Water Resources Accounting

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Acknowledgements

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  - Initiative in taking water accounting forward in South Africa
  - Research funding
  - Mr Nomquphu – Project Manager
- Members of the WRC Reference Groups
- Colleagues in the CWRR

Natural Capital Accounting

- **Gross Domestic Product (GDP)**
  - Monetary value of goods and services
  - Use of natural resources?
  - Environmental sustainability?
- **Natural Capital Accounting (NCA)**
  - Stocks and flows of natural resources and services
  - Physical or monetary terms
  - Informs government, corporate, consumer decision making
- **Water Accounting (WA)**
  - Water is one component of NCA
  - Quantity and quality
    - Domestic Purposes
    - Economic production
    - Environmental sustainability

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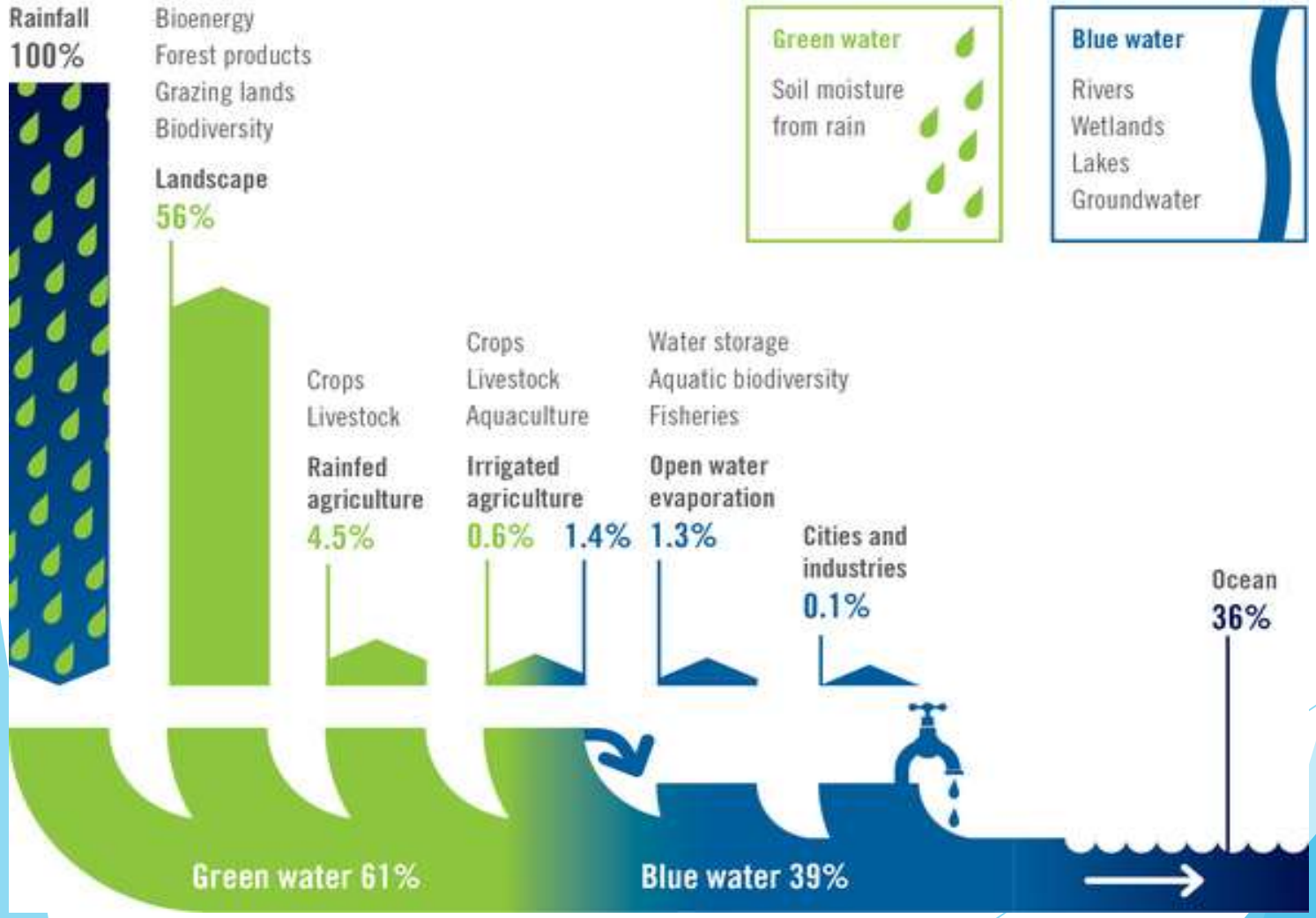
Water Accounting



http://www.globalagriculture.org/report-topics/water.html based on Molden (2007)

Water Accounting

- **Definition**
  - "An analytical framework within which stocks, flows, fluxes and consumption of water are quantified within a defined spatial and temporal domain"
- Where, when, how, who, what for
- **Purpose**
  - Quantification
  - Better understanding
  - Communication

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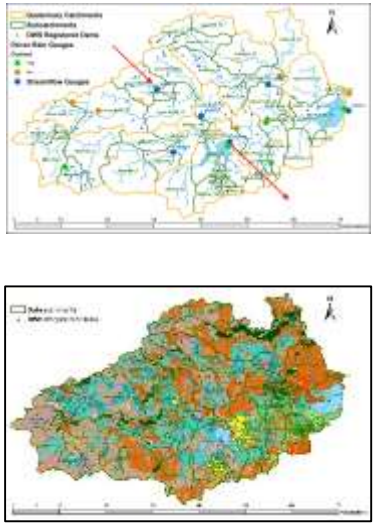
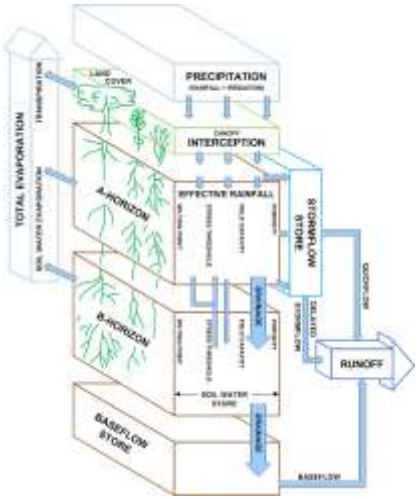
Research Objectives

- Review water accounting frameworks
- Develop an integrated water resources accounting methodology
- Apply and evaluate the methodology

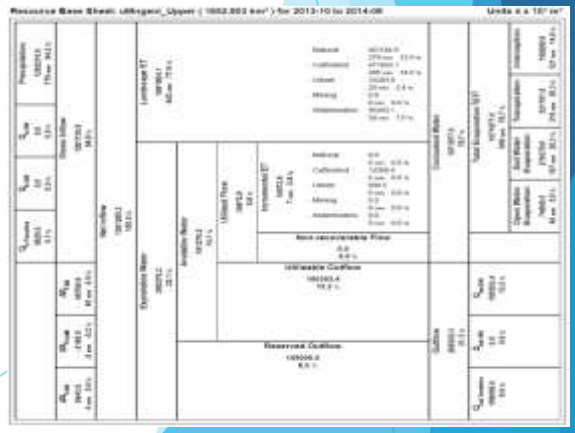
Data



Modelling

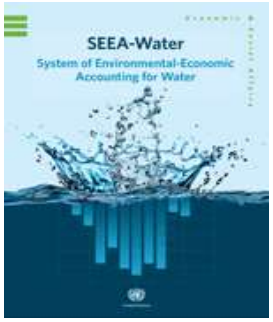


Accounts



Water Accounting Frameworks

- **System of Environmental-Economic Accounting for Water (SEEA-Water)**
  - National water accounts
  - United Nations standard
  - Strong economic emphasis



- **Australian Water Accounting Standard (AWAS)**
  - General Purpose Water Accounts
  - Financial accounting procedures
  - Water auditing
- **Water Accounting Plus (WA+)**
  - Catchment water availability and depletions
  - Land and water management

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Challenges

- Climate - high spatial and temporal variability
- Complex systems - natural and engineered flows
- Scale influences the story: cause and effect
- How much detail? Value for effort?

- Data availability
  - Some good datasets
  - Monitoring network: sparse, declining
  - Monitoring mostly at a point scale
  - Urban, irrigation, mining abstractions and return flows
  - Stocks

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Key Decisions

- **Use WA+ framework**
- **Use hydrological modelling approach**
  - Not possible to measure everything everywhere
  - Innovative data sources (remote sensing)
  - Scenario analysis and forecasting
- **Spatial domain**
  - Accounts at Quaternary catchment scale (aggregate up)
  - Model land use HRUs within sub-Quaternary catchments
- **Temporal domain**
  - Annual accounts
  - Model at daily time step (aggregate up)
- **Strong land cover/use focus**
  - Hierarchy of land cover/use classes
- **Focus on water quantity accounts**

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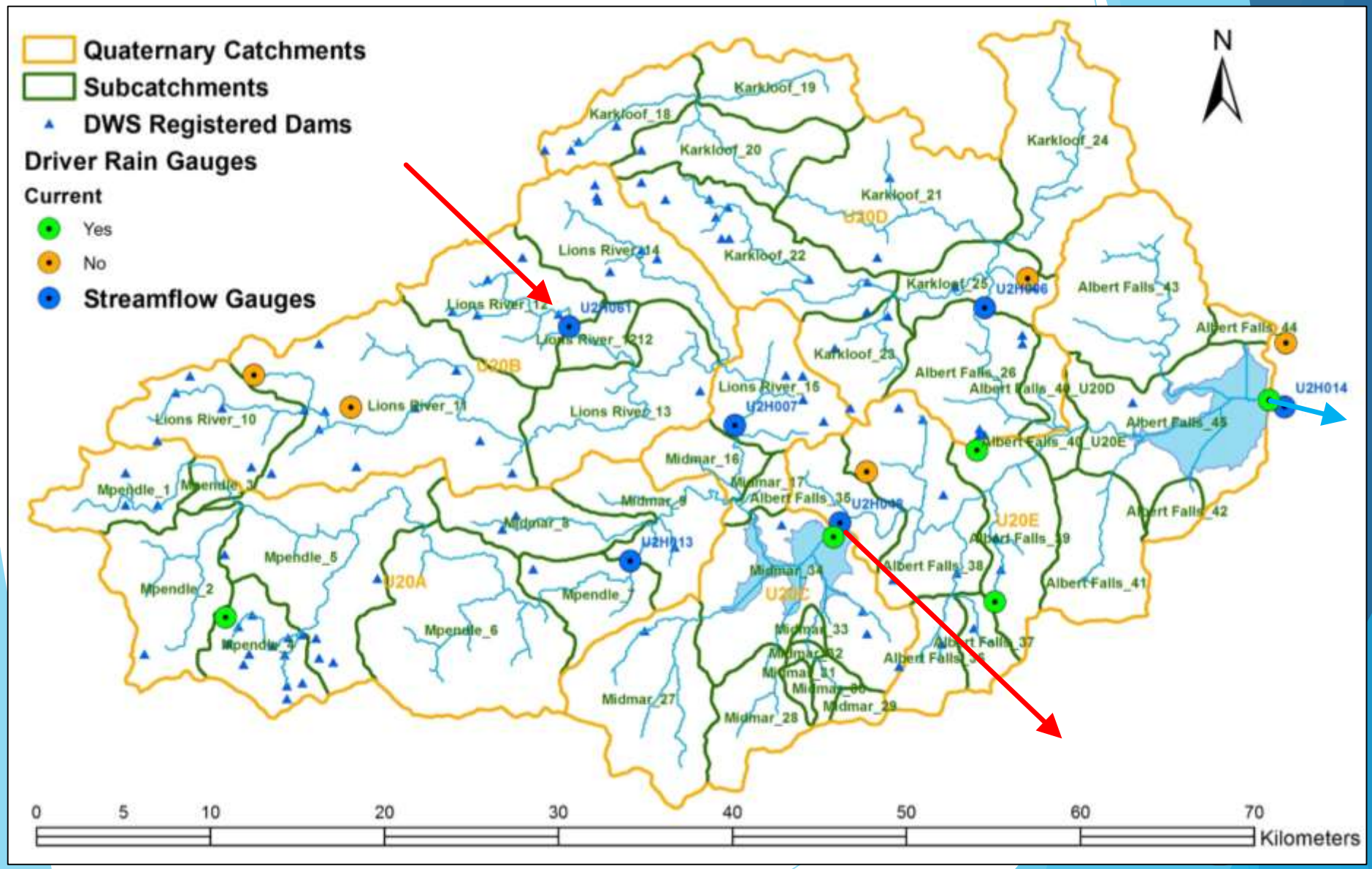
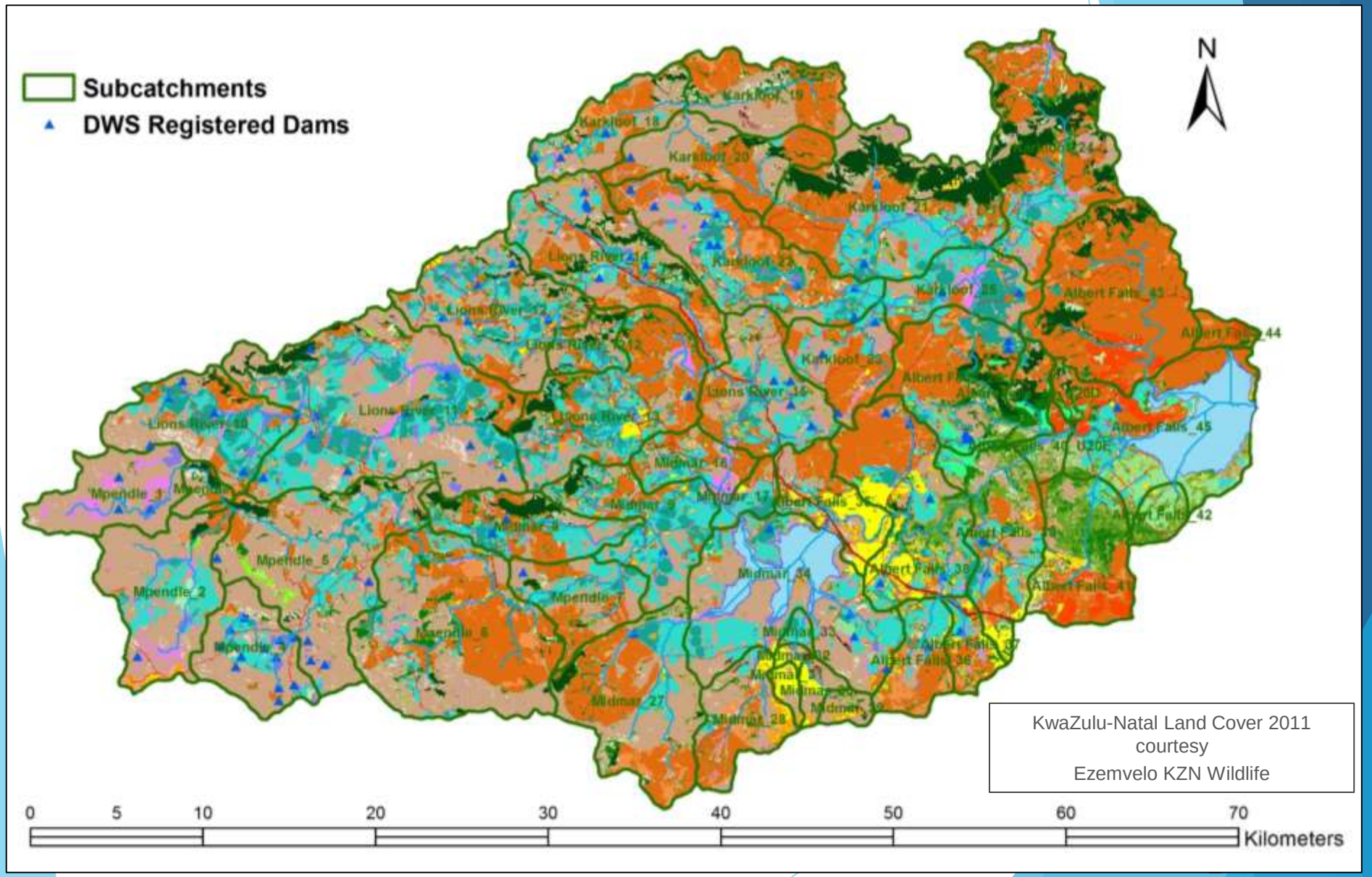
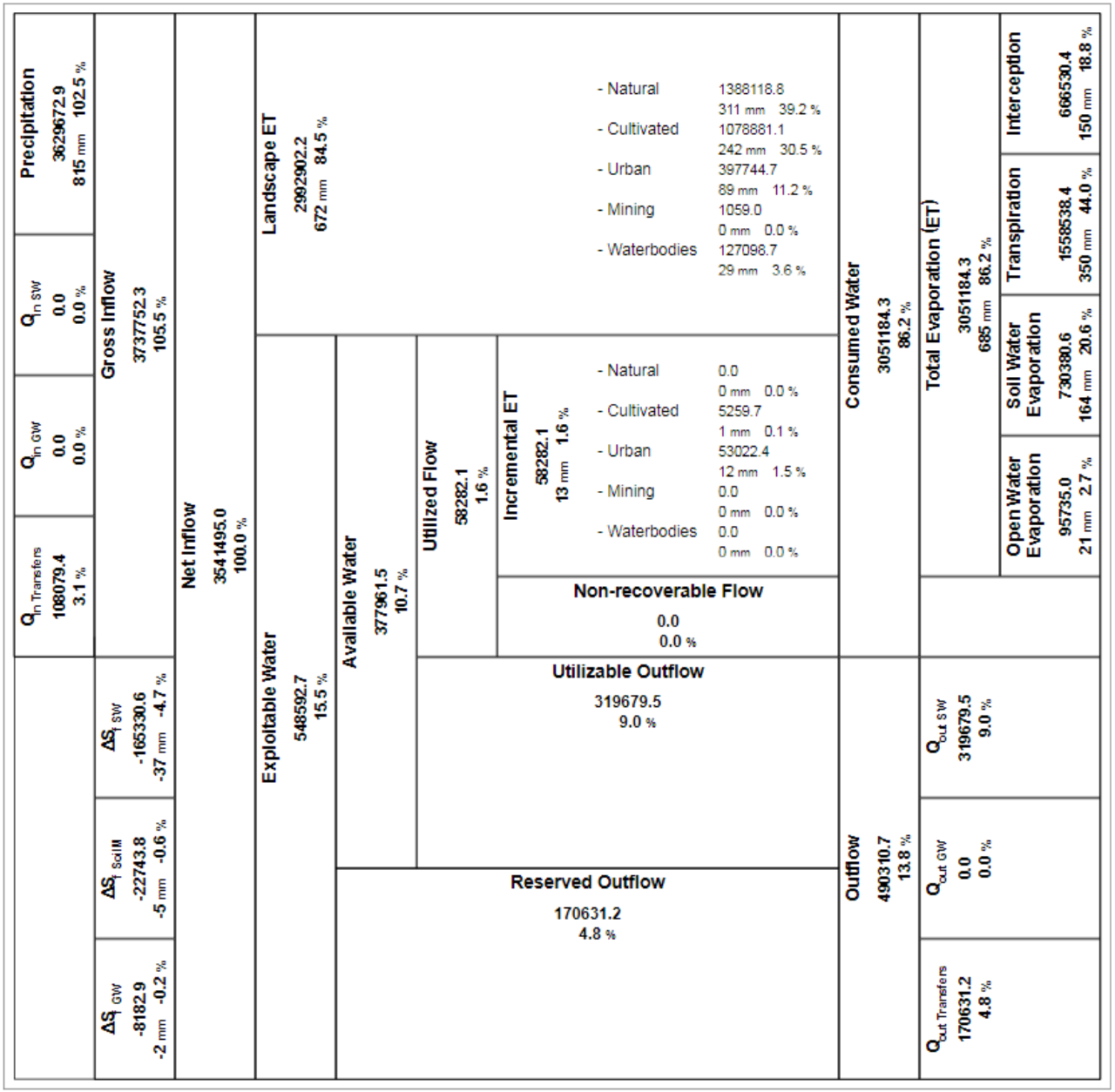
Example – upper uMngeni



Example – upper uMngeni



Resource Base Sheet



	Area	Rainfall	Interception Evaporation	Transpiration	Soil Water Evaporation	Open Water Evaporation	Total Evaporation
Natural	43.2	43.2	45.4	45.0	51.6	0.0	44.3
Intact	92.1	92.1	95.5	95.7	83.1	0.0	92.1
Coastal Tropical Forest	19.9	18.9	17.8	20.1	16.5	0.0	18.8
Karoo and Karroid	25.5	24.0	29.9	25.0	19.7	0.0	24.6
Temperate and Transitional Forest and Scrub	41.9	44.1	40.2	41.7	51.4	0.0	43.8
False Grassveld	12.6	12.8	12.1	13.3	12.2	0.0	12.8
Bare	0.1	0.1	0.1	0.0	0.1	0.0	0.0
Degraded	7.9	7.9	4.5	4.3	16.9	0.0	7.9
Coastal Tropical Forest	15.8	15.2	13.9	15.8	14.1	0.0	14.6
Karoo and Karroid	22.2	21.0	28.0	22.1	20.0	0.0	21.4
Temperate and Transitional Forest and Scrub	45.9	47.4	42.8	45.9	49.5	0.0	47.8
False Grassveld	15.6	15.9	15.2	16.1	15.8	0.0	15.8
Bare	0.5	0.5	0.0	0.0	0.7	0.0	0.4
Cultivated	34.7	35.1	38.8	44.2	34.1	1.4	38.6
Agriculture	52.1	51.8	37.4	48.1	75.3	100.0	52.1
Commercial	85.9	86.5	90.6	90.9	77.3	100.0	86.7
Dryland	85.2	84.6	87.2	87.8	75.1	0.0	83.9
Irrigated	14.8	15.4	12.8	12.2	24.9	100.0	16.1
Subsistence	14.1	13.5	9.4	9.1	22.7	0.0	13.3
Forest Plantations	47.9	48.2	62.6	51.9	24.7	0.0	47.9
Urban/Built-up	18.7	18.3	15.2	9.8	11.8	7.1	11.1
Industrial/Transport	11.7	11.9	9.5	0.0	0.0	0.0	2.3
Residential	86.9	86.7	89.0	97.2	97.3	100.0	95.4
Open Spaces	1.4	1.4	1.5	2.8	2.6	0.0	2.3
Mines and Quarries	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Waterbodies	3.3	3.4	0.5	1.0	2.5	91.5	6.0
Artificial	61.4	60.7	0.0	0.0	0.0	89.0	70.4
Natural	38.6	39.3	100.0	100.0	100.0	11.0	29.6

Utilized Flows Sheet

Utilized Flows Sheet: uMngeni for 2017-10 to 2018-09 — **Units = x 10^3 m^3**

Gross Withdrawal	Surface Water	Natural	Returned
139100.0 100.0 %	139100.0 100.0 %	0.0 0.0 %	0.0 0.0 %
		Cultivated 5260.4 3.8 %	Consumed 4165.5 79.2 %
			Returned 15.13 0.3 %
	Groundwater 0.0 0.0 %	Urban 133830.2 96.2 %	Consumed 46599.9 34.8 %
			Returned 80788.7 60.4 %
		Mining 0.0 0.0 %	Consumed 0.0 0.0 %
	Transfers 0.0 0.0 %		Returned 0.0 0.0 %
		Waterbodies 9.3 0.0 %	Consumed 9.3 0.0 %
		Hydropower 0.0 0.0 %	Returned 0.0 0.0 %

Total Consumed		
50774.7 36.5 %		
Total Returned	Surface Water	
80803.8 58.1 %	80726.9 99.9 %	
	Groundwater 76.9 0.1 %	
	Transfers 0.0 0.0 %	

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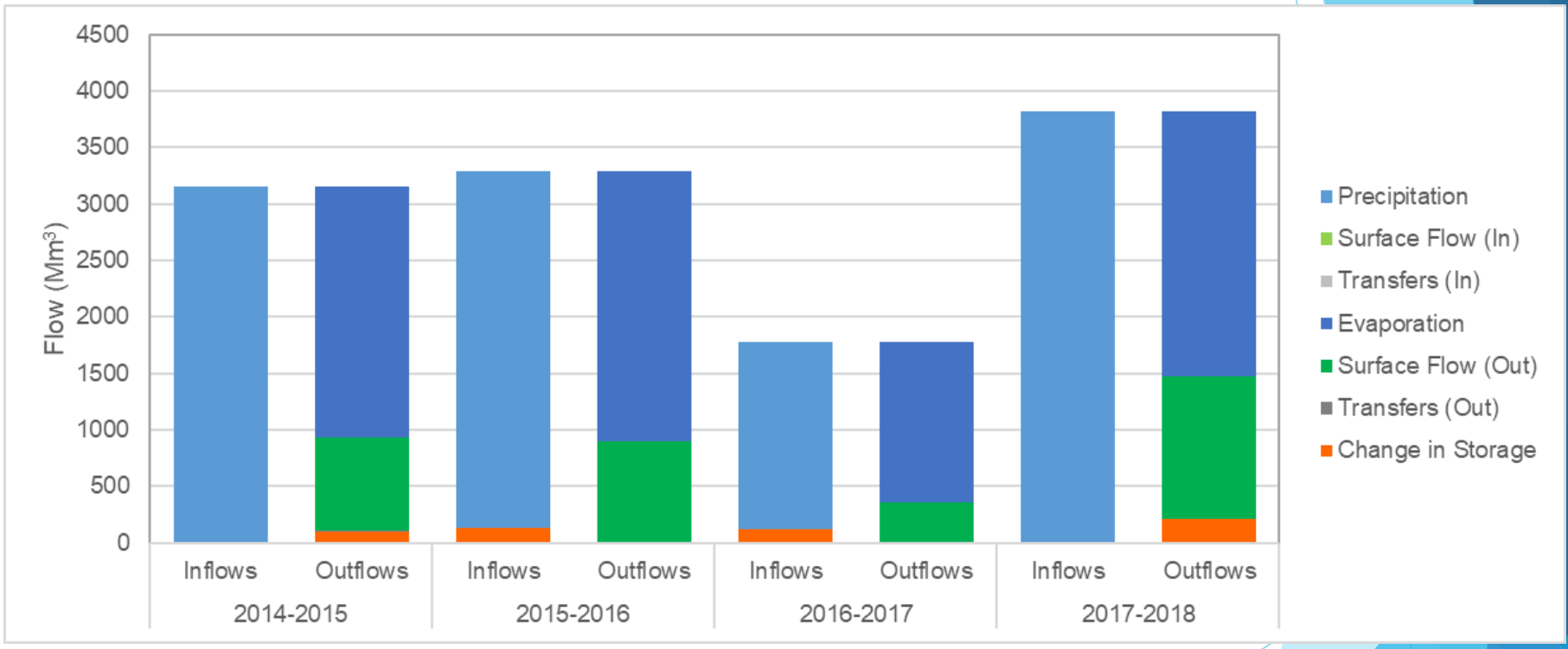
Data Visualisation

Example from the Breede Catchment



Vision

- Water resource accounts
  - For the whole of South Africa
  - Annually (possibly monthly)
  - Quaternary catchment scale (or smaller)

- An operational water resource accounting system that provides spatially and temporally consistent summaries of the country's water resources, based on measured and modelled data, to promote informed, sustainable and equitable use of these resources

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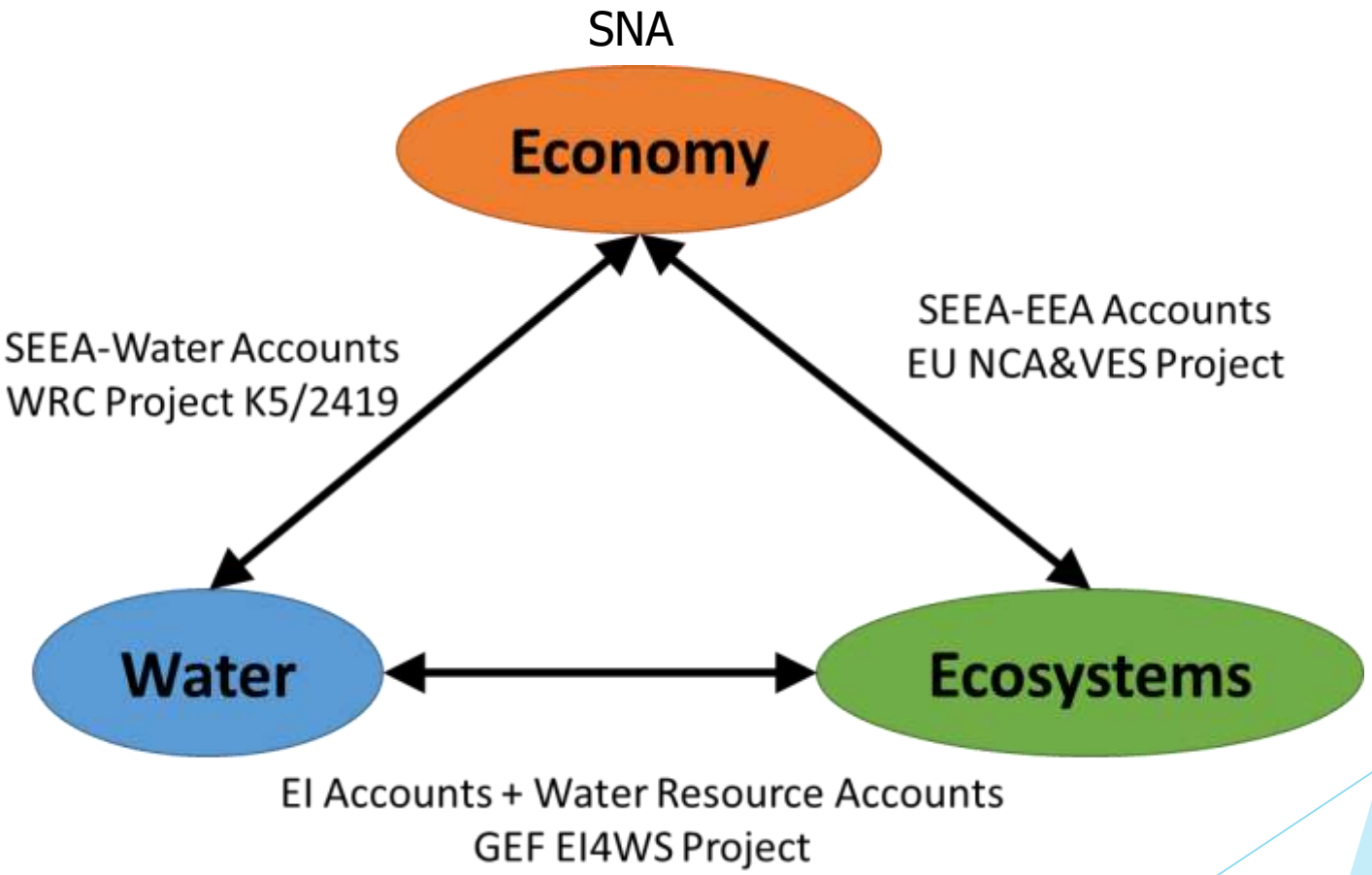
New Horizons



Conclusions

- Good data for good management
  - Availability and accessibility
- Integrated view of water resources within a catchment
  - Promotes understanding
  - Promotes communication
  - Information tool for management
- Way forward?
  - Critical to continue monitoring
  - Provide access to data
  - Funding to operationalize
  - Build capacity in compiling and interpreting

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