



water & sanitation
 Department:
 Water and Sanitation
 REPUBLIC OF SOUTH AFRICA

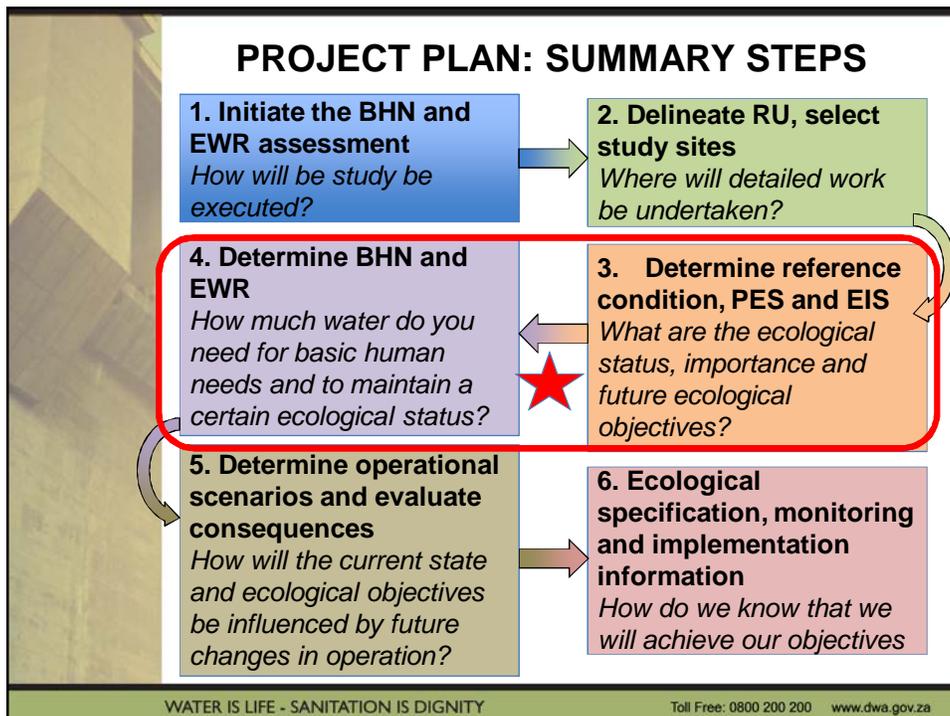
Determination of Ecological Water Requirements for Surface Water (Rivers, Estuaries and Wetlands) and Groundwater in the Lower Orange WMA: WP10974

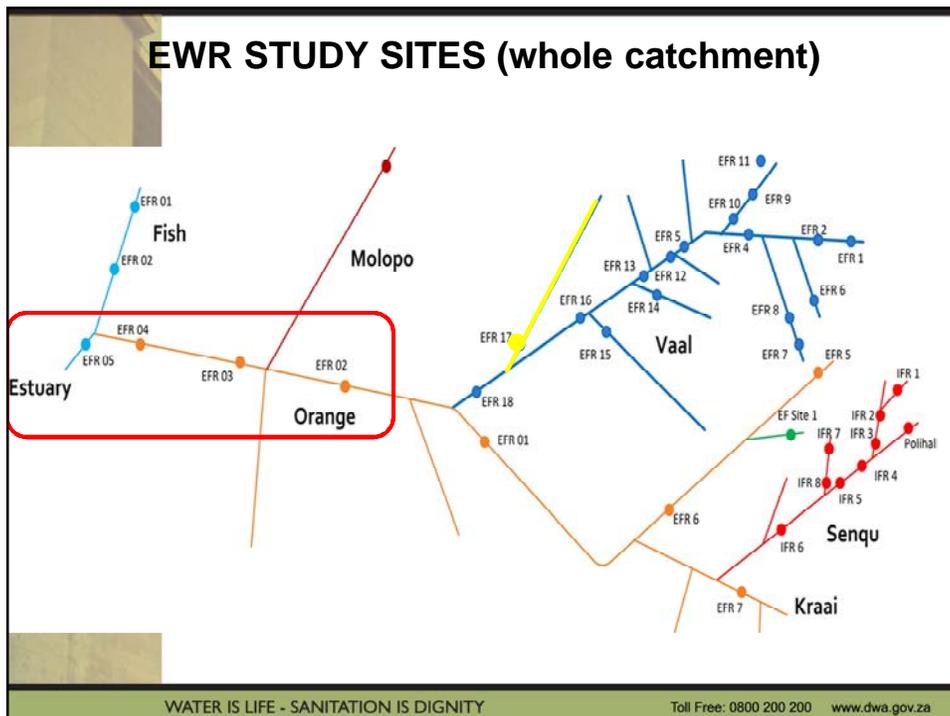
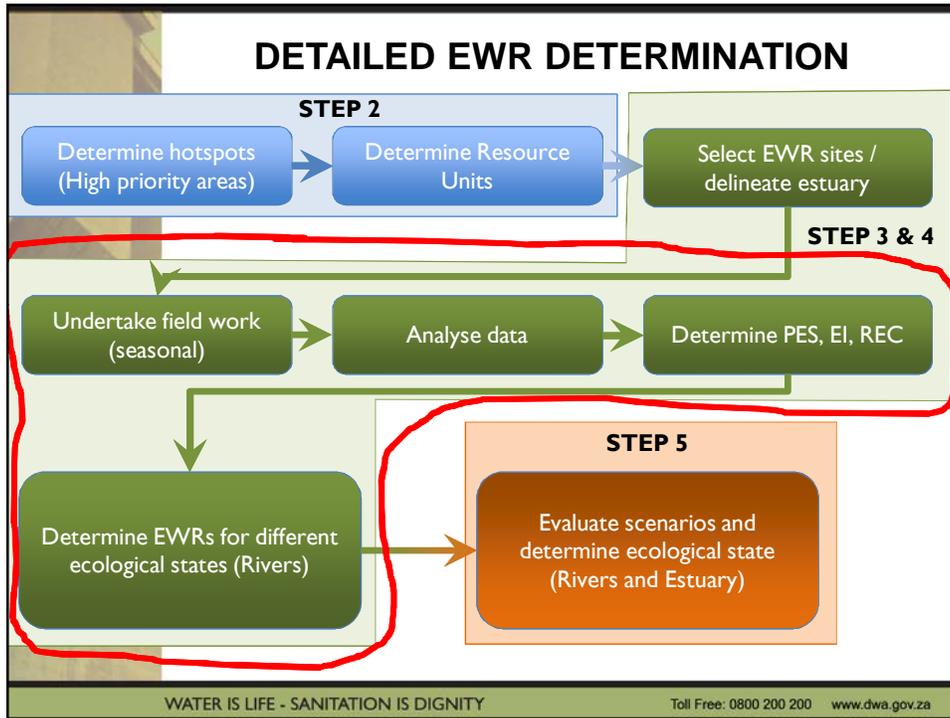
23 June 2016

ORANGE RIVER EWRs (ECOCLASSIFICATION AND EWR)

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ECOLOGICAL CLASSIFICATION

What is ecological classification?

- EcoClassification consists of three processes:
 - Present Ecological State (PES)
 - Ecological Importance
 - Recommended Ecological Category (REC)
- The PES describes river according to ecological status or health compared to natural conditions.

ECOLOGICAL CLASSIFICATION

Ecological status described in terms of Ecological Categories:

- A – near natural,
- B – largely natural
- C – moderately modified
- D – largely modified
- E – seriously modified
- F - critically modified.

A A/B B B/C C C/D D D/E E E/F F

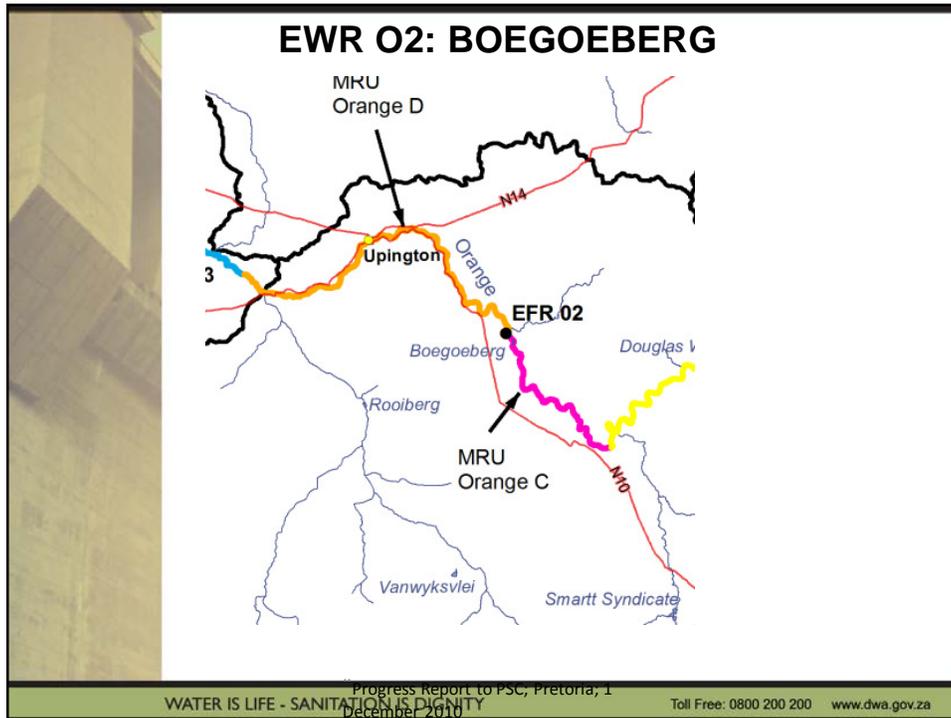
ECOLOGICAL CLASSIFICATION

Steps in EcoClassification:

- Predict the natural condition (the “A”).
- Evaluate human impacts & describe how ecology changed. (Present Ecological State).
- Identify whether changes are flow, non-flow or quality.
- Determine the Ecological Importance and Sensitivity.
- Derive a Recommended Ecological Category (target state)(usually maintain or improve the PES)

ORANGE RIVER RESULTS





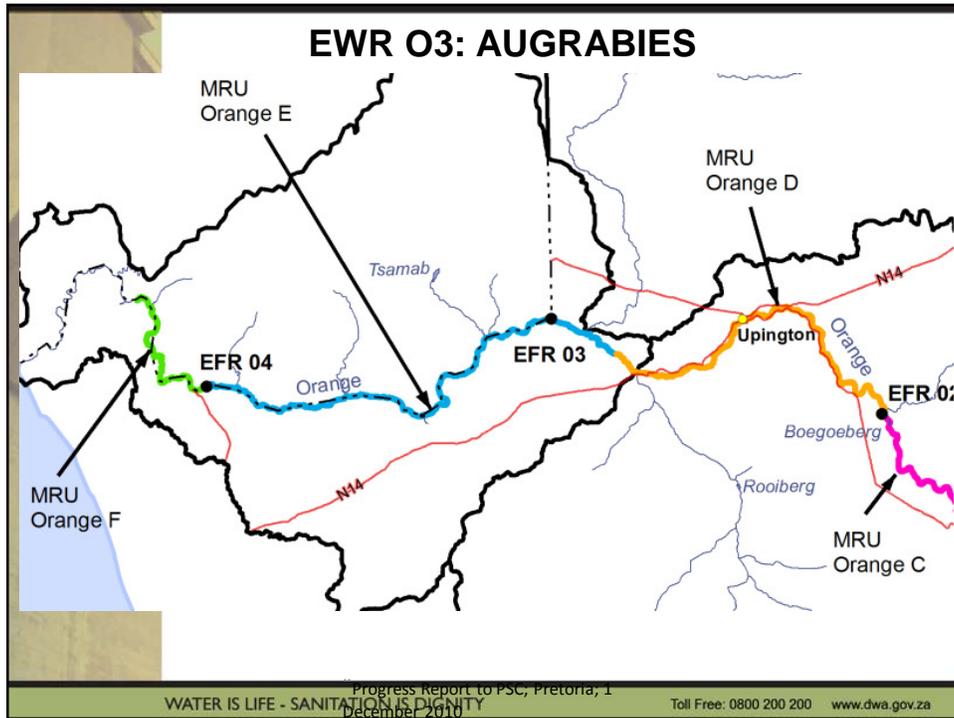
EWR O2: BOEGOEBERG

PES: C
Loss of frequency of large floods. Higher low flows than natural (dry season – droughts and dry periods). Decreased low flows at other time. Release of sediment, alien fish, barrier effects of dams.

EIS: High (Rare & endangered riparian & instream biota, unique riparian etc)

REC: ↑ Not possible due to constraints.

REC: C

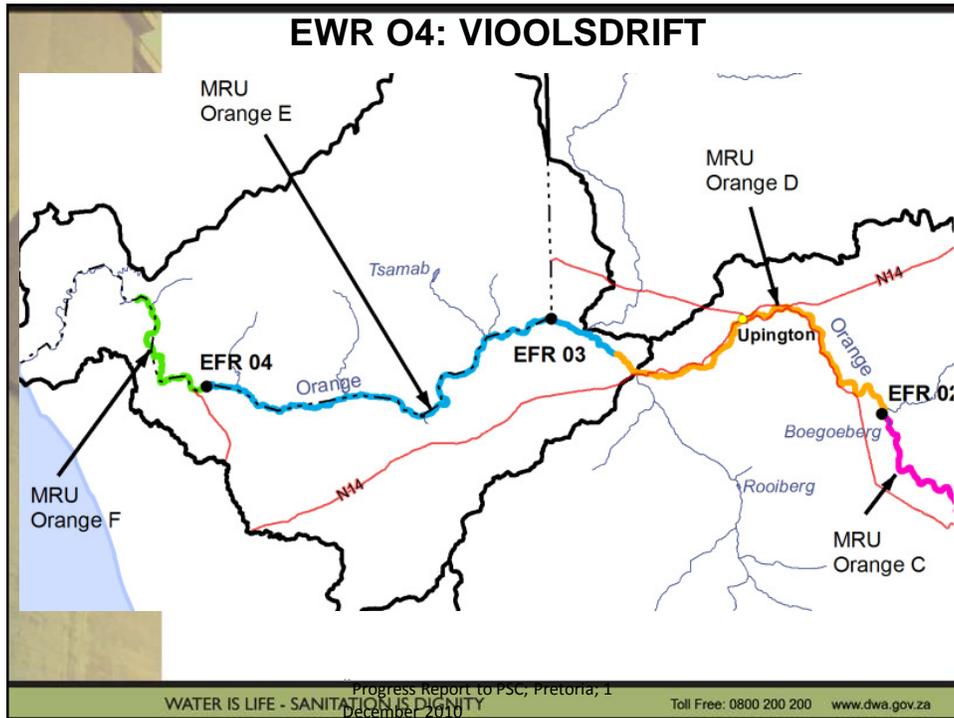


EWR 03: AUGRABIES

PES: C
Loss of frequency of large floods. Agricultural return flows. Higher low flows than natural (dry season – droughts and dry periods). Decreased low flows at other time. Sedimentation, alien fish, barrier effects of dams.

EIS: High (Rare & endangered riparian & instream biota etc, NP)

REC: ↑B: Reinstate droughts, Higher wet season low flows. Clear alien veg, Better agricultural practices.



EWR 04: VIOOLSDRIFT

PES: C
 Loss of frequency of large floods. Agricultural return flows. Mining. Higher low flows than natural (dry season – droughts and dry periods). Decreased low flows at other time. Sedimentation, alien fish, barrier effects of dams.

EIS: High (Rare & endangered riparian & instream biota etc, NP)

REC: ↑B: Reinstate droughts, Higher wet season low flows. Clear alien veg, Control grazing & trampling.

EWR O5: SENDELINGSDRIFT



PES B/C: Change in flow regime (floods & base flows). Alien fish & veg. Barriers. Agricultural return flows.

EIS High

REC: ↑B: More wet season base flows, less flows during droughts (links to objectives set at Violsdrift and Augrabies)

EWR site	EC	Maintenance low flows		Drought low flows		High flows		Long term mean	
		(%nMAR)	MCM	(%nMAR)	MCM	(%nMAR)	MCM	(% nMAR)	MCM
EWR O2	PES/REC	11.6	1226.6	4.4	465.2	5.4	571	15.2	1607.2
EWR O3	PES: C	8.4	883.1	2.6	273.3	4.7	494.1	11.9	1251.1
	REC: B	17.6	1850.3	3.4	157.4	4.7	494.1	19.2	2018.5
EWR O4	PES: C	6.3	651.11	0.9	35.2	4.2	434.1	8.9	919.8
	REC: B/C	10.1	1043.9	1.3	134.4	4.2	434.1	12.2	1260.9
EWR O5	PES: B/C	6.4	721.6	1	109.4	4.51	512.9	10.85	1234.5
	REC: B	10.2	1154.5	1.3	149.6	4.51	512.9	14.66	1667.3



Variety of estuarine habitat types



Back water channels & reed beds

Inter tidal sandy areas intersperse with boulder beaches

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Rehabilitated area near mouth where causeway were opened - increasing tidal flows and causing reduction in soil salinity that allow saltmarsh to grow



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 <p>1994</p>	Story of the Orange River Estuary	
	1929	Mouth management & mining started
<p>Saltmarshes are a barren salt desert where once saltmarsh used to grow. Ramsar site on the Montreux record – threatened SA ensure ecological character restored</p>  <p>May 2003</p>	1968	Dam development regulated flow
	1960's	beach access road, loss of tidal exchange, connection
	1974	Diversion of flood channels & levees
	1980	Disposal of north sieve wastewater, increased salinity
	1986	Increase in dust from slime dams
	1988	Large flood - silt deposition & standing water kills vegetation
	1993 & 1995	Mouth closes & causeway prevents drainage - backflooding, standing water & die-back
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PRESENT ECOLOGICAL STATUS		
	Variable	Health score
Habitat health	Hydrology	D
	Hydrodynamics & mouth condition	C
	Water quality	D
	Physical habitat alteration	B
Biotic health	Microalgae	E
	Macrophytes	D
	Invertebrates	D
	Fish	D
	Birds	E
PRESENT ECOLOGICAL STATUS		D
Largely modified – Category D		
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ESTUARY IMPORTANCE

Criterion	Level	Score
Estuary Size	High	Very large estuary on a regional scale
Zonal Rarity Type	High	River mouth on a desert coastline
Habitat Diversity	High	High diversity of habitat types
Biodiversity Importance	High	Plants, invertebrates, fish and birds
Functional Importance	High	Out put to marine environment

Estuary Importance Score: 99 out of 100

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RAMSAR SITE

- Rare and unusual wetland type on the arid and semi-arid coastline of western southern Africa
- Supports appreciable numbers of rare and endangered bird species, 14 SA Red Data species + 7 occasional
- At times supports more than 20,000 waterbirds
- Regularly supports >1% of
 - (a) world pop of 3 endemics (Cape Cormorant, Hartlaub's Gull and Damara Tern) and
 - (b) southern African pop of 6 species (Black-necked Grebe, Lesser Flamingo, Chestnut-banded Plover, Curlew Sandpiper, Swift Tern, Caspian Tern)

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RECOMMENDED ECOLOGICAL CATEGORY

- Ramsar site
- (Desired) Protected Area
- High Estuarine Importance

Recommended Ecological Category should be an A

But: Large dams, mining, fishing, agriculture

Best Attainable State: Category C

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ACTIONS REQUIRED TO ACHIEVE REC

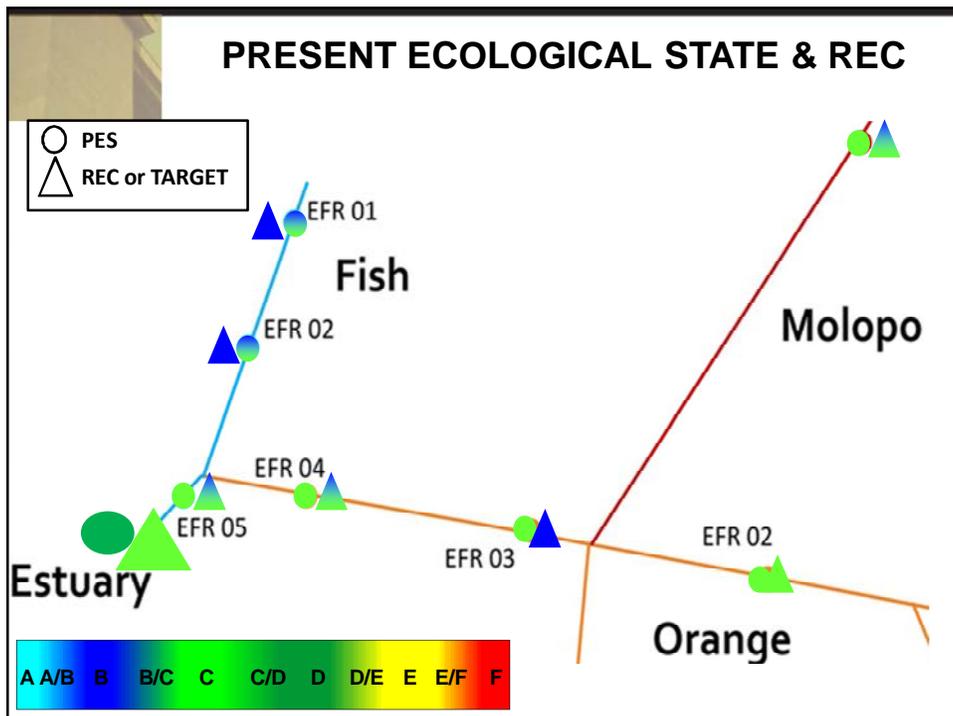
- Decrease flows **below $< 2\text{m}^3/\text{s}$ for 1 - 2 months** in winter **2 - 4 times in 10 years** to allow for mouth closure and related back flooding of the saltmarshes
- Control fishing effort on SA & Namibian side through increased compliance & law enforcements. Alignment of the fishing regulations (eg size, bag limits).
- Removal of the remnant causeway that still transects the saltmarshes to improve circulation during high flow and floods events.
- Decrease nutrient input from the catchment ds of Vioolsdrift, through improved agricultural practises.
- Control wind-blown dust and wastewater from mining activities.
- Feral cattle and hunting on SA side

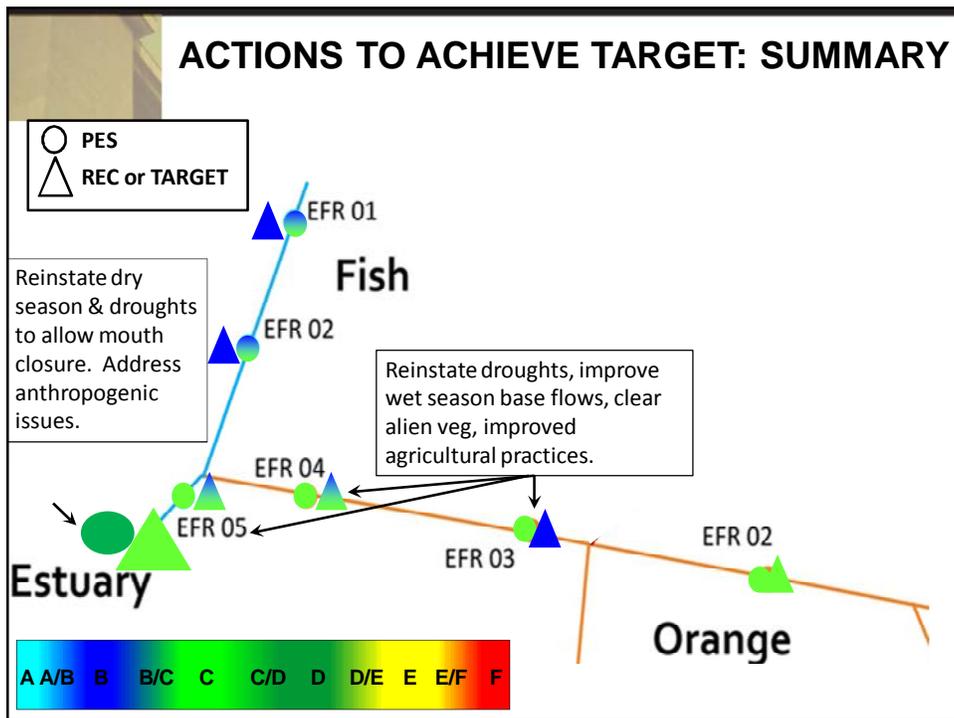
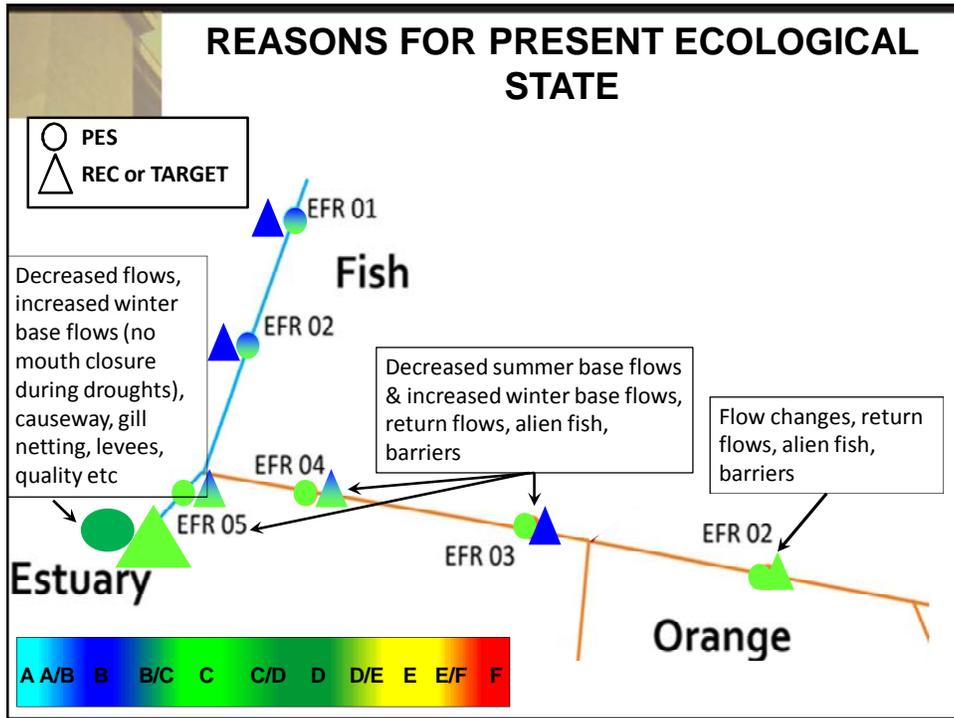
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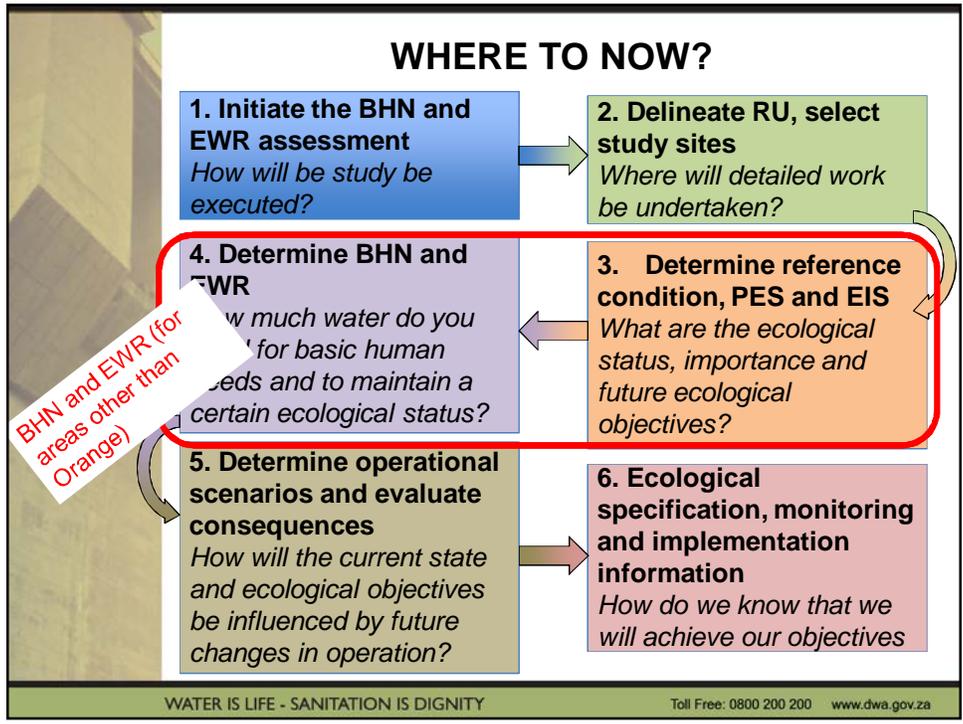
EWR SUMMARY

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QUESTIONS FOR CLARIFICATION

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EWR 2: BOEGOEBERG



EIS: HIGH

rare & endangered riparian & instream biota, unique riparian, etc

PES: C

Loss of frequency of large floods
 Agricultural return flows
 Higher low flows than natural (dry season – droughts and dry periods)
 Decreased low flows at other time.
 Release of sediment, alien fish, barrier effects of dams

EWR 2: EcoClassification

Driver Components	PES
IHI HYDROLOGY	E
WATER QUALITY	C
GEOMORPHOLOGY	C
INSTREAM IHI	C/D
RIPARIAN IHI	B/C
Response Components	PES
FISH	C
MACRO INVERTEBRATES	C
INSTREAM	C
RIPARIAN VEGETATION	B
RIVERINE FAUNA	C
ECOSTATUS	C
EIS	

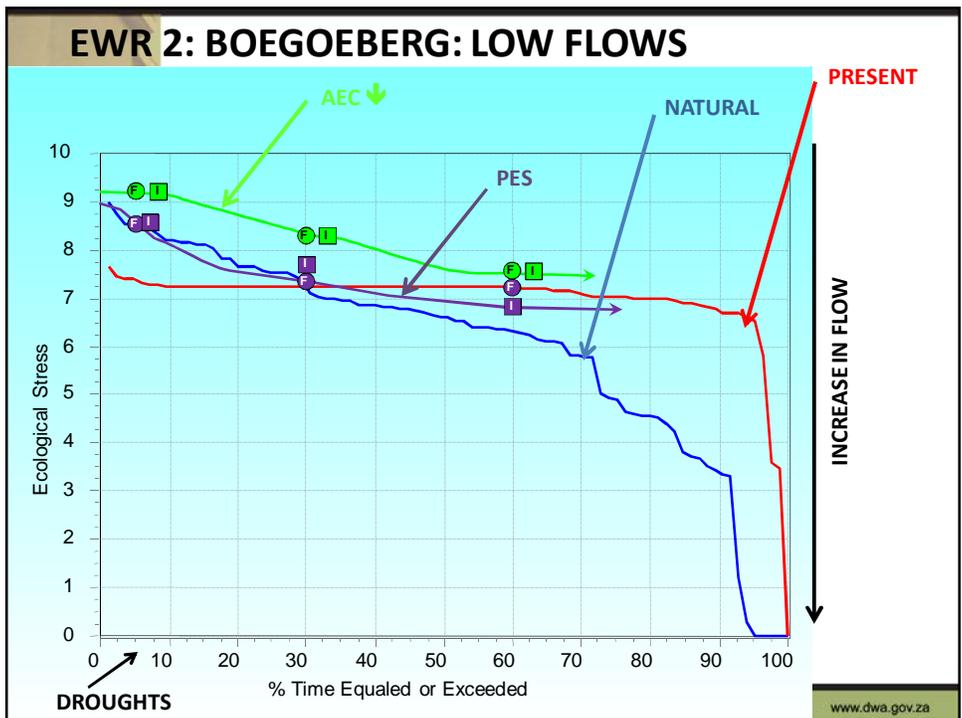
EWR 2: EcoClassification

REC = ↑
Not possible due to constraints

AEC ↓
Decreased flows
Decreased floods
Decreased dilution
Less light penetration – algal and benthic growth

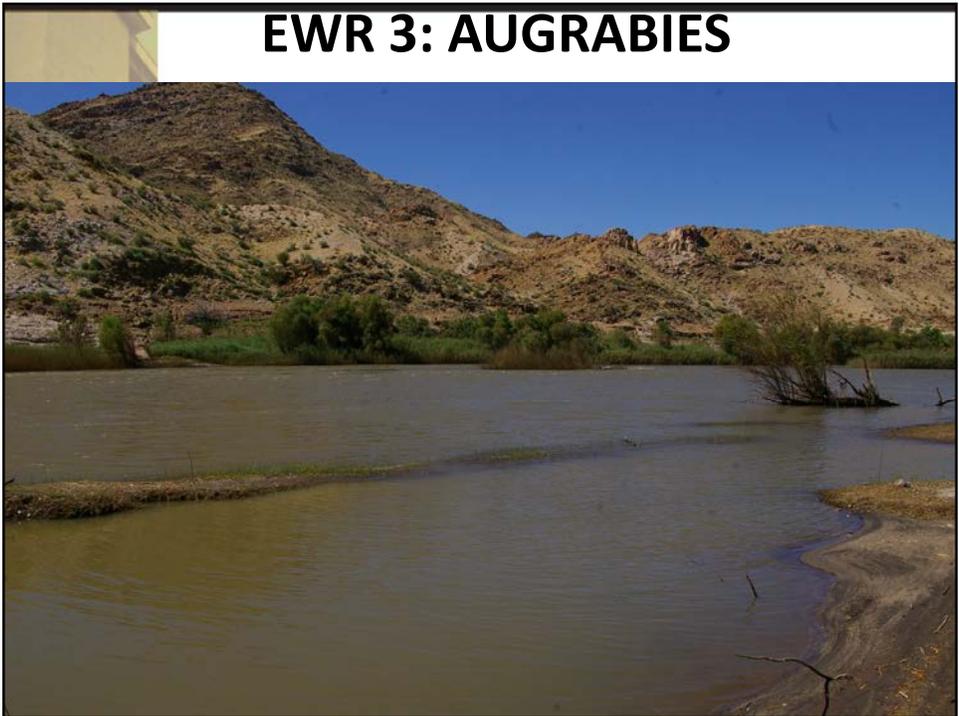
Driver Components	PES	TREND	REC	AEC↓
IHI HYDROLOGY	E			
WATER QUALITY	C		C	D
GEOMORPHOLOGY	C	0	C	C
INSTREAM IHI	C/D			
RIPARIAN IHI	B/C			
Response Components	PES	TREND	REC	AEC↓
FISH	C	0	C	D
MACRO INVERTEBRATES	C	0	C	D
INSTREAM	C	0	C	D
RIPARIAN VEGETATION	B	0	A/B	B/C
RIVERINE FAUNA	C	0	B	C
ECOSTATUS	C	0	B/C	C
EIS	HIGH			

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EWR 2: BOEGOEBERG: FLOODS				
FLOOD RANGE (m³/s)	No of events	MONTHS	DAILY AVERAGE (m³/s)	DURATION
PES and REC: C				
150-200	3	Nov, Dec, Jan	150	6
300-400	1	Feb	350	8
850-1000	1:3	Mar	850	12
2000+	1:5	Late summer		

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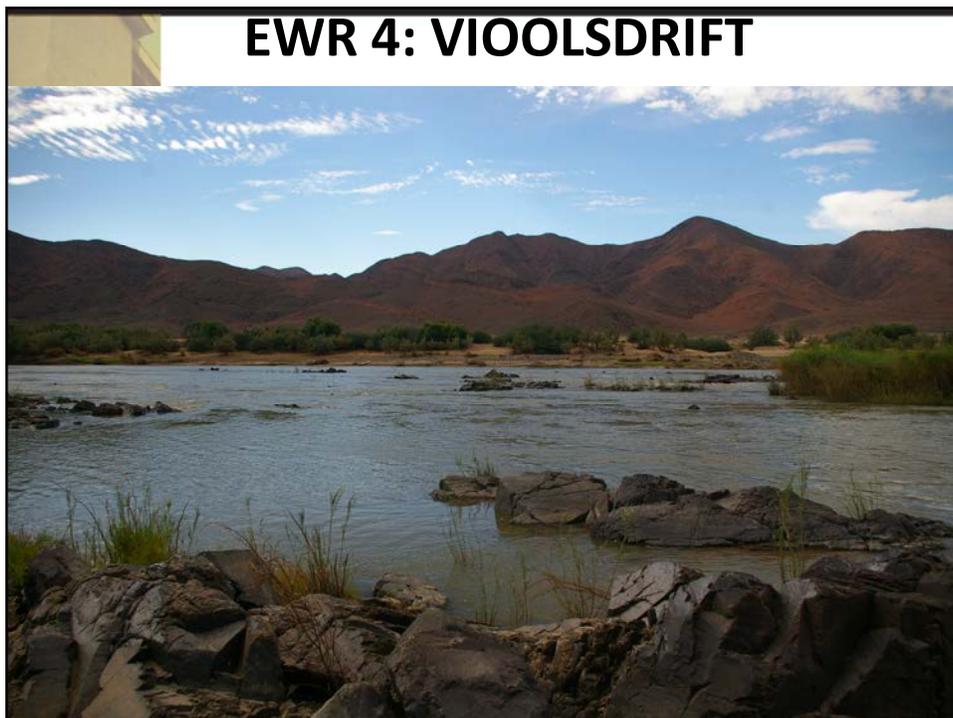
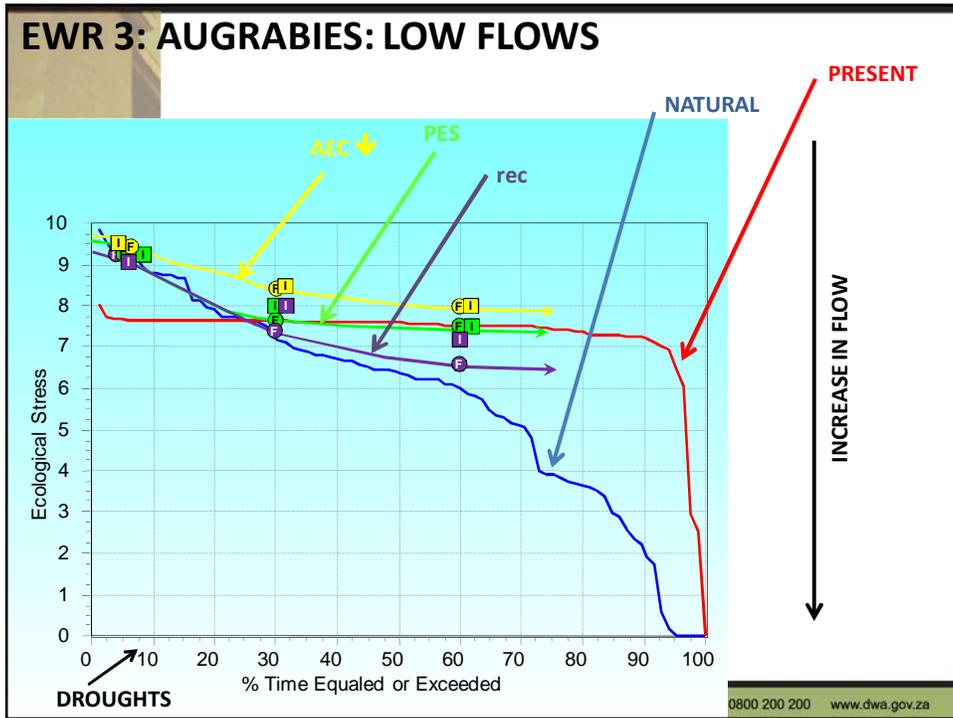


<p>EIS: HIGH (EWR 3) rare & endangered riparian & instream biota, unique riparian, NP PES: C Loss of frequency of large floods Agricultural return flows Higher low flows than natural (dry season – droughts & dry periods) Decreased low flows at other time. Decrease sedimentation, alien fish, alien veg, barrier effects of dams</p>	Driver Components	PES
	IHI HYDROLOGY	E
	WATER QUALITY	C
	GEOMORPHOLOGY	C
	INSTREAM IHI	D
	RIPARIAN IHI	C/D
	Response Components	PES
	FISH	C
	MACRO INVERTEBRATES	C
	INSTREAM	C
	RIPARIAN VEGETATION	B/C
	RIVERINE FAUNA	C
	ECOSTATUS	C
	EIS	

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<p>EWR 3: EcoClassification REC = ↑ Reinstate droughts Higher wet season low flows. Clear alien veg Better agricultural practices</p> <p>AEC ↓ Increased agriculture Decreased low flows Decreased floods Increased veg aliens</p>	Driver Components	PES	TREND	REC	AEC↓
	IHI HYDROLOGY	E			
	WATER QUALITY	C		C	D
	GEOMORPHOLOGY	C	0	C	C-
	INSTREAM IHI	D			
	RIPARIAN IHI	C/D			
	Response Components	PES	TREND	REC	AEC↓
	FISH	C	0	B	D
	MACRO INVERTEBRATES	C	0	B	D
	INSTREAM	C	0	B	D
	RIPARIAN VEGETATION	B/C	-	B	C
	RIVERINE FAUNA	C	0	B	C
	ECOSTATUS	C	0	B	C*
	EIS	HIGH			

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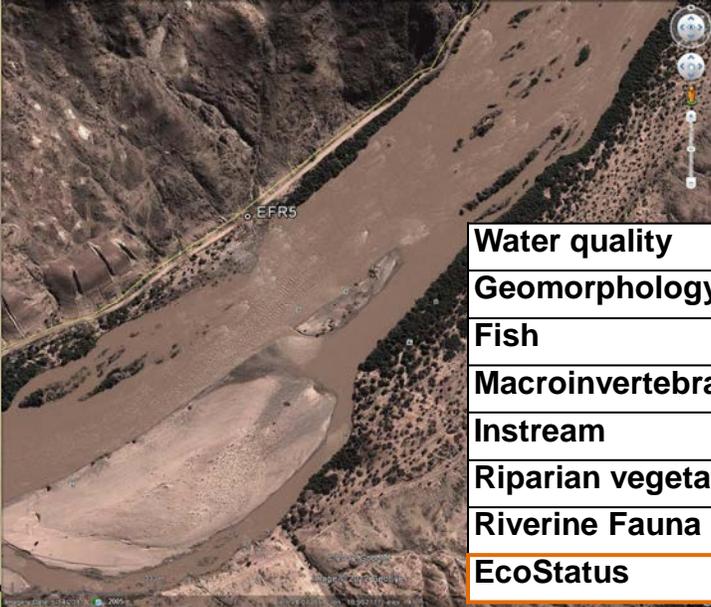
EWR 4: EcoClassification		Driver Components	PES
<p>EIS: HIGH rare & endangered riparian & instream biota, unique riparian, NP</p> <p>PES: C Loss of frequency of large floods Agricultural return flows, Mining Higher low flows than natural (dry season – droughts & dry periods) Decreased low flows at other time. Decrease sedimentation, alien fish, alien veg, barrier effects of dams</p>	IHI HYDROLOGY	D	
	WATER QUALITY	C/D	
	GEOMORPHOLOGY	C	
	INSTREAM IHI	D	
	RIPARIAN IHI	D	
	Response Components	PES	
	FISH	C	
	MACRO INVERTEBRATES	C	
	INSTREAM	C	
	RIPARIAN VEGETATION	C	
	RIVERINE FAUNA	C	
	ECOSTATUS	C	
	EIS		

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EWR 4: EcoClassification		Driver Components	PES	Trend	REC	AEC↓
<p>REC = ↑ Reinstate droughts Higher wet season low flows. Clear alien veg Control grazing & trampling</p> <p>AEC ↓ Increased mining Decreased low flows Decreased floods Increased veg aliens</p>	IHI HYDROLOGY	D				
	WATER QUALITY	C/D		C/D	D	
	GEOMORPHOLOGY	C	0	C	C	
	INSTREAM IHI	D				
	RIPARIAN IHI	D				
	Response Components	PES	Trend	REC	AEC↓	
	FISH	C	0	B/C	D	
	MACRO INVERTEBRATES	C	0	B/C	D	
	INSTREAM	C	0	B/C	D	
	RIPARIAN VEGETATION	C	-	B	C/D	
	RIVERINE FAUNA	C	-	B/C	C/D	
	ECOSTATUS	C	-	B/C	D	
	EIS	HIGH				

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Orange River PES EWR O5



	PES
Water quality	C
Geomorphology	B/C
Fish	B/C
Macroinvertebrates	B/C
Instream	B/C
Riparian vegetation	B/C
Riverine Fauna	B
EcoStatus	B/C

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Orange River EIS: EWR O5

Criterion	Level	Score
Important instream biota	Very High	<i>Simulium gariense</i> , BKIM
Important riparian biota	Very High	Threatened vegetation species and Red Data birds
Critical instream refuge	High	Riparian vegetation in a desert landscape
Migration corridor (riparian)	High	Bird and other movements within the riparian corridor.
Conservation or natural area	Very High	Natural areas

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Orange River Summary: EWR O5



PES B/C: Change in flow regime (floods & base flows). Alien fish & veg. Barriers. Agricultural return flows.

EIS High

REC: More wet season base flows, less flows during droughts