water affairs

Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

Classification of Water Resources and Determination of the Comprehensive Reserve in the Mvoti to Mzimkhulu Water Management Area

Description of Operational Scenarios

23 May 2014

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Mvoti NWRCS integrated steps

1: Delineate units of analysis and describe the status quo

2: Initiation of stakeholder process and catchment visioning

3: Quantify EWRs

4: Identification and evaluation of scenarios within IWRM

5: Draft Management Classes

6: Resource Quality Objectives (EcoSpecs & water quality (user))

7: Gazette class configuration

Scenario Analysis: Where does it fit in?

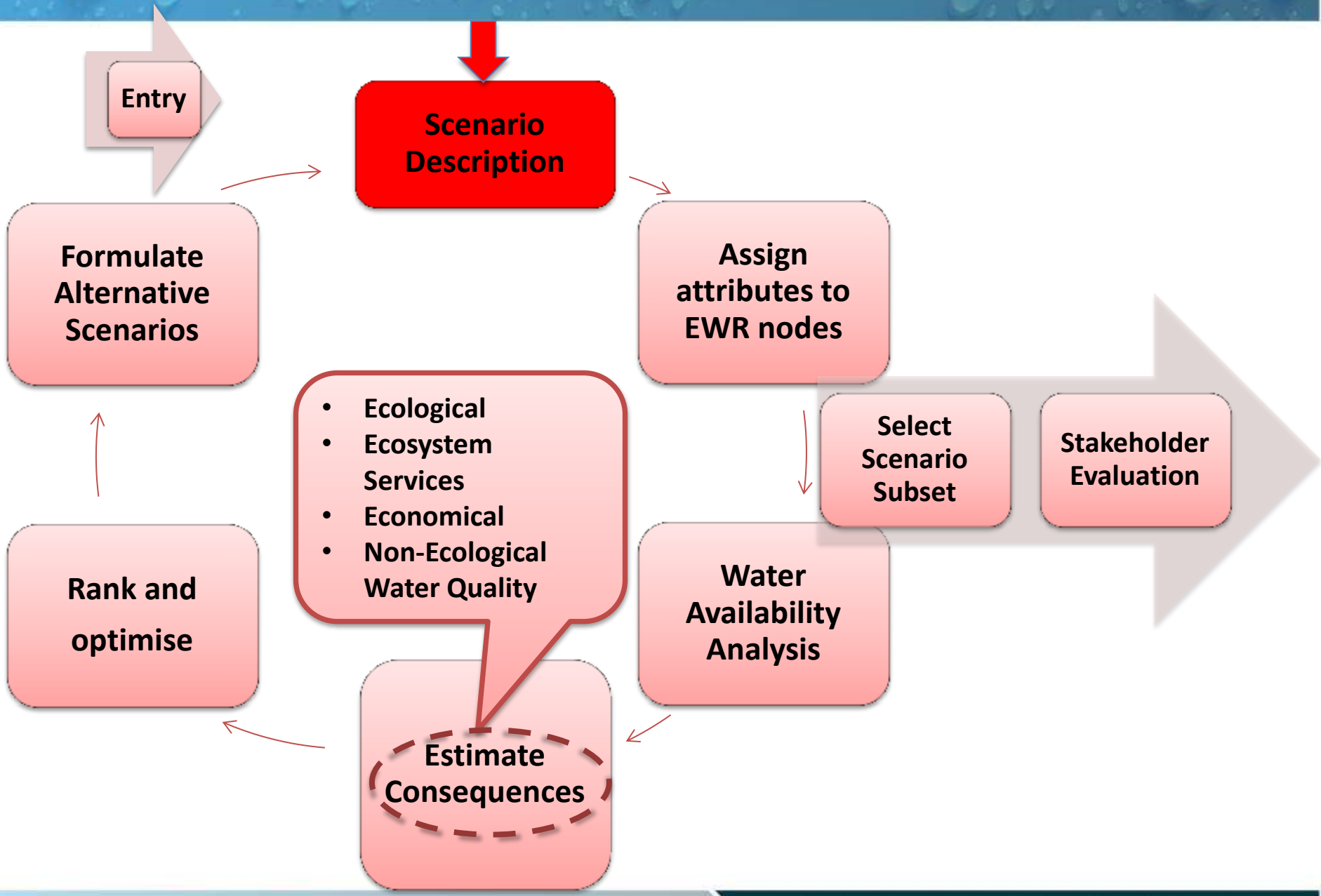
What are scenarios?

- Scenarios, in context of water resource management and planning, are plausible definitions (settings) of all the factors (variables) that influence the water balance and water quality in a catchment and the system as a whole

What are scenarios used for?

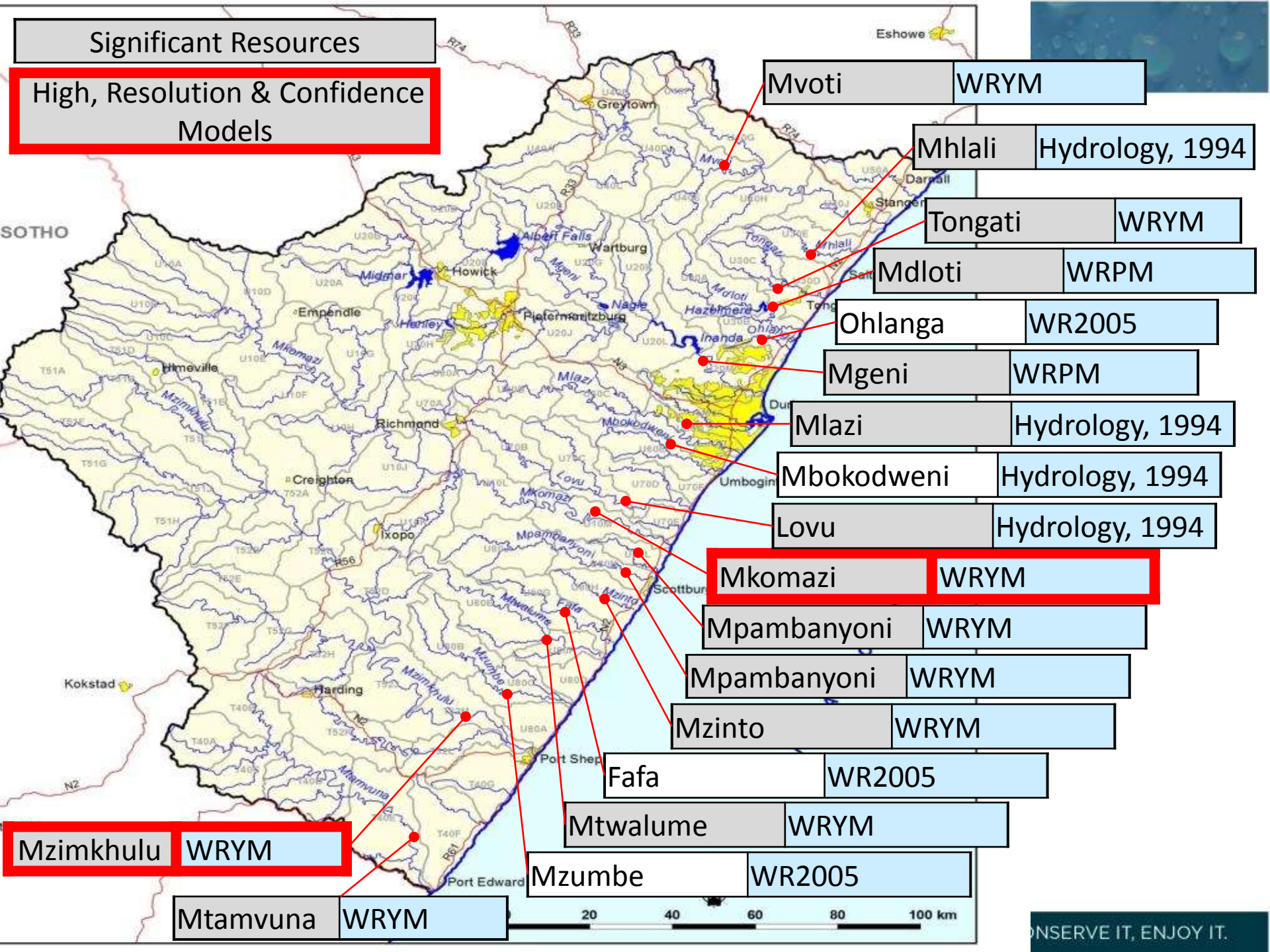
- Different levels of water use and protection are evaluated with the aim to find a balanced scenario
- Water Resource Classification is the process to evaluate and recommend what that balance scenario entails

Evaluation of Scenarios



Hydrology

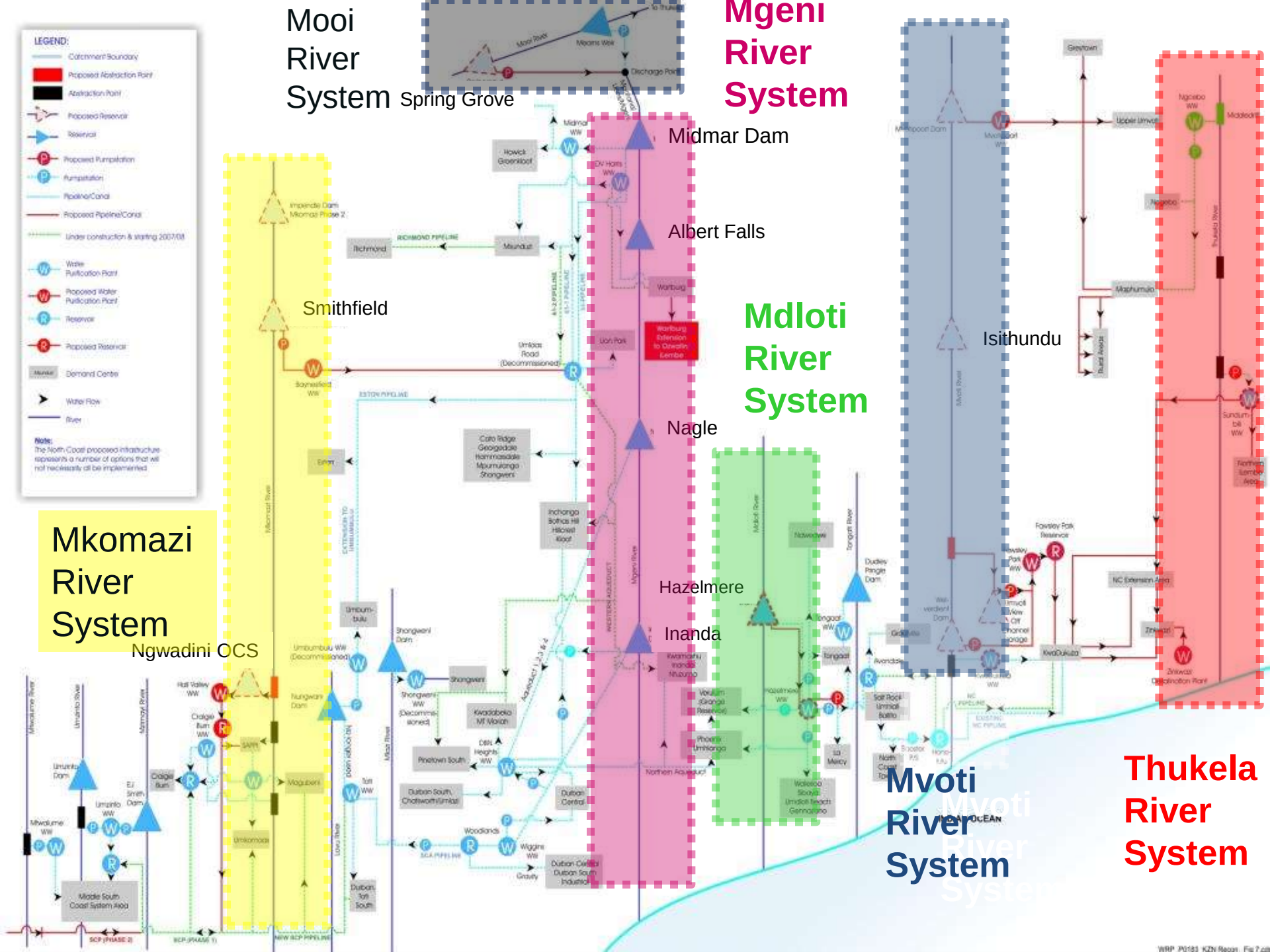
- The natural flow forms the baseline against which all scenarios will be considered
- Hydrology for the baseline derived from past study information
- Hydrology's available at a particular resolution of quaternary level are downscaled linearly to incorporate catchment areas of the bio-physical nodes
- Update Water resources models available to produce the best possible estimates of present day flow


Significant Resources
High, Resolution & Confidence Models
Mvoti WRYM
Mhlali Hydrology, 1994
Tongati WRYM
Mdloti WRPM
Ohlanga WR2005
Mgeni WRPM
Mlazi Hydrology, 1994
Mbokodweni Hydrology, 1994
Lovu Hydrology, 1994
Mkomazi WRYM
Mpambanyoni WRYM
Mpambanyoni WRYM
Mzinto WRYM
Fafa WR2005
Mtwalume WRYM
Mzumbe WR2005
Mzimkhulu WRYM
Mtamvuna WRYM
SOTHO
Eshowe
Greytown
Darnall
Albert Falls
Wartburg
Howick
Midmar
Empendle
Henley
Pietermaritzburg
Nagle
Hazelmere
Inanda
Himeville
Richmond
Creighton
Ixopo
Umbogintwini
Scottburgh
Port Shepstone
Port Edward
Kokstad
Harding
N2
R56
R61
20 40 60 80 100 km

Identification of Operational Scenarios

- Operational scenarios include changes to present operation, land use and/or future developments

- Information sourced:
  - Water Reconciliation Strategy Study for the Kwazulu Natal Coastal Metropolitan Areas
  - uMkhomazi Feasibility study
  - Southern KwaZulu-Natal Water Resources Pre-Feasibility Study
  - Ncwabeni Off-channel Storage Dam Feasibility Study
  - Mzimkhulu River Catchment Water Resource Study: Riverine Ecological Water Requirements
  - DWA All Towns Recon Study
  - WRC: The resilience of South Africa's estuaries to future water resource development based on a provisional ecological classification of these systems
  - EThekwini Spatial Development Framework


LEGEND:
Catchment Boundary
Proposed Abstraction Point
Abstraction Point
Proposed Reservoir
Reservoir
Proposed Pumpstation
Pumpstation
Pipeline/Canal
Proposed Pipeline/Canal
Under construction & starting 2007/08
Water Purification Plant
Proposed Water Purification Plant
Reservoir
Proposed Reservoir
Demand Centre
Water Flow
River
Note:
The North Coast proposed infrastructure represents a number of options that will not necessarily all be implemented
Mooi River System
Spring Grove
Mgeni River System
Midmar Dam
Albert Falls
Nagle
Inanda
Hazelmere
Mdloti River System
Smithfield
Isithundu
Mkomazi River System
Ngwadini OCS
Mvoti River System
Thukela River System

Pilot Investigation: Ultimate Wastewater Scenario

Estuary Ecological Category for Scenarios

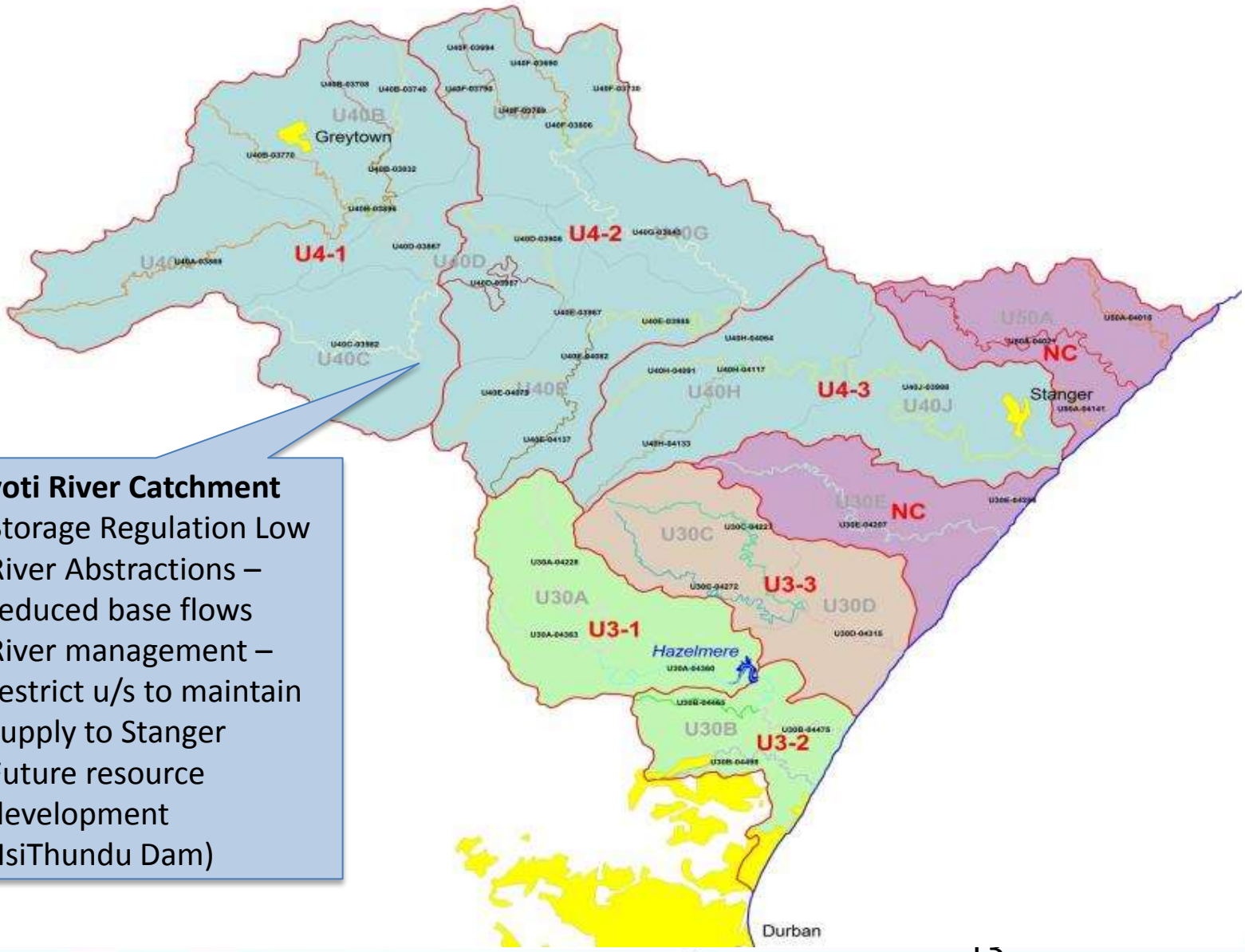
NAME	Size (ha)	IEI	PES	REC/BAS	UWS
Tongati	37	3	D	D*	E
Mdloti	58	3	D	C*	E
Mhlanga	83	3	D	B*	D
Mgeni	83	3	E	D	E
Durban Bay	1148	3	E	D	E
Sipingo	27	5	F	E	F
Mbokodweni	18	2	E	D	E
Manzimtoti	21	2	D	D	D
Little Manzimtoti	10	2	E	D	E
Lovu	40	4	C	A/B	C
Msimbazi	28	5	B	A/B	B
Umgababa	47	4	C	A/B	C
Ngane	8	3	C	C	C
Mkomazi	75	4	C	B	C
Mahlongwane	21	3	C	A/B	C
Mahlongwa	14	3	C	A/B	C


WMA 11 (Mvoti to Umzimkulu)
6
Usuthu to
Mhlatuze
7
Thukela
12
Mzimvubu to
Keiskamma
Cathedral Peak
Lesotho
Mokhotlong
Giant's Castle
Mooirivier
Kranskop
Mandini
Mtunzini
Albert Falls
Dam
Midmar
Dam
Nagle Dam
Henley
Dam
Inanda
Dam
Dudley
Pringle
Salt Rock
Umhlanga
Rocks
DURBAN
Amanzimtoti
Scottburgh
Himeville
Ixopo
Umzimkulu
Qachasnek
Matatiele
Kokstad
Harding
Hiberdene
Gilbert Eyles
Dam
Mount Ayliff
Mount
Frere
Tabankulu
Flagstaff
Margate
Port Edward
Mvoti
Mgeni
Mkomazi
Mzimkhulu
Nonoti
INDIAN OCEAN
LEGEND
Quaternary Catchment
Secondary Catchment
Primary Catchment
WMA Boundary
Major River
International Boundary
Provincial Boundary
Major City/Town
Dam
Secondary
T4
T5
U1
U2
U3
U4
U5
U6
U7
U8
N
0
20
40
60 Km
Map produced by DWA: Dir. SLIM (GI&A)
GM11_137: WMA11_A4
29°E
30°E
31°E
32°E
29°S
30°S
31°S

Identification of Operational Scenarios

1. MAIN RIVER SYSTEMS INFLUENCED BY OPERATIONAL ACTIVITIES
2. SMALLER COASTAL SRIVER SYSTEMS

Mvoti River Catchment



Mvoti River Catchment

- Storage Regulation Low
- River Abstractions – reduced base flows
- River management – restrict u/s to maintain supply to Stanger
- Future resource development (IsiThundu Dam)

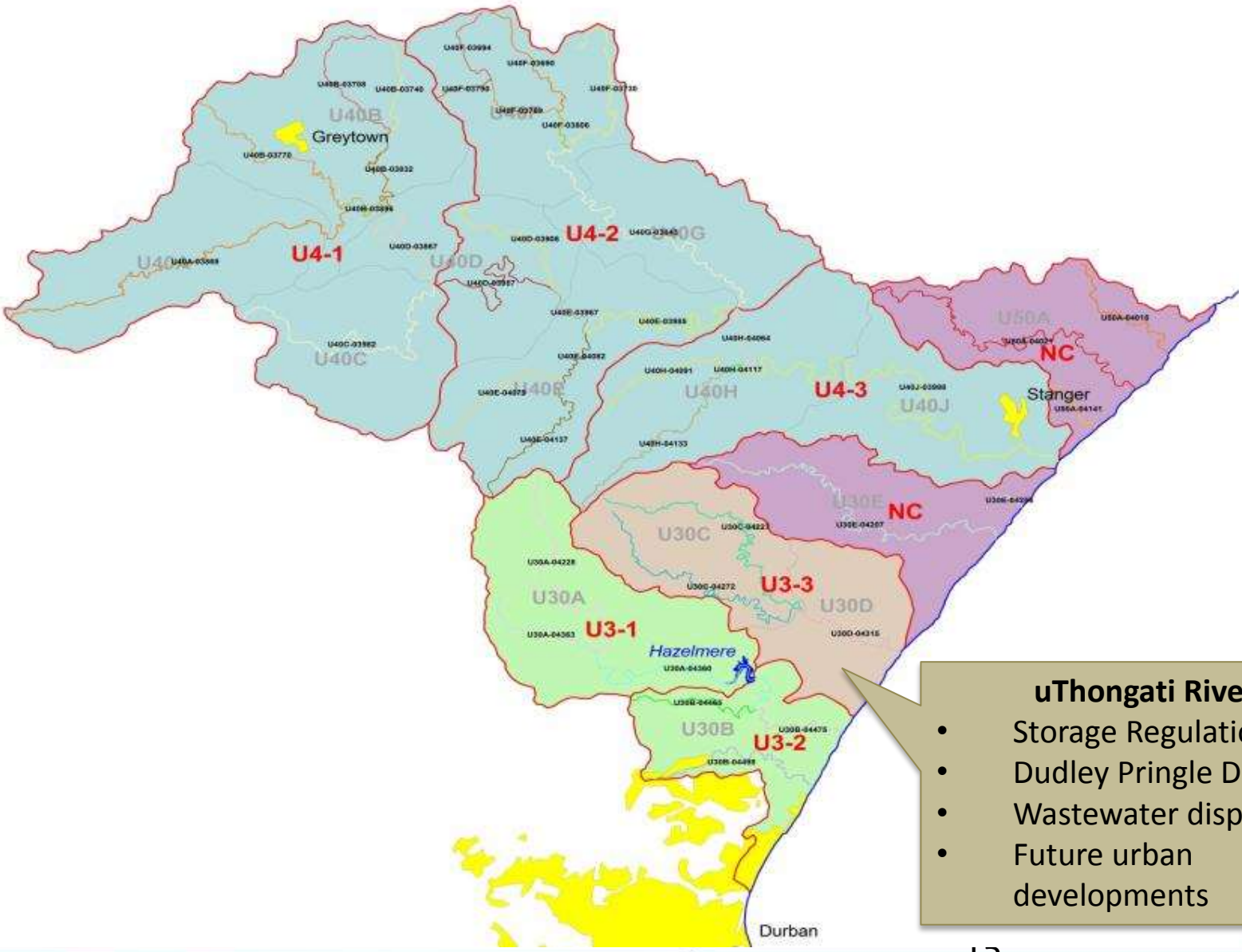
Mvoti River Catchment

Mvoti Scenarios

Scenario	Scenario Variables		
	Ultimate Development Demands & Return Flows (2040)	EWR[1]	MRDP[4]
MV1	No	No	No
MV2	No	Yes (REC[3])	No
MV3	Yes	Yes (PES[2]/REC[3])[5]	Yes

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Category
4 Mvoti River Development Project (Isithundu Dam)
5 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES

uThongati River Catchment



uThongati River

- Storage Regulation Low
- Dudley Pringle Dam
- Wastewater disposal
- Future urban developments

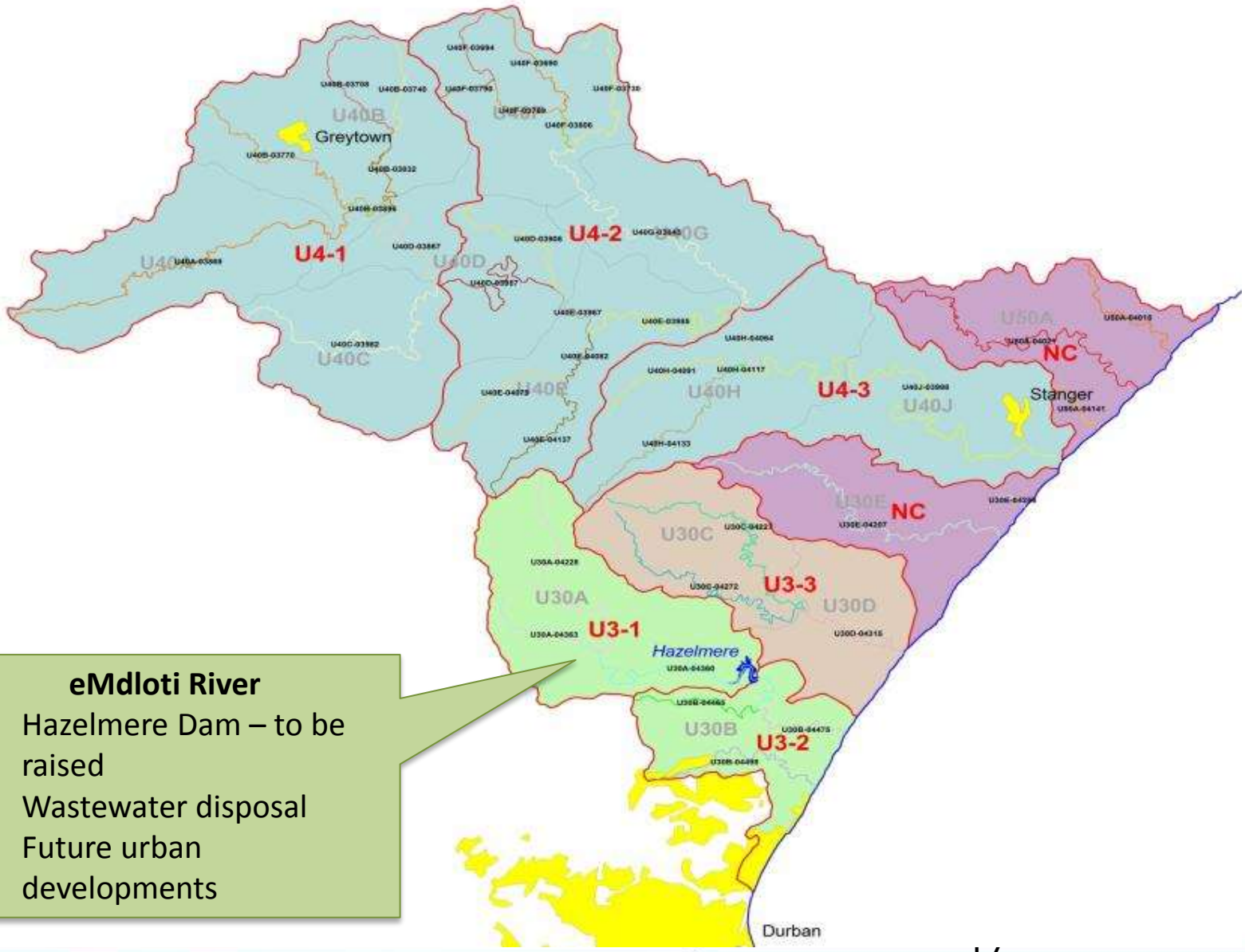
uThongati River

Scenarios for uThongati

Scenario	Scenario Variables		
	Ultimate Development Demands & Return Flows (2040)	EWR[1]	AWWM[5]
UT1	No	No	No
UT2	Yes	Yes (PES[2]/REC[3]) [4]	No
UT3	Yes	Yes (PES[2]/REC[3])[4]	Yes

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Categories
4 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
5 Alternative Waste Water Management Options (direct re-use, sea outfall, transfer to other catchment)

eMdloti River Catchment



eMdloti River

- Hazelmere Dam – to be raised
- Wastewater disposal
- Future urban developments

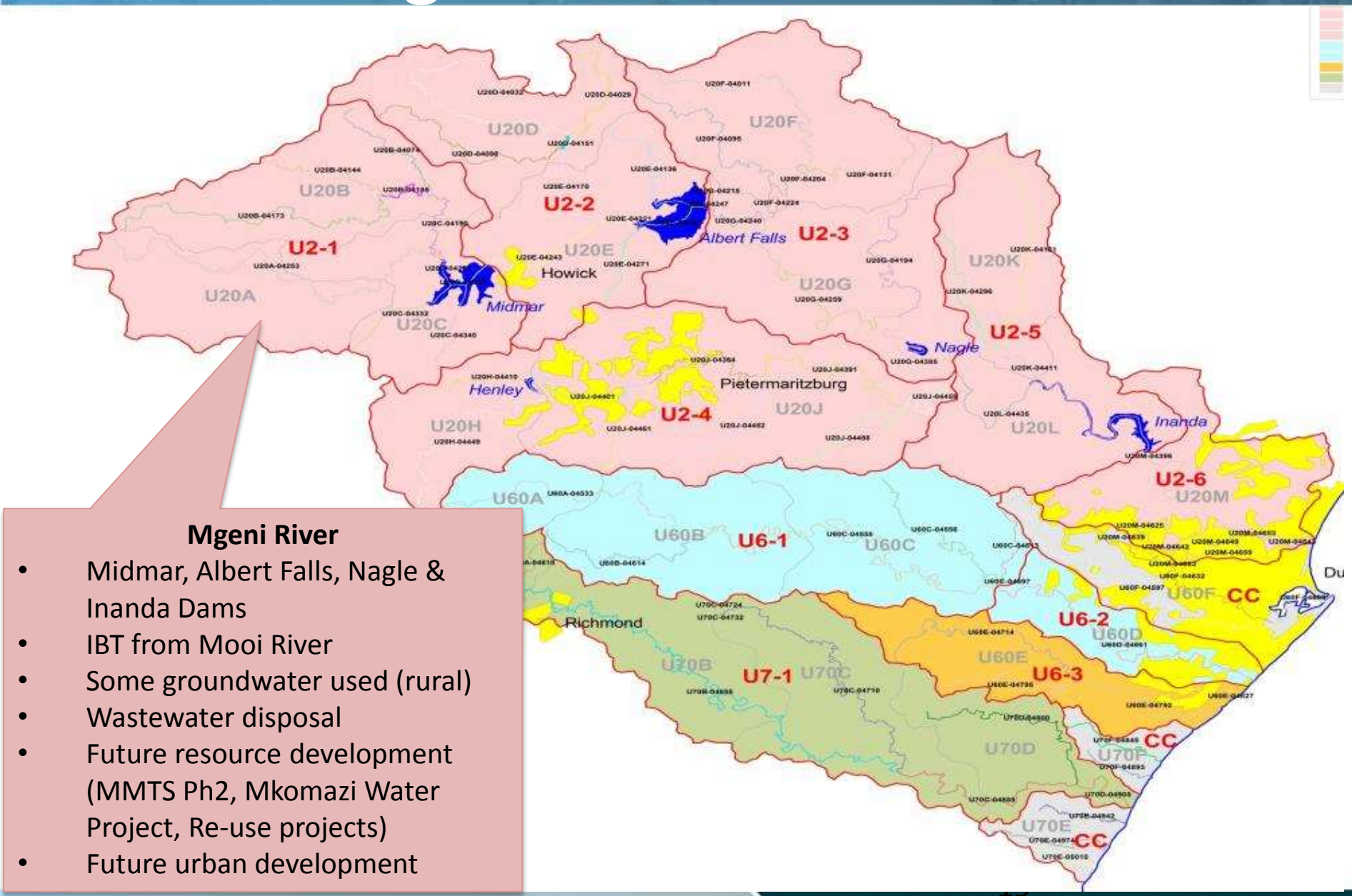
eMdloti River

Scenarios for eMdloti

Scenario	Scenario Variables				
	Ultimate Development Demands & Return Flows (2040)	EWR[1]	Dam Raising[4]	Indirect Re-use	AWWM[6]
EM1	No	No	No	No	No
EM2	Yes	Yes (PES^2/REC^3)[5]	Yes	No	No
EM3	Yes	Yes (PES^2/REC^3)[5]	Yes	Yes	No
EM4	Yes	Yes (PES^2/REC^3)[5]	Yes	No	Yes

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Category
4 Hazelmere Dam Raising
5 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
6 Alternative Waste Water Management Options (direct re-use, sea outfall, transfer to other catchment)

uMngeni River Catchment



Mgeni River

- Midmar, Albert Falls, Nagle & Inanda Dams
- IBT from Mooi River
- Some groundwater used (rural)
- Wastewater disposal
- Future resource development (MMTS Ph2, Mkomazi Water Project, Re-use projects)
- Future urban development

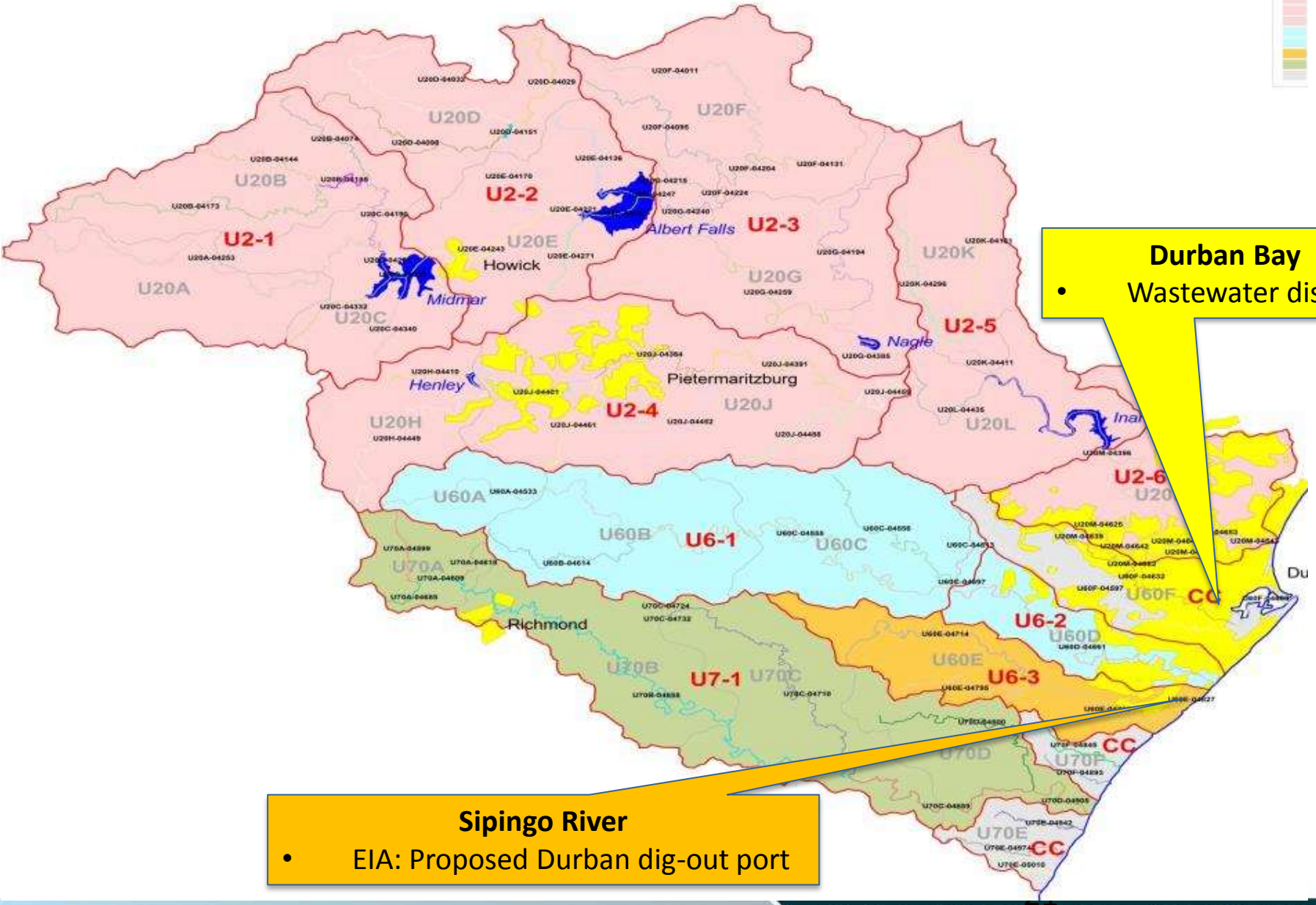
uMngeni River

Scenarios for uMngeni

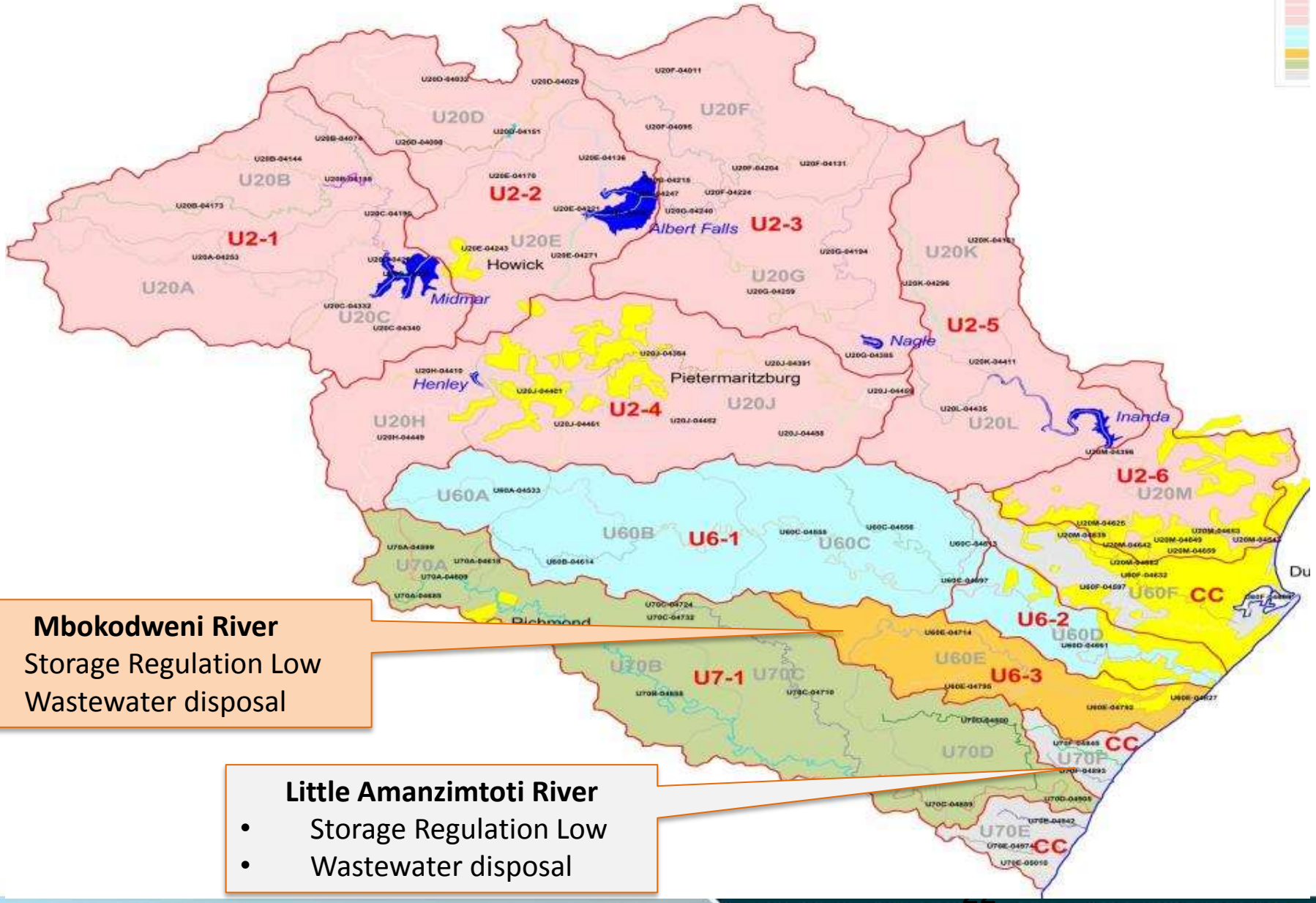
Scenario	Scenario Variables					
	Ultimate Development (2040)	EWR[1]	MMTS2[4]	MWP[6]	Darvill Re-use	Ethekwini Direct Re-use
UM1	No	No	Yes	No	No	No
UM2	No	Yes (PES[2]/REC[3])[5]	Yes	No	No	No
UM3	Yes	Yes (PES[2]/REC[3])[5]	Yes	Yes	No	No
UM4	Yes	Yes (PES[2]/REC[3])[5]	Yes	Yes	Yes	Yes

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Category
4 Mooi-Mgeni Transfer Scheme Phase 2 (Springrove Dam)
5 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
6 uMkhomazi Water Project (Smithfield Dam)

Durban Bay Catchment



Mbokodweni & Little Amanzimtoti River Catchment



Mbokodweni River

- Storage Regulation Low
- Wastewater disposal

Little Amanzimtoti River

- Storage Regulation Low
- Wastewater disposal

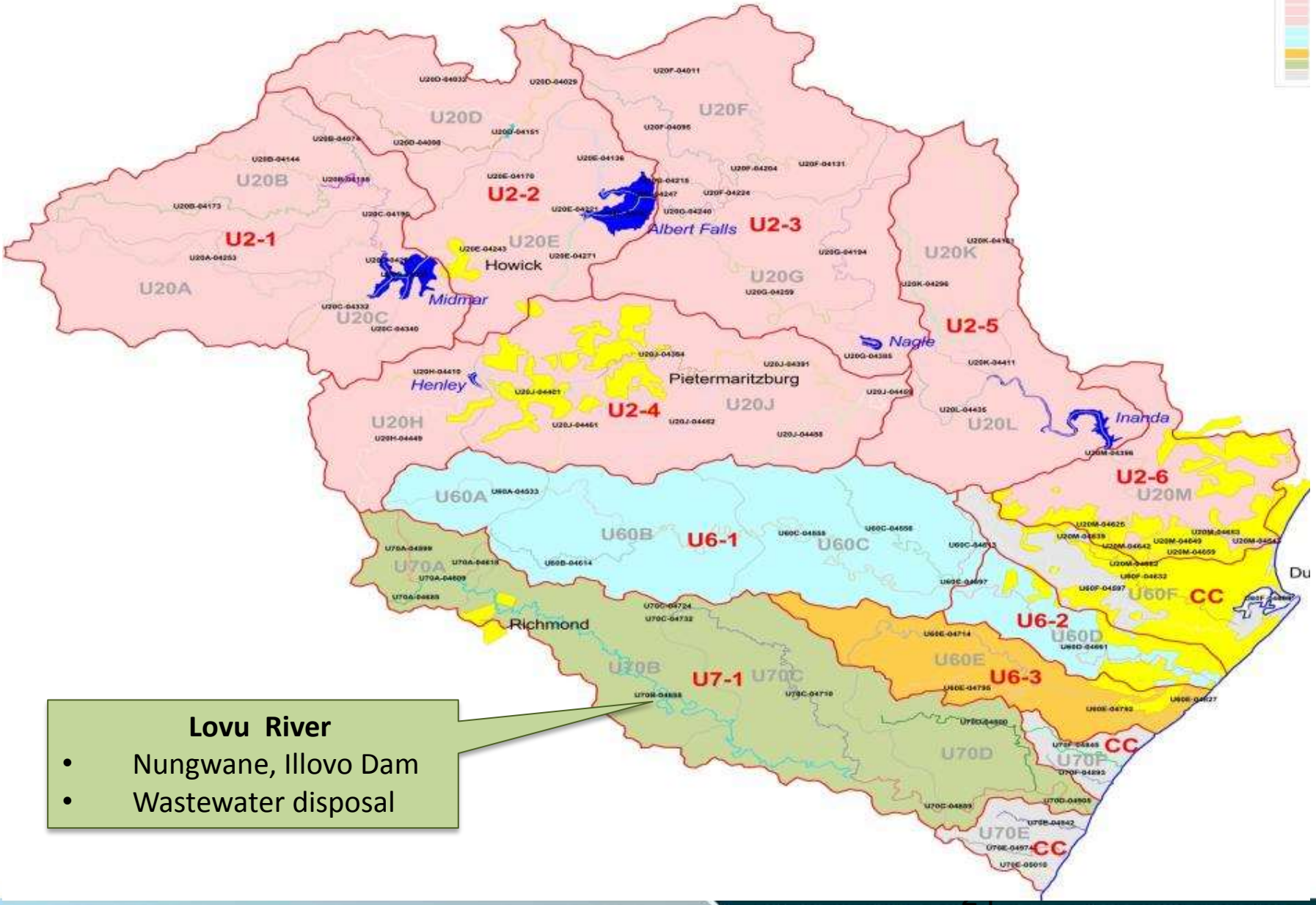
Mbokodweni & Little Amanzimtoti River Catchment

Scenarios for Mbokodweni and Little aManzimtoti

Scenario	Scenario Variables		
	Ultimate Development Demands & Return Flows (2040)	EWR[1]	AWWM[5]
MA1	No	No	No
MA2	Yes	Yes (PES[2]/REC[3]) [4]	No
MA3	Yes	Yes (PES[2]/REC[3])[4]	Yes

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Categories
4 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
5 Alternative Waste Water Management Options (direct re-use, sea outfall, transfer to other catchment)

Lovu River Catchment



Lovu River

- Nungwane, Illovo Dam
- Wastewater disposal

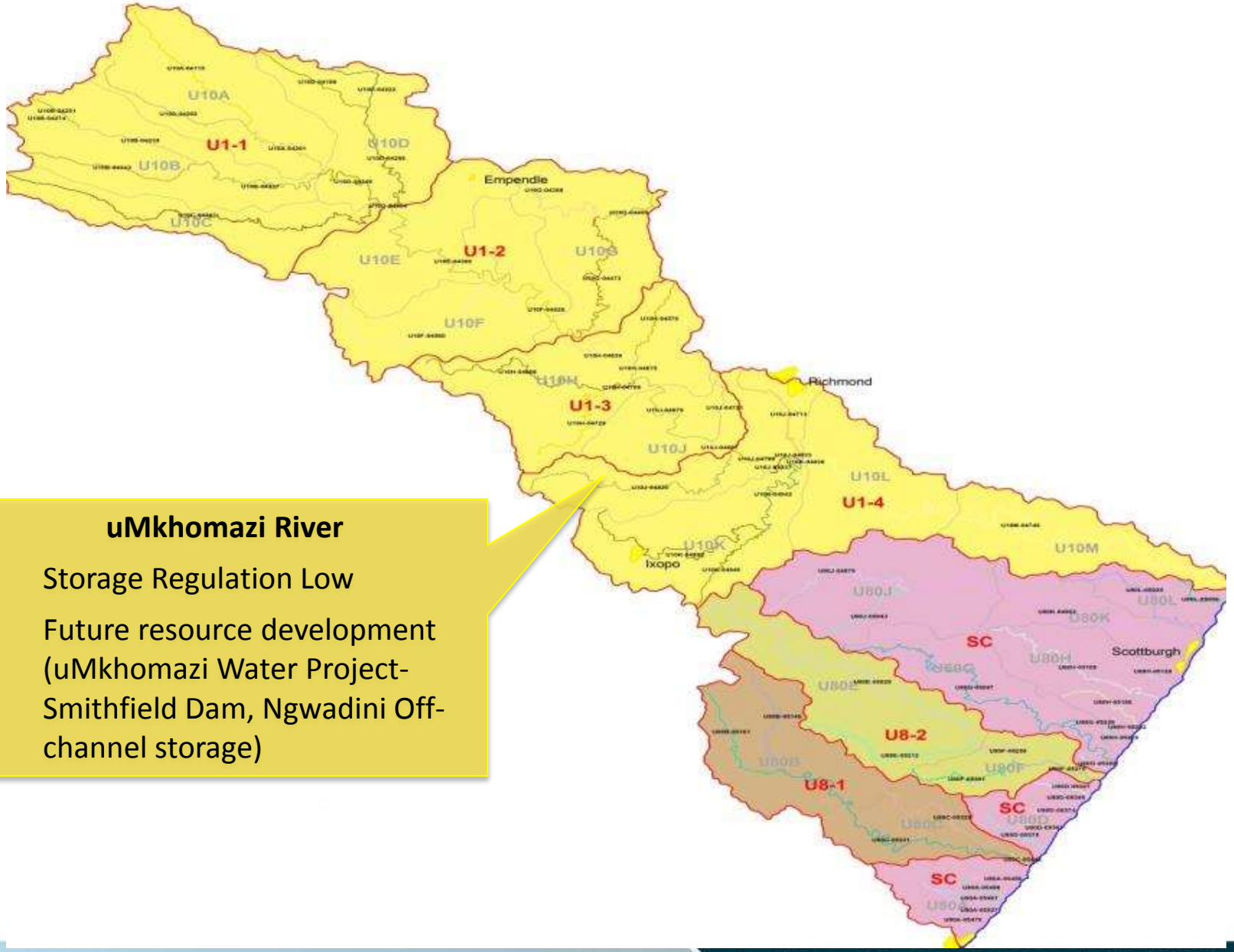
Lovu River

Scenarios for Lovu

Scenario	Scenario Variables		
	Ultimate Development Demands & Return Flows (2040)	EWR[1]	Reduced Abstraction and Afforisted Areas[5]
LO1	No	No	No
LO2	Yes	Yes (PES[2]/REC[3]) [4]	No
LO3	Yes	Yes (PES[2]/REC[3])[4]	Yes

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Categories
4 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
5 Reduction of abstraction from Lovu Dam in the upper part of the catchment as well as afforested areas in order to increase base flows

uMkhomazi River Catchment



uMkhomazi River

- Storage Regulation Low
- Future resource development (uMkhomazi Water Project-Smithfield Dam, Ngwadini Off-channel storage)

uMkhomazi River

Scenarios for uMkhomazi

Scenario	Scenario Variables			
	Ultimate Development (2040)	EWR[1]	MWP[4]	Ngwadini OCD[6]
MK1	No	No	No	No
MK2	Yes	Yes (PES[2]/REC[3])[5]	Yes	Yes

1 Ecological Water Requirement (uMkhomazi Feasibility study scenarios)
2 Present Ecological State
3 Recommended Ecological Category
4 uMkhomazi Water Project (Smithfield Dam)
5 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
6 Ngwadini Off-Chanel Storage Dam (Lower uMkhomazi)

Mzimkhulu River Catchment

Mzimkhulu River

- Storage Regulation low

  (Gilbert Eyles, Lake Eland)
- Regional water abstractions
- Some groundwater use (rural and municipal)
- Wastewater disposal
- Future resource development (Ncwabeni off-channel dam with abstraction from new weir on Mzimkhulu)

Mzimkhulu River

- Ecological consequences of development/operational scenarios analysed by Mzimkhulu River Catchment Water Resource Study: Riverine Ecological Water Requirements Report (2011)

- Scenarios entailed:
  - Development of 20 000 to 50 000 ha forestry in most suitable areas (mid-altitude parts of the catchment)
  - Additional irrigation development with increase in water use by 20% (upper reaches of catchment)
  - A number of dam options; some for providing mitigation for the forestry and irrigation developments, and others as water storage reservoirs to supply consumptive users

Mzimkhulu River

- Four scenarios relevant to the study selected:

  1. Increased afforestation (21 050 ha), dam on tributary

  2. Increased afforestation (50 350 ha), increased irrigation (20%), Ncwabeni OCS Dam

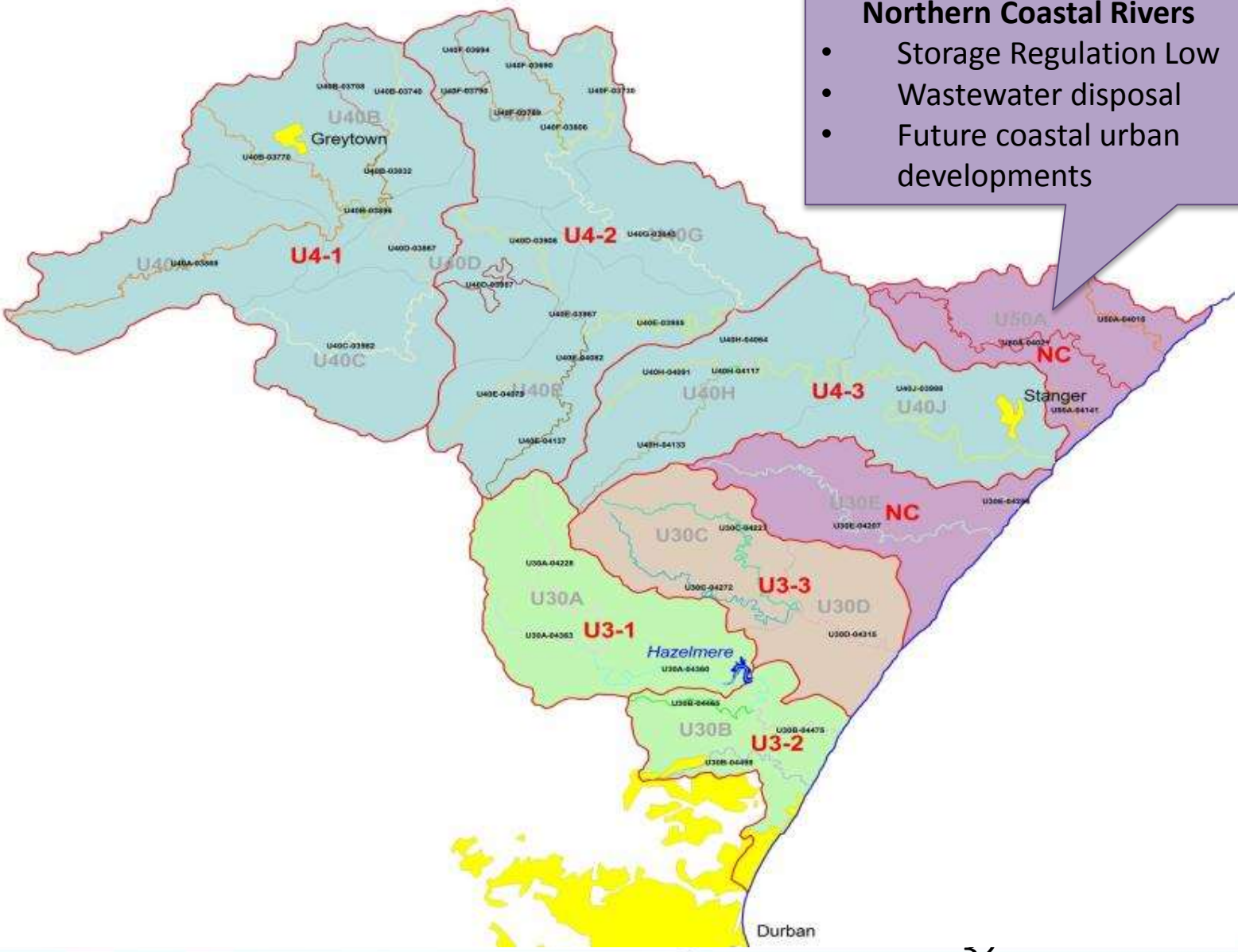
  3. Increased afforestation (50 350 ha), increased irrigation (20%), 2 dams on tributaries and on Mzimkhulu main stem

  4. Increased afforestation (50 350 ha), increased irrigation (20%), 1 on tributary and on Mzimkhulu main stem

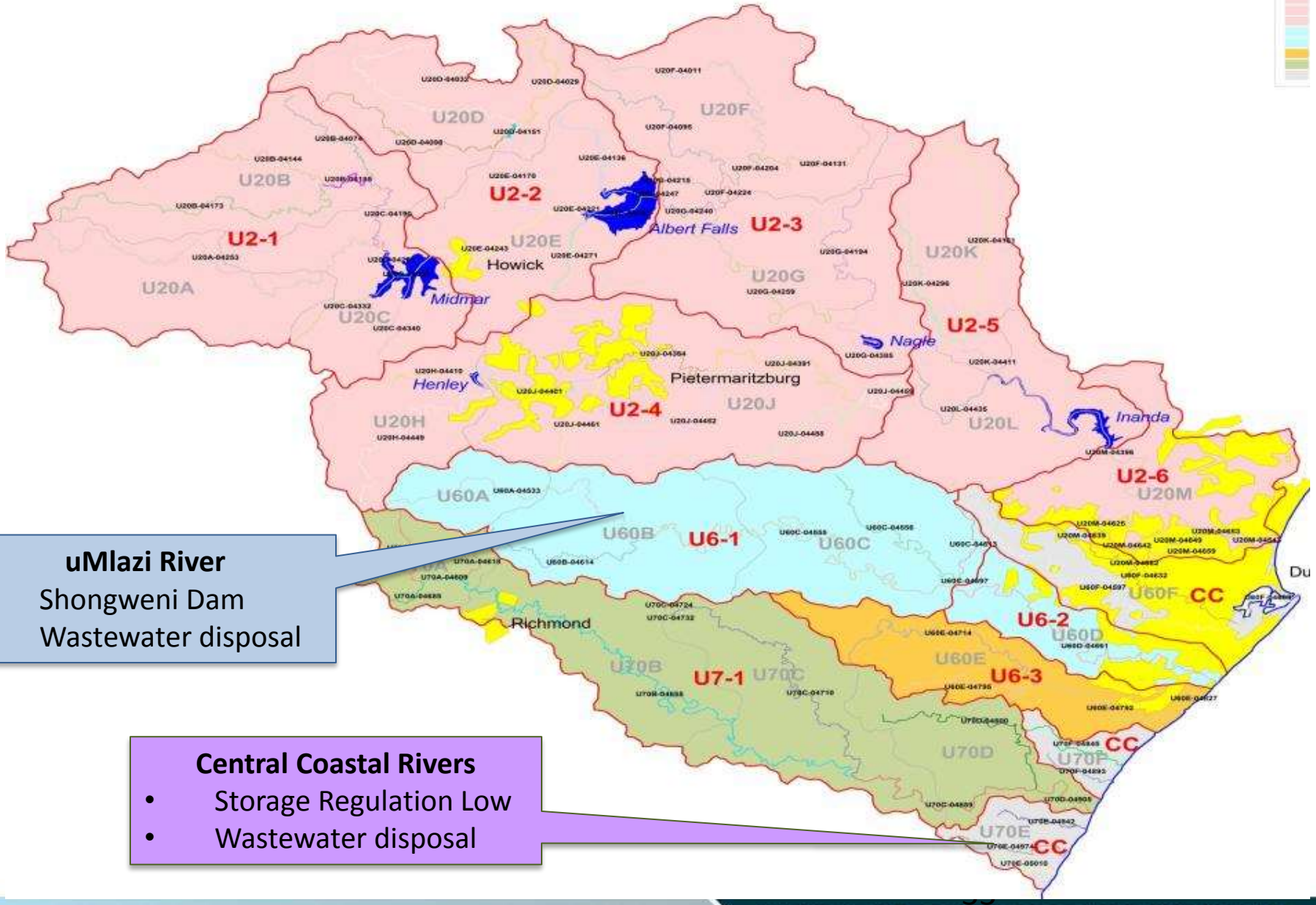
- The results of the scenarios analysed to be incorporated into the study and the socio-economic implications of meeting the EWR can also be determined

2. SMALLER COASTAL RIVER SYSTEMS

Northern Coastal River Catchments



uMlazi & Central Coastal Rivers Catchments



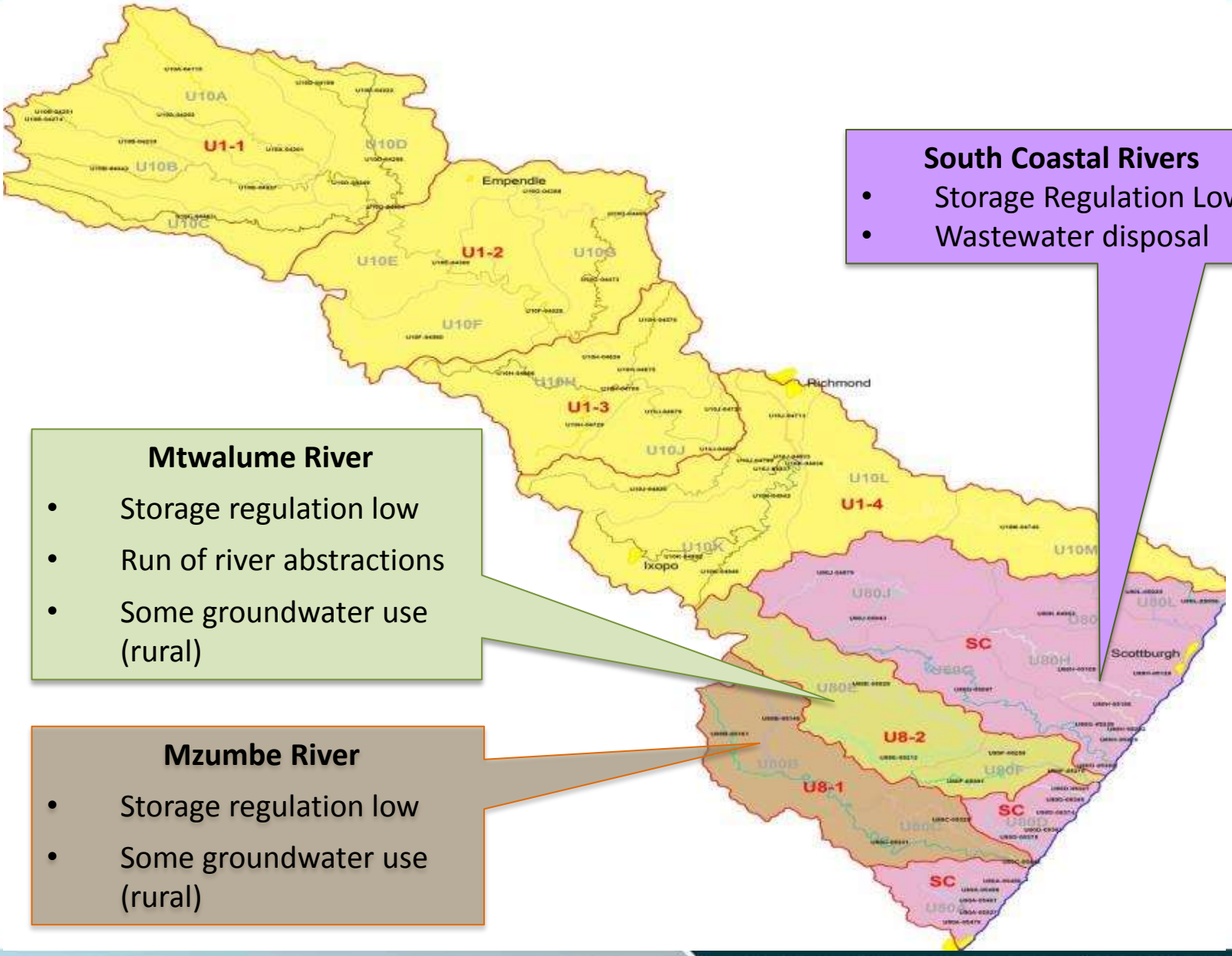
uMlazi River

- Shongweni Dam
- Wastewater disposal

Central Coastal Rivers

- Storage Regulation Low
- Wastewater disposal

Mtwalume & Mzumbe River Catchment



South Coastal Rivers

- Storage Regulation Low
- Wastewater disposal

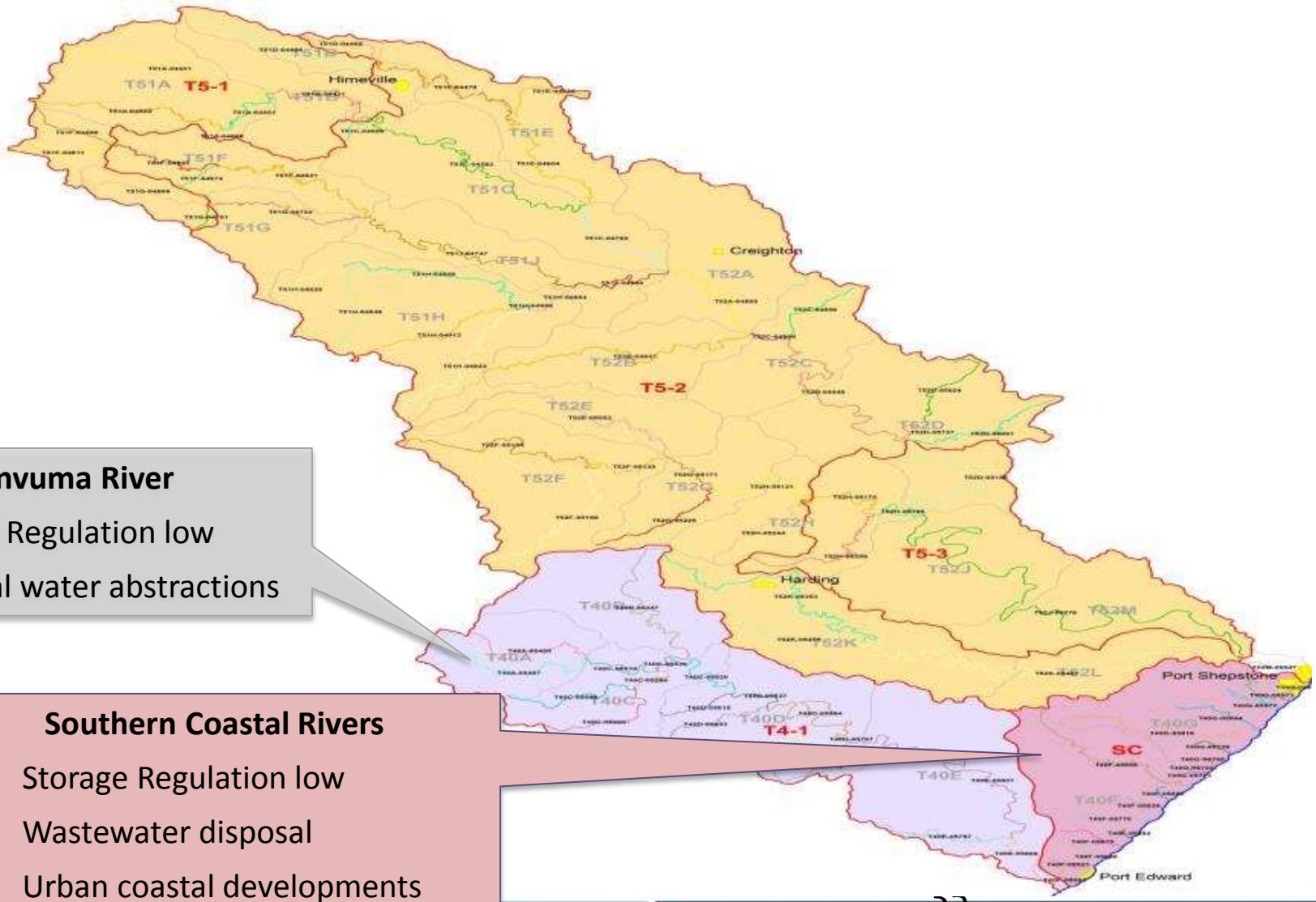
Mtwalume River

- Storage regulation low
- Run of river abstractions
- Some groundwater use (rural)

Mzumbe River

- Storage regulation low
- Some groundwater use (rural)

Mtanvuma & Southern Coastal River Catchments



Mtanvuma River

- Storage Regulation low
- Regional water abstractions

Southern Coastal Rivers

- Storage Regulation low
- Wastewater disposal
- Urban coastal developments

Smaller Coastal Rivers

Possible scenarios for identified smaller coastal rivers

Scenario	Scenario Variables[5]	
	Ultimate Development Demands & Return Flows (2040)	EWR[1]
NO1	No	No
NO2	Yes	Yes (PES[2]/REC[3])[4]

1 Ecological Water Requirement
2 Present Ecological State
3 Recommended Ecological Category
4 If REC=PES only one scenario required as indicated, If REC≠PES, separate scenarios will be required for REC and PES
5 No infrastructure developments currently know of

Comments and Discussion