Central to Integrated Water Resource Management (IWRM).
 - **Monitoring & Accountability (SDG 6.1, 6.2, 6.a):** Provides measurable targets to enhance governance and ensure equitable access.



6

Criteria for setting Resource Quality Objectives

- Simple, easily measured, understood, applied
- Cost effective
- Use existing information where possible
- At appropriate scale and must detect change
- Comparable, repeatable, defensible
- Narrative and/or numeric (where possible, and if data available)
- Meaningful in terms of the Act

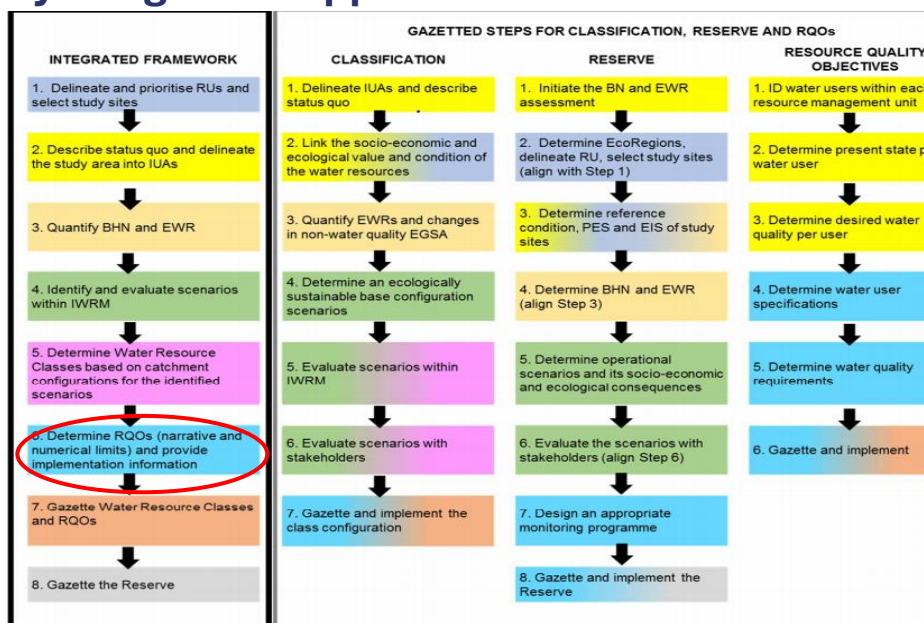


- RQOs cannot/do not:
 - Be applied to an individual licence
 - Replace the need for other monitoring programmes
 - Include every available indicator of resource quality



7

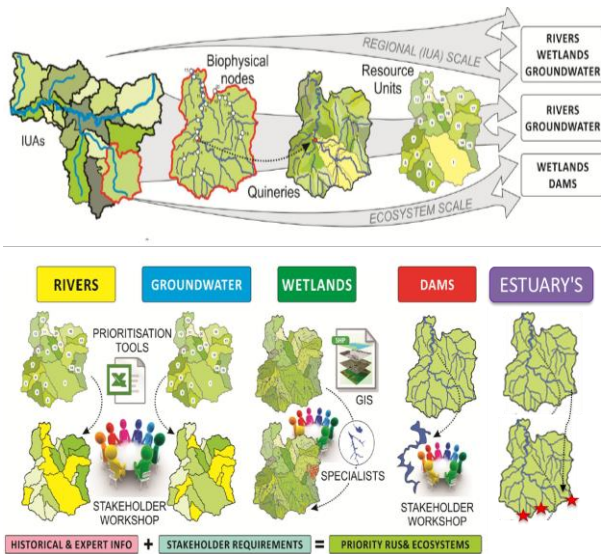
Study Integration Approach



8

Resource Quality Objectives

Delineate and prioritise Resource Units

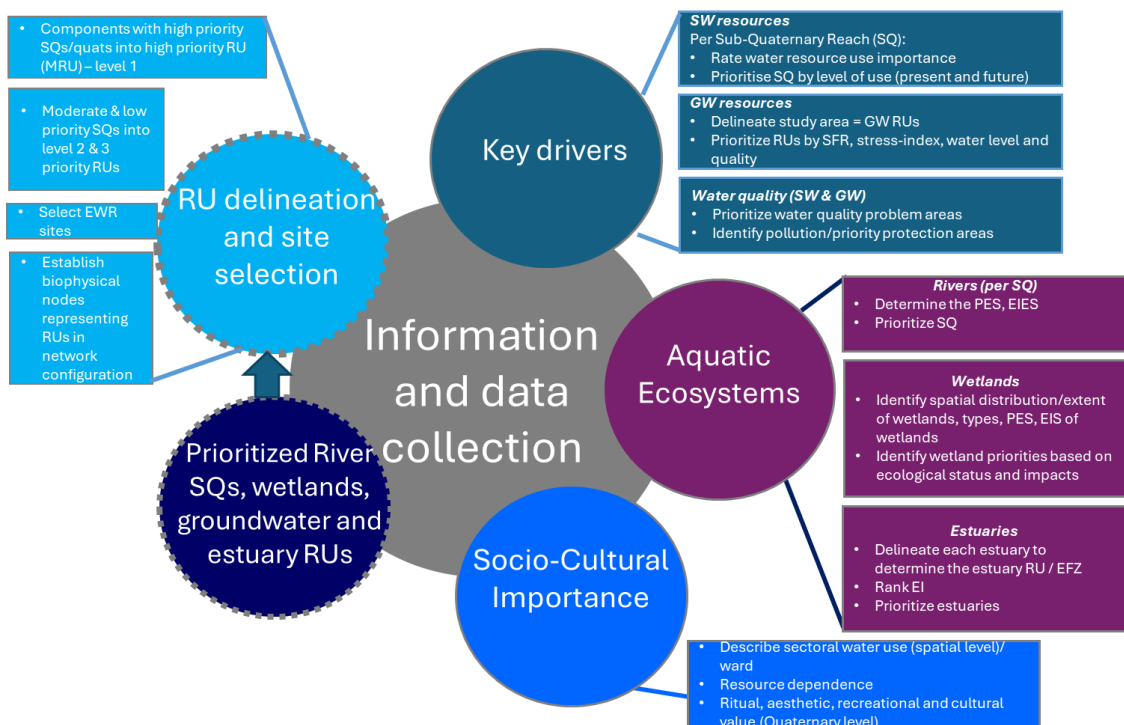


Prioritisation of RUs criterion:

- Position of RU within IUA
- Importance of each RU to users
- Social-Cultural Importance
- Level of threat posed to the water resource quantity and quality for users and ecology (resource stress)
- Present Ecological State, Ecological importance/ sensitivity
- Strategic Water Resource Areas
- Priority wetlands
- Groundwater units
- Management considerations
- Practical considerations - *Expert knowledge of the catchment area and system*

RQOs then set for all prioritised RUs for all water resources

9

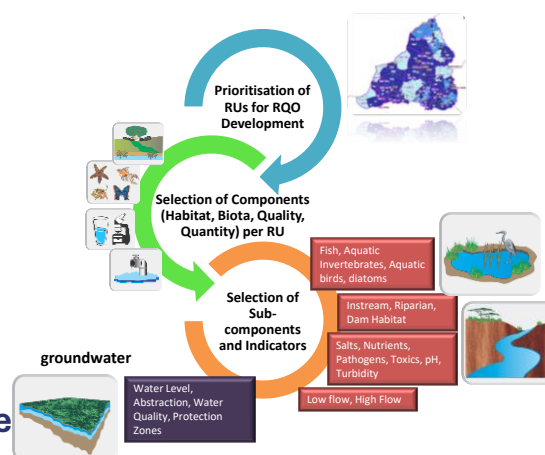


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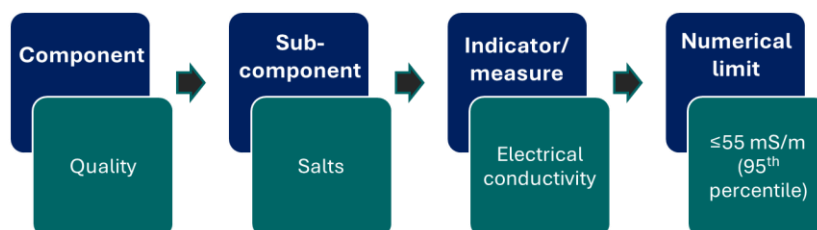
Resource Quality Objectives

Resource evaluation tool

- Model run per priority Resource Unit
- Based on:
 - Activities that impact on water resources
 - User requirements
- Protection of the resource
- Overall: selects the components and sub-components



Indicators and numerical limits or descriptive statements for RQOs should be set



11

Resource Quality Objectives

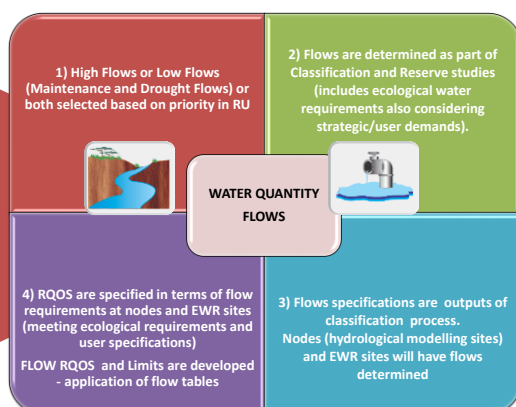
Resource evaluation tool

- RQOs for each resource unit:
 - May not always possible due the potentially large number of priority RUs that could be delineated for a catchment.
 - A rationalisation process has therefore been developed as part of the RQO Determination Procedure (DWA, 2011)
 - RU Evaluation Tool – to select the key indicators and sub-indicators appropriate and required per priority RU
 - Objective:
 - To evaluate and select the most useful indicators per priority RU for RQOs
 - Realistic and pragmatic: achievable and measurable
 - Rolcs Royce *versus* a Mahindra

12



- High Flows
- Low Flows



Resource Quality Objectives

Quantity Indicator and sub-indicators EXAMPLE

WATER QUANTITY

- High Flows
- Low Flows

RU	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
	Quantity	Low flows	The maintenance of low flows and drought flows must be attained to support healthy conditions for the ecosystem and users	Total EWR = 1.097 million cubic meters/annum (Mm³/a) (51.8% of the Virgin Mean Annual Runoff (MAR) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Month	Maintenance Low Flows		Drought Flows	
						m³/second	Percentile	m³/second	Percentile
					Oct	0.0172	40	0.0000	90
					Nov	0.0428	50	0.0000	99
					Dec	0.0463	60	0.0000	99
					Jan	0.0597	60	0.0037	99
					Feb	0.0616	40	0.0000	99
					Mar	0.0455	40	0.0000	99
					Apr	0.0243	30	0.0000	99
					May	0.0093	30	0.0000	90
					Jun	0.0062	30	0.0000	90
					Jul	0.0049	50	0.0000	99
					Aug	0.0045	50	0.0000	99
					Sep	0.0073	30	0.0000	99

15

Resource Quality Objectives

Quantity Indicator and sub-indicators EXAMPLE

WATER QUANTITY

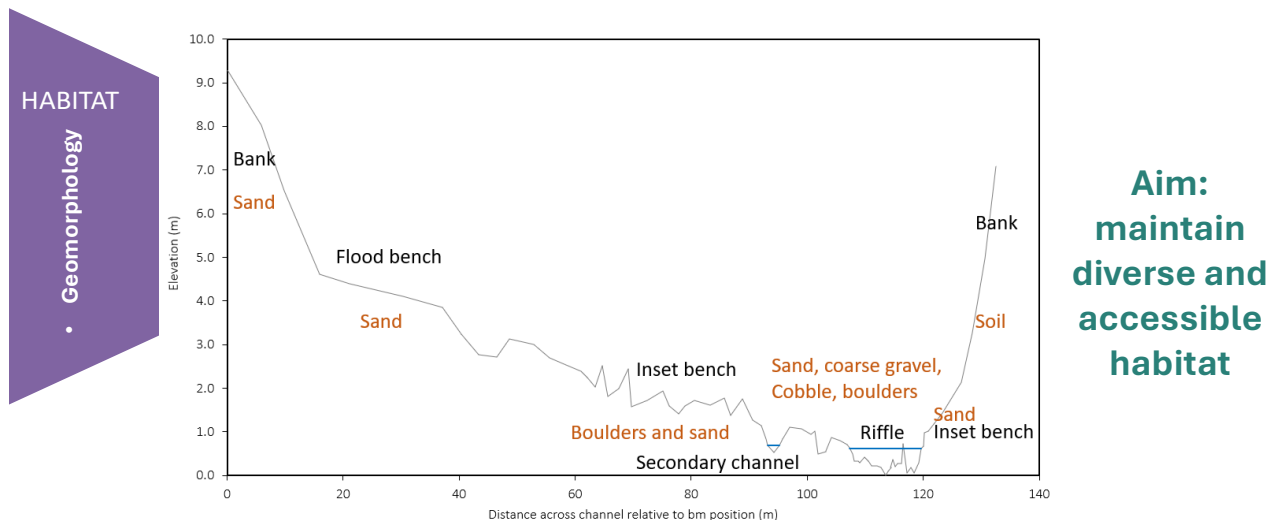
- High Flows
- Low Flows

RU	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit			
	Quantity	High flows	EWR freshets/ floods to be released from the upstream dam	Total EWR = 1.097 million cubic meters/annum (Mm³/a) (51.8% of the natural Mean Annual Runoff (MAR) Freshets/ floods required for the river	Freshet (m³/s)	Days	Flood (m³/s)	Days
					Sep	15	4	
					Oct	15	4	
					Nov	55	4	90 6
					Dec	55	4	90 6
					Jan	90	6	120 7
					Feb	55	4	250 8
					Mar	55	4	90 6

16

Resource Quality Objectives

Habitat indicators and sub-indicators (Geomorphology)



17

Resource Quality Objectives

Geomorphological indicators and rationale

- GAI score - maintain or improve GAI score – integrates catchment drivers, reach impacts and site impacts
- Bed erosion – maintain the elevation of the river bed – allow some vertical variation, but monitor for ongoing directional change – incision or sedimentation
- Bank erosion – erosion is a natural process, but needs some balance with stable/aggrading banks for habitat – channel dimensions
- Riffle sediment size – does it show armouring or sedimentation?
- Embeddedness – are the larger particles smothered by fine sediment?
- Pool depth – are the deep portions of pools being lost?
- Benches – links to bank erosion – are there some depositional features in the macro channel that serves as habitat/growth medium and is inundated during freshes and floods?

18

Resource Quality Objectives

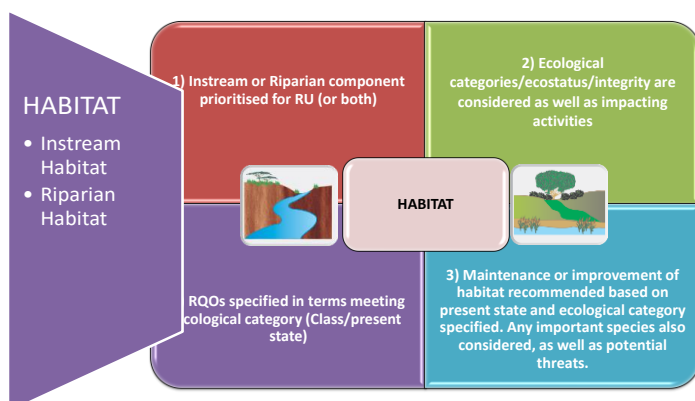
Habitat indicators and sub-indicators (geomorphology):
EXAMPLE

INDICATOR	RQO NARRATIVE	RQO NUMERIC	TPC
GAI score	Maintain or improve catchment drivers and site impacts. Maintain pool-riffle/rapid morphology	Maintain a GAI PES score of at least a 'C' or > 63%.	GAI PES score < 63%. Change from pool-riffle/rapid channel morphology
Bed erosion	Maintain bed elevation in relation to banks and benches	Maintain lowest point along riffle cross-section at < 0.5 m difference in elevation	Riffle bed aggradation or degradation of more than 0.5 m from reference/longer-term average
Bank erosion	Maintain low to moderate proportion of banks actively eroding	Maintain bank erosion below 30% of riverbank length	Bank erosion of more than 30% of riverbank length
Bed sediment size	Maintain dominant riffle sediment size to include gravel and cobble	Maintain riffle with mobile sediment in the range of a D50 of 24 mm D16 of 15 mm and D84 of 50 mm	Riffle dominated by sand or only cobble
Embeddedness	Maintain low embeddedness of riffle sediment	Maintain embeddedness of < 25% for riffle sediment	Embeddedness levels of > 25% for 25% of riffle area/sampling points
Pool depth	Maintain downstream pool with deep open water	Maintain downstream pool with water > 0.5 m deep for 60% of pool area	Downstream pool is > 60% filled with sediment
Flood bench	Maintain flood benches along at least one of the banks	Maintain flood bench of > 5 m wide along at least one bank with signs of recent fine sediment deposition	Channel erosion to the extent where there are no benches wider than ~ 5 m and no signs of recent fine sediment deposition on the benches

19

Resource Quality Objectives

Habitat indicators and sub-indicators (vegetation)



- The vegetation components, assessed for higher confidence, collectively describe the riparian zone's state and serve as indicators for setting RQOs:
 - The PES of vegetation (score and category)
 - Dominant vegetation cover within the riparian and sub-zones
 - Invasion by perennial alien species
 - Terrestrialisation
 - General vegetation structure (proportions of riparian woody species, reeds and non-woody species (grasses, sedges and dicotyledonous forbs)
 - General vegetation composition (species richness, rarity and endemism and key species
 - Threatened/protected riparian plant species

20

Resource Quality Objectives

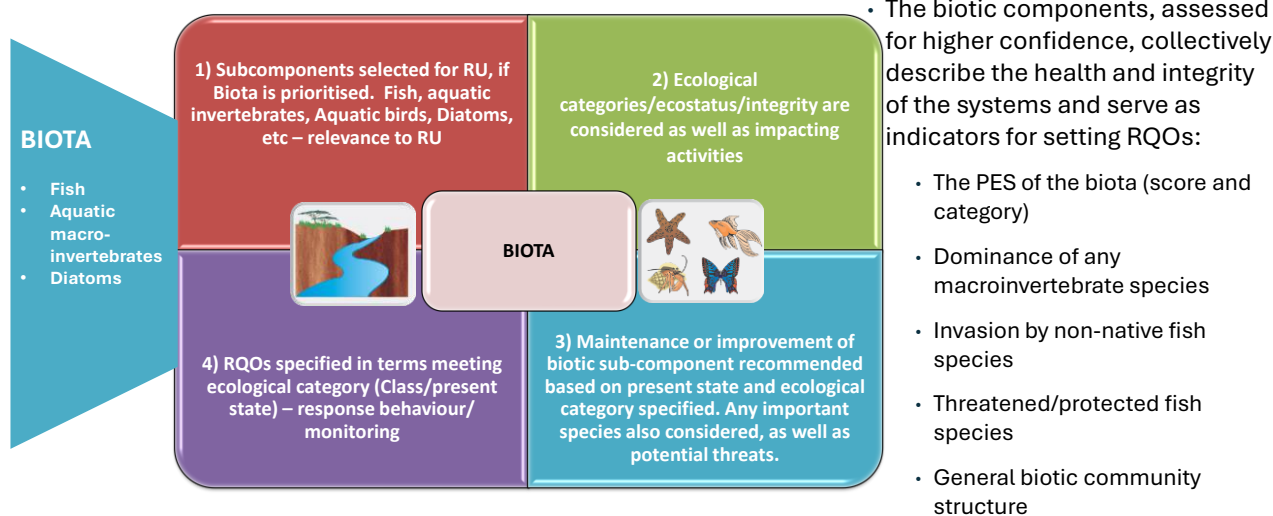
Habitat indicators and sub-indicators (habitat) EXAMPLE

Component	Sub-component	Indicator	RQO Narrative	RQO Numeric
HABITAT • Instream Habitat • Riparian Habitat	Marginal zone	Alien plant species	The riparian vegetation structure and composition in the marginal zone should maintain desired dominance and non-dominance.	Perennial alien plant species <= 20% (aerial cover).
		Terrestrial woody cover		No terrestrial woody plants.
		Indigenous woody cover		Woody cover <= 10% (aerial cover).
		Non-woody cover		Non-woody cover >= 20% (aerial cover).
		Reed cover		Reed cover <= 30% (aerial cover).
	Non-marginal (upper - banks)	Dominant vegetation	Woody vegetation should dominate the macro-channel banks	Woody cover >= 40% (aerial cover).
		Alien invasive plant species	Alien invasive plant species should be kept low or absent on macro-channel banks	perennial alien plant species <= 50% (aerial cover).
	Riparian zone	PES	The PES category should be a D at least	VEGRAI (4) >= 42% (aerial cover).
		Species richness	Indigenous plant species richness in the riparian zone should be maintained.	>= 20 indigenous species.
		Endemic riparian species	<i>Combretum erythrophyllum</i> (southern African endemic) must be present.	1 listed species present.

21

Resource Quality Objectives

Biota Indicator and sub-indicators



22

Resource Quality Objectives

Biota Indicator and sub-indicators: EXAMPLE

BIOTA

- Fish
- Aquatic and Riparian plant species
- Mammals
- Birds
- Amphibians and reptiles
- Periphyton
- Aquatic Invertebrates
- Diatoms

Component	Sub-component	Indicator	RQO Narrative	RQO Numeric	TPC
Biota	Fish	FRAI score	The Ecological Category should be maintained at a Category D or greater.	FRAI score ≥42%	FRAI score <44%
		Overall fish health	To ensure fish population recorded is in good health with no prevalence of disease and/or anomalies.	<2% of fish population with externally evident disease or other anomalies. Parasite infestation to be noted but not used in this assessment of anomalies.	>2% of fish population with externally evident disease or other anomalies.
		Species diversity			
		Key species	Anguilla mossambica Sandella bairdii must be present	1 listed species present.	
	Macroinvertebrates	MIRAI Category and Score	The Ecological Category should be maintained within a C Category.	To ensure the MIRAI score remains within the range of a C category (>62 - <78%), using the same reference data used in the EWR study	A MIRAI score of 65% or less.
		SASSS Total Score and ASPT	To ensure that the SASSS scores attained, support the specified Ecological Category.	To ensure that the SASSS scores and ASPT values occur in the following range: SASSS score: >115; ASPT value: >5.0	SASSS scores less than 120 and ASPT less than 5.8
		Key taxa and abundance	To maintain suitable flow velocity (>0.6m/s) and to maintain clean, unembedded surface area (cobble) to support the following flow-dependent taxa:		
		Baetidae >2sp		Minimum abundance of an A attained.	If Baetidae >2sp is missing in two consecutive surveys or has a single individual present in two consecutive surveys. Velocities decrease below 0.6m/s for longer than a week, water quality deterioration and biotopes become exposed.
		Leptophlebiidae		Minimum abundance of an A attained.	If Leptophlebiidae is missing in two consecutive surveys or has a single individual present in two consecutive surveys. Velocities decrease below 0.3m/s for longer than a week, water quality deterioration and SIC become exposed.
		Hydropsychidae 2sp		Minimum abundance of an A attained.	If Hydropsychidae >2sp is missing in two consecutive surveys or has a single individual present in two consecutive surveys. Velocities decrease below 0.6m/s for longer than a week, water quality deterioration and biotopes become exposed.
		To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxon: Coenagrionidae		Minimum abundance of an A attained.	If Coenagrionidae is missing in two consecutive surveys or has a single individual present in two consecutive surveys. If marginal vegetation becomes exposed for longer than a week.
		Taxon dominance	Ensure that no family dominates the macroinvertebrate assemblage.	Ensure that no family dominates the macroinvertebrate assemblage, defined as D (>1000) abundance for more than two consecutive surveys.	Any taxon occurring in an abundance of >100 for two consecutive surveys.

23

Resource Quality Objectives

Quality Indicator and sub-indicators

Basic Principles (maintain or improve)

- In absence of macro-water quality data (pre-2018)
- Adopt basic principles



25

Resource Quality Objectives

Water quality: limited DWS data

Site Type	River	Site ID	Latitude	Longitude	Notes on DWS Site	Year Range	Date Entries
Intermediate	Groot River	L7H006Q01	-33.7311	24.6183	Different River within same catchment	1968 - 2016	2486
Intermediate	Kouga River	L8R001Q01	-33.7400	24.5881	Different SQ Reach, immediately downstream of Kouga Dam. Groot, Doringkraal and Hol confluence DOWNSTREAM of DWS site and U/S of the EWR site.	1968 - 2016	1047
Intermediate	Swartkops River	M1R001Q01	-33.6900	25.2667	Dam in different SQ reach	2012	659
Intermediate	Sundays River	N4H002Q01	-33.4225	-33.4225	Different SQ	1986 - 2012	158
Intermediate	Great Fish	Q5R001Q01	-32.5298	25.7568	Site at dam wall U/S of EWR site in different SQ reach. Non-perennial stream draining a relatively little impacted area (sparse farmhouses) confluent before EWR site	1977 - 2008	1630
Intermediate	Keiskamma River	R1H017Q01	-32.7181	27.1064	Dam in different SQ reach 27km upstream of EWR site, stream confluent upstream of EWR. Seems to be draining rural built-up area.	1989 - 2022	1283

26

Resource Quality Objectives

Quality Indicator and sub-indicators EXAMPLE

IUA 3 & 4	RU EWR 4 (Letaba River, B81J-00219; B81J-00209)	Nutrients (phosphate)	B/C	Acceptable	50th percentile of the data must be less than 0.025 mg/L PO4-P (Aquatic ecosystems: driver).
		Electrical Conductivity (salts)		Ideal	95th percentile of the data must be less than or equal to 30 mS/m (Industry Cat 3: driver).
		pH		Acceptable	5th and 95th percentiles of pH data must be between 6.5 and 8.4 (Industry Cat 3: driver).
		Toxics		Ideal	95th percentile of the data must be within the TWQR or A categories for toxics.
		Turbidity		Acceptable	Not available (Aquatic ecosystems: driver)

27

80 No. 40531
NO. 1617
GOVERNMENT GAZETTE, 30 DECEMBER 2016
DEPARTMENT OF WATER AND SANITATION
NATIONAL WATER ACT, 1998
(ACT NO.36 OF 1998)
CLASSES OF WATER RESOURCES AND RESOURCE QUALITY OBJECTIVES FOR THE
LETABA CATCHMENT
I, Sifiso Mkhize, in my capacity as Acting Director-General of the Department of Water and Sanitation, and duly authorised in terms of sections 13(1) and 63(1)(a) of the National Water Act, 1998 (Act No.36 of 1998), hereby publish the notice for the classes of water resources and the resource quality objectives for the Letaba Catchment.
Director: Water Resource Classification
Attention: Ms Letopang Matlala
Department of Water and Sanitation
176 Francis Baard Street
Private Bag x 512
Pretoria
0001

Hennops River

Sub-component	RQO	Indicator	Numerical Limit
Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category and the water quality requirements of the water users are met.	Orthophosphate (PO ₄ ⁻) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50 th percentile)
		Dissolved Inorganic Nitrogen	≤ 3.0 milligrams/litre (50 th percentile)
		Nitrate (NO ₃ ⁻) & Nitrite (NO ₂ ⁻) as Nitrogen	≤ 1.0 milligrams/litre (50 th percentile)
Salts	Instream salinity must be improved to meet the recommended ecological category and the water quality requirements of the water users. Land based impacts and wastewater discharges must be controlled and managed to protect the resource	Electrical conductivity (EC)	≤ 85 milliSiemens Siemens/metre (mS/m) (95 th percentile)
		Sulphate	≤ 70 milligrams/litre (95 th percentile)
		Sodium	≤ 70 milligrams/litre (mg/l) (95 th percentile)
Pathogens	The presence of pathogens should pose a low risk to human health.	<i>Escherichia coli</i>	130 counts/100 millilitres (95 th percentile)
System Variables	pH must be maintained within the prescribed limits.	pH range	pH range 7.5 (5 th percentile) - 9.2 (95 th percentile)
Toxics	The concentrations of toxins should not be toxic to aquatic organisms and a threat to human health	Ammonia	≤ 0.007 milligrams/litre (mg/l) (95 th percentile)
		Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95 th percentile)
		Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95 th percentile)
		Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95 th percentile)
		Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95 th percentile)
		Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95 th percentile)
		Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95 th percentile)
		Atrazine	≤ 0.078 milligrams/litre (mg/l)
		Mancozeb	0.009 milligrams/litre (mg/l)

28

Resource Quality Objectives

Quality Indicator and sub-indicators

Basic Principles (maintain or improve): preferred approach

- Target Water Quality Range (DWS, 1996 Volume 7 – Aquatic Ecosystem Guidelines)
- Updated WRC project, 2024
 - Tolerable limits of the system for all specified parameters
- Phased approach / preferred approach:
 - Biological
 - Diatoms (surrogate)
 - Macroinvertebrates (that have a preference for water quality) (independent RQOs)
- Any specific/risk-based issues – focused monitoring and ranges

29

Resource Quality Objectives

Dams Indicator and sub-indicators

Quantity

- Dam level
- Dam operating rules
- Bathymetry

Quality

- Clarity / Secchi disc indication
- Cyanobacteria

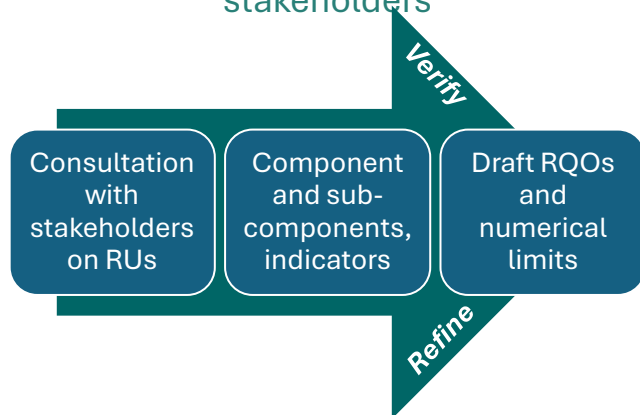
Vegetation

- Alien aquatic plant species
- In-channel Phragmites sp. / reeds

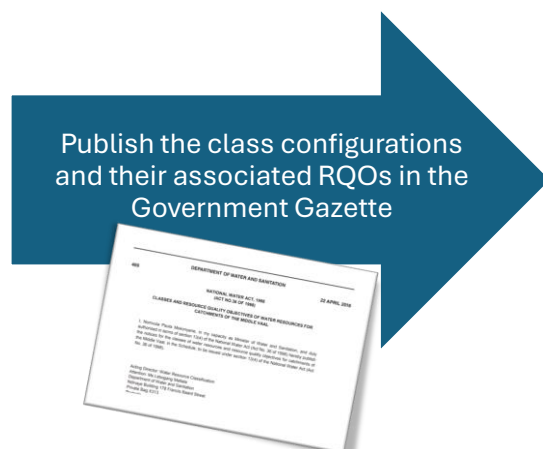
30

Resource Quality Objectives

Step: Agree RUs, RQOs & numerical limits with stakeholders



Step: Finalise and Gazette



31

Thank you



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32

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33