water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

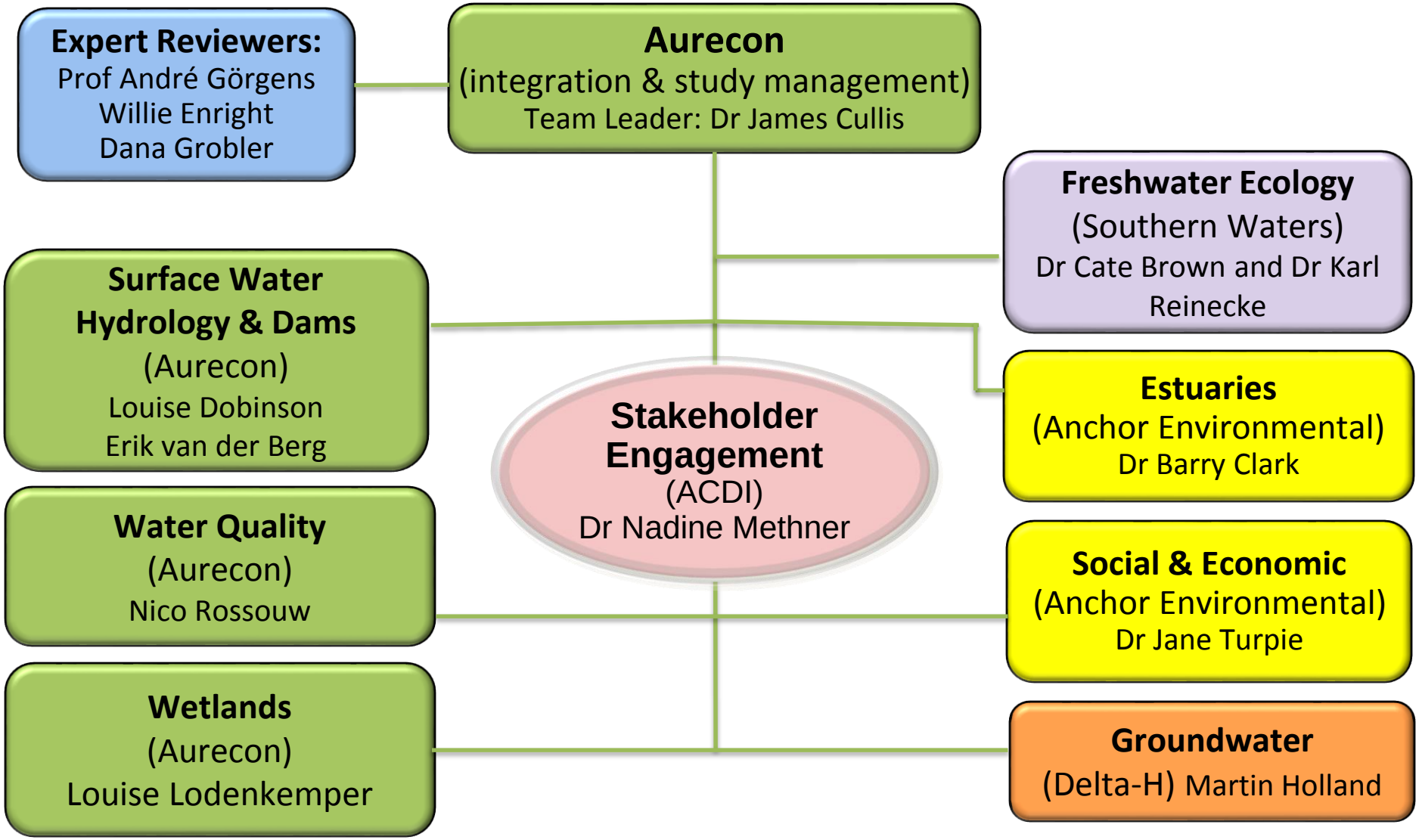
Determining Water Resources Classes and Associated Resource Quality Objectives in the Berg Catchment (WP10987)

Project Steering Committee Meeting

15 February 2017
Venue: DWS offices, Bellville, Cape Town

Overview of study objectives & tasks

The Study Team

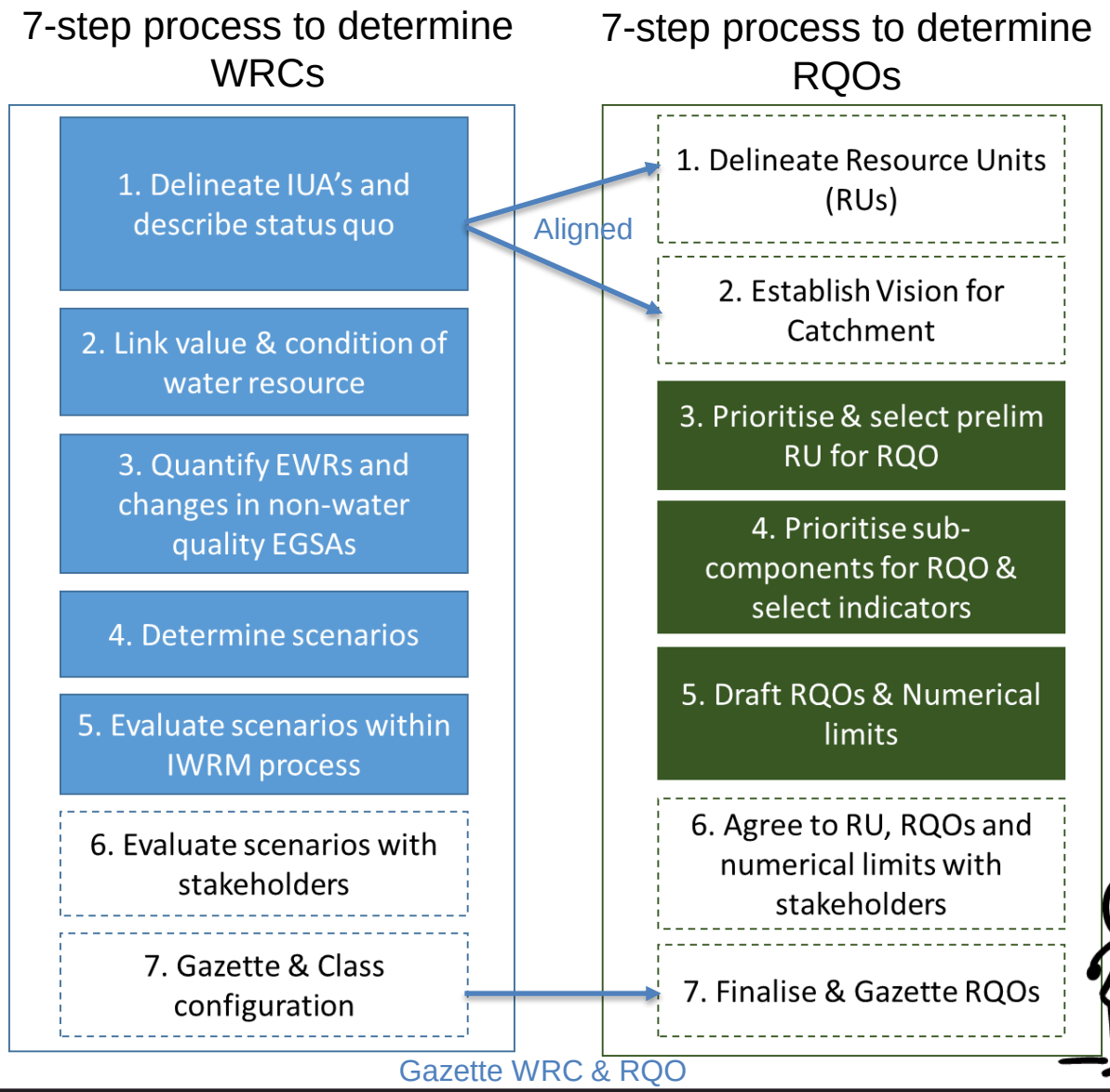


Study Objectives

Co-ordinate implementation of the Water Resources Classification System (WRCS)

- **Determine Water Resource Classes (WRCs)**
- **Determine Resource Quality Objectives (RQOs)**
- **Support Gazetting of Recommended Water Resources Classes and RQOs**

Classification and RQOs Steps



Main study tasks (stakeholder engagement throughout)

- **Task 1: Inception** → Completed
  - Inception Report
  - Stakeholder Identification and Mapping Report
- **Task 2: Information gathering** → Completed
  - Water Resources Information and Gap Analysis
- **Task 3: Determine Water Resource Classes**
  - Resource Units & IUA Delineation Report → Completed
  - Status Quo Report → Draft
  - Linking the Value & Condition of Water Resources → Draft
  - Quantification of the EWR and changes in EGSAs → in progress
  - Ecological Base Configuration Scenarios Report
  - Report on Evaluation of Classification Scenarios
- **Task 4: Determine Resource Quality Objectives**
  - Resource Unit Prioritization Report
  - Evaluation of Resource Units
  - Outline of Resource Quality Objectives
  - Monitoring Program to Support RQOs Implementation
  - Confidence Assessment of Resource Quality Objectives
- **Task 5: Support Gazetting done by DWS to legalise**
  - Final Report and Gazette template

Study Status: Classification Steps 1-7 (Stakeholder engagement throughout)

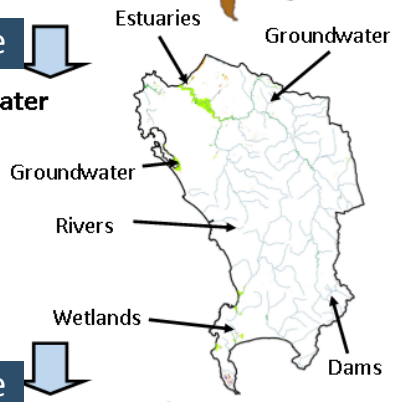
STEP 1: DELINEATE CATCHMENT & DESCRIBE STATUS QUO

Outcome: Integrated Units of Analysis with nested sub-units (nodes) and overview of status quo of Water Management Area (WMA) concerning all aspects of water resources.

Socio-economic Zones

Complete

Significant water resources



Complete

Integrated Units of Analysis

Complete

STEP 2: LINK VALUE & CONDITION OF WATER RESOURCE

Outcome: Set of qualitative relationships determining how economic value and social wellbeing are influenced by ecosystem characteristics and the sectoral use of water.

SOCIAL WELL BEING

ECOSYSTEM INDEX

ECONOMIC PROSPERITY

Draft

STEP 3: QUANTIFY THE ECOLOGICAL WATER REQUIREMENTS & CHANGES IN EGSAs

Outcome: Quantification of the Ecological Water Requirements (EWRs) and description of changes in non-water quality EGSAs. Provide a table of EWRs for each node at various levels of ecological integrity.

In progress

STEP 4: SET AN ECOLOGICALLY SUSTAINABLE BASE SCENARIO & ESTABLISH STARTER SCENARIOS

Outcome: Provide a ESBC and establish starter catchment configuration scenarios. This scenario will give lowest feasible level of protection required for sustainable use of entire catchment.

Water Resource Classification Procedure

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STEP 5: EVALUATE SCENARIOS WITHIN INTEGRATED WATER RESOURCE MANAGEMENT PROCESS

Outcome: Evaluate scenarios within IWRM process so that subset of catchment configuration scenarios can be put forward for stakeholder evaluation

STEP 6: EVALUATE SCENARIOS WITH STAKEHOLDERS

Outcome: Evaluate scenarios with stakeholders and decide upon an agreed upon configuration short-list for the Minister's consideration. This is an iterative process between step s 5 and 6.

STEP 7: GAZETTE WATER RESOURCE CLASS CONFIGURATIONS

Outcome: A Water Resource Class configuration (and associated RQOs) for the entire catchment is published by the Minister in the Government Gazette as required in the National Water Act of 1998.

IUA delineation & status quo

STEP 1

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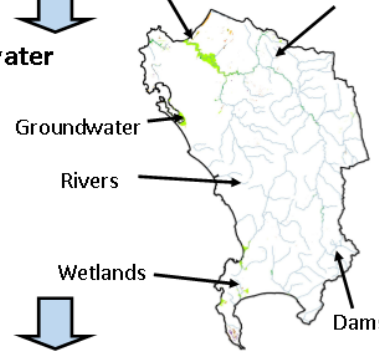

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Step 1: Delineate catchment & describe status quo

- What are **significant resources**?
  - Based on Physical, Biological & Socio-economic factors
  - Surface water (rivers, wetlands, estuaries, dams)
  - Groundwater

Each IUA (12) represents a similar area requiring a Water Resources Class

- Why do we need these?
  - Broad-scale units to assess socio-economic implications of scenarios *(possible future situations)*
  - Report on ecological conditions at a sub-catchment scale
  - Set Water Resource Classes for different parts of a catchment

Step 1: Delineate catchment & describe status quo

Delineation

Part 1: RESOURCE UNIT DELINEATION AND IUA REPORT

1b. Divide catchment into socio-economic zones

1d. Define network of significant resources & establish biophysical & allocation nodes

1h. Define preliminary IUAs

Status Quo

Part 2: STATUS QUO REPORT

1a. Describe present-day socio-economic status

1c. Describe network of significant resources & establish biophysical & allocation nodes

1e. Describe well being of communities

1f. Describe value of water use

1g. Describe value of ecosystem use

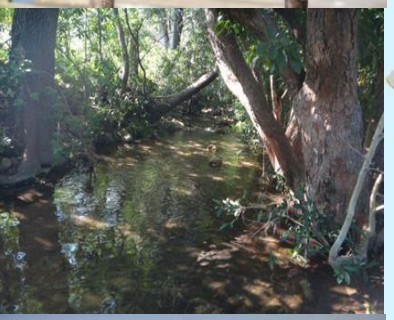
1i. Develop socio-economic & decision-analysis framework

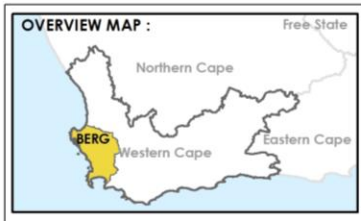
1j. Describe present-day community wellbeing within each IUA

STEP 1

STEP 1: Delineate the units of analysis & describe the status quo of the water resources

Study area





LEGEND

- Towns
- Rivers
- Dams

Roads

- Main
- Major
- Quaternary Catchments
- Berg Water Management Area
- Municipal Boundary
- District Boundary

DRAWN : CHERYL BEUSTER
SOFTWARE : ESRI ARCMAP 10.3

COORDINATE SYSTEM
UTM Zone 34S

SCALE
0 10 20 30 40 km
1:1,000,000

CONSULTANT
aurecon

CLIENT
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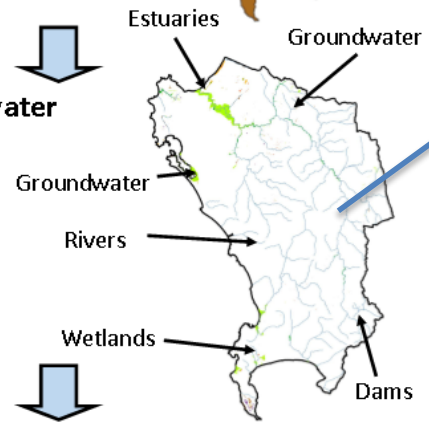
FIGURE NO.

STEP 1: DELINEATE CATCHMENT & DESCRIBE STATUS QUO

Outcome: Integrated Units of Analysis with nested sub-units (nodes) and overview of status quo of Water Management Area (WMA) concerning all aspects of water resources.

Socio-economic Zones

Significant water resources



Integrated Units of Analysis

Step 1: Delineate catchment & describe status quo

1.Socio-economic zones

Objective: predict & report implications of scenarios on social wellbeing, economic prosperity & ecosystem health.

Berg: 5 Socio-economic zones.

2.Resource Units

Objective:

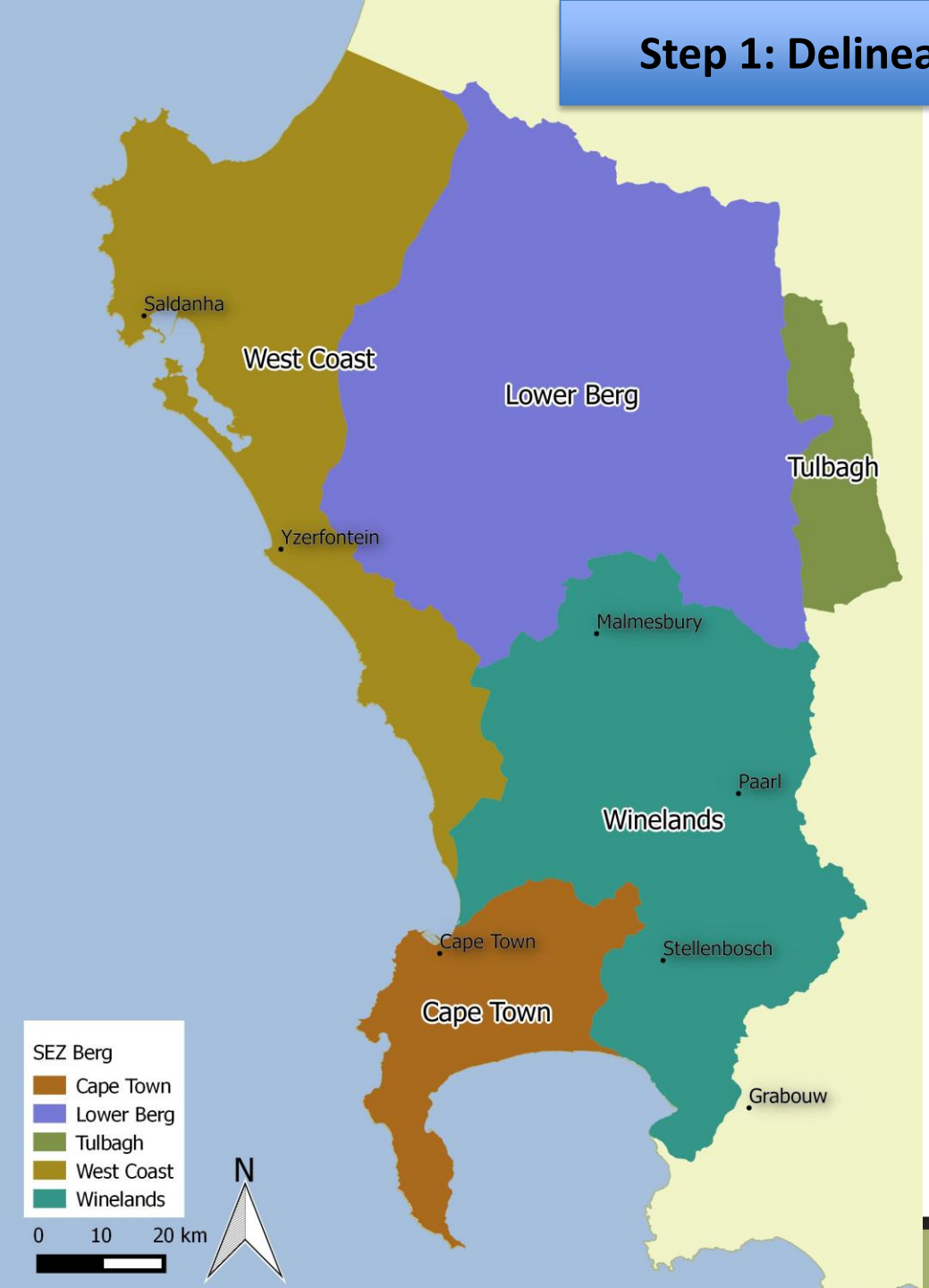
- an identified network of significant resources (rivers, estuaries, wetlands, aquifers).
- describe water resource infrastructure & water user allocations.

3.Integrated Units of Analysis

Objective: provides broader-scale units for assessing socio-economic implications of scenarios & to report on ecological conditions at a sub-catchment scale.

Berg: 12 Integrated Units of Analysis (IUAs)

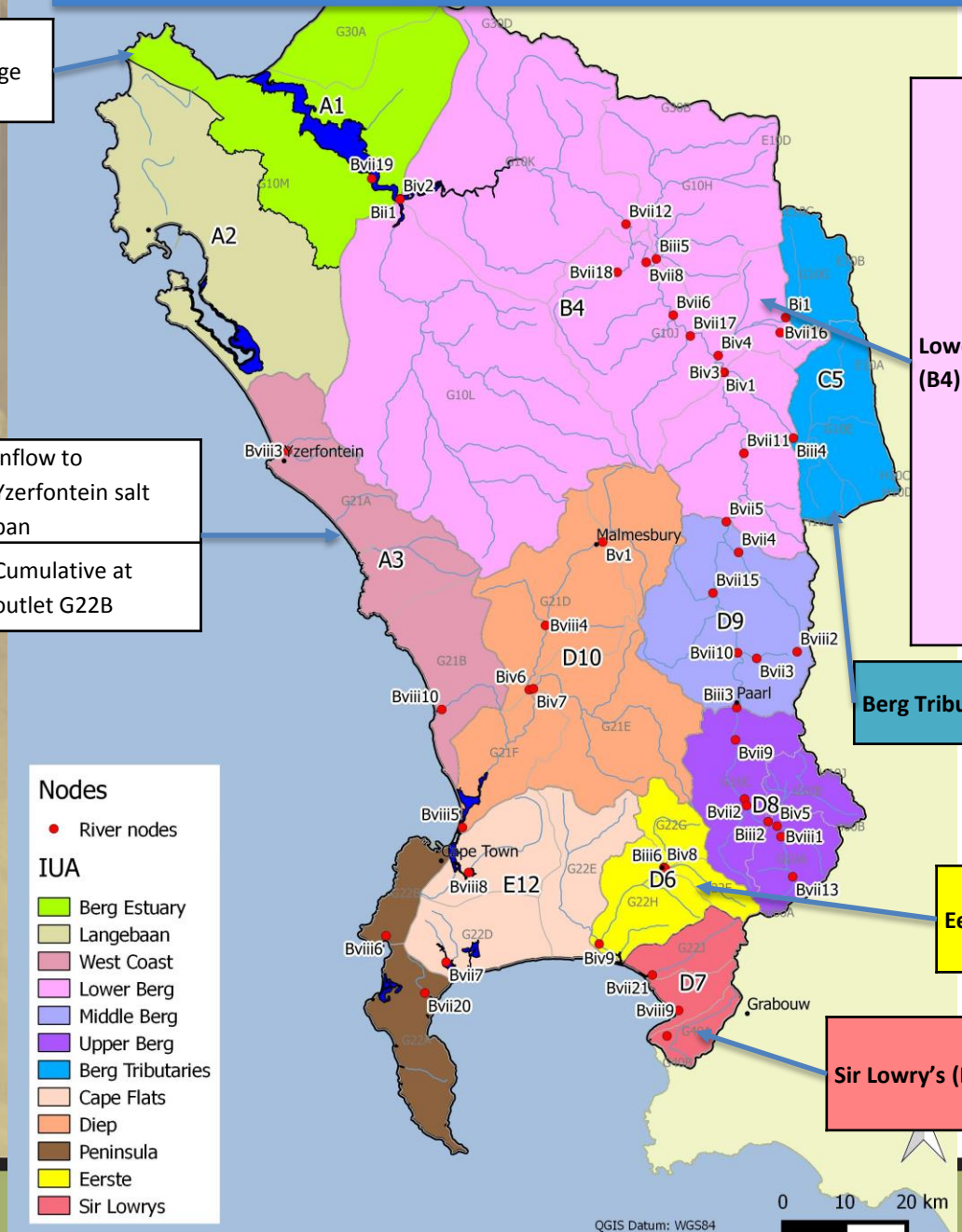
Step 1: Delineate catchment & describe status quo



1. Socio-economic Zones

Socio-economic Zone	Zone Code
West Coast	A
Lower Berg	B
Tulbagh Fruit Area	C
Winelands	D
Cape Town	E

Step 1: Delineate catchment & describe status quo



River Nodes: 47

Berg Estuary (A1)	Bvii19	Gauge

West Coast (A3)	Bviii3	Inflow to Yzerfontein salt pan
	Bviii10	Cumulative at outlet G22B

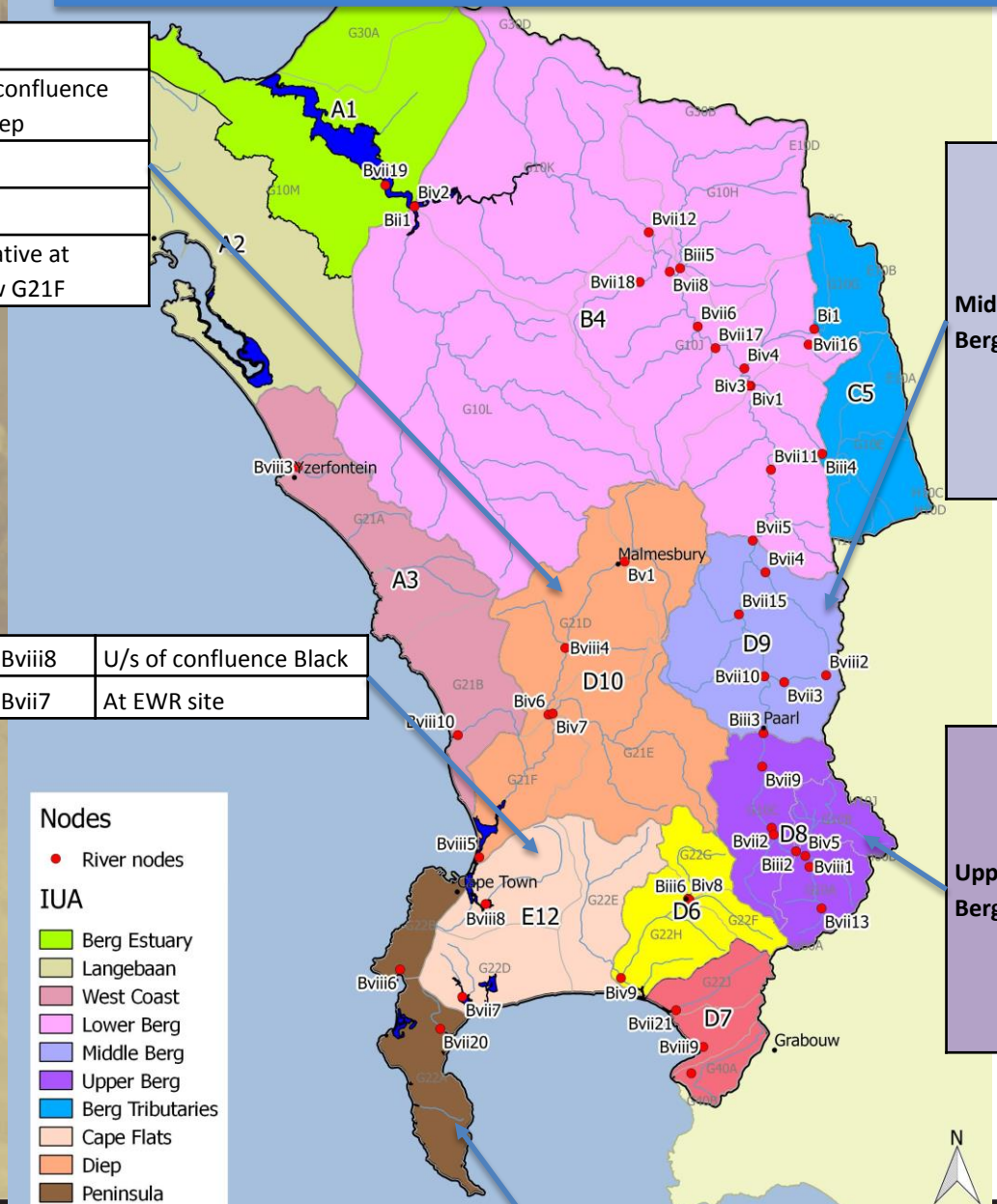
Lower Berg (B4)	Biv3	U/s of confluence with Berg
	Biv1	U/s of confluence Klein-Berg
	Bvii16	Gauge
	Biv4	U/s of confluence with Berg
	Bvii17	Gauge
	Bvii6	D/s of EWR 4, at gauging weir G1H013
	Biii5	At gauging weir G1H035
	Bvii8	U/s Misverstand reservoir, d/s confluence with Matjies
	Bvii18	Gauge
	Bvii12	3.5 km d/s of Misverstand reservoir, at EWR 5
	Bii1	U/s of confluence with Berg
	Biv2	U/s of confluence with Sout, head of estuary

Berg Tributaries (C5)	Biii4	At gauging weir G1H008
	Bi1	At gauging weir G1H028

Eerste (D6)	**Biii6**	
	Biv8	
	Biv9	U/s confluence Eerste

Sir Lowry's (D7)	Bvii21	Town
	Bviii9	Cumulative at outlet G22K
	Bvii22	Gauge

Step 1: Delineate catchment & describe status quo



Diep (D10)		
	Bv1	
	Bviii4	U/s of confluence with Diep
	Biv6	
	Biv7	
	Bviii5	Cumulative at outflow G21F

Middle Berg (D9)		
	Bviii2	**At EWR 6 d/s of confluence with Pombers**
	Bvii3	North of Wellington, G1H037
	Bvii10	D/s of confluence Kromme, at gauging weir G1H015
	Bvii15	Gauge
	Bvii4	At gauging weir G1H041
	Bvii5	At gauging weir G1H036 and u/s of EWR 3

Cape Flats (E12)		
	Bviii8	U/s of confluence Black
	Bvii7	At EWR site

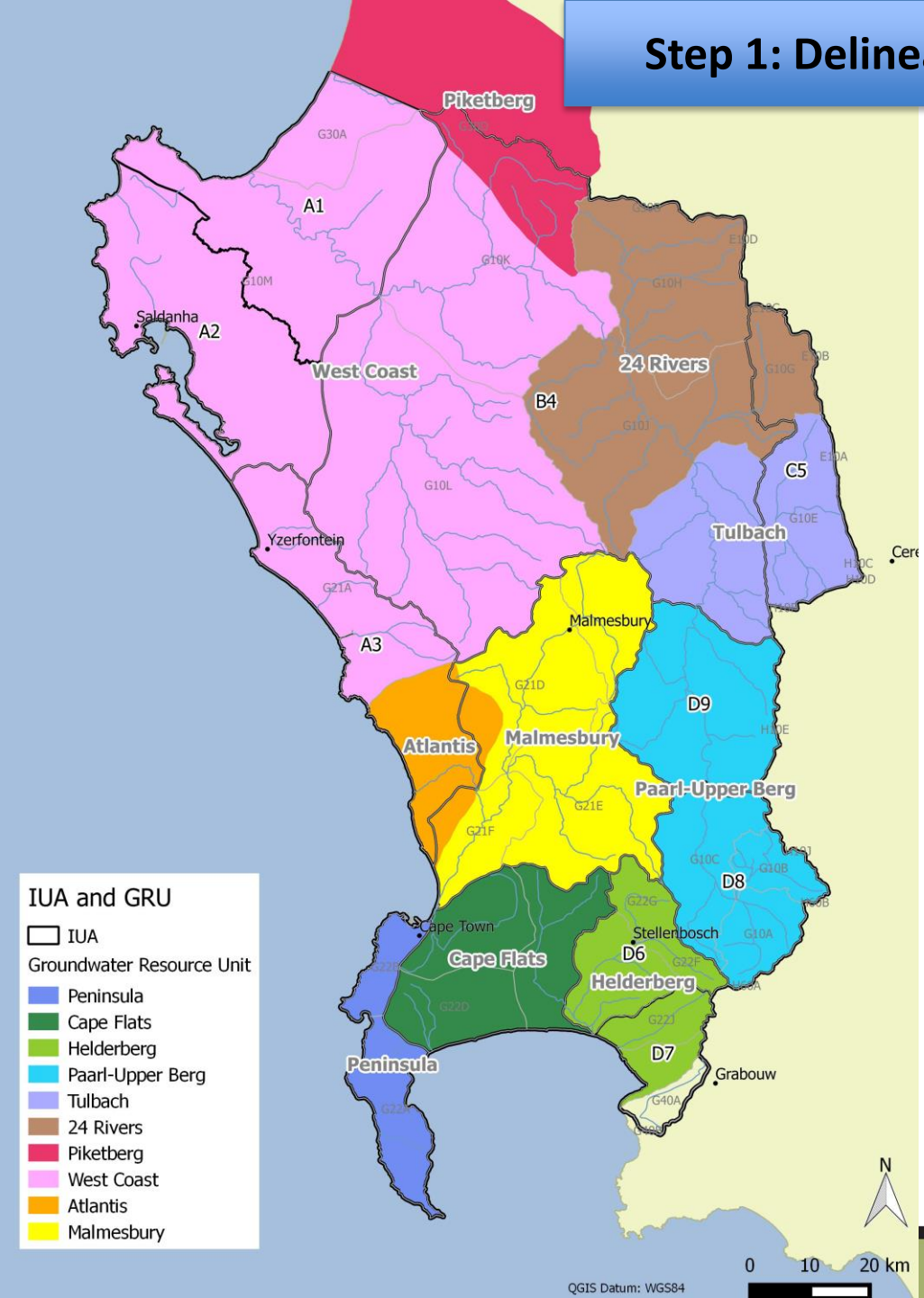
Upper Berg (D8)		
	Bvii13	Gauge
	Bviii1	D/s of Berg River dam at EWR 1
	Biv5	U/s of confluence with Berg
	Biii2	U/s of confluence with Berg
	Bvii14	Gauge
	Bvii2	Skuifraam pump station area
	Bvii9	U/s of Paarl
	Biii3	At gauging weir G1H020

Nodes
- River nodes

IUA
- Berg Estuary
- Langebaan
- West Coast
- Lower Berg
- Middle Berg
- Upper Berg
- Berg Tributaries
- Cape Flats
- Diep
- Peninsula
- Eerste
- Sir Lowrys

Peninsula (E11)		
	Bviii6	At EWR site
	Bvii20	Town

Step 1: Delineate catchment & describe status quo

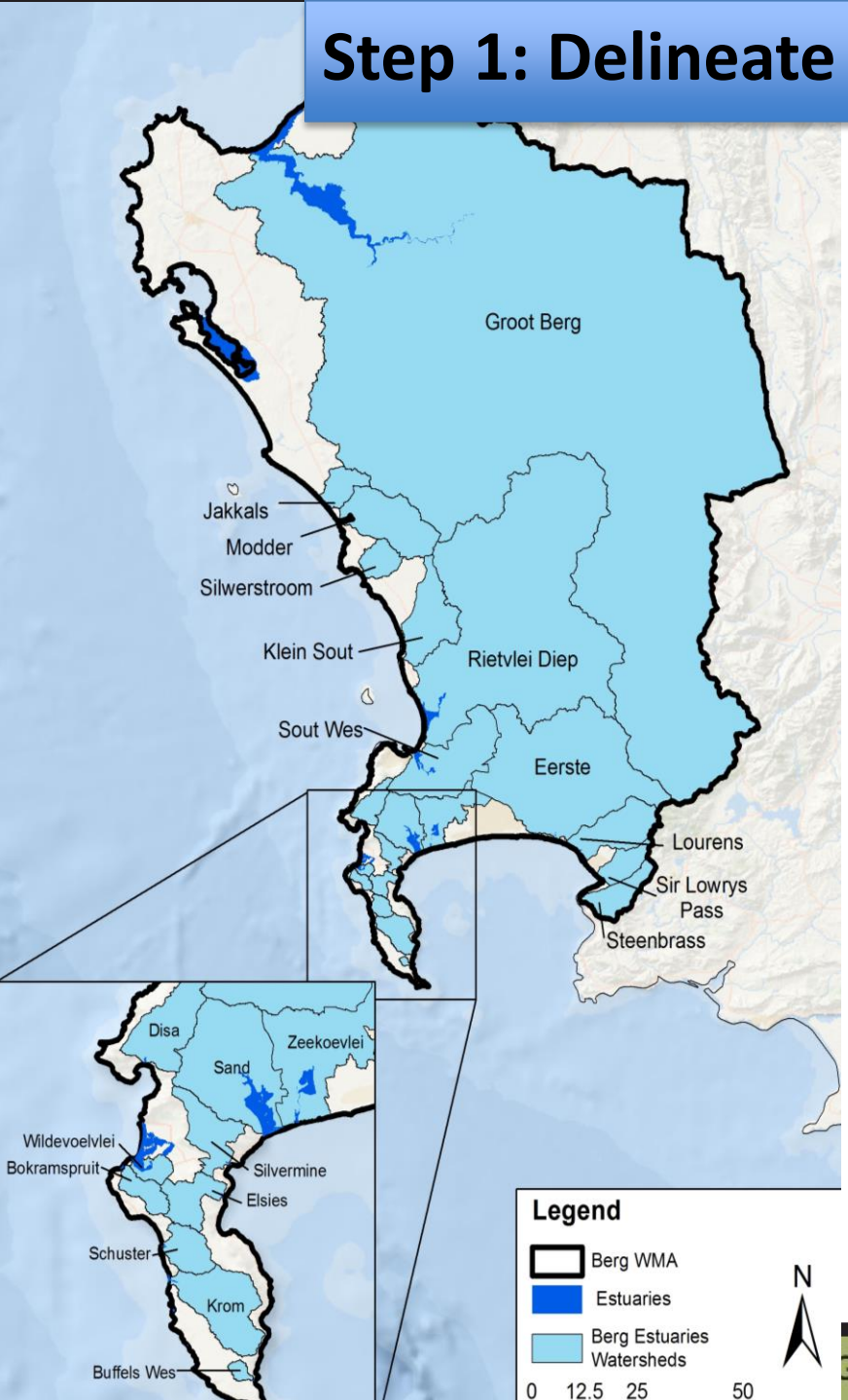


2. Resource Units

Groundwater RUs: 10

GRU	IUA	Quaternary
Peninsula	Peninsula (E11)	G22A and G22B
Cape Flats	Cape Flats (E12)	G22C, G22D and G22E
Helderberg	Eerst (D6) and Sir Lowry's (D7)	G22G; G22H; G22K and G22J
Paarl-Upper Berg	Berg Tributaries (D8) and Upper Berg (D9)	G10A; G10B; G10C and G10D
Tulbagh Valley	Middle Berg (B4) and Berg Tributaries (C5)	G10E and G10F
24 Rivers	Middle Berg (B4)	G10G; G10H and G10J
Piketberg	Middle Berg (B4)	G30A and G30D
West Coast	Berg Estuary (A1)	G10K; G10M; G10L and G21A
Atlantis	West Coast (A3)	G21B
Malmesbury	Diep (D10)	G21C; G21D and G21E

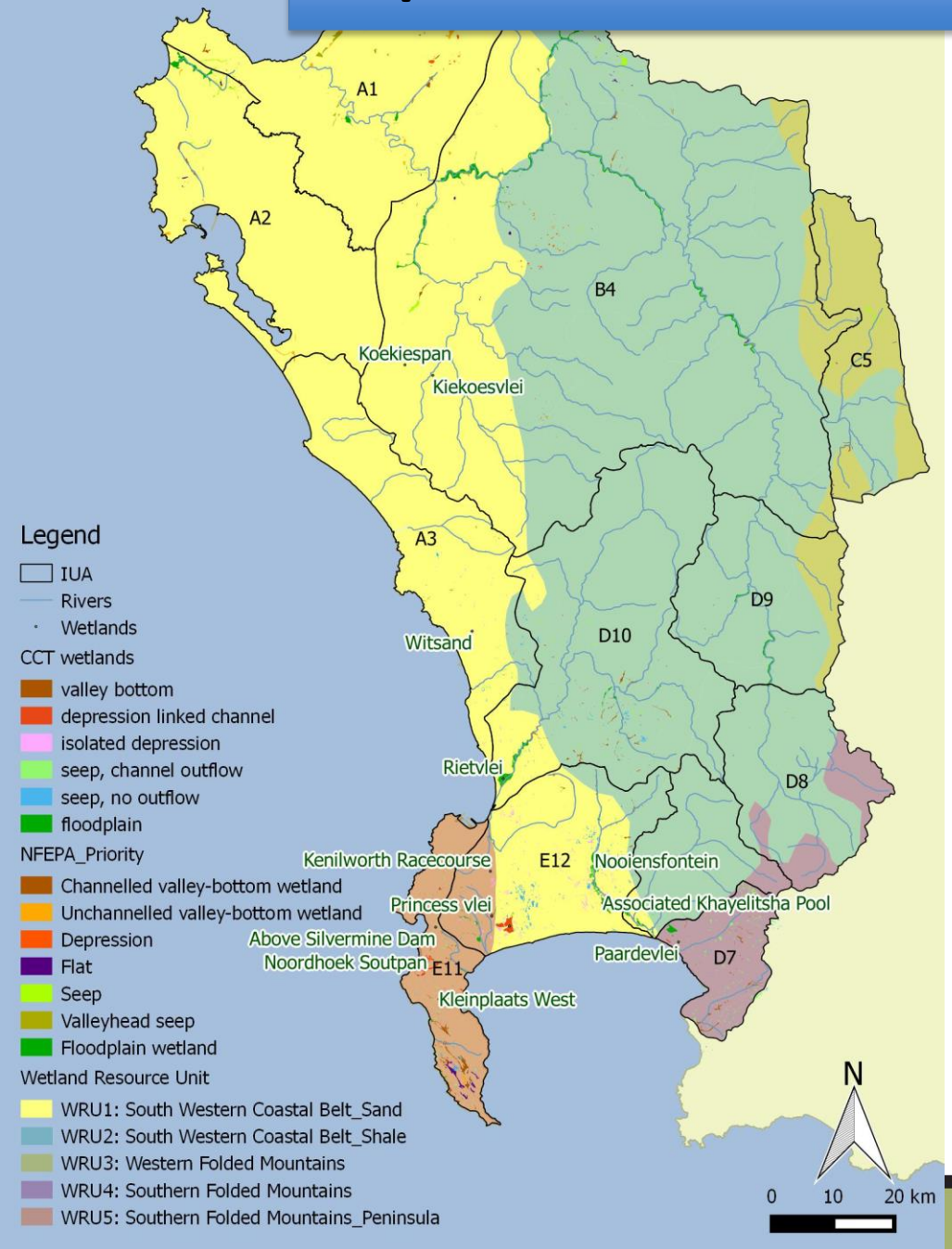
Step 1: Delineate catchment & describe status quo



2. Resource Units: Estuary RUs

Estuary	Type Whitfield (1992)
Berg (Groot)	Permanently open
Langebaan	Estuarine Bay
Rietvlei/Diep	Temporarily open
Wildevöelvlei	Temporarily open
Sand	Temporarily open
Zeekoe	Permanently open
Eerste	Temporarily open
Lourens	Temporarily open

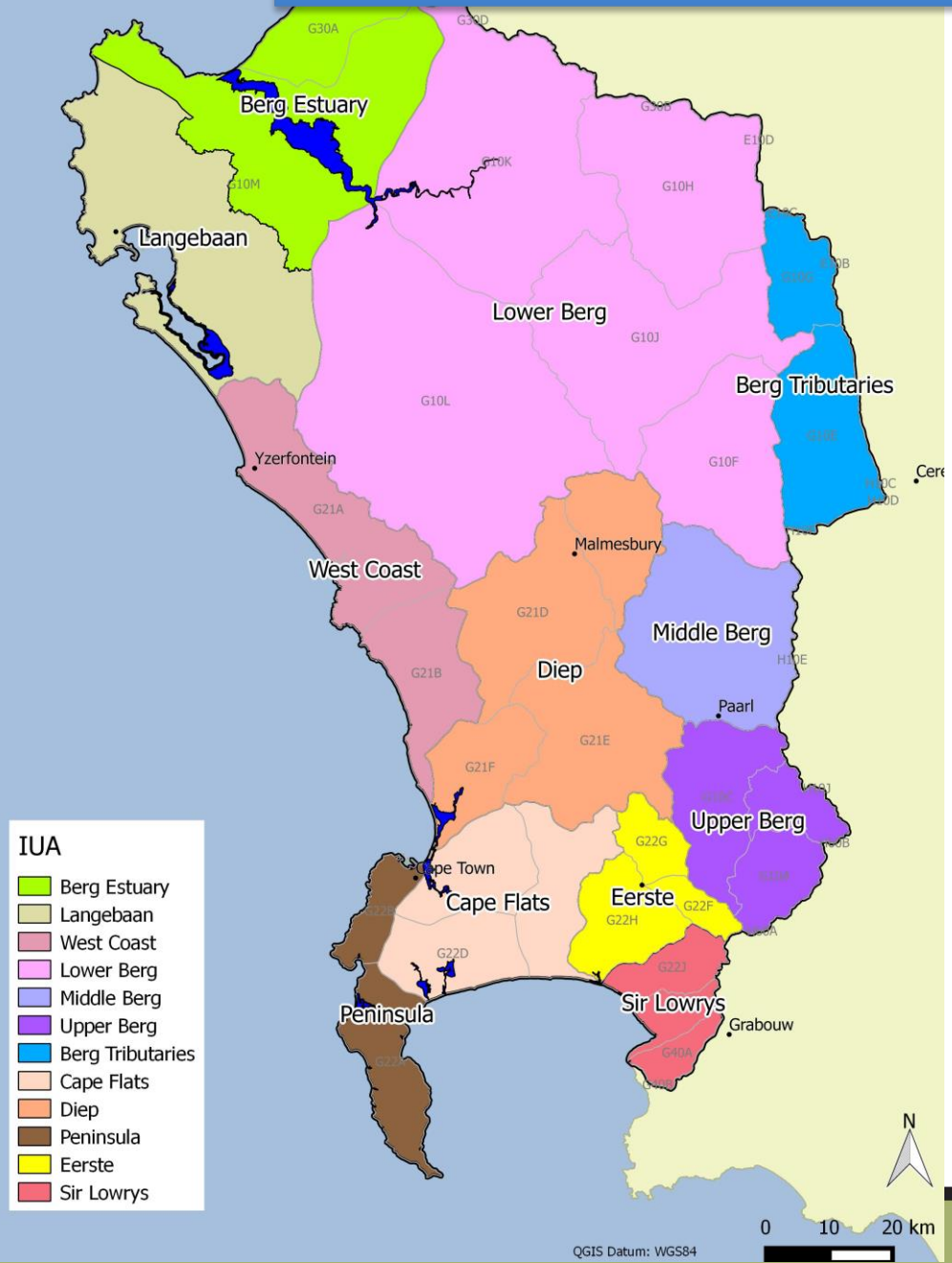
Step 1: Delineate catchment & describe status quo



2. Resource Units: Wetland RUs

Wetland Resource Unit	IUA
South Western Coastal Belt_Sand	Berg Estuary (A1)
	Langebaan (A2)
	Wes Coast (A3)
	Cape Flats (E12)
	Lower Berg
	Diep
South Western Coastal Belt_Shale	Lower Berg
	Diep
	Middle Berg
	Upper Berg
	Eerste
Western Folded Mountains	Berg Tributaries
Southern Folded Mountains	Upper Berg
	Sir Lowry's
Southern Folded Mountains_Peninsula	Cape Flats
	Peninsula

Step 1: Delineate catchment & describe status quo



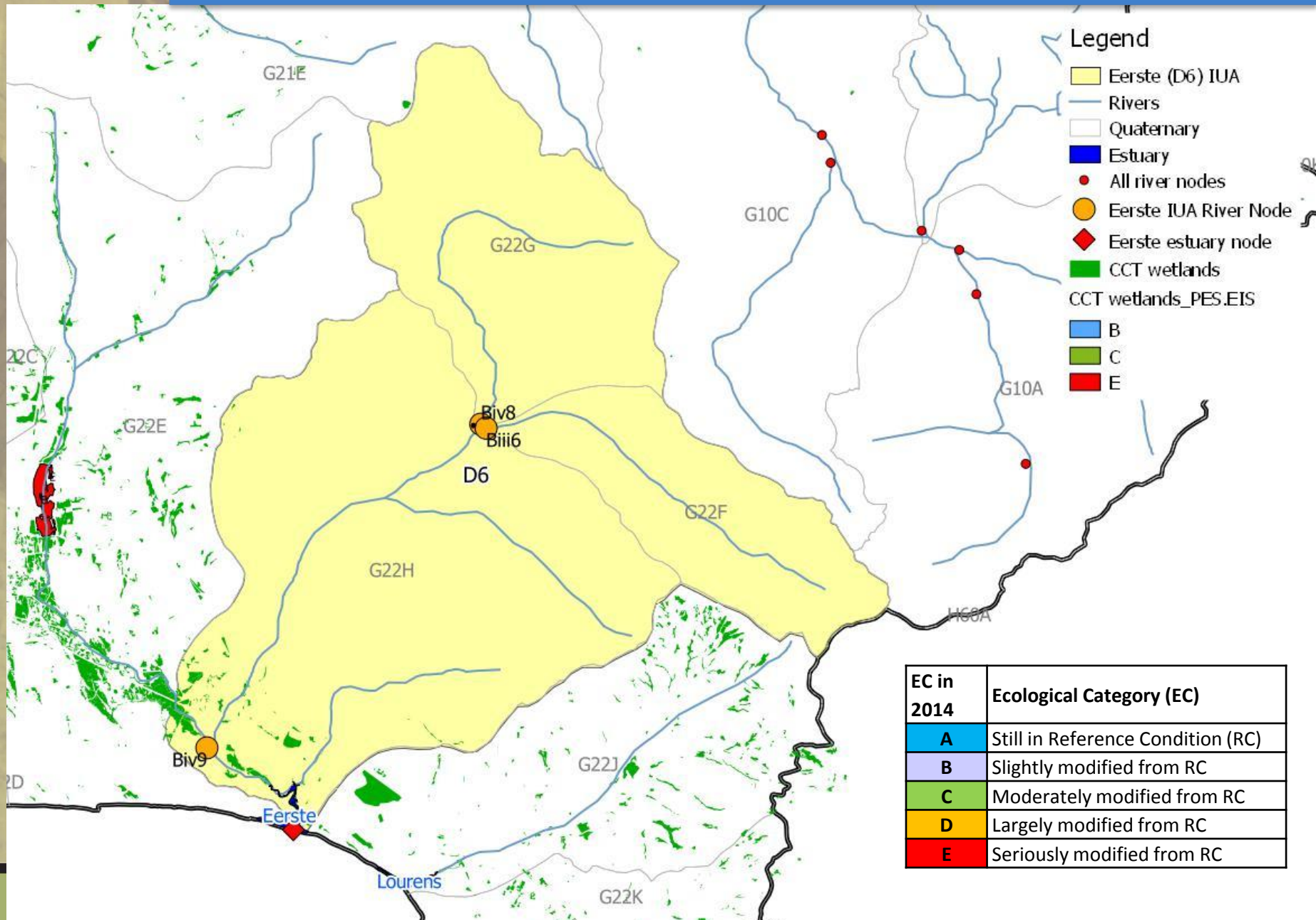
3. Integrated Units of Analysis:

12 IUAs

IUA Name	IUA Code
Berg Estuary	A1
Langebaan	A2
West Coast	A3
Lower Berg	B4
Berg Tributaries	C5
Eerste	D6
Sir Lowry's	D7
Upper Berg	D8
Middle Berg	D9
Diep	D10
Peninsula	E11
Cape Flats	E12

Catchment vision

Status Quo of the Water Resources in the Eerste IUA (D6)



EC in 2014	Ecological Category (EC)
A	Still in Reference Condition (RC)
B	Slightly modified from RC
C	Moderately modified from RC
D	Largely modified from RC
E	Seriously modified from RC

Step 2: Link Value & Condition of Water Resource

WMA Visioning

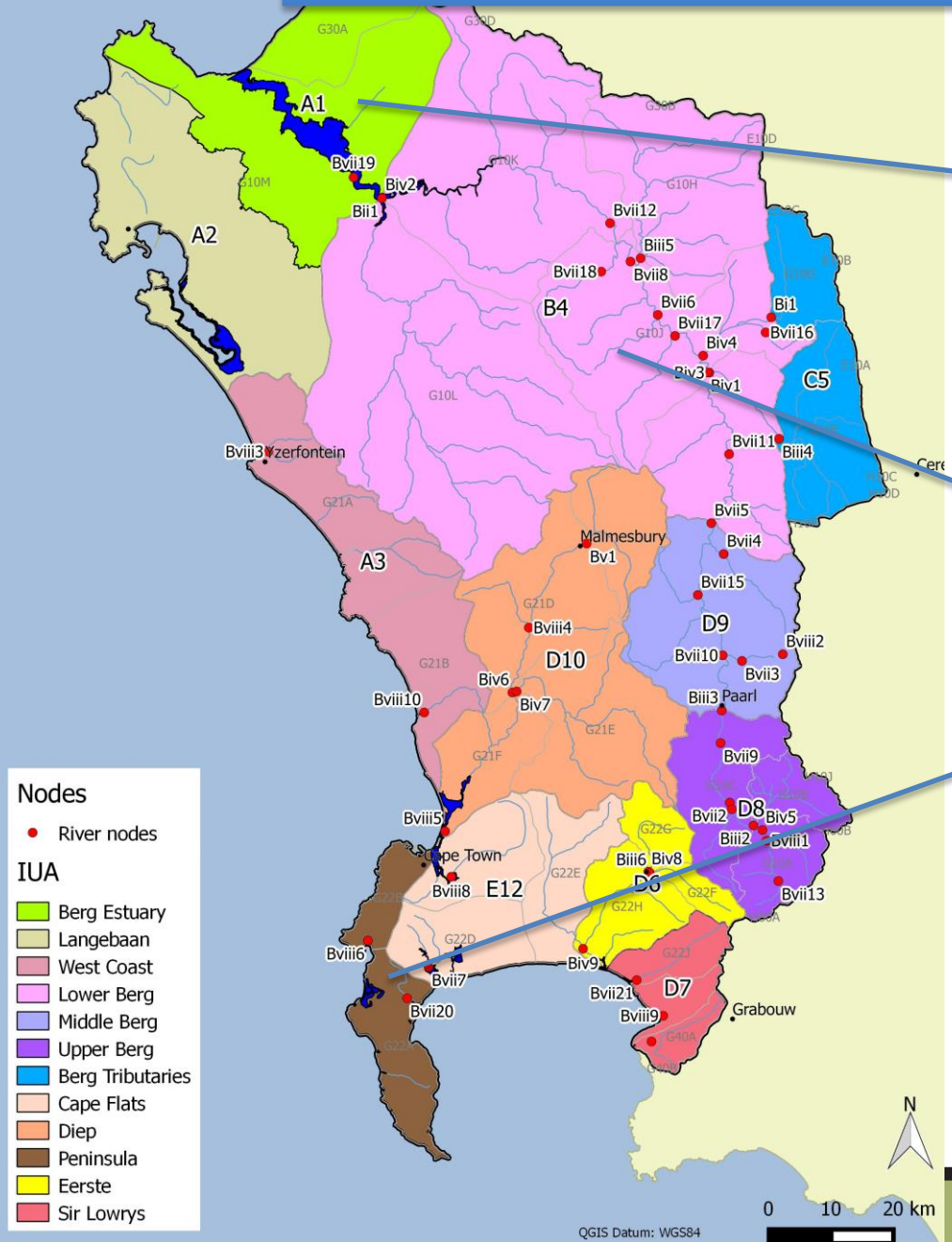
Forms part of Step 2 – Linking economic & Social Value, to help guide the formulation of the scenarios

e.g. Vision of the Western Cape Sustainable Water Plan:
Sustainable water management for growth and development in the Western Cape, without compromising ecological integrity."

VISION: "Sustainable water management for growth and development in the Berg catchment, without compromising ecological integrity."

Scenarios: PSC vision for each IUA

Step 2: Link Value & Condition of Water Resource



Vision per IUA

<u>i.e. IUA A1: Berg Estuary</u>

As a fisherman I would like to see the estuary maintained to increase my fish yield.

<u>i.e. IUA B4: Lower Berg</u>

As a farmer it is critical that the salinity of the Berg River stays below a certain level.

<u>i.e. IUA E1: Peninsula</u>

As a representative of the City I would like to see more conservation measures in place to conserve wetlands in Silvermine.

Link Value & Condition of Water Resource

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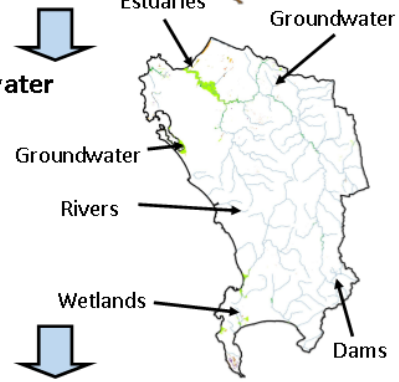

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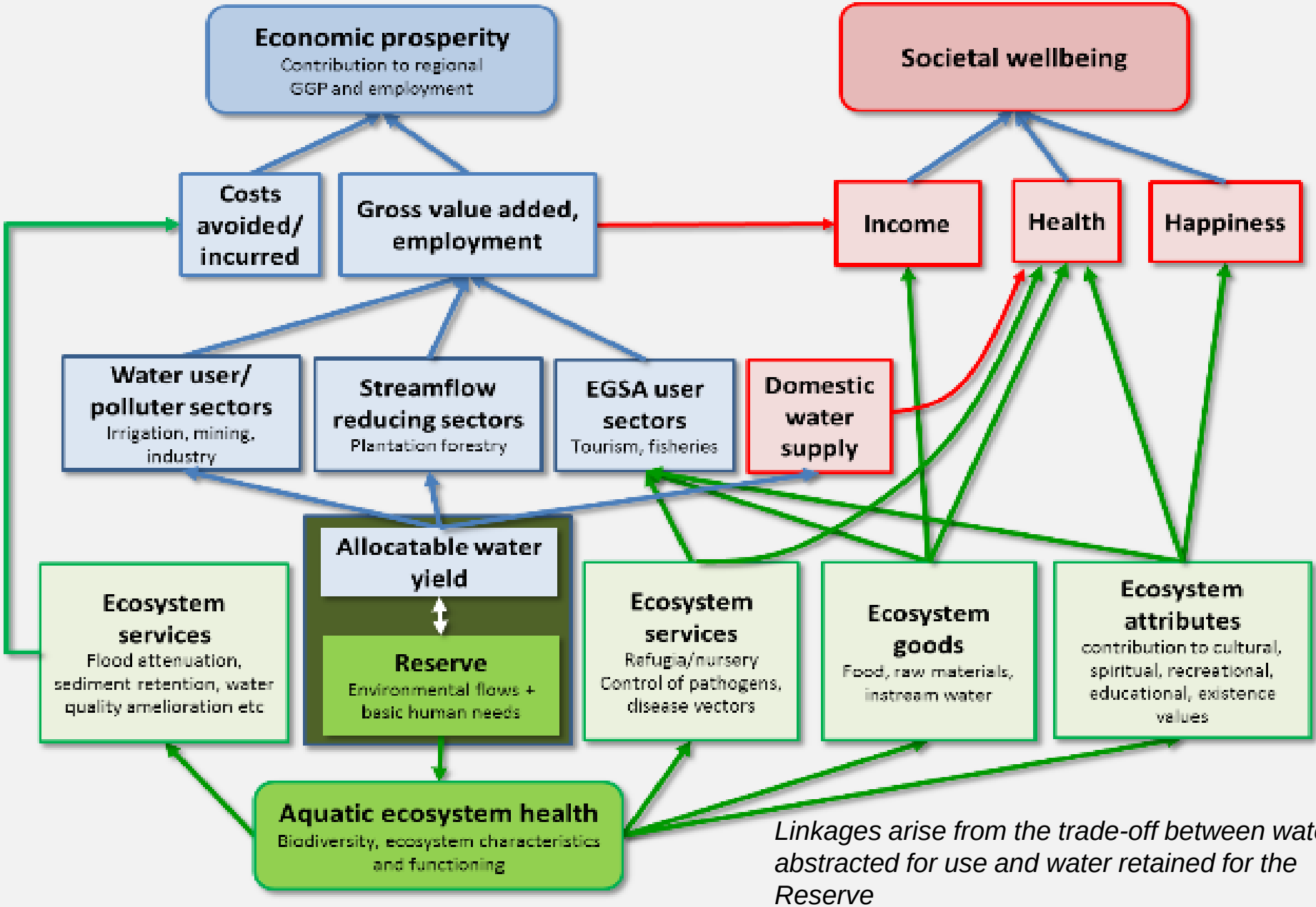
Step 2: Link Value & Condition of Water Resource

- How to link **Economics** & **Social Value**?
  - Value:
    - Social
    - Economic
  - Condition:
    - Water resource state
    - Water quantity & quality
    - Aquatic ecosystem

Need to estimate the relationships between water use and economic outputs as a result of production in water user sectors, stream flow reducing sectors & sectors relying on ecosystem services

- What are EGSAs?
  - Ecosystem Goods, Services and Attributes
  - Ecosystems offer a range of goods, services and attributes that contribute to the economy and human wellbeing

Step 2: Link Value & Condition of Water Resource



Linkages arise from the trade-off between water abstracted for use and water retained for the Reserve

Step 2: Link Value & Condition of Water Resource

The Objectives of Step 2 are:

- Identification of Classification scenarios
- Define consequences of:
  - Water quality
  - River (ecological) at key biophysical nodes
    - *evaluating and determining the impact on the Ecological Category (EC) and capacity to supply ecosystem services*
  - Economic
    - *determining sectoral impacts of scenarios on yield and ecosystem services*
  - Socio-economic
    - *determining impacts of any water allocation changes*
- Integrating and evaluating the consequences to provide preliminary Water Resources Classes for stakeholder evaluation

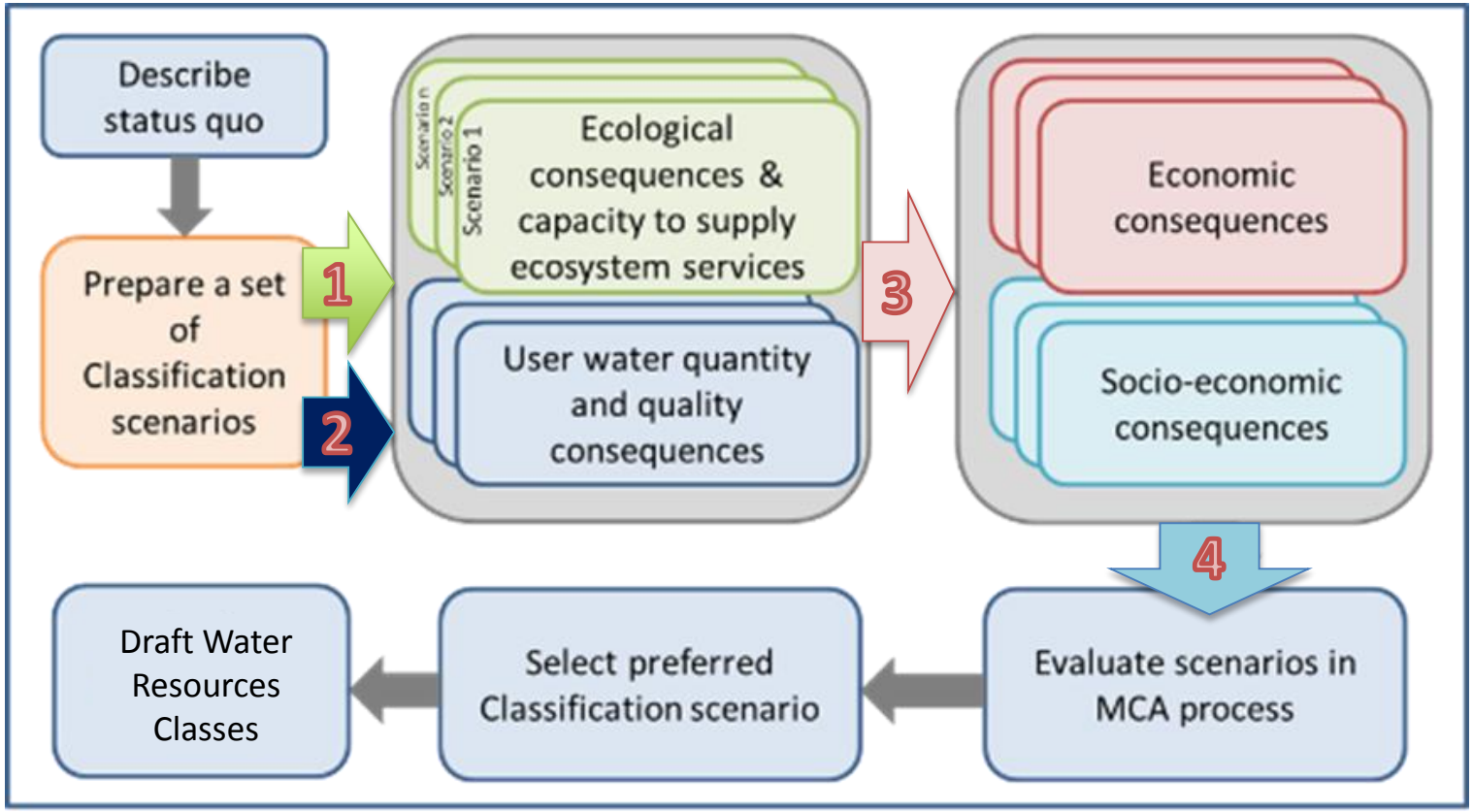
Step 2: Link Value & Condition of Water Resource

Variables considered in linking the value and condition of the Water Resource:

Variable	Components
Ecological	• Overall state of aquatic ecosystem health • % of freshwater conservation targets met • % of estuary conservation targets met
Water Quality for Users	• Empirical impacts on salinity and nutrient enrichment • Qualitative impacts on constituents of concern in a particular IUA
Economic	• Losses / gains in Total Value Added + Costs saved/incurred • Losses/gains in Total Employment
Society	• Impact on livelihoods, • Income to poor households • Intangible benefits to society

Step 2: Link Value & Condition of Water Resource

Framework scenarios



1 Relationships and thresholds between flows and ecosystem condition and EGSA (EWR analysis)

2 Operational assumptions, yield modelling and allocation rules

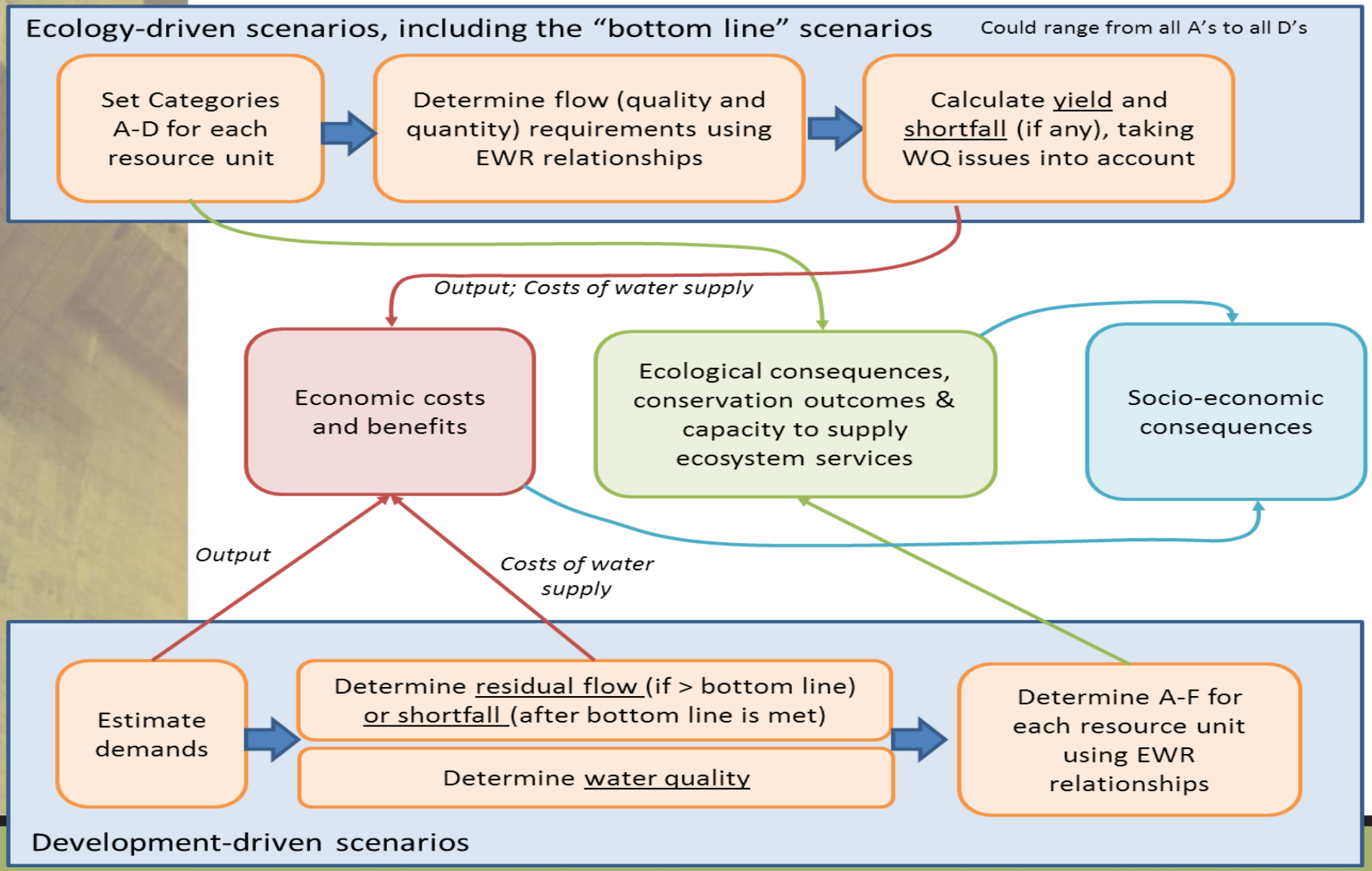
3 Linking ecosystem condition (Class), economic outputs and human wellbeing (models, assumptions and measures)

4 Multi-criteria analysis framework and methods

EGSA: Ecosystem Goods, Services and Attributes **MCA:** Multi-criteria analysis
EWR: Ecological Water Requirements

Step 2: Link Value & Condition of Water Resource

The technical processes for classification scenario assessment involve both ecology driven and development driven scenarios



Step 2: Link Value & Condition of Water Resource

Classification Scenarios Framework

	#	Scenario	Description
1	1A	**Maintain PES + low growth (=Baseline)**	River, wetland and estuary systems are maintained in their present condition.
	1B	**Maintain PES + high growth**	
2	2A	**Bottom line + low growth**	The maximum volume of water is made available for abstraction from the system for economic activities, with the proviso that all water resources are just maintained in a D Ecological Category (the ecological "bottom line")
	2B	**Bottom line + high growth**	
3	3A	**RECs + low growth**	The RECs determined for rivers, wetlands and estuaries based on present health and conservation importance (but without any consideration of socio-economic effects) are applied in thes scenarios.
	3B	**RECs + high growth**	
4	4A	**Targeted cons+ low growth**	High ECs are given to areas of high conservation importance, but for other areas, the ECs can be below REC. It may end up that this scenario set is similar to the above.
	4B	**Targeted cons+ high growth**	
5	5A	**High conservation + low growth**	This scenario represents the situation where conservation targets are met, with an emphasis on a tourism-based economy, with most resources in a good condition and a significant proportion in EC A or B.
	5B	**High conservation + high growth**	

Quantifying the EWR & changes in EGSAs

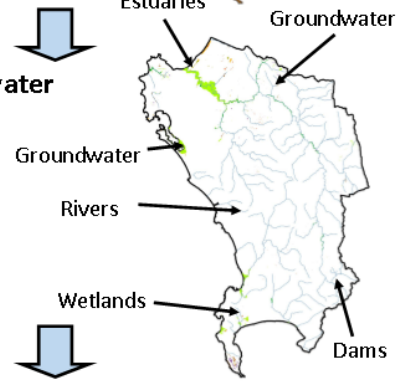
Study Status

STEP 1: DELINEATE CATCHMENT & DESCRIBE STATUS QUO

Outcome: Integrated Units of Analysis with nested sub-units (nodes) and overview of status quo of Water Management Area (WMA) concerning all aspects of water resources.

Socio-economic Zones

Significant water resources



Integrated Units of Analysis

STEP 2: LINK VALUE & CONDITION OF WATER RESOURCE

Outcome: Set of qualitative relationships determining how economic value and social wellbeing are influenced by ecosystem characteristics and the sectoral use of water.

SOCIAL WELL BEING

ECOSYSTEM INDEX

ECONOMIC PROSPERITY

STEP 3

STEP 3: QUANTIFY THE ECOLOGICAL WATER REQUIREMENTS & CHANGES IN EGSAs

Outcome: Quantification of the Ecological Water Requirements (EWRs) and description of changes in non-water quality EGSAs. Provide a table of EWRs for each node at various levels of ecological integrity.

STEP 4: SET AN ECOLOGICALLY SUSTAINABLE BASE SCENARIO & ESTABLISH STARTER SCENARIOS

Outcome: Provide a ESBC and establish starter catchment configuration scenarios. This scenario will give lowest feasible level of protection required for sustainable use of entire catchment.

STEP 5: EVALUATE SCENARIOS WITHIN INTEGRATED WATER RESOURCE MANAGEMENT PROCESS

Outcome: Evaluate scenarios within IWRM process so that subset of catchment configuration scenarios can be put forward for stakeholder evaluation

STEP 6: EVALUATE SCENARIOS WITH STAKEHOLDERS

Outcome: Evaluate scenarios with stakeholders and decide upon an agreed upon configuration short-list for the Minister's consideration. This is an iterative process between step s 5 and 6.

STEP 7: GAZETTE WATER RESOURCE CLASS CONFIGURATIONS

Outcome: A Water Resource Class configuration (and associated RQOs) for the entire catchment is published by the Minister in the Government Gazette as required in the National Water Act of 1998.

Step 3: Quantifying the EWR & changes in EGSAs

- What is the **Ecological Water Requirement (EWR)?**
  - In terms of the National Water Act (Act 36 of 1998) calculation of the Reserve is a part of the Classification process
  - The Reserve refers to the **Quantity** & **Quality** of water required to achieve certain Ecological state and Basic Human Needs requirements
  - **EWRs** are determined for different ecological categories ranging from A (close to natural) to F (heavily degraded)
  - **Reserves** can have low, medium or high confidence
  - Factors influencing *confidence* are:
    - Magnitude of the impact of the proposed use
    - The ecological importance and sensitivity (EIS) of the resource under consideration
    - The present ecological state (PES) of the resource
    - The biodiversity status of the related ecosystems that could be impacted
    - The existing use and potential for conflict amongst users

The EWRs will be used in STEP 4 and 5 to determine the ecological impacts under different classification scenarios.

Step 3: Quantifying the EWR & changes in EGSAs

- Step 3 provides the introductory tasks for Steps 4 & 5
  - Step 3: Quantify EWR at each node
    - Step 3a: Identify nodes to which existing Reserve data can be extrapolated, and extrapolate
    - Step 3b: Develop rule curves, summary tables and modified time series for all nodes for all categories
    - Step 3c: Quantify changes in relevant ecosystem components, functions & attributes for each category for each node
  - Step 4: Set baseline for ecological sustainability
  - Step 5: Evaluate scenarios within Integrated Water Resource Management framework

Step 3 provides information to be used in later steps of classification procedure in order to assess impacts of changes in catchment configuration scenarios

Step 3: Quantifying the EWR & changes in EGSAs

- Data on Ecological Water Requirements and changes in the non-water quality Ecosystem Goods, Services and Attributes are used to determine:
  - Flow requirements at individual nodes based on the recommended EC
  - Impact of alternative development scenario on the ecological condition of individual nodes
- Associated impact in terms of changes in Ecosystem Goods, Services and Attributes will then be used to evaluate the impacts of alternative scenarios
- The general approach to the scenario analysis has been described in STEP 2 and will be further developed as part of STEP 4 (Baseline)

The development of current and future development scenarios and the analysis of the potential impact of these scenarios is the next step.

General Discussion

PSC Discussion points

- Study Area Vision linking to individual IUAs vision
- Scenario Evaluation Process
- Preliminary Classification Scenarios