DETERMINATION OF WATER RESOURCE CLASSES AND ASSOCIATED RESOURCE QUALITY OBJECTIVES IN THE THUKELA CATCHMENT

PROJECT STEERING COMMITTEE (PSC) MEETING 2

Presented by:
Golder Associates and Prime Africa

Date: 22 September 2020

Study objective

➢ To determine appropriate Water Resource Classes and Resource Quality Objectives (RQOs) for all significant water resources in the Thukela River catchment area

  ➢ that would facilitate sustainable use of the water resources while maintaining ecological integrity,

  ➢ specifically maintaining or improving the present ecological state of the water resources.
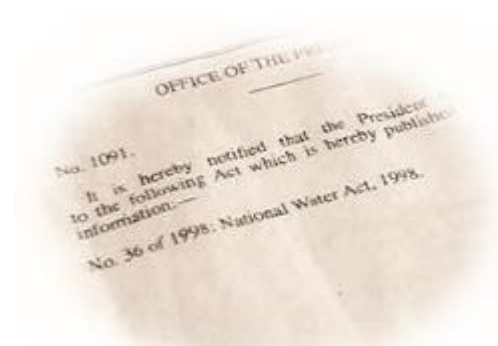
Legal Foundation

➤ *Water Resources* need to be managed so that they are **protected** on one hand and

➤ **utilised** for social and economic development on the other hand.

➤ **The National Water Act** provides decision-making tools to achieve a balance between protecting and utilising water resources.

Protect   **Utilise**

OFFICE OF THE PR...

No. 1091.
It is hereby notified that the President
to the following Act which is hereby publishe...
information.

No. 36 of 1998: National Water Act, 1998.

How does national government determine the level of protection required for a particular water resource?

➤ Very few water sources that are in a natural state and therefore our water resources require protection.

➤ Protection is aimed at ensuring current and future use of water resources

➤ Quantity and quality (overall health)

➤ Different water resources require different levels of protection.

Chapter 3 - Resource Directed Measures (RDM) which together are intended to ensure the comprehensive protection of all water resources. These include:
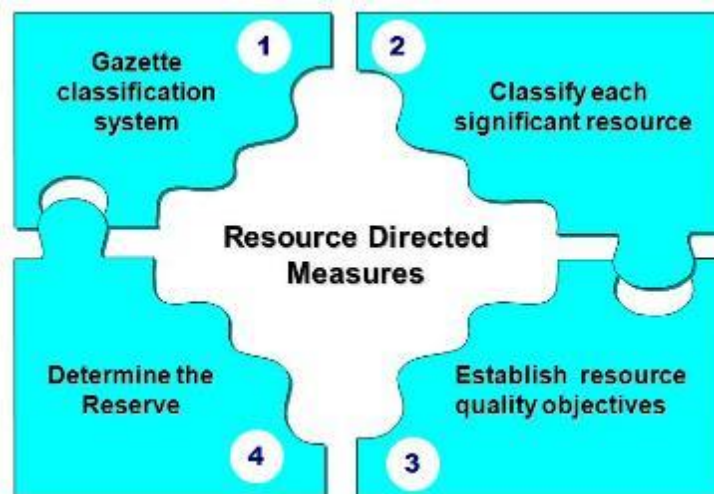
Classifying each major resource

- Rivers,
- Groundwater,
- Wetlands and estuaries.

Each class represents:

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

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

Determining Resource Quality Objectives

Resource quality objectives provide statements about:

- what the quantity of water should be (water level, pattern, timing)

- what the water quality should be (physical, chemical, biological)

- what the condition of the instream and riparian (river bank) habitat should be

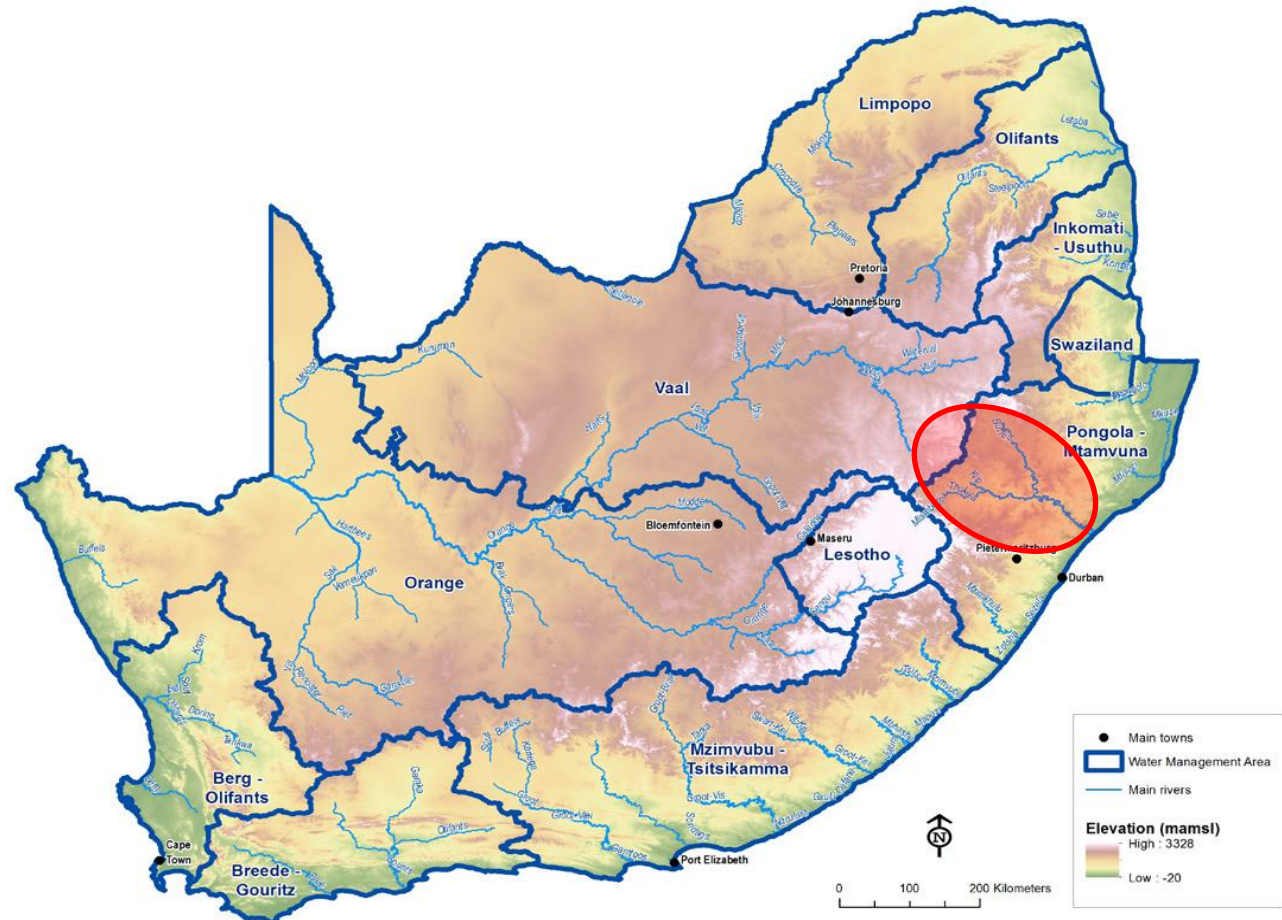- what the condition of the aquatic (water) animal and plant life should be.

STUDY AREA

Thukela catchment

- Pongola to Mtamvuma Water Management Area (WMA 4)
- Largest river system within the WMA
- Catchment drains an area of 29 040km^2
- Two main drainage systems: Upper Thukela and Buffalo rivers

Water Resources

- Tugela River – primary river
- Major surface water resource of SA
- Originates on the 3 050 m high Mont-aux-Sources plateau in the Drakensberg Mountain Range along the border between Lesotho and the KZN
- a funnel shaped catchment with several tributaries
- discharge into the Indian Ocean on the eastern side of catchment (512 km).
- Major tributaries flowing into the Thukela River from the north include:
  - The Klip River, which passes through Ladysmith,
  - The Sundays River, and
  - The Buffalo River, which rises above Newcastle.
- Major tributaries into the Thukela River from the south include:
  - The Little Thukela River,
  - The Bloukrans River,
  - The Bushmans River, passing though Estcourt, and
  - The Mooi River.
- Thukela Estuary
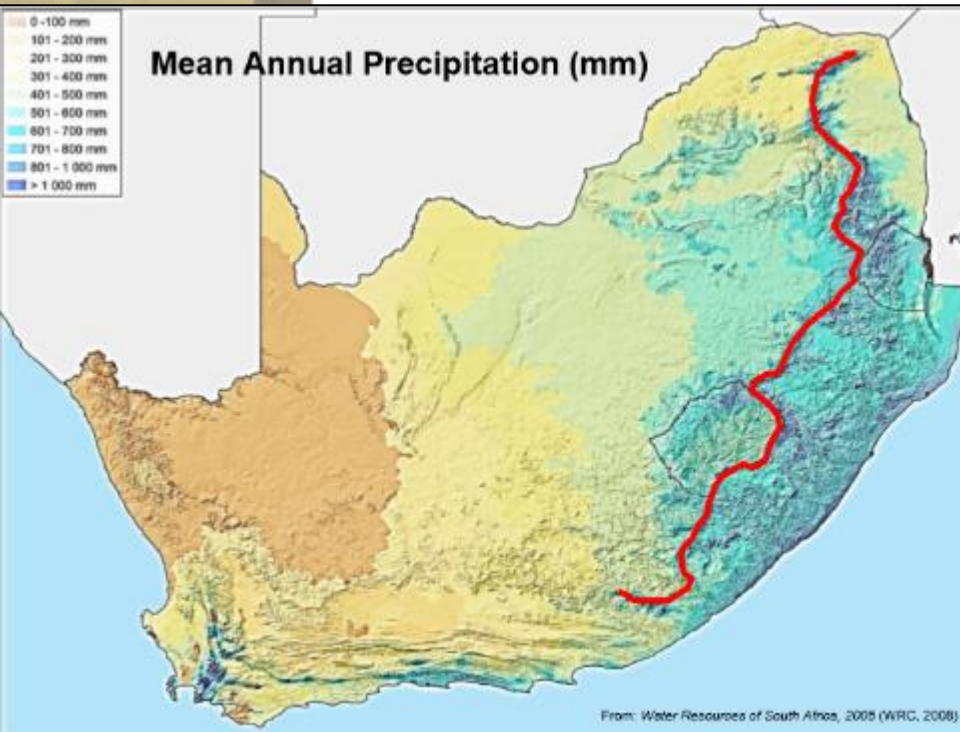- Aquifers – weathered and fractured hard rock systems
- Protected Wetlands

Key sub-catchments
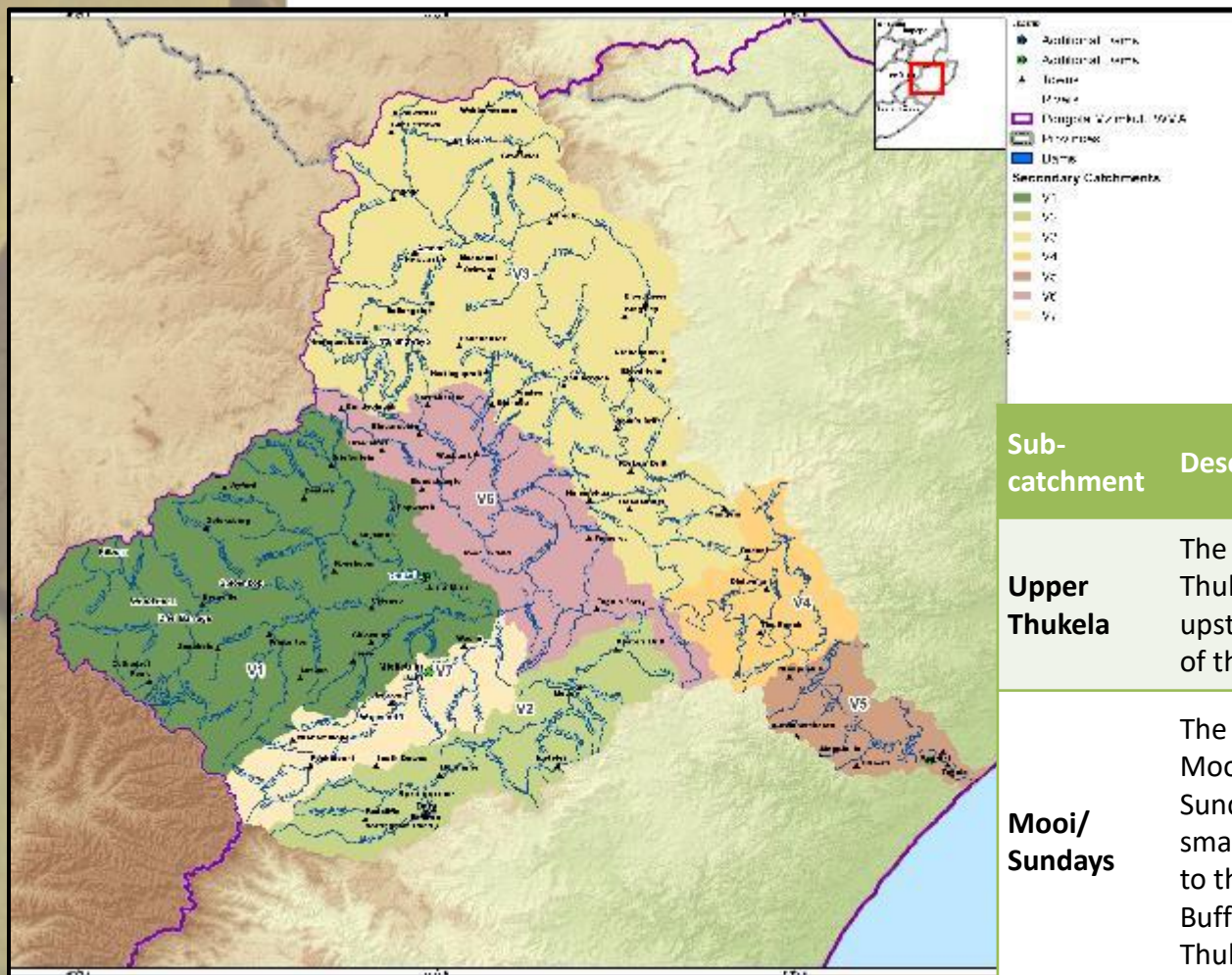
Sub-catchment	Description	Tertiary drainage regions	Catchment area[1] (km²)
Upper Thukela	The catchment of the Thukela River to just upstream of the confluence of the Bushmans River.	V11, V12, V13 and V14	7645
Mooi/ Sundays	The catchment of the Mooi, Bushmans and Sundays River as well as of smaller tributaries, down to the confluence of the Buffalo River with the Thukela River.	V20, V60, V70	8496
Buffalo	The catchment of the Buffalo River.	V31, V32 and V33	9803
Lower Thukela	The catchment of the Thukela River between the confluence of the Buffalo River and the Indian ocean.	V40 and V50	3102

Hydrological characteristics

Mean Annual Precipitation (mm)

From: Water Resources of South Africa, 2005 (WRC, 2008)

- Second highest MAR of 3799 Mm^3/a,

- 9.9% of South Africa's total runoff after the Orange/ Gariep River

- Transfers - 60 to 70 % of yield

Mean Annual Runoff (mm)

From: Water Resources of South Africa, 2005 (WRC, 2008)

- Rainfall average SA = 450mm
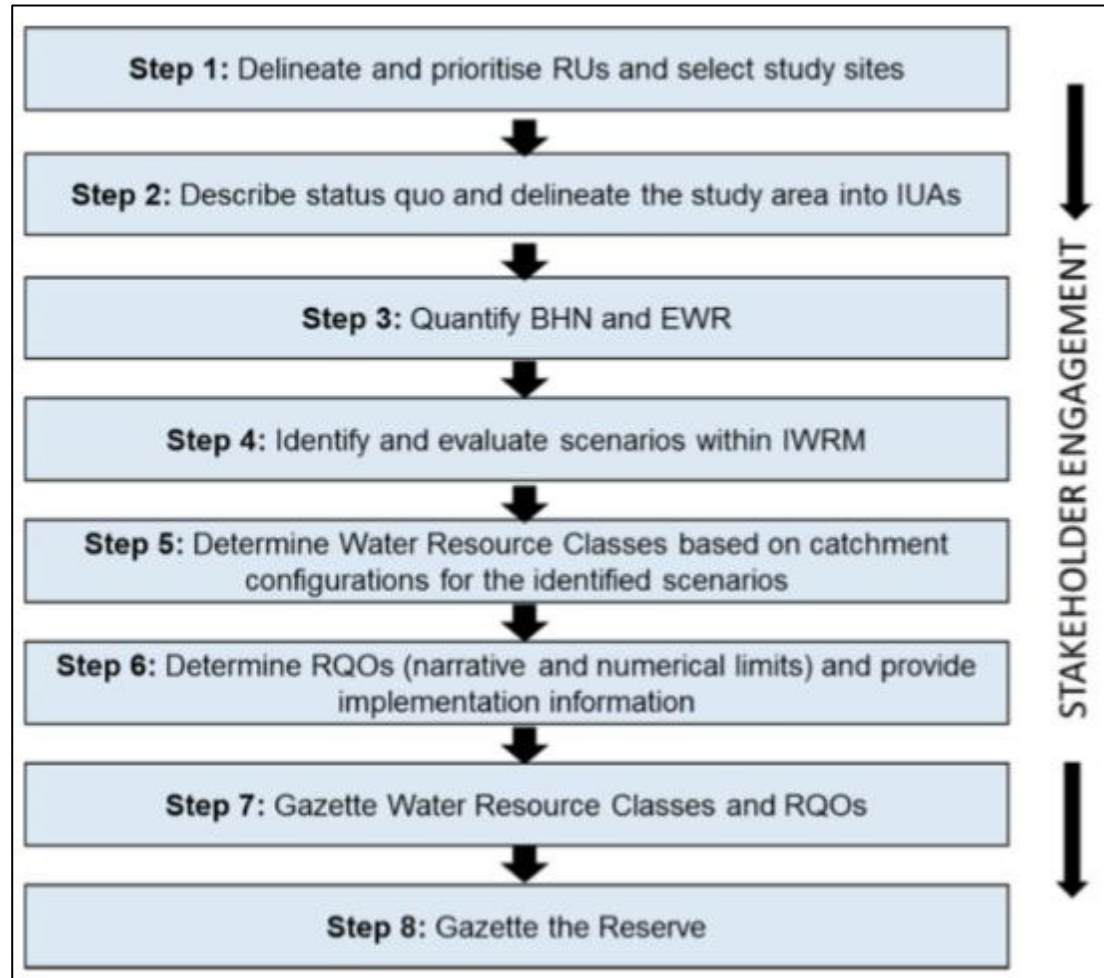
- Thukela ranges = 800 to 1500 mm
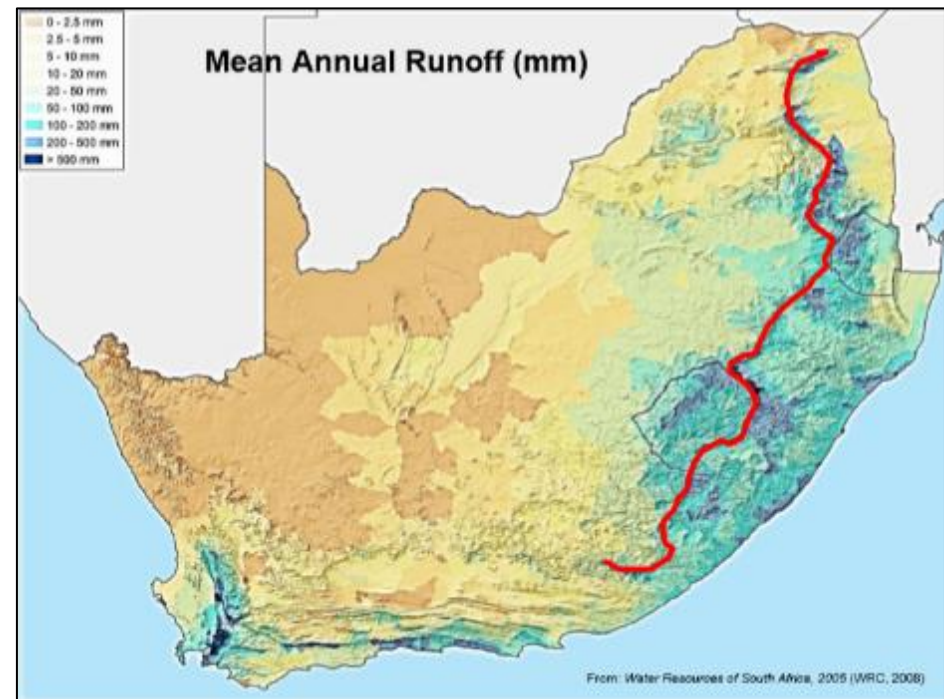
OVERVIEW OF TECHNICAL PROCESS

Key aims of this study

- co-ordinating the implementation of the Water Resource Classification System (WRCS); and
- undertaking the implementation of the RQO determination procedure (7 step process)

- It is noted that the study is linked to the previous Reserves studies and other water resource management initiatives.

- Where the preliminary Reserve is available and relevant, this information is to be adopted and where needed, gaps will be filled.
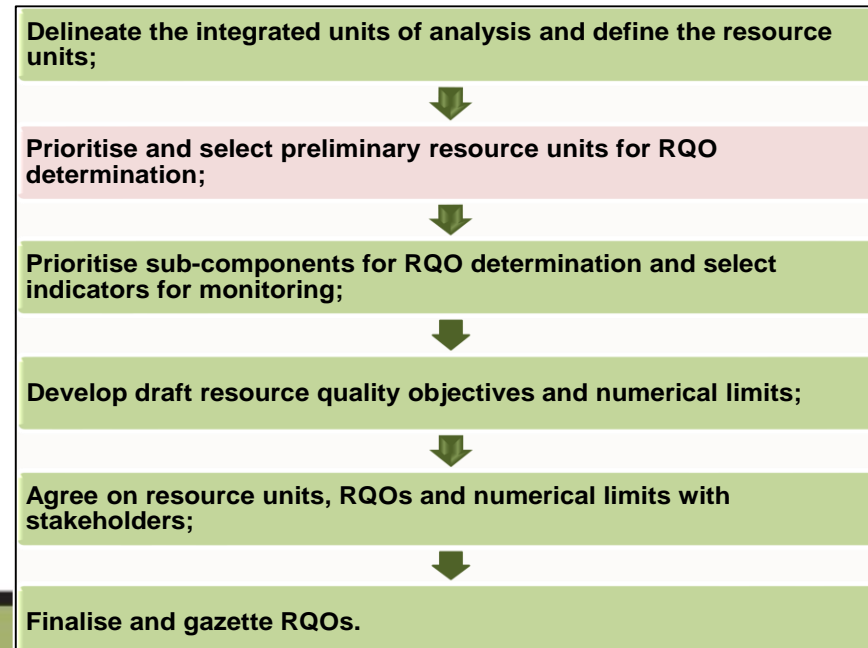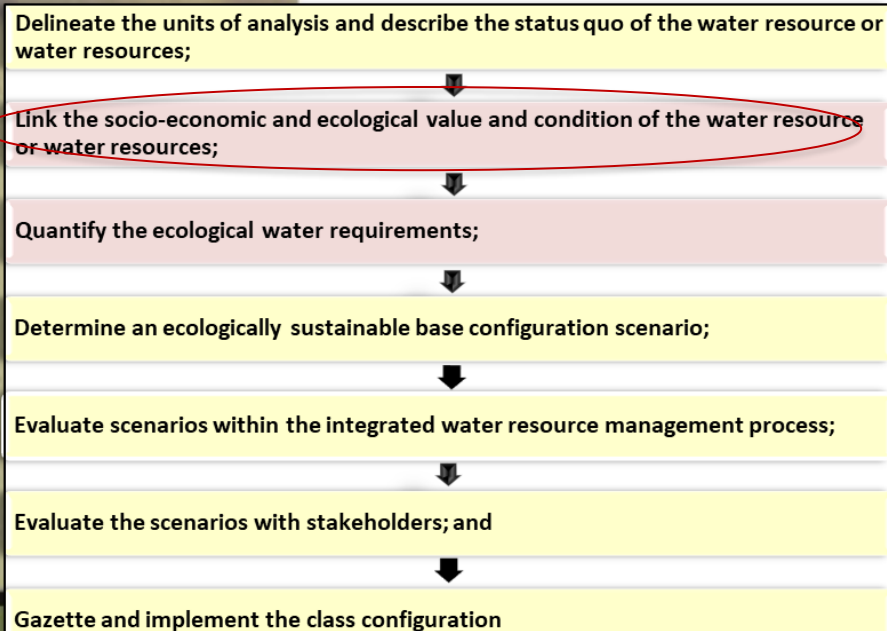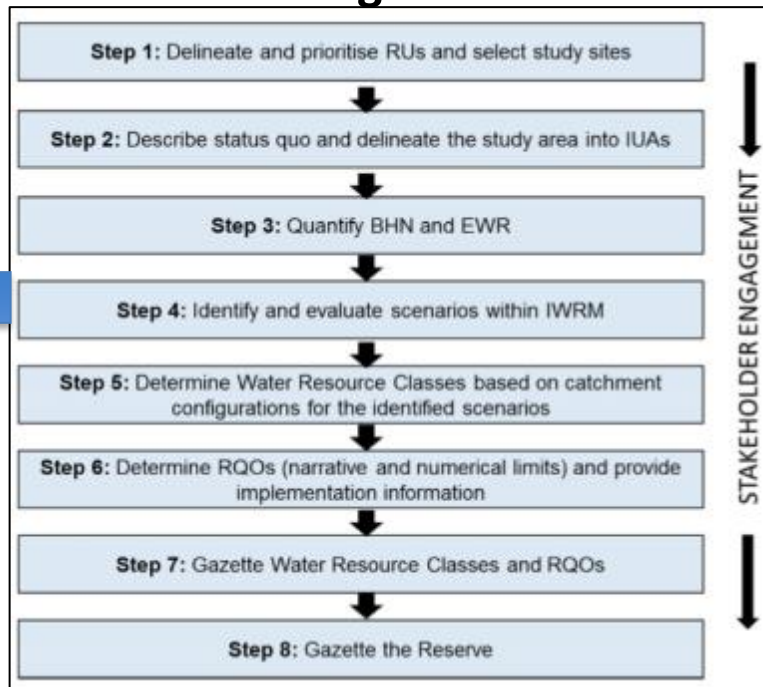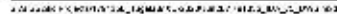
Water Resource Classes and RQOs

Integrated Process

Integrated

Step 1: Delineate and prioritise RUs and select study sites

Step 2: Describe status quo and delineate the study area into IUAs

Step 3: Quantify BHN and EWR

Step 4: Identify and evaluate scenarios within IWRM

Step 5: Determine Water Resource Classes based on catchment configurations for the identified scenarios

Step 6: Determine RQOs (narrative and numerical limits) and provide implementation information

Step 7: Gazette Water Resource Classes and RQOs

Step 8: Gazette the Reserve

STAKEHOLDER ENGAGEMENT

Water Resources Classification

Delineate the units of analysis and describe the status quo of the water resource or water resources;

Link the socio-economic and ecological value and condition of the water resource or water resources;

Quantify the ecological water requirements;

Determine an ecologically sustainable base configuration scenario;

Evaluate scenarios within the integrated water resource management process;

Evaluate the scenarios with stakeholders; and

Gazette and implement the class configuration

Resource Quality Objectives

Delineate the integrated units of analysis and define the resource units;

Prioritise and select preliminary resource units for RQO determination;

Prioritise sub-components for RQO determination and select indicators for monitoring;

Develop draft resource quality objectives and numerical limits;

Agree on resource units, RQOs and numerical limits with stakeholders;

Finalise and gazette RQOs.

Step 1: Integrated Units of Analysis

Purpose of the Meeting

- To present the methods for linking the socio-economic and ecological value and condition of the water resources in the Thukela catchment
  - The Decision-making Framework
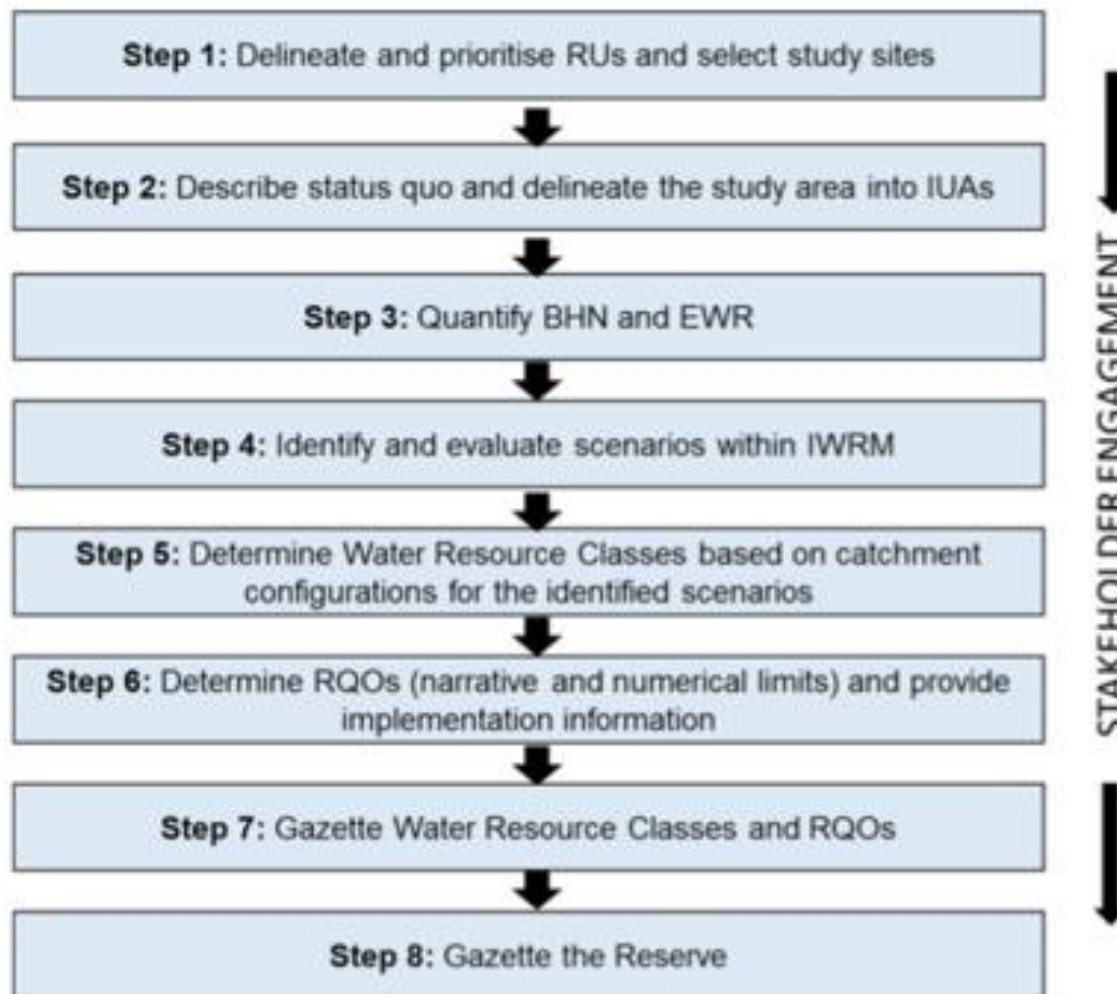- To obtain feedback and input

SOCIO ECONOMIC ANALYSIS

Prime Africa Team

- Resource Economists
  - Jackie Crafford (PhD Environmental Economics)
  - Joe Mulders (MSc Ecology)
  - Dineo Maila (MTech Water Chemistry)
  - Valmak Mathebula (B. Hons. QRA)
  - Karen Eatwell (PhD Genetics)
  - Micah Moynihan (BCom Economics, MPhil Climate Change (in prog))
- Prime Africa has
  - Completed more that 200 resource economics studies across Africa over the past 10 years
  - Completed to previous WRCS studies and was instrumental in the WRCS methodology review by DWS and WRC.

Process

Step 1: Delineate and prioritise RUs and select study sites

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STAKEHOLDER ENGAGEMENT

The Socio-Economic Component

- To determine appropriate Water Resource Classes and Resource Quality Objectives (RQOs) for all significant water resources in the Thukela River catchment area

  - that would facilitate sustainable use of the water resources while maintaining ecological integrity,

  - specifically maintaining or improving the present ecological state of the water resources.

- This is analysed at the hand of various Scenarios (still to be defined), and further, the trade-offs associated with each Scenario.

The Socio-Economic Component

- To **inform decision-making** based on socio-economics
  - Economics does not make the decision … rather, it demonstrates the consequences of making specific decisions
- **Assess trade-offs** using scenarios
  - The decisions we need make here are defined by the Scenarios to be developed for the WMA
- **Link** the changes of management with **impacts on beneficiaries**
  - Use an evidence-based economic analysis that links all the work done by ecologists, hydrologists, engineers and other specialists
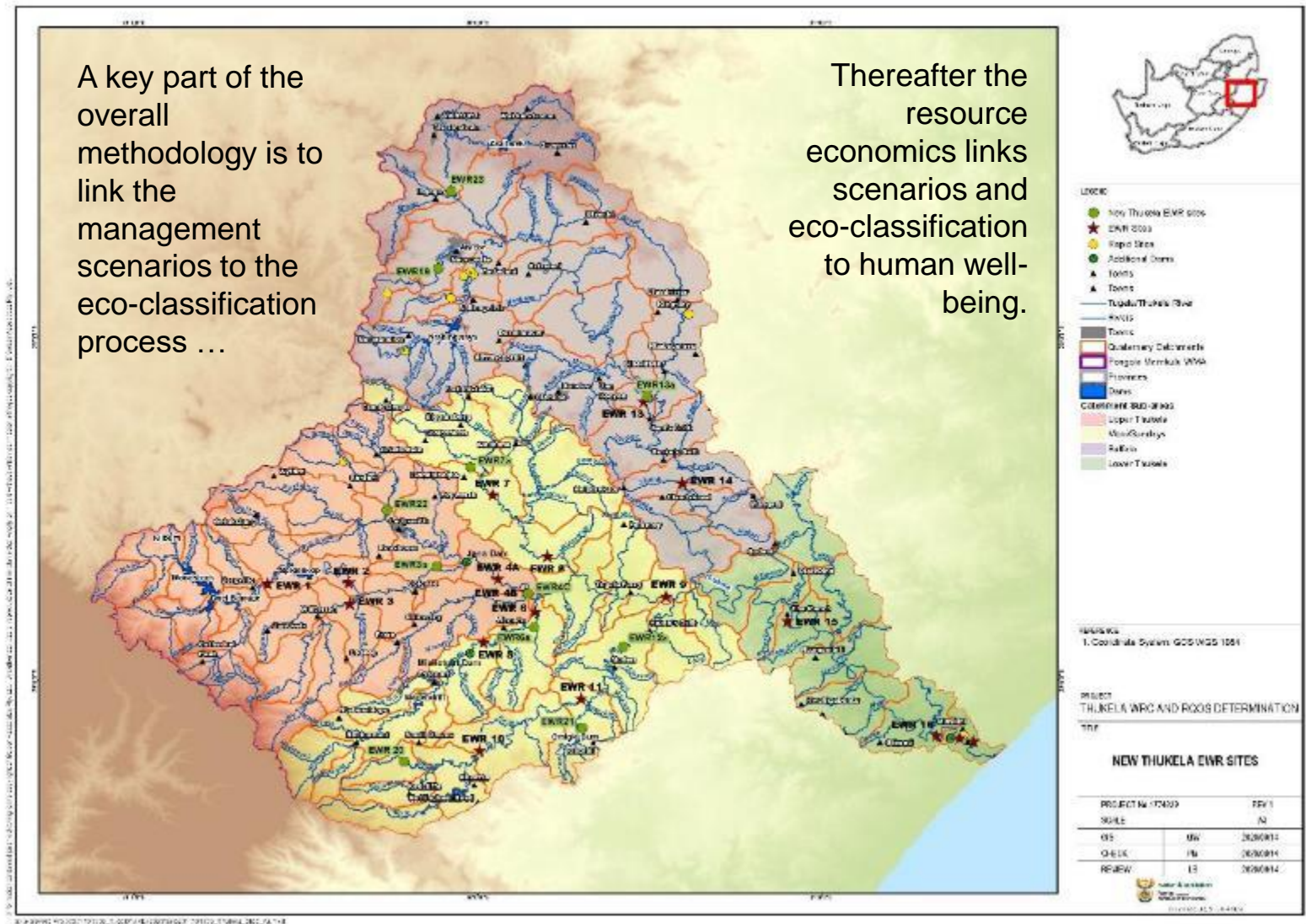
Identifying Linkages

- The things that will change in future?
  - Population growth, economic growth, water resource management scenarios, water demands in other catchments, climate change, etc

- Beneficiaries: Who are impacted?
  - People impacted, positively and/or negatively
  - Who are they, where are they?
  - How will they be impacted? (Income, health, well-being, security, higher water prices?)

- Link "the things that will change" with the beneficiaries through the following:
  - Flow / water quality / eco-classification / water resource changes
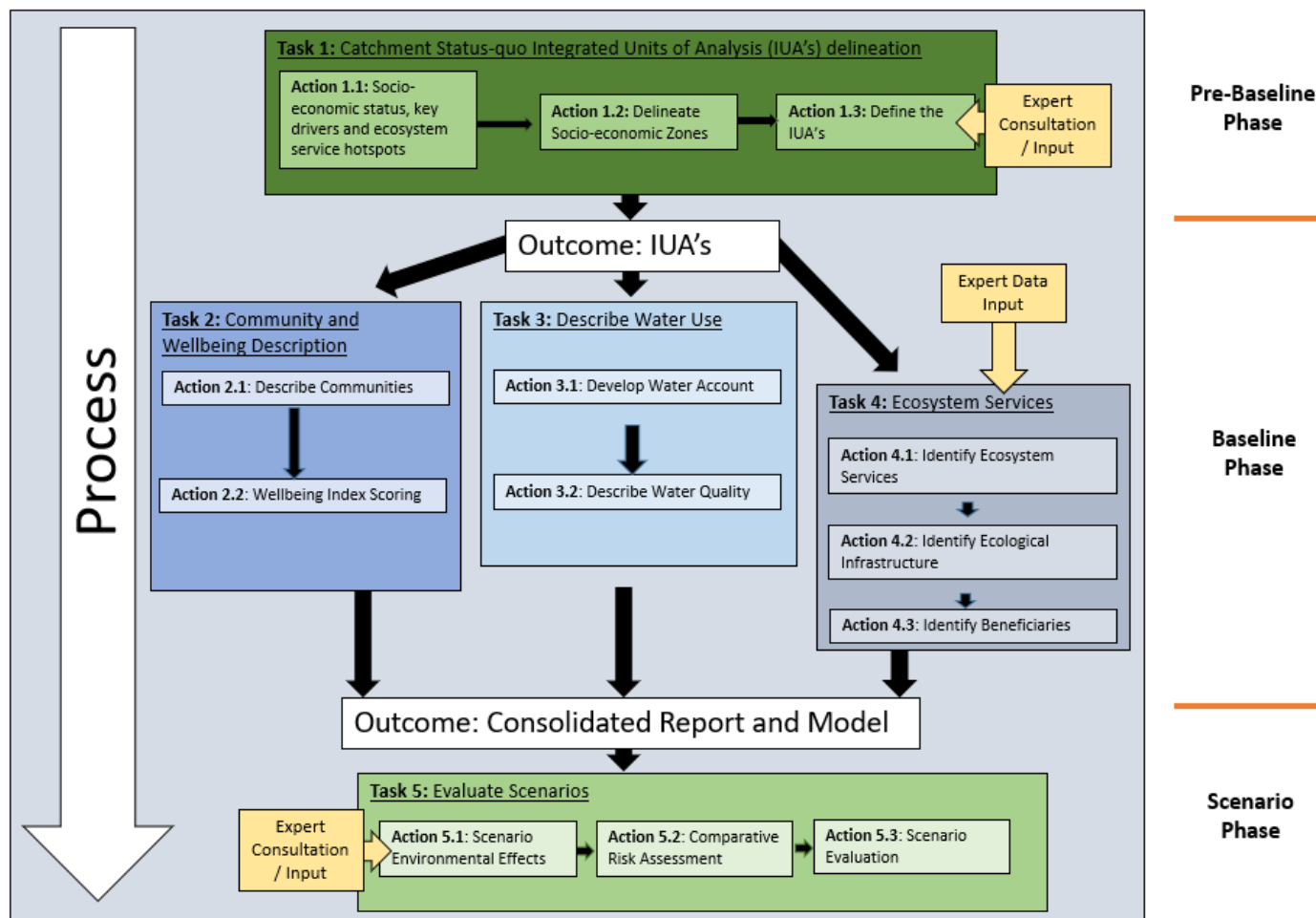 - Ecosystem services
  - Economic transactions

Foresighting Scenarios

Present: Scenario 1	
Scenario 1a	Current development levels (Status quo); no EWR
Scenario 1b	Current development levels (Status quo); with full EWR
Future: Scenarios X_i	
Scenario X_1 (a)	[Future water use with no new water resource development; no EWR]
Scenario X_1 (b)	[As above with full EWR]
Scenario X_n (a)	[Future water use with [to be determined] new water resource development; no EWR]
Scenario X_n(b)	[Future water use with [to be determined] new water resource development; with full EWR]

EWR Sites are the eco-classification monitoring points in the WUA and the eco-classification links to the final Classification
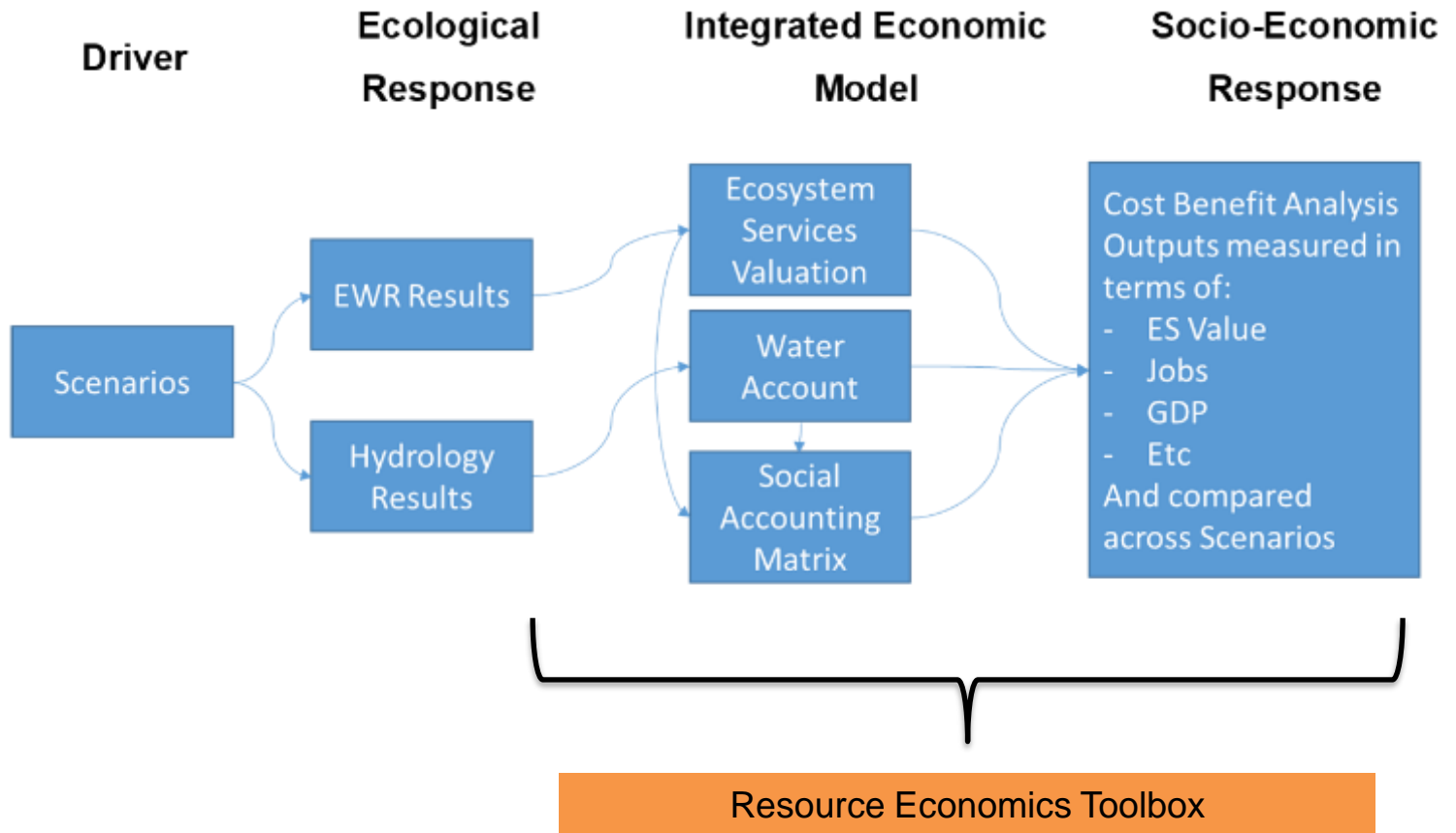

A key part of the overall methodology is to link the management scenarios to the eco-classification process …

Thereafter the resource economics links scenarios and eco-classification to human well-being.

WRC-developed methodology to support classification process: SEcT

WRC, 2018 K5/2465

Overview of Analysis

Ecosystem Service Frameworks

Ecosystem Services Typology as per MEA (2005)	Ecosystem Services Typology as per TEEB (2010)	Ecosystem Services Typology as per CICES (Haines-Young & Potschin, 2013)	Natures Contribution to People (NCP) as per IPBES (IPBES 2018; Diaz et al 2018, Kadykalo et al 2019)
Focus on framing Ecosystem Services	Focus on framing Ecosystem Services	Focus on framing Ecosystem Services in hierarchical system	Focus on framing the benefits. This drives the consideration of variation in benefits between groups of beneficiaries.

Provisioning Services
- Food
- Fresh Water
- Fiber
- Fuelwood
- Genetic resources
- Biochemicals
	Provisioning Services
	- Food
	- Fresh water
	- Raw materials
	- Genetic resources
	- Medicinal resources
	- Ornamental resources
		Provisioning
		- Nutrition
		   o biomass
		   o water
		- Materials
		   o biomass, fibre
		   o water
		- Energy
		   o biomass based energy sources
		   o mechanical energy
			Material NCP (includes non-material elements)
			11. Energy
			12. Food and feed
			13. Materials, companionship and labour
			14. Medicinal, biochemical and genetic resources

Ecosystem Service Frameworks

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Regulating Services
- Climate Regulation
- Disease Regulation
- Water Regulation
- Water Purification
	Regulating Services
	- Air quality regulation
	- Climate regulation
	- Moderation of extreme events
	- Regulation of water flows
	- Waste treatment
	- Erosion prevention
	- Maintenance of soil fertility
	- Pollination
	- Biological control
		Regulation and Maintenance
		- Mediation of wastes, toxics, and other nuisances
		  o mediation by biota
		  o mediation by ecosystems
		- Mediation of flows
		  o Mass
		  o Liquids
		  o gaseous/airflows
		- Maintenance of physical, chemical and biological conditions
		  o lifecycle maintenance, habitat and gene pool protection
		  o pest and disease control
		  o soil formation and composition
		  o water conditions
		  o atmospheric composition and climate regulation
			Regulating NCP
			1. Habitat creation and maintenance
			2. Pollination and dispersal of seeds and other propagules
			3. Regulation of air quality
			4. Regulation of climate
			5. Regulation of ocean acidification
			6. Regulation of freshwater quantity, location and timing
			7. Regulation of freshwater and coastal water quality
			8. Formation, protection and decontamination of soils and sediments
			9. Regulation of hazards and extreme events
			10. Regulation of detrimental organisms and biological processes

Ecosystem Service Frameworks

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Cultural Services
- Aesthetic values
- Spiritual/ religious values
- Educational
- Recreation and ecotourism
- Inspirational
- Sense of place
- Cultural heritage
	Cultural and Amenity Services
	- Recreation, mental and physical health
	- Tourism
	- Aesthetic appreciation
	- Spiritual experience and sense of place
		Cultural Services
		- Physical and intellectual interactions with ecosystems and land-/seascapes
		  o Physical and experiential interactions
		  o Intellectual and representational interactions
		- Spiritual, symbolic and other interactions with ecosystems and land-/seascapes
		  o Spiritual and/or emblematic
		  o Other cultural outputs
			Non-Material NCP
			15. Learning and inspiration
			16. Physical and psychological experiences
			17. Supporting identities

Ecosystem Service Frameworks

Ecosystem Services Typology as per MA (2005)	Ecosystem Services Typology as per TEEB (2010)	Ecosystem Services Typology as per CICES (Haines-Young & Potschin, 2013)	Natures Contribution to People (NCP) as per IPBES (IPBES 2018; Diaz et al 2018, Kadykalo et al 2019)
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Supporting Services - Nutrient Cycling - Soil Formation - Primary Production - Habitat - Biodiversity	**Habitat Services** - Habitat for species - Maintenance of genetic diversity		**Material, Non-material and Regulating NCP** 18. Maintenance of options **Nature (Intrinsic) Eg:** - Genetic Diversity, Species diversity - Evolutionary and ecological processes - Gaia, Mother Earth - Animal welfare / rights

Ecosystem Services: Salient Features

- SANBI, UN Agencies, Stats SA estimate of ESV for KZN province
  - Used MEA Framework
  - R33 billion per year (2011)
- Clark (2019)
  - Ongoing work on developing water accounting methodology in the uThukela catchment
- 29 of 56 economic sectors benefit directly from ecosystem services: water provisioning, water regulatory, tourism and recreation; these constitute 45% of total GVA (R35 billion GVA)
- All ecosystem services are important, however some would have significant linkages to anticipated water resource management scenarios

Ecosystem Services in Context
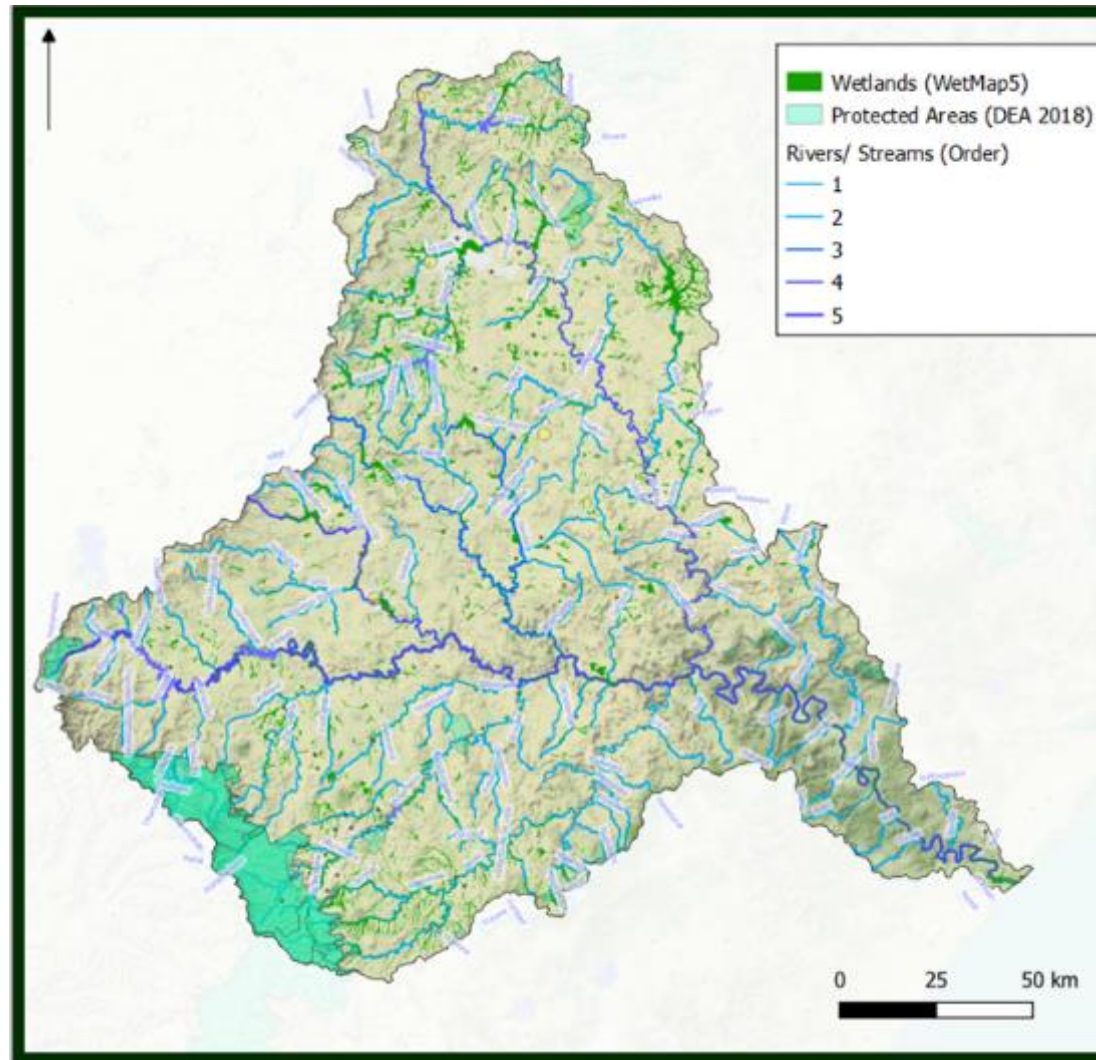
ES closely tied to water resources:

1. Fresh Water Provisioning
2. Water Quantity Regulation
3. Erosion Regulation
4. Water Quality Regulation: Purification and Waste Management
5. Food, Raw Materials and Wild Collected Products Provisioning
6. Spiritual, Landscape and Amenity Services
7. Tourism and Recreational Services and
8. Biodiversity Support.

Thoughts on Ecosystem Services Valuation

- Driven by management scenarios and its effects on hydrology and eco-classification

- Comparative Risk Assessment performed with all experts – this prioritises ecosystem services that may be affected (positively or negatively)

- ES that are deemed to be at risk requires evaluation and feeds back into Scenario assessment

- Eco-classification is a proxy for valuation of regulating and supporting services

Evaluating Impact of Transfers
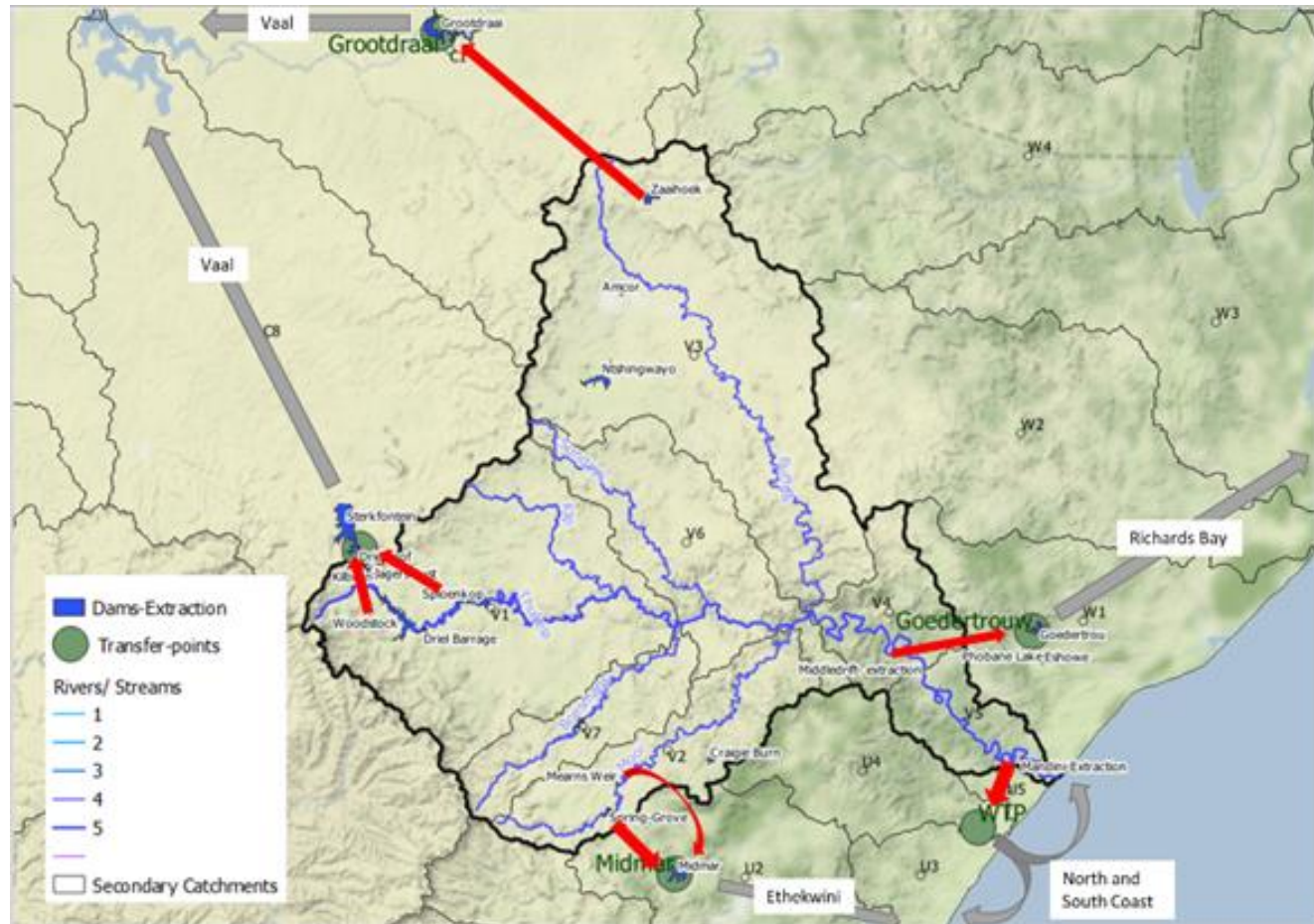
National Water Accounts used to measure costs and benefits of transfers, supported by existing DWS Specialist Studies

Estimating Impact on the Formal and Informal Economy: Q-SAM

- A Social Accounting Matrix (SAM) is a well-established macro-economic modelling tool, which has been used in several WRCS studies in the past

- It quantifies all transactions between sectors and actors in the economy

  – Primary (predominantly agriculture, forestry and mining)

  – secondary (predominantly manufacturing)

  – Tertiary (all service sectors) sectors

  – Households

  – Trade outside of the economy.

- The underlying data used to construct a SAM is official economic data provided by Statistics SA

- The SAM can be restructured into a modelling tool though which the impact of water resource management scenarios can be evaluated.

Estimating Impact on the Formal and Informal Economy: Q-SAM
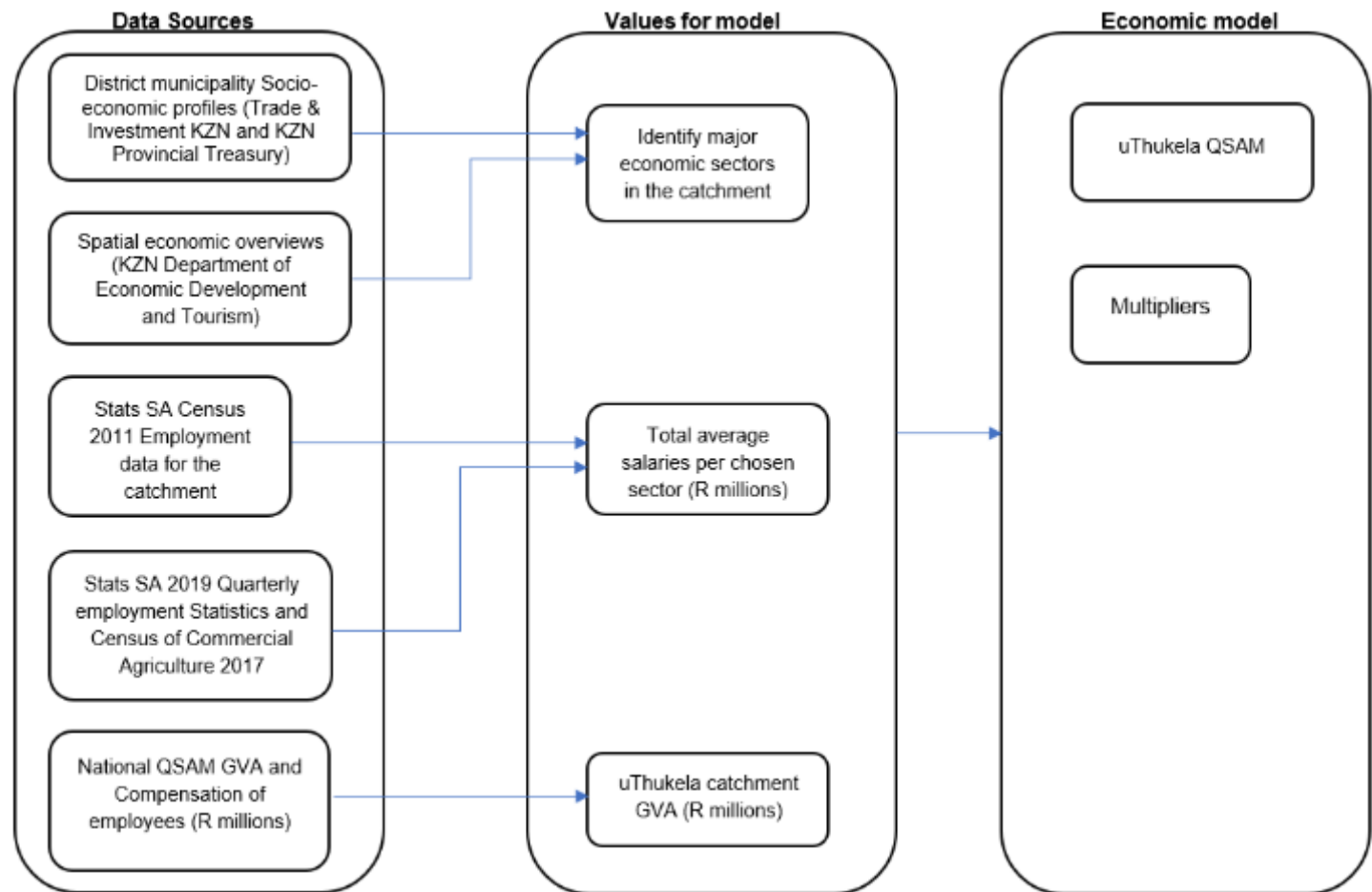
Demonstrating Linkages between ES and the Economy

| Intermediate Ecosystem Service	Final Ecosystem, Services	General Sector	QSAM Beneficiary Class
Water Quality Regulation Water Quantity Regulation Erosion and Soil Regulation	Food Provisioning	Informal Households	Non-observed, informal, non-profit, households
		Agriculture	Agriculture
	Fresh Water (Water quantity) Provisioning	Households	Non-observed, informal, non-profit, households
			Households
		Agriculture	Agriculture (Irrigation)
		Forestry	Forestry
		Manufacturing	Food
			Beverages and tobacco
			Tanning and dressing of leather
			Paper
			Other chemical products, man-made fibres
			Rubber
			Plastic
			Glass
			Basic iron and steel, casting of metals
			Basic precious and non-ferrous metals
			Machinery and equipment
			Electrical machinery and apparatus
			Radio, television, communication equipment and apparatus
			Motor vehicles, trailers, parts
			Other transport equipment
			Furniture
			Manufacturing n.e.c, recycling
		Mining	Mining of coal and lignite
			Other mining and quarrying
		Government Services	Electricity, gas, steam and hot water supply
			Collection, purification and distribution of water
			Sewerage and refuse disposal
	Raw Materials Provisioning	Informal Households	Non-observed, informal, non-profit, households,
	Medicinal resources Provisioning	Informal Households	Non-observed, informal, non-profit, households,
		Households	Non-observed, informal, non-profit, households,
			Households

Demonstrating Linkages between ES and the Economy

- 29 of the 56 sectors identified are directly linked as beneficiaries of ecosystem services: water provisioning, water regulatory, tourism and recreation

- These 29 sectors constitute 45% of total GVA (R35 billion GVA) and provide approximately 125 000 jobs

- The agriculture sector, is the largest sector within the uThukela catchment relying heavily on water provisioning services. The sector contributes 10.3% to the total GVA, and provides an estimated 44,000 jobs

- Tourism sector is observed to make a relatively large contribution, at 4.9%, to catchment GVA, providing 10,700 jobs

- The linkages with cultural ecosystem services provided by key ecological infrastructure, with direct linkages to the presence of ecological features associated with tourism and recreational activities, such as the Drakensberg escarpment, protected areas (both government and private), large dams, the midlands, the coast, and the Tugela estuary.

Comments received on Methodology Report

- Number of comments received from the steering committee: 27

- All comments captured in IRR and addressed in revised report

Way Forward
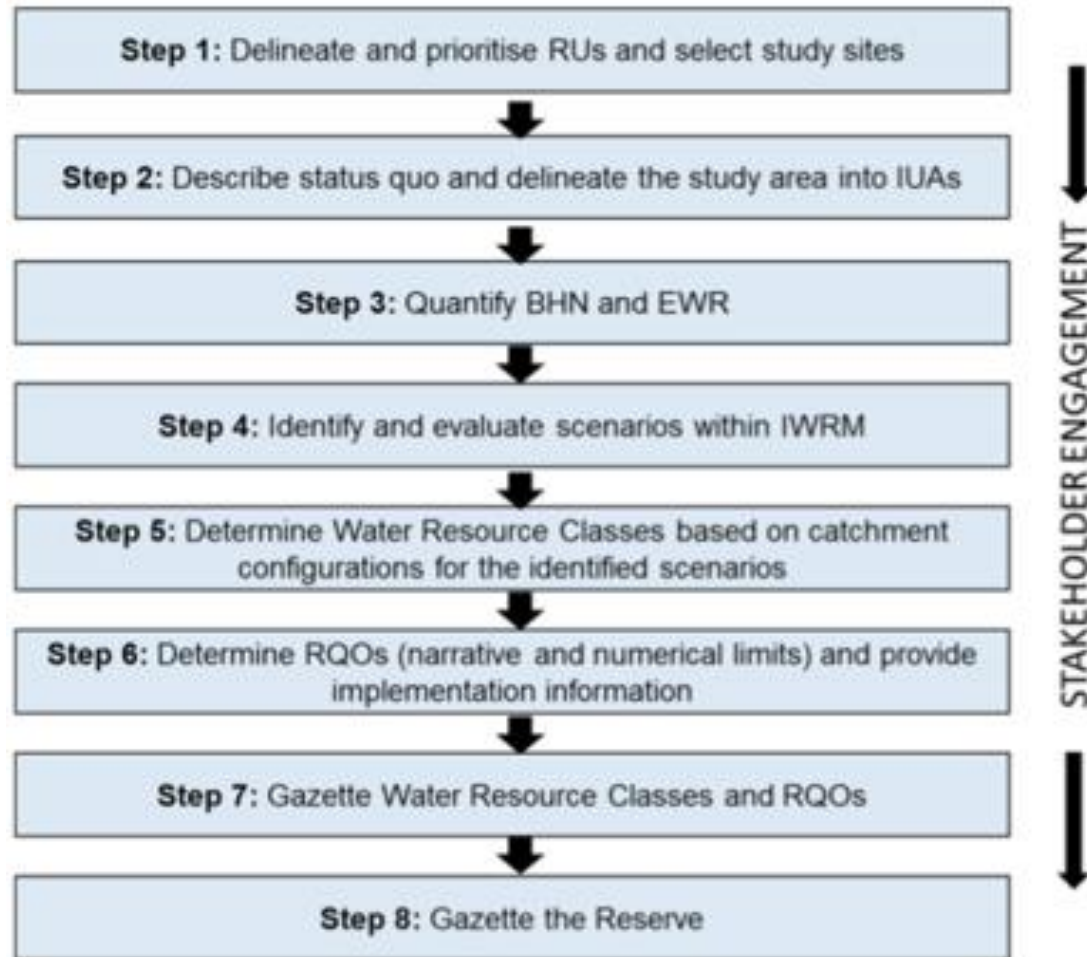
UPCOMING ACTIVTIES

Upcoming Tasks/Activities

➢ Finalise - Linking of the Socio-Economic and ecological value of the water resources (end September 2020)

➢ Quantification of EWRs (October 2020)

➢ Resource Unit Delineation and Selection for setting of RQOs (September 2020)

➢ Water Resource Model Setup and Scenarios analysis (Nov 2020)

➢ PSC Meeting 3 – November 2020

THANK YOU