



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

INKOMATI NWRCS

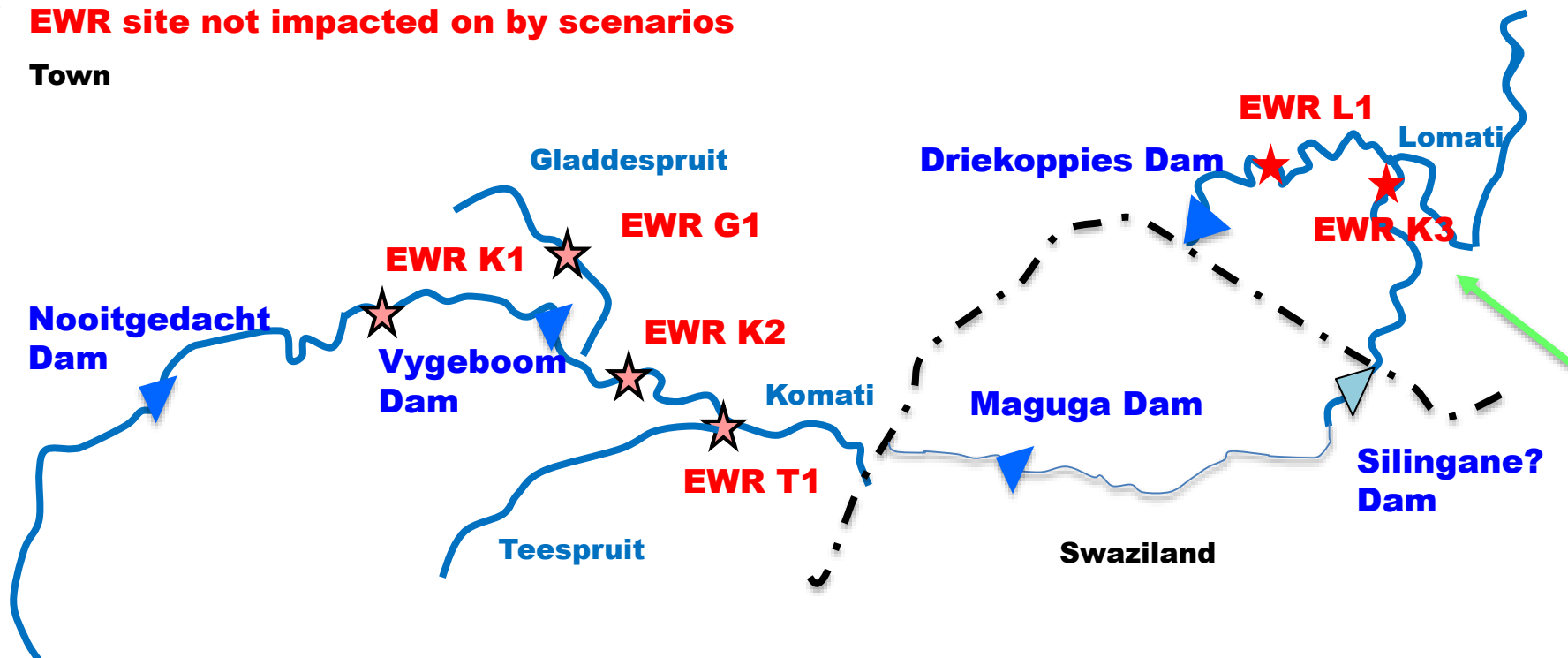
CONSEQUENCES OF SCENARIOS & RECOMMEND MANAGEMENT CLASSES: KOMATI (X₁) RIVER

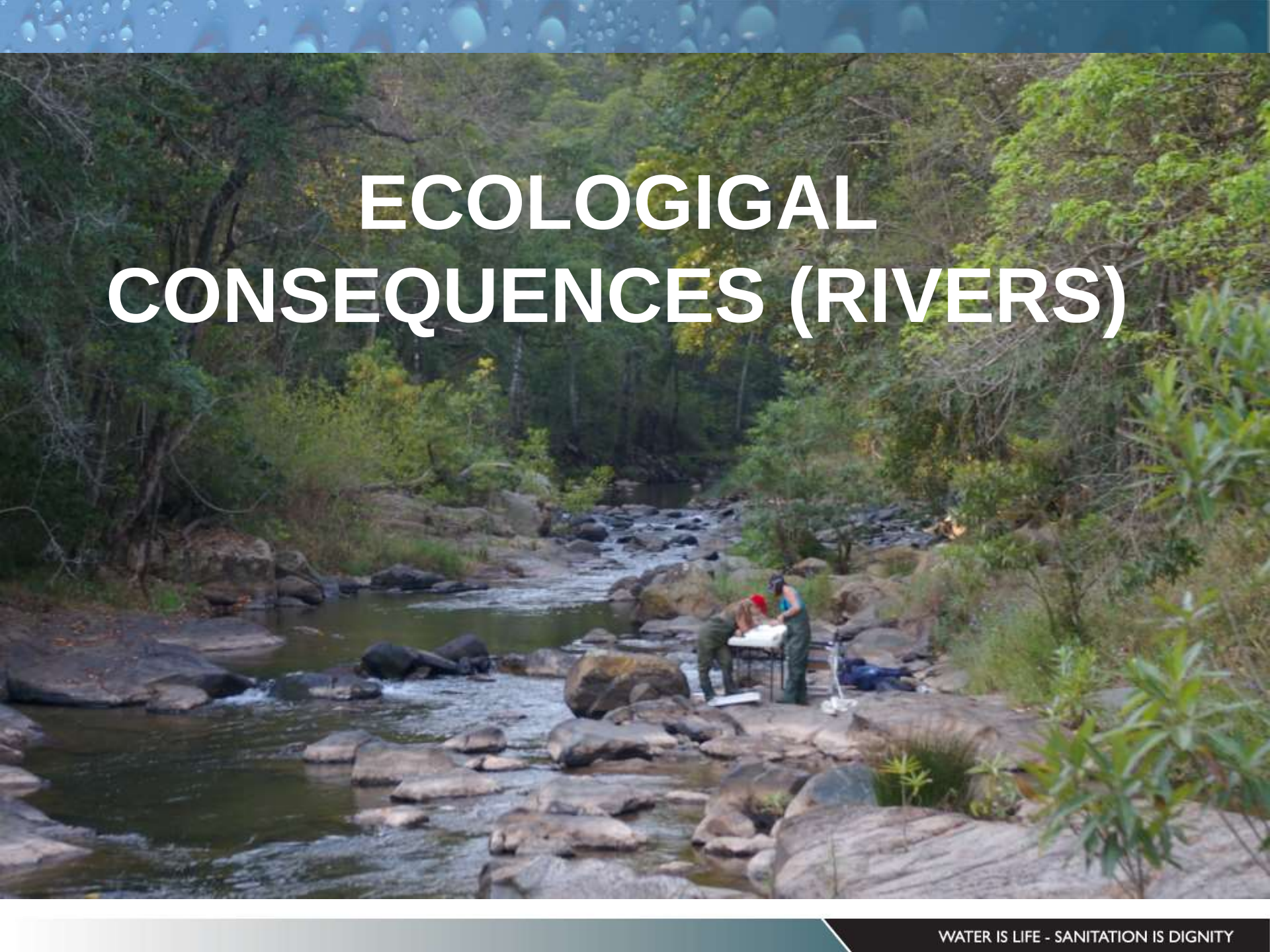
- **Ecology**
- **Water quality**
- **Ecosystem Services**
- **Economics**
- **Management classes**

24 November 2014

- **Provide ecological, water quality, ecosystem services and economic consequences**
- **Select recommended scenario**
- **Derive Management Class**

- ◀ **Proposed dam**
- ▶ **Existing dam**
- ★ **EWR site impacted on by scenarios**
- ★ **EWR site not impacted on by scenarios**
- **Town**



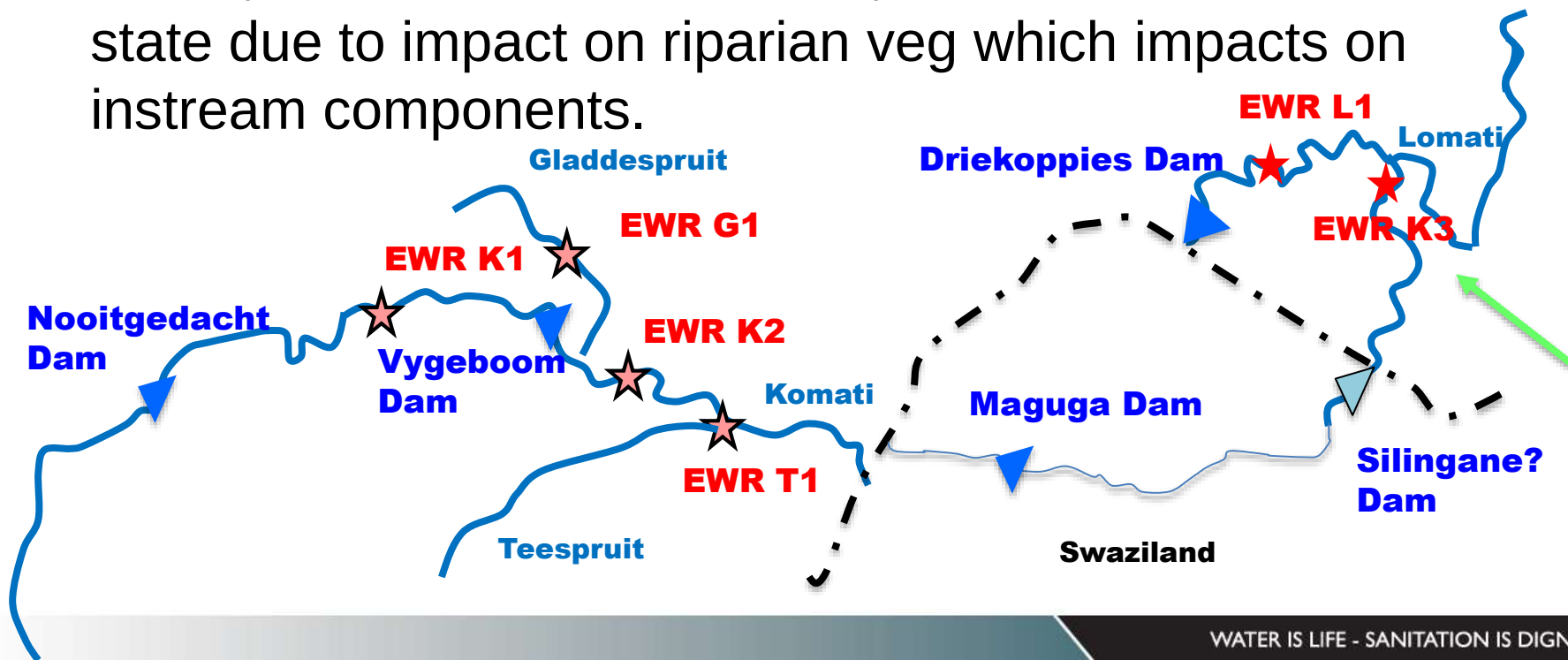


ECOLOGICAL CONSEQUENCES (RIVERS)

KOMATI RIVER (X1) RESULTS

SCENARIOS ONLY IMPACT ON SITES DOWNSTREAM OF MAGUGA AND DRIEKOPPIES DAMS.

- No impact on K3 – improvement in ecology under current operating rule.
- Impact on Lomati due to unseasonal releases for irrigation.
- Sc K2, K31 and K41 meet PES, other scenarios in worse state due to impact on riparian veg which impacts on instream components.



A photograph of two young children playing in a river. The child on the left is smiling and splashing water, while the child on the right is also smiling and splashing. The water is murky and brown. The background shows a riverbank with dense green vegetation and tall reeds.

USER WATER QUALITY CONSEQUENCES (RIVERS)

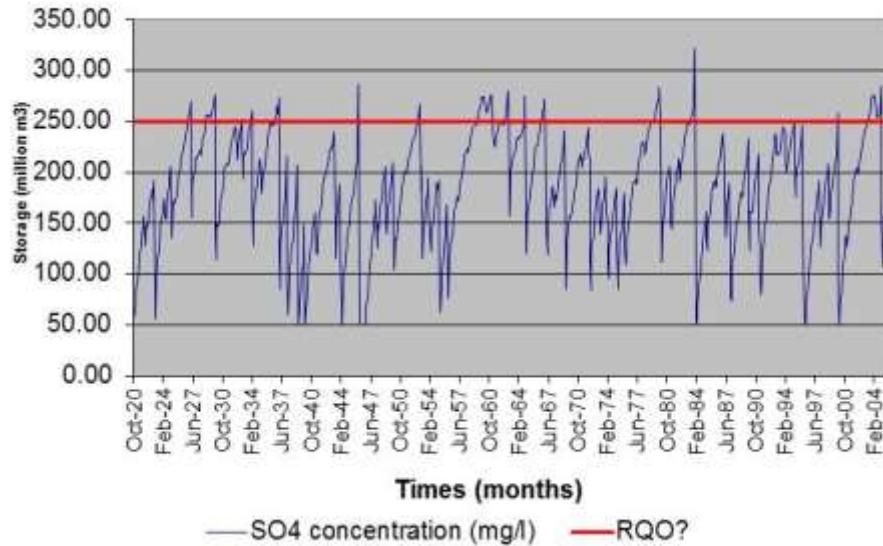
WQ SCENARIO: UPPER KOMATI - COAL MINING

AIM: To test the impacts of additional coal mining + increasing AMD levels on the Upper Komati.

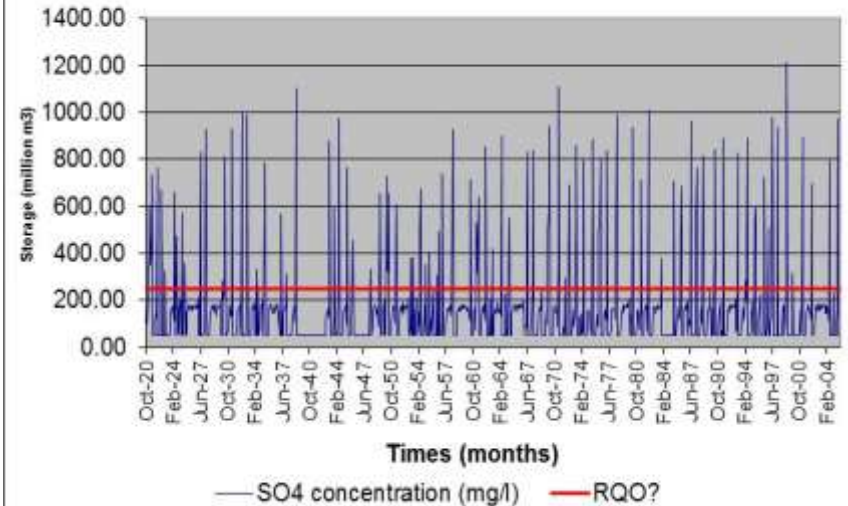
- Use an AMD decant volume of 5 million m³/a upstream of Nooitgedacht Dam; equating to a concentration of 2 000 mg/L SO₄
- This equates to 2 million m³/a upstream Boesmanspruit
- Assume a background of 50 mg/L SO₄ in surface runoff
- Two scenarios were run for each of the Nooitgedacht and Vygeboom dams (that supply Eskom), and the Boesmanspruit Dam (that supplies Carolina) i.e. with and without the Usuthu transfer
- Note tentative sulphate RQO of 250 mg/L (*Acceptable level*); TWQR = 38 mg/L (DWA, 2012)

WQ SCENARIO RESULTS: UPPER KOMATI (1)

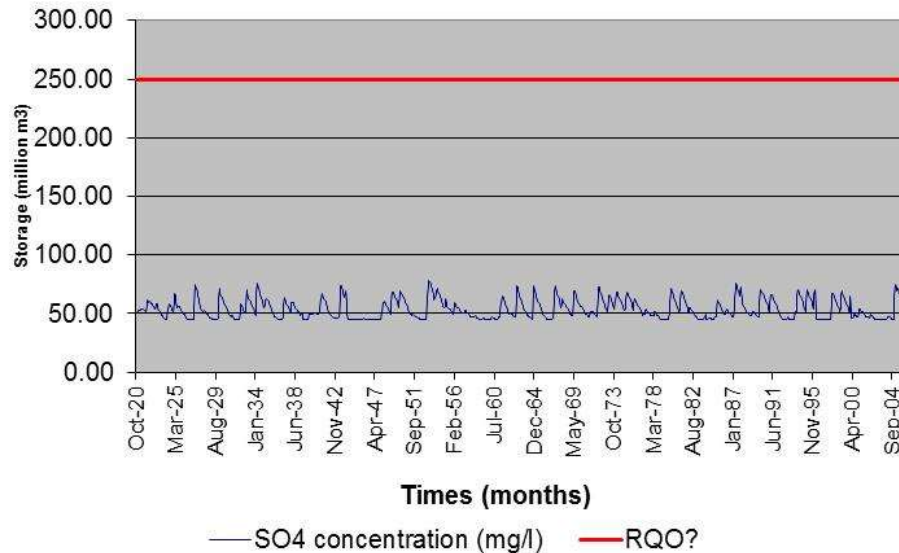
Usutu transfer: SO₄ concentrations in Nooitgedacht Dam



Usutu transfer: SO₄ concentrations in Boesmansspruit

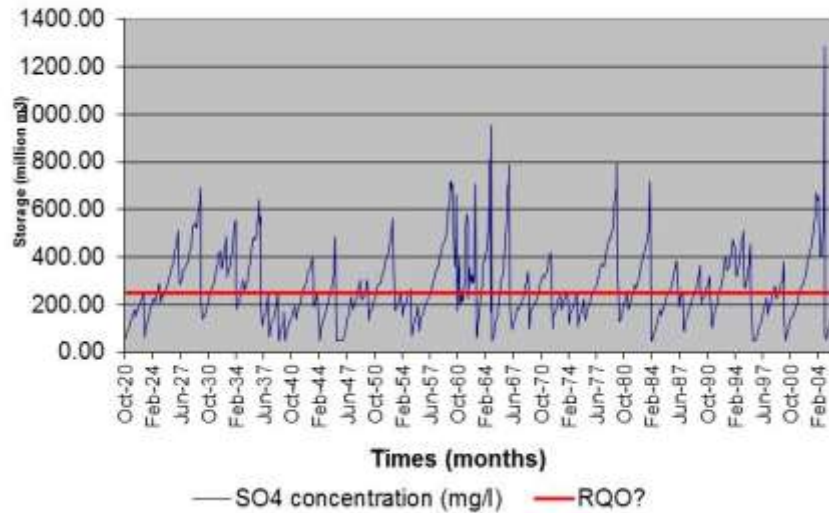


Usutu transfer: SO₄ concentrations in Vygeboom Dam

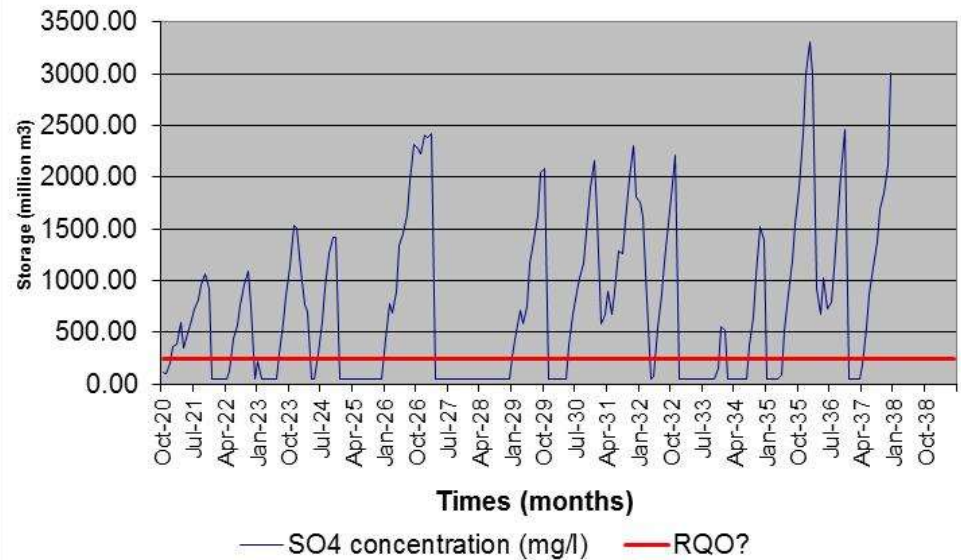


WQ SCENARIO RESULTS: UPPER KOMATI (2)

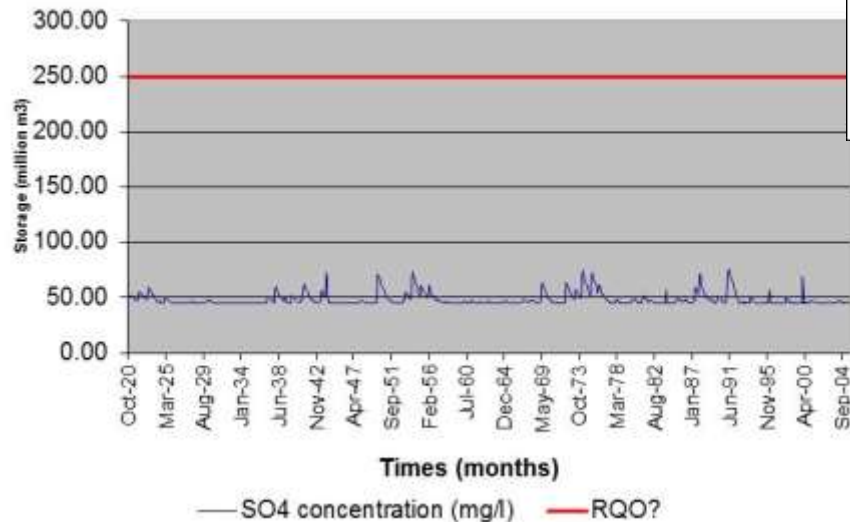
No Usutu transfer: SO₄ concentrations in Nooitgedacht Dam



No Usutu transfer: SO₄ concentrations in Boesmansspruit



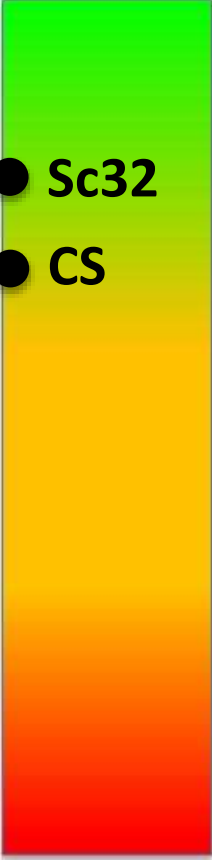
No Usutu transfer: SO₄ concentrations in Vygeboom Dam



WQ SCENARIO: CONCLUSIONS

- **Significant dilutory effect of pumping water from the Usuthu**
- **The wq of the Vygeboom Dam will be largely unaffected due to the dilution effect of natural inflow between the Nooitgedacht and Vygeboom dams**
- **Should AMD volumes + sulphate levels reach those modelled, a significant impact would be seen on the wq of the Nooitgedacht and Boesmanspruit dams, which will be exacerbated without the Usuthu transfer**
- **TWQR for sulphate would be exceeded in all dams under both scenarios**

RESULTS: USER CONSEQUENCES: KOMATI RIVER



- Sc32

- CS

Site location

MRU Komati M, incl
EWR L1 on the
Lomati River

Primary role players

Settlements, WWTW,
extensive crops, sand-
mining

Primary wq drivers

Nutrients, salts, toxics,
turbidity, *E. coli* /
coliforms

Site location

MRU Komati D, incl
EWR K3 on
the **Komati River**

Primary role players

Irrigation return-
flows, Tonga
WWTW

Primary wq drivers

Nutrients, salts, toxics,
E. coli / coliforms



- Sc43

- CS



ECOSYSTEM SERVICES CONSEQUENCES



CONSEQUENCES –Komati

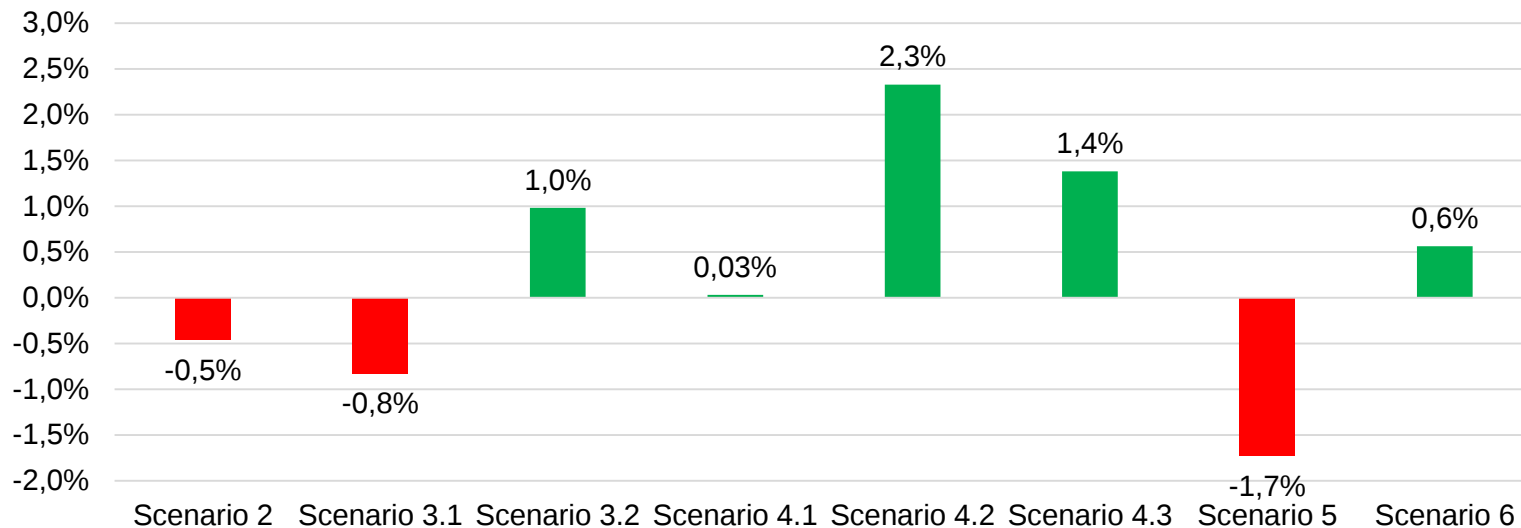
- Komati – all scenarios meet REC and no have Ecosystem Services impact that could be discerned.
- EWR sites not overly sensitive to livelihood linked characteristics.
- As such all scenarios in evaluation treated as current state = 1



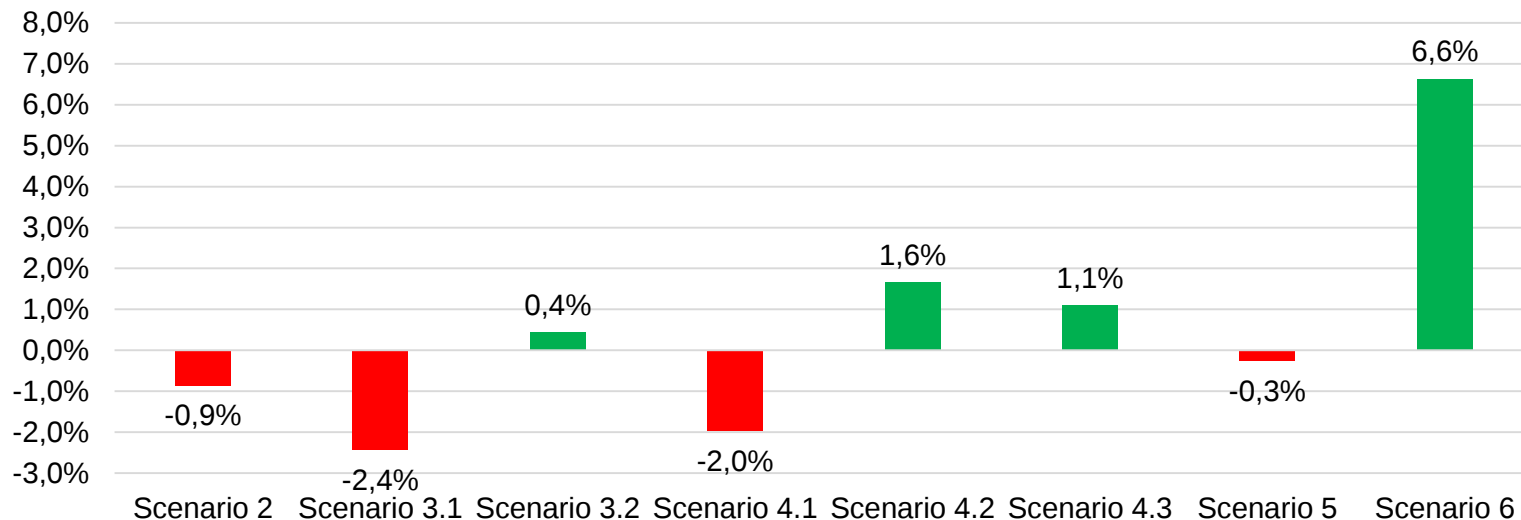
ECONOMIC CONSEQUENCES

Scenario Evaluation – Komati River System

Komati River system - GDP (Percentage Change)



Komati River system - Employment (Percentage Change)





RECOMMENDED SCENARIO AND DRAFT MC



Variable Scores & Weights

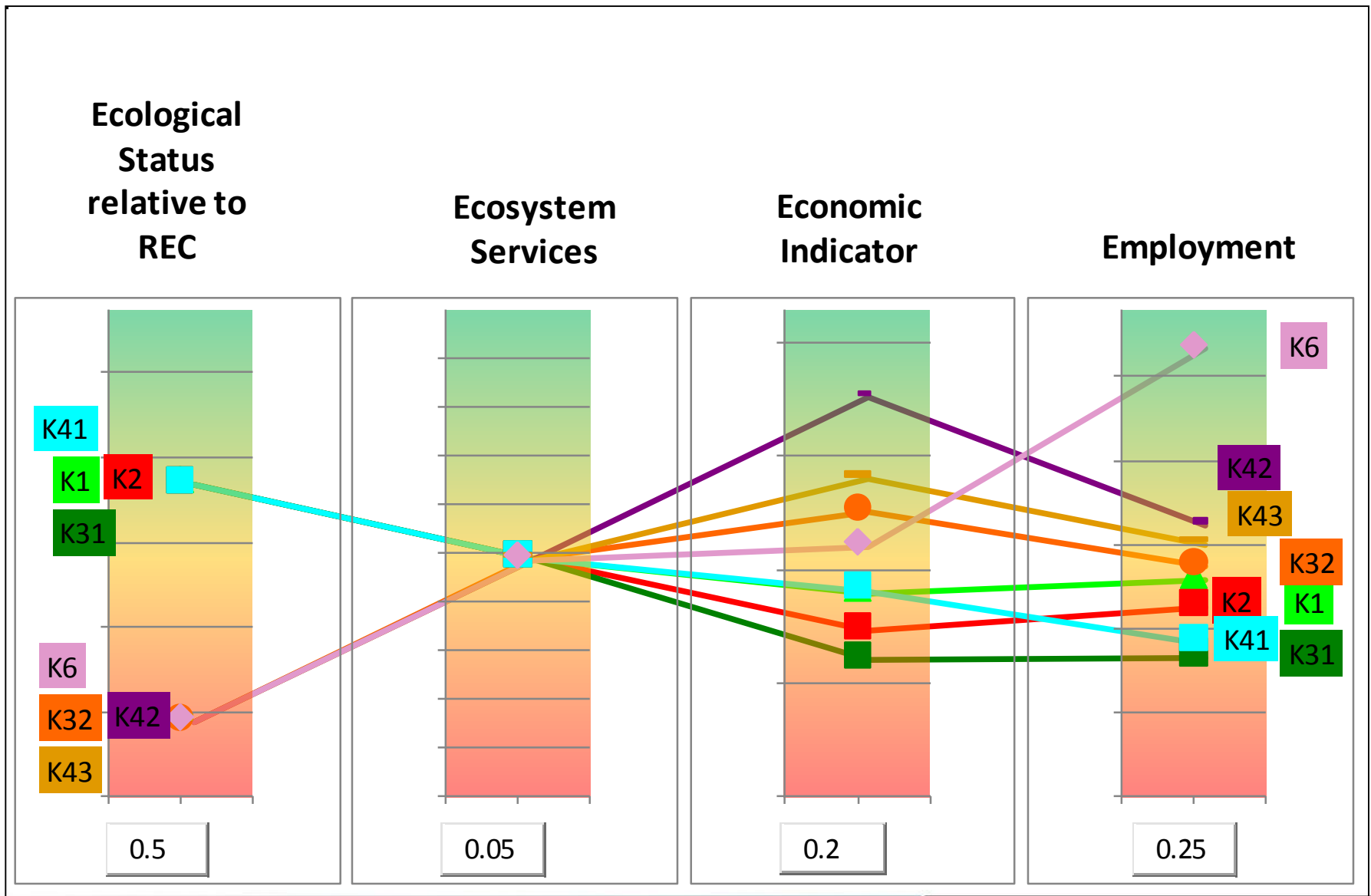
Variables	Scenarios							
	K1	K2	K31	K32	K41	K42	K43	K6
Ecological Status	1.00	1.00	1.00	0.99	1.00	0.99	0.99	0.99
Ecosystem Services	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Economic Indicator (GDP) (R Millions)	3592	3575	3562	3628	3593	3678	3642	3612
Employment	19 318	19 155	18 860	19 402	18 945	19 642	19 531	20 690

Variables	Weights
Ecological Status	0.5
Ecosystem Services	0.05
Economic Indicator	0.2
Employment	0.25

50% Ecology

50% Socio-Economic

Visualisation of Variables Scores



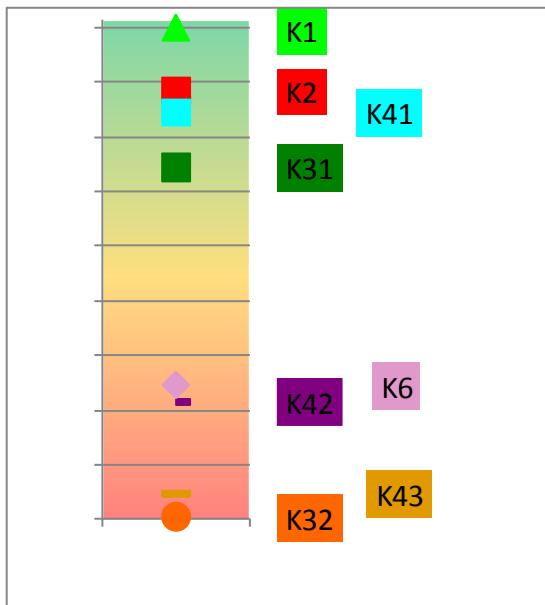
Ecological Ranking Discussion

- Scores form two groups:
 - K1, K2, K31 and K41 (EC for Lomati is C/D).
 - K5, K32, K42, K43 (EC for Lomati is C).
- Komati River same EC for all the scenarios.
- Lomati's lower score is due to increased base flows, supplying downstream needs.
- It may be possible to implement certain mitigation measures and achieve a C Ecological Category for the lower scoring scenarios.
- **Therefore the selection of the preferred scenario is primarily on socio-economic rating. (Scenario K6)**

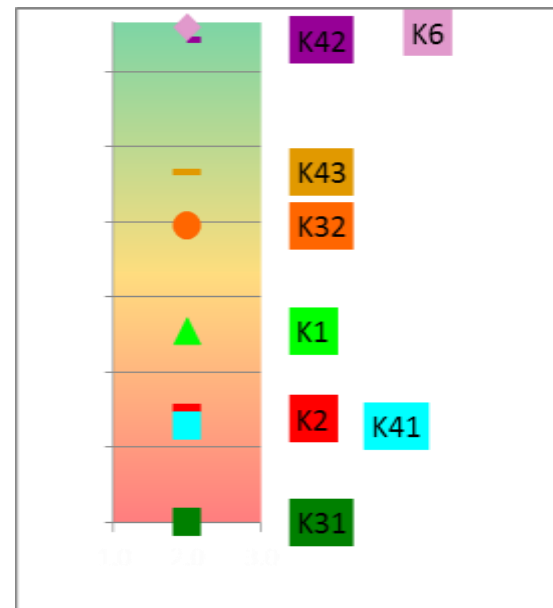
Scenario Ranking

Method	Scenarios							
	K1	K2	K31	K32	K41	K42	K43	K6
Overall Score (Rank Order method)	5.25	4.75	4	3.95	4.75	4.75	4.25	4.3
Rank (1 = best, 8 = worse)	1	3	7	8	3	3	6	5
Overall Score (Normalisation Method)	0.664	0.606	0.536	0.216	0.586	0.321	0.237	0.337
Rank (1 = best, 8 = worse)	1	2	4	8	3	6	7	5

**Overall Ranking
(All Variables)**



**Ranking
(Only Socio-economic Variables)**



Derivation of the Water Resource Class for each IUA

Recommended Management Class Criteria Table

		% EC representation at units represented by biophysical nodes in an IUA					Prominent Ecological Categories
		$\geq A/B$	$\geq B$	$\geq C$	$\geq D$	$< D$	
Class I		0	60	80	95	5	A & B
Class II			0	70	90	10	C
Class III	Either			0	80	20	D
	Or				100		

Unit Percentages:

Length of river in a given Ecological Category
divided by the total river length in an IUA .

Resulting IUA Management Classes for all scenarios

Integrated Unit of Analysis	Scenarios and Management Class									
	PES	REC	K1	K2	K31	K32	K41	K42	K43	K6
X1-1	III	III	III	III	III	III	III	III	III	III
X1-2	II	II	II	II	II	II	II	II	II	II
X1-3	II	II	II	II	II	II	II	II	II	II
X1-4	III	III	III	III	III	III	III	III	III	III
X1-5	II	I	II	II	II	II	II	II	II	II
X1-6	II	I	I	I	I	I	I	I	I	I
X1-7	II	I	II	II	II	II	II	II	II	II
X1-8	III	II	III	III	III	III	III	III	III	III
X1-9	III	III	III	III	III	III	III	III	III	III
X1-10	XXX	III	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

“XXX” – Scenario did not achieve Class III criteria

KOMATI SCENARIO MATRIX

Scenario	Scenario variables					
	Update water demands	Domestic growth and increase irrigation	IIMA ¹ Flows	DARDLA	Silingane Dam (DS Maguga)	EWR
Sc K1	Yes	No	No	No	No	No
Sc K2	Yes	No	No	No	No	Yes
Sc K31	Yes	Yes	Yes	No	No	Yes
Sc K32	Yes	Yes	Yes	No	No	No
Sc K41	Yes	Yes	Yes	Yes	No	Yes
Sc K42	Yes	Yes	Yes	Yes	No	No
Sc K43	Yes	No	Yes	Yes	No	No
Sc K5	Water quality scenario (not for ecological assessment), includes mining aspects)					
Sc K6	Yes	Yes	Yes	Yes	Yes	Yes