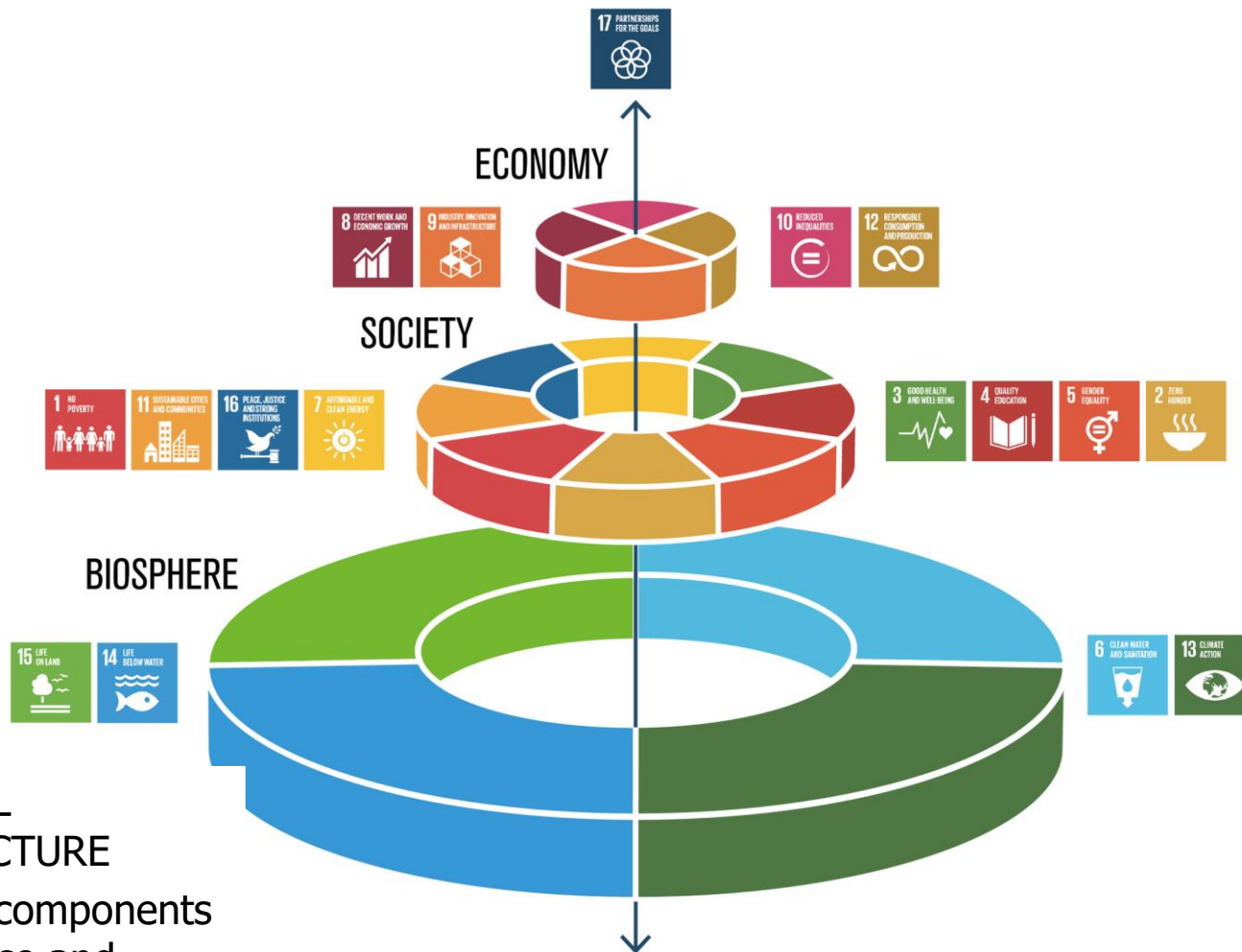


Costs, benefits and financial flows from water at a catchment scale: Linking green and grey infrastructure

Graham Jewitt on behalf of a large
project team

Centre for Water Resources Research



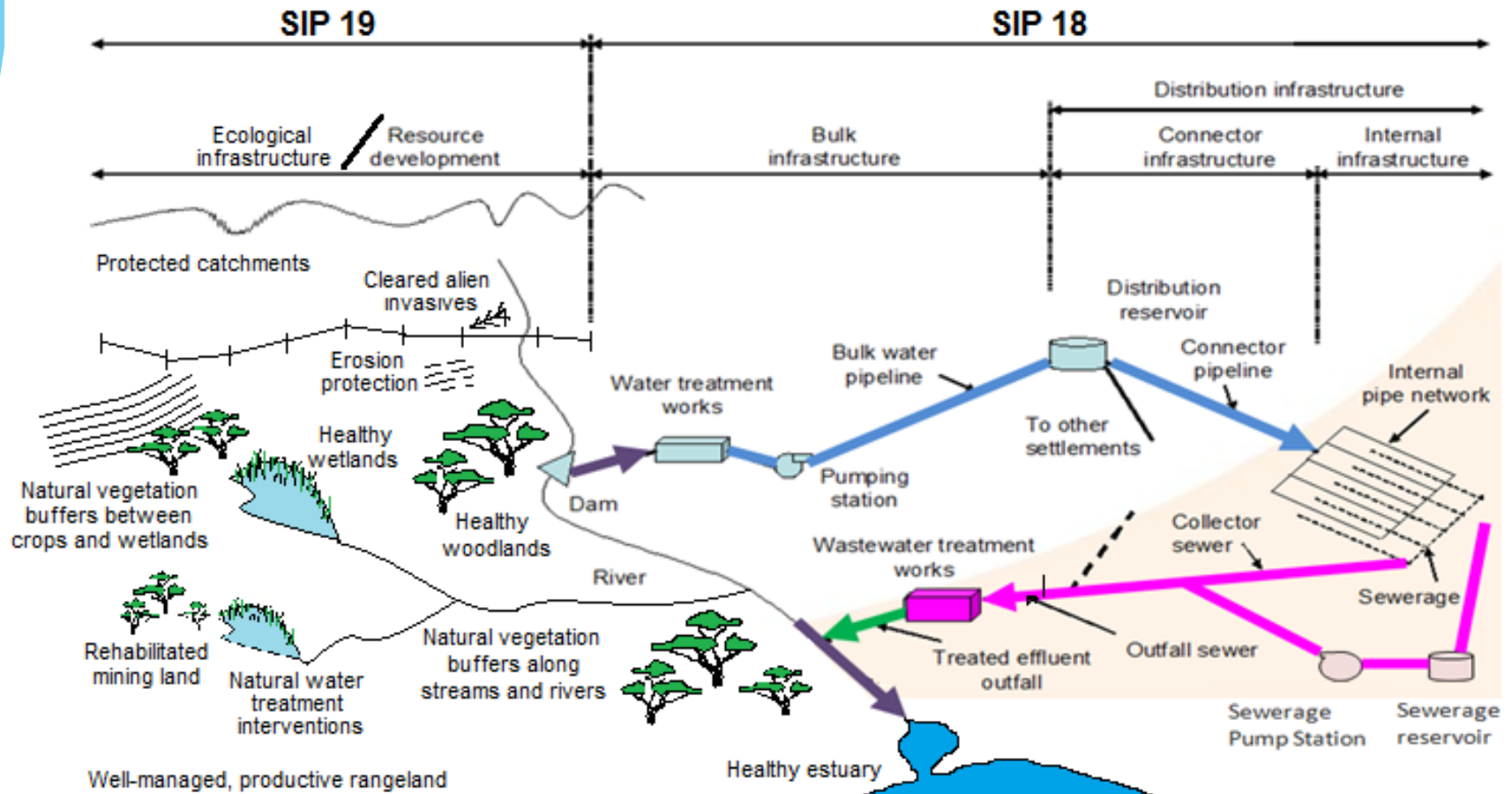


ECOLOGICAL INFRASTRUCTURE
 - landscape components which produce and deliver services to society

•Azote Images for Stockholm Resilience Centre



• DRAFT NATIONAL WATER AND SANITATION MASTER PLAN VOLUME 1: CALL TO ACTION



Water and Financial Flows

water resource management

EVIDENCE SUGGESTS THAT
NBS ACCOUNT FOR
LESS THAN 5%
OF ALL EXPENDITURE IN
WATER RESOURCES MANAGEMENT

water resource management

water resource development charge

2

waste discharge charge

7

abstraction, treatment and distribution

treatment and return water to the river

3

bulk water tariff

bulk wastewater tariff

6

human excreta wastewater collection

4

5

1

retail sanitation charge

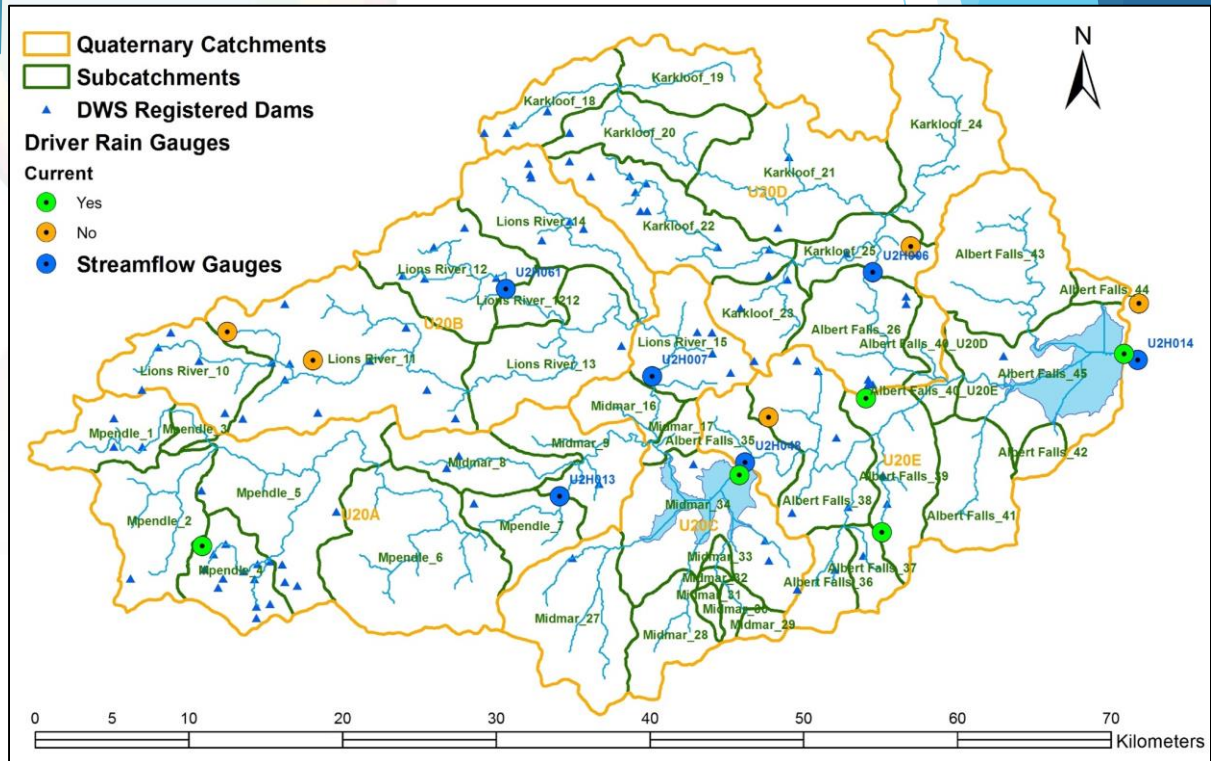
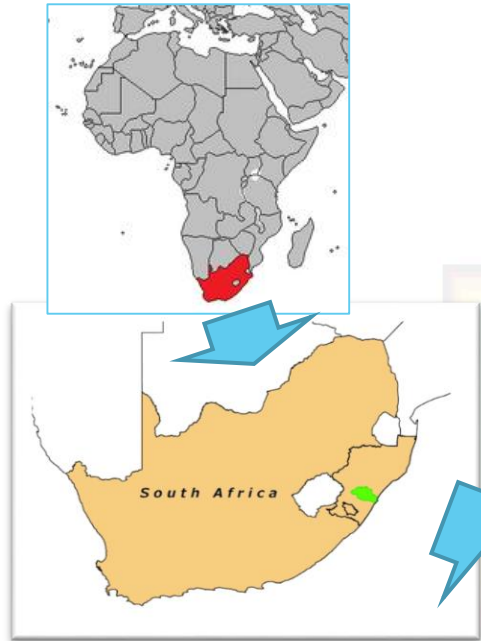
Water Utility Cost Drivers

- ▶ Raw Water
- ▶ Energy (pumping and treatment)
- ▶ Chemicals
- ▶ Maintenance
- ▶ Human Resources
- ▶ Capital repayment

uMngeni Catchment Case Study

Costs and Benefits of Investing in Ecological
Infrastructure

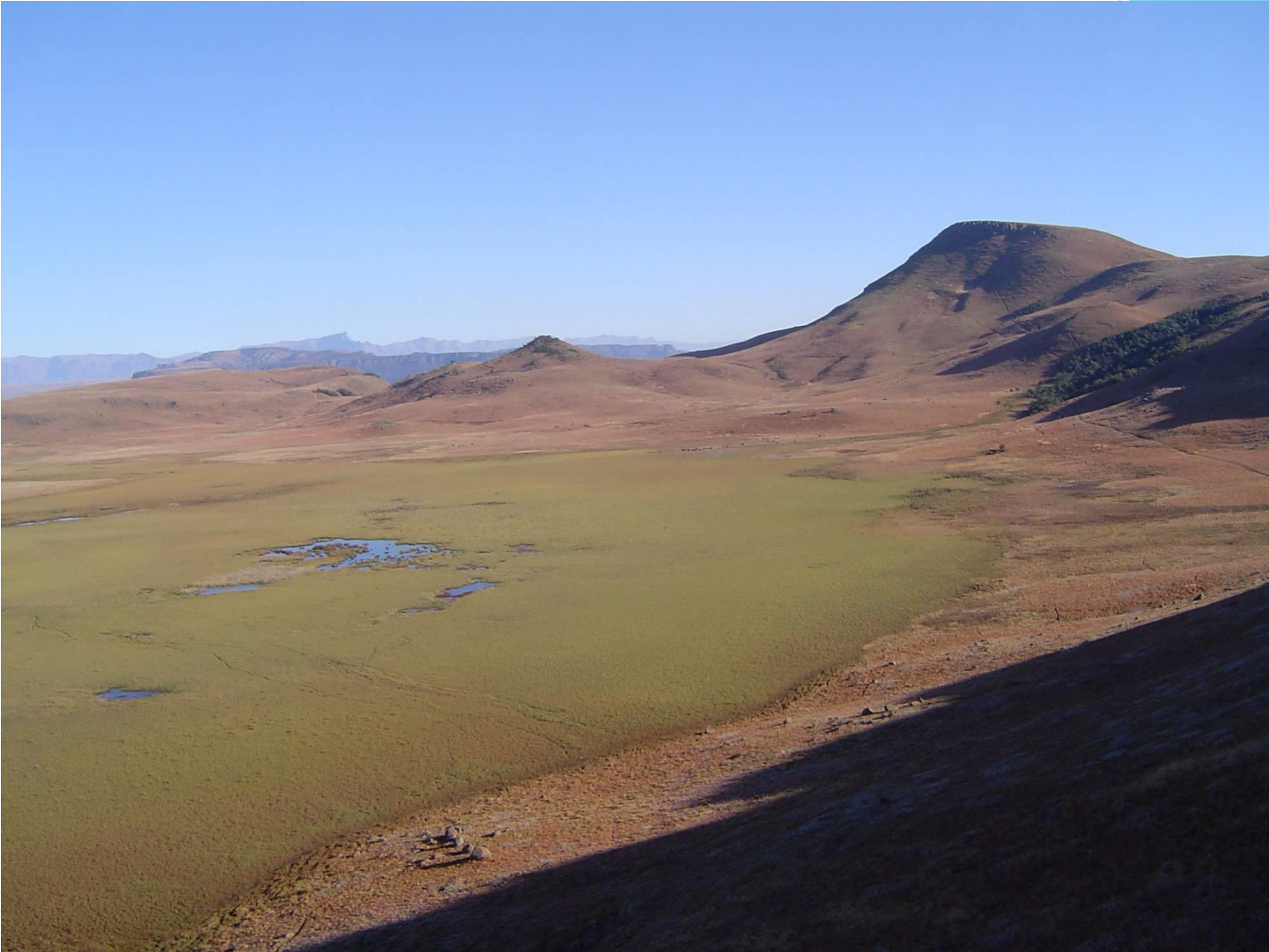
The uMngeni catchment, KwaZulu-Natal, South Africa



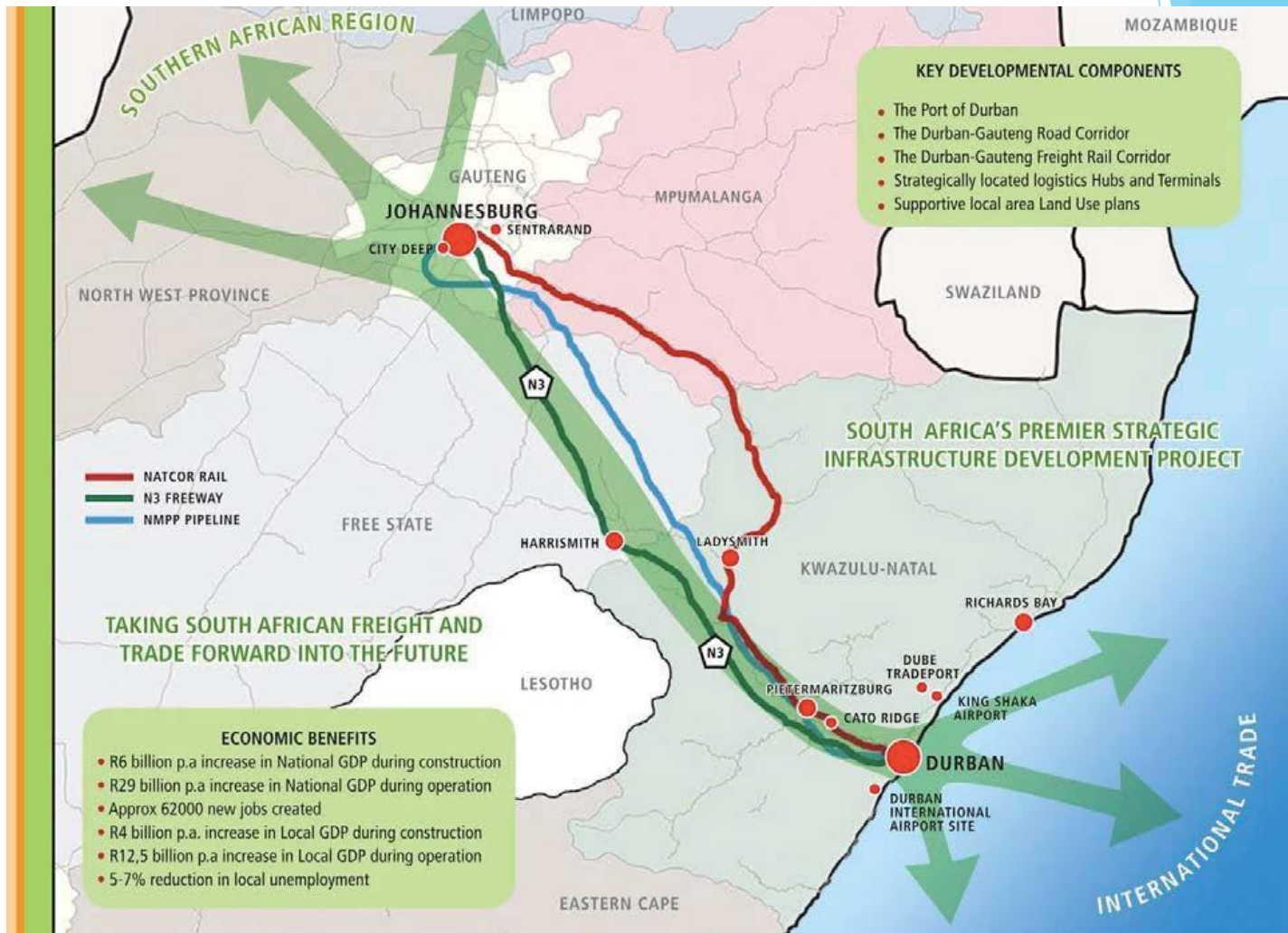


UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

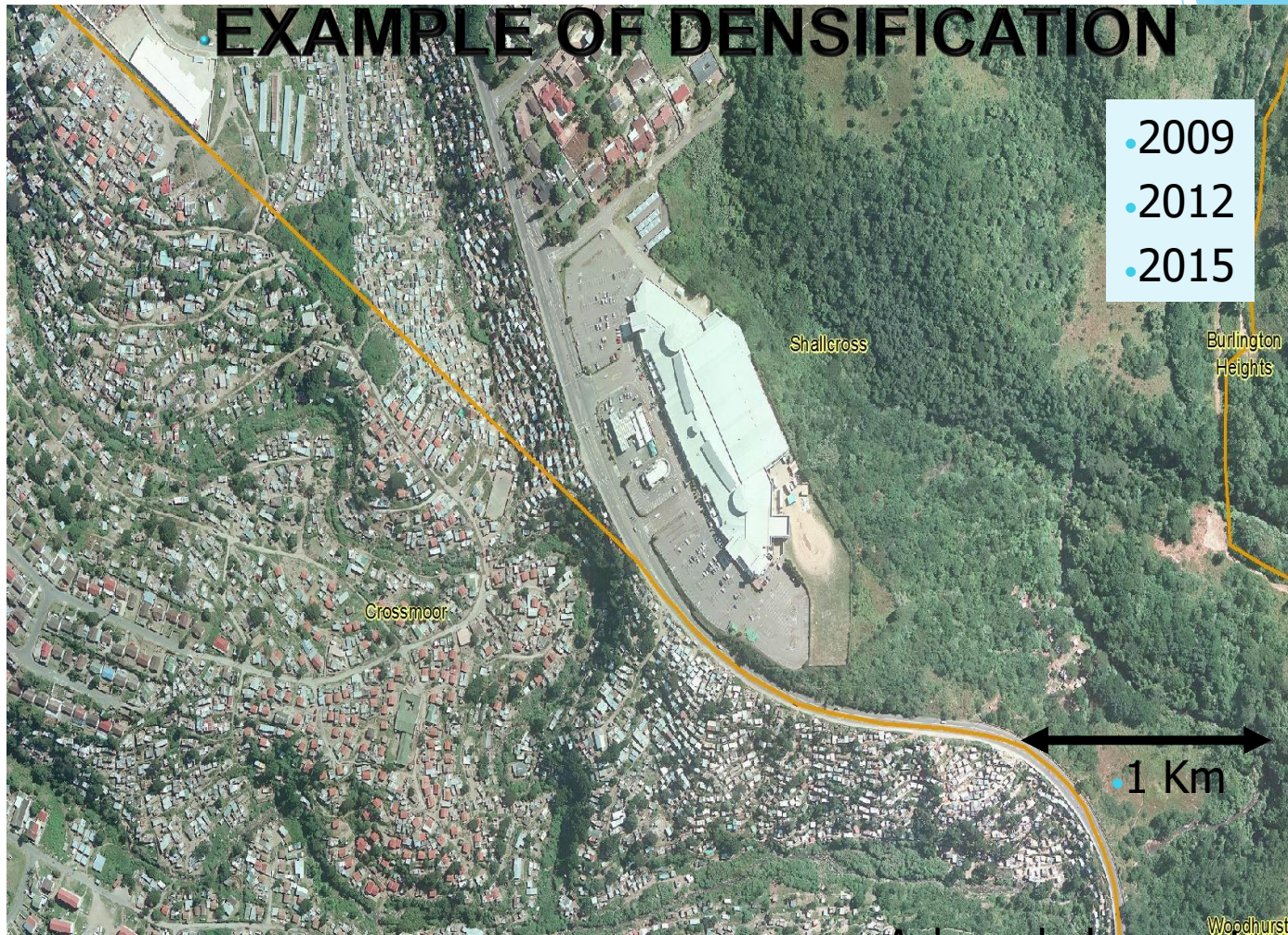
 Centre for Water
Resources Research



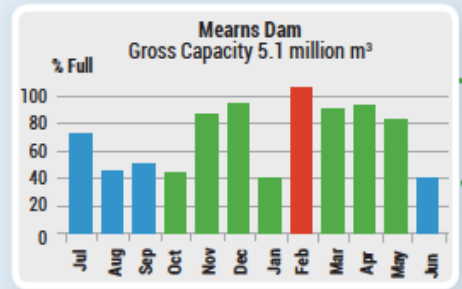
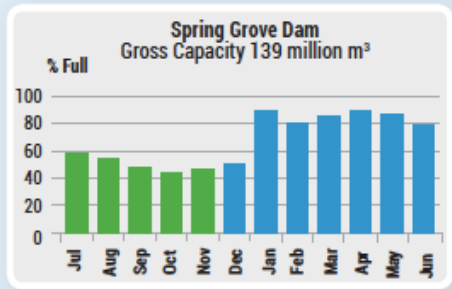
INSPIRING GREATNESS



EXAMPLE OF DENSIFICATION



• Acknowledgements: Neil Mcleod

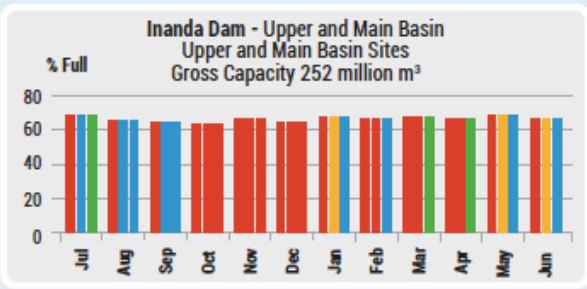
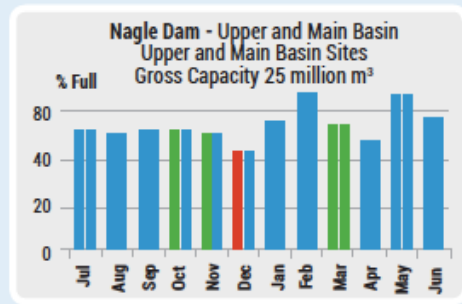
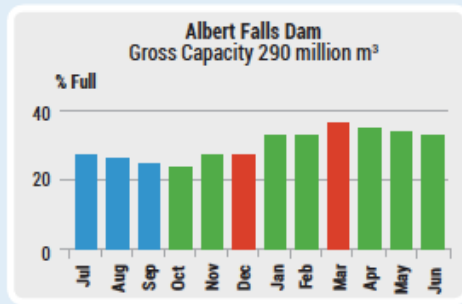
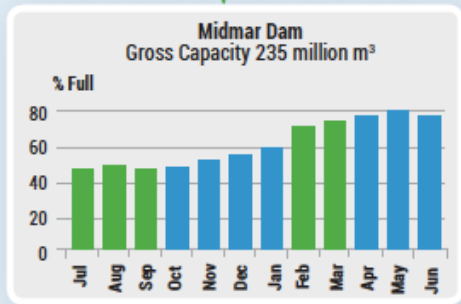


Mooi River System

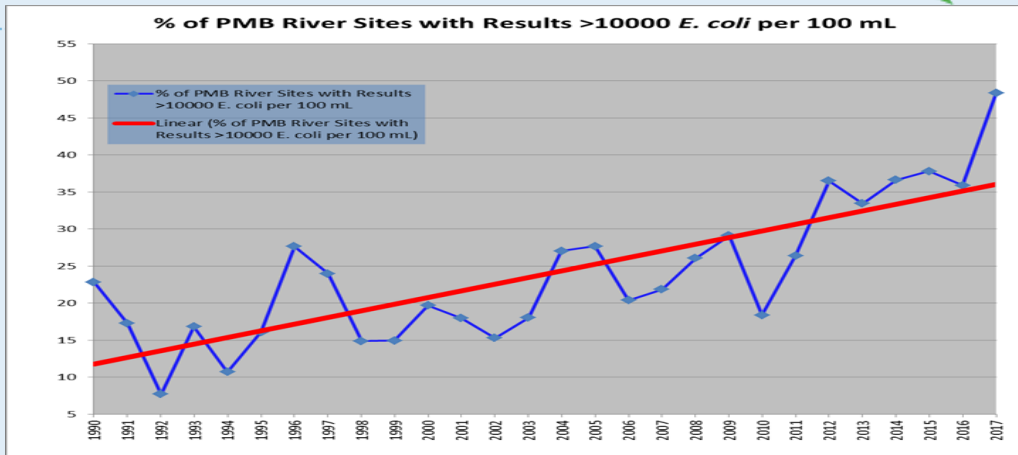


Mooi-Mgeni Transfer

uMgeni River

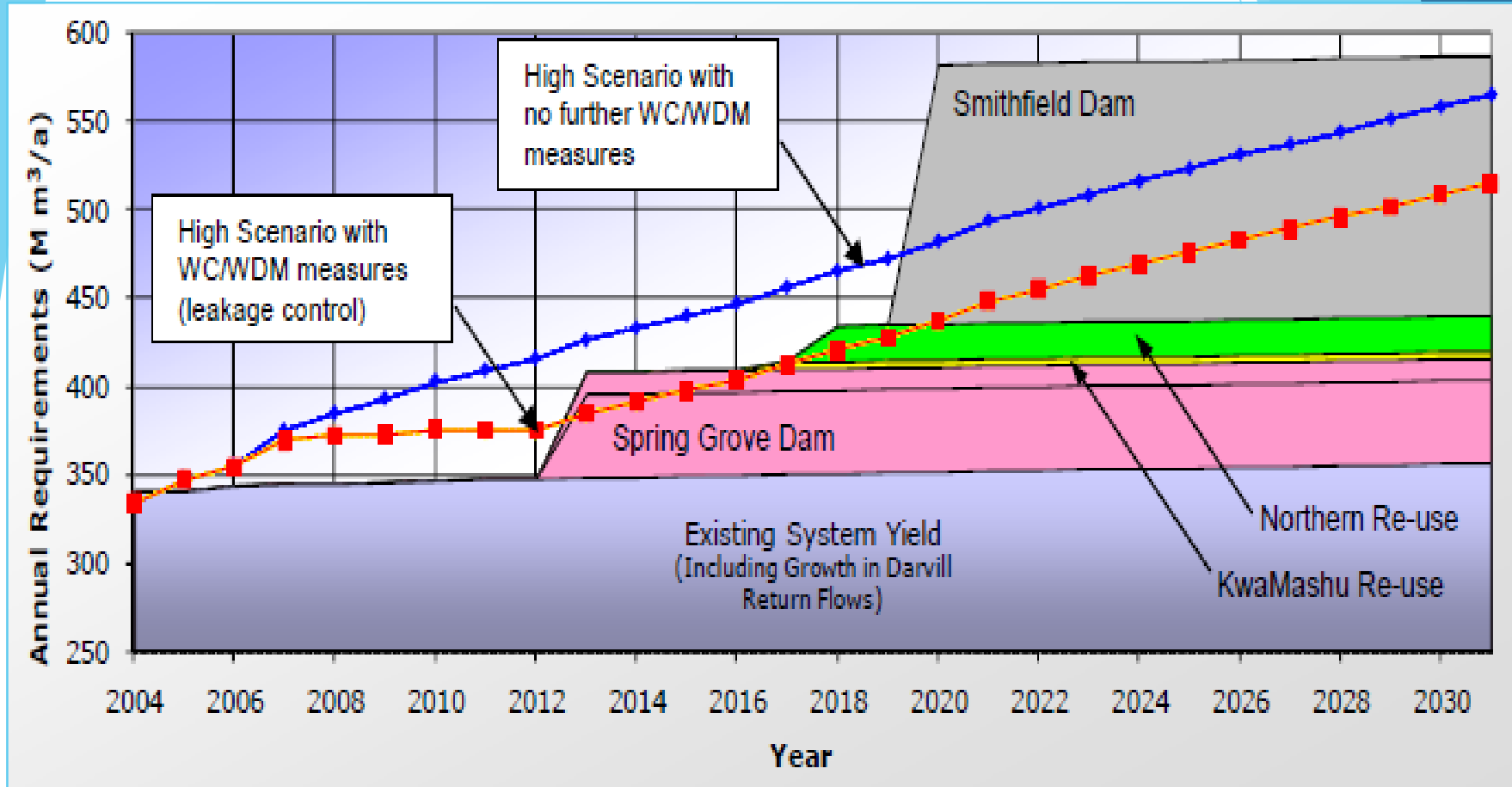


uMgeni River



■ Excellent
 ■ Good
 ■ Satisfactory
 ■ Poor
 ■ Unsatisfactory

KZN Reconciliation Strategy (DWAF, 2009)



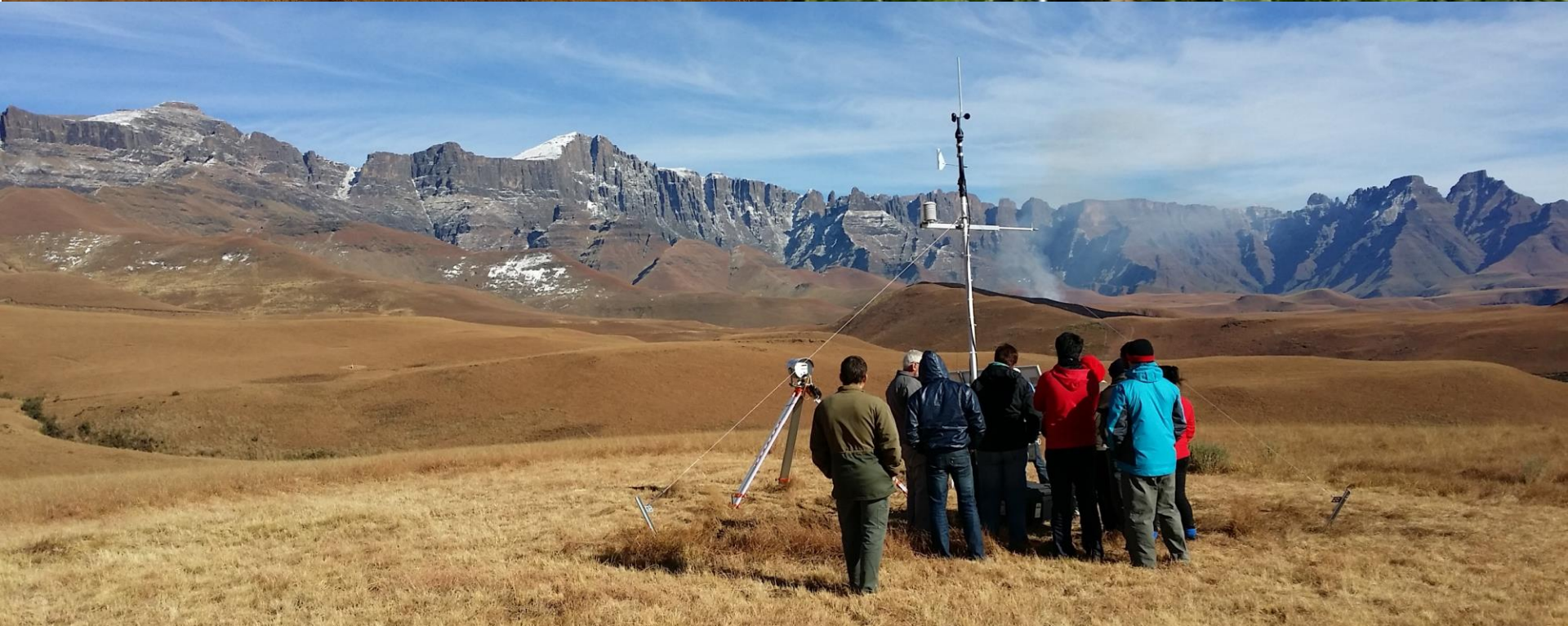
Costs and Benefits of Investing in EI to enhance water supply

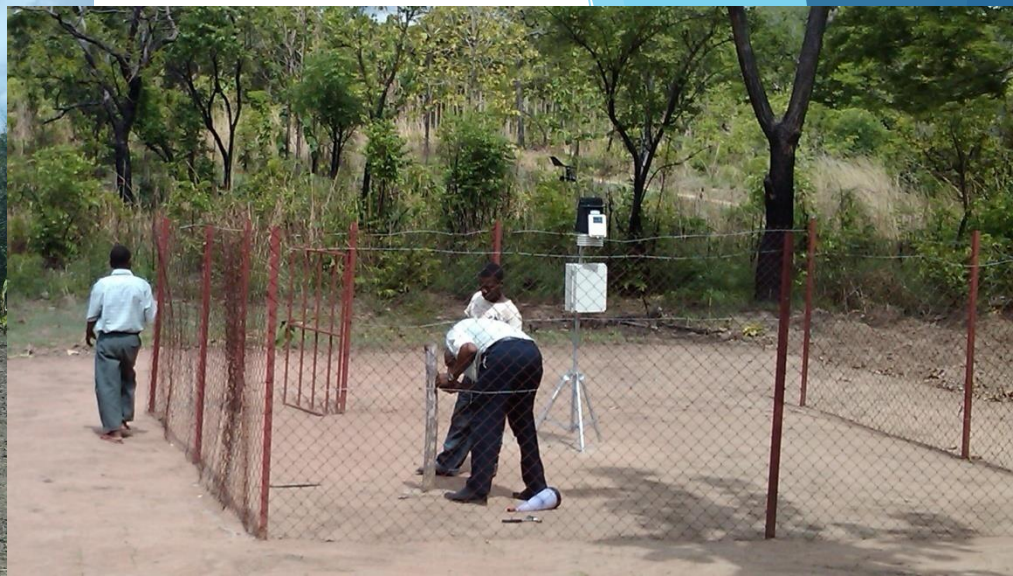
Costs – Invasive alien plant clearing and grassland restoration

Grassland/woodland categories	Average rehabilitation costs per ha	Alien Plant clearing categories	Average rehabilitation costs per ha
Severely degraded	R 7 836	>70% Canopy cover	R 14 566
Moderately degraded	R 237	30-70% canopy cover	R 6 450
Untransformed management	R 20	<30% Canopy cover	R 2 000
		Restored management	R 150

- ▶ Costs were calculated on the basis of restoration and management scenarios for grassland and indigenous forest using information supplied by local organisations

• 1US\$=14ZAR
1Euro=16.5ZAR

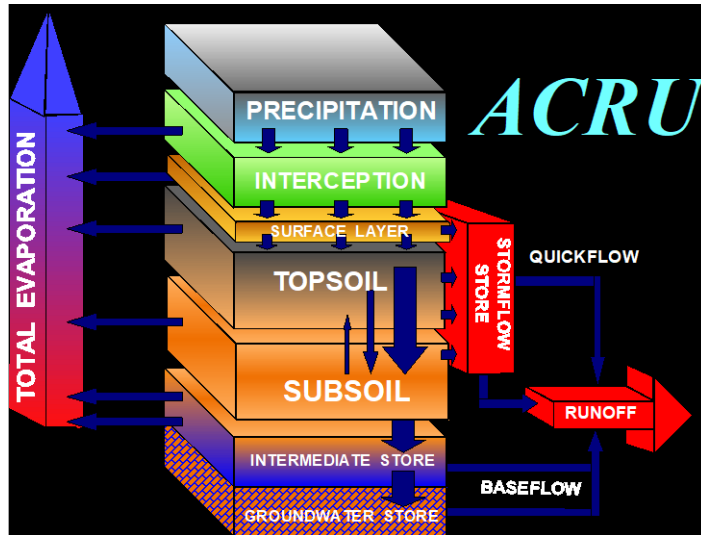




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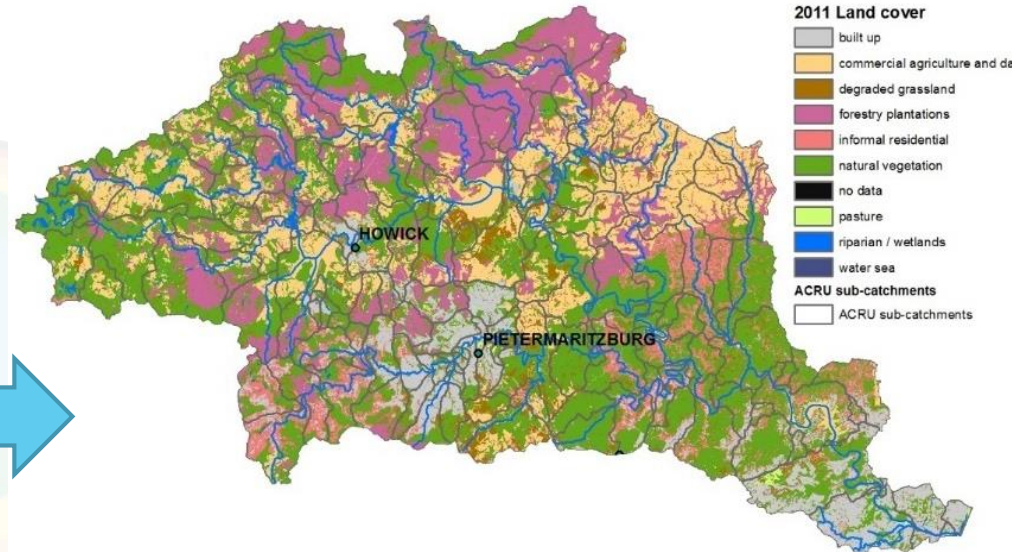
2009/11/28 11:32

Application of hydrological model



ACRU ...A Daily Time-Step, Conceptual-Physical, Process-Based Soil Water & Hydrological Budgeting Model

~Schulze (1995) and updates



•Based on Warburton (2011) and 2011 land cover (Ezemvelo KZN Wildlife & GeoTerra Image)

Benefits and Cost

	Total additional yield*	Total additional baseflow	Total avoided sediment	Number of direct beneficiaries	NPV of total project cost	Water Cost (total cost : yield over 50 years – 6% discount rate to both costs and benefits)	Water Cost (total cost : yield over 50 years – 6% discount rate to costs and 0% benefits)
	m ³	m ³	m ³	User population	R	R/m ³	R/m ³
Midmar	107 679 991	15 552 401	4 970 930	2 562 370	R 63 863 301	R 2.44	R 0.72
Albert Falls	15 283 944	8 626 877	3 450 870	2 599 811	R 17 973 109	R 5.02	R 1.49
Henley/Pietermaritzburg	170 027 198	5 070 222	7 322 015	1 964 414	R 50 500 692	R 1.14	R 0.34
Nagle	4 223 375	26 295 543	24 431 540	2 611 713	R 33 805 461	R 29.97	R 8.88
Inanda	43 169 206	26 497 528	6 063 435	1 388 728	R 41 362 996	R 3.99	R 1.18
Durban (uMngeni Estuary)	18 973 247	616 867	4 226 254	1 200 000	R 16 170 192	R 3.92	R 1.16
Total	359 356 960	82 659 438	50 465 045	4 500 000	R 223 675 751	R 2.52 *	
Additional benefits not quantified	<ul style="list-style-type: none"> • Meet provincial and national biodiversity objectives • Maintenance and elevation of recreation values • Maintenance of food security services • Maintenance and elevation of visual, smells and sense of place values • E-Flows • Create long term jobs • * Total over 50 years at 50% assurance of supply 						

* Weighted average

Unit Reference Values (Rands/m³)

Ecological infrastructure

Baviaanskloof-Tsitsikamma (streamflow maximisation)	R1.17
Baviaanskloof-Tsitsikamma (baseflow maximisation)	R4.67
uMngeni (streamflow gains)	R2.50

Built infrastructure

Groundwater (borehole installation) ¹	R4.56 – R5.40
Water transfer schemes ¹	R5.51
Treatment of used water ¹	R7.15
uMkhomasi Water Scheme ²	R7.20 – R8.20
Desalinisation ¹	R9.01

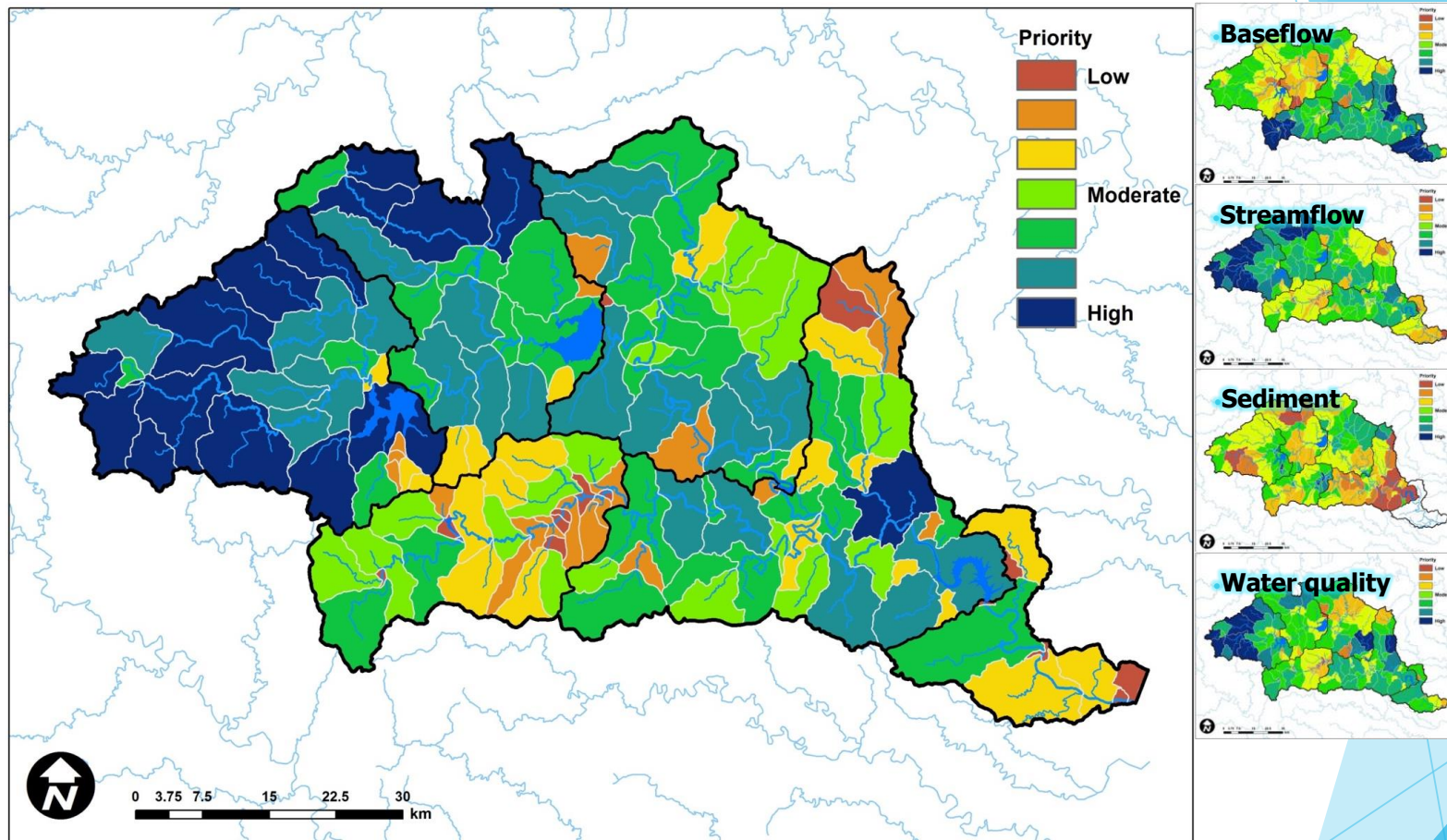
Dam infrastructure

Nandoni Dam ³	R0.50 – R0.67
Inyaka Dam ³	R1.13
Berg River Dam ³	R2.00 – R2.82
De Hoop Dam ³	R3.79
Spring Grove Dam ⁴	R0.46 – R0.76

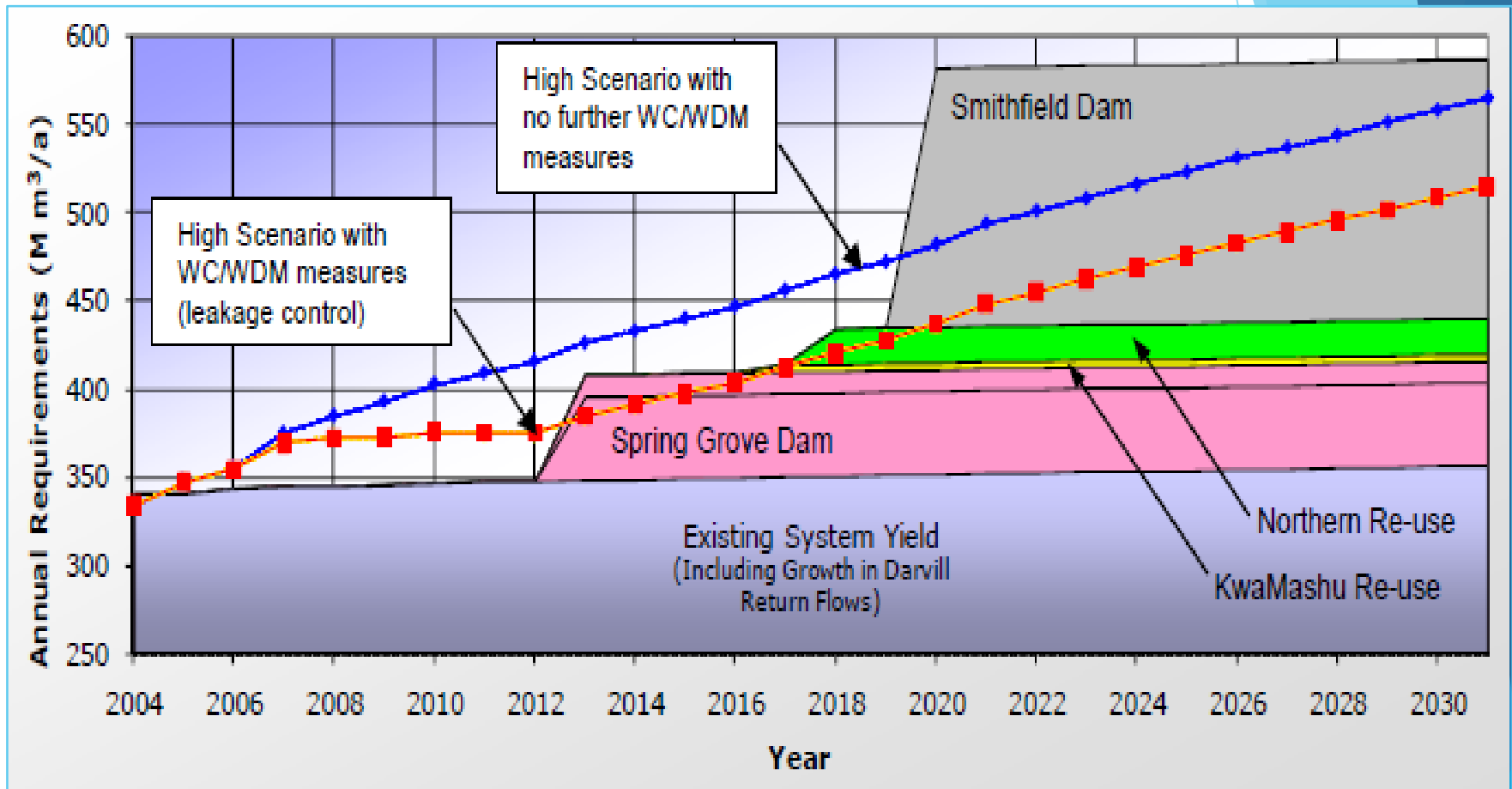
•Mander et al 2017

•(drawn from different sources)

Priority catchments to conserve ecological infrastructure



Water Utility Cost Drivers



- ▶ Risk avoidance/buffer
- ▶ Replace grey infrastructure??

Is the money available??

	UW bulk sales (1000m ³)	Bulk water tariff (R/m ³)	Bulk water cost (R/m ³)	Raw water cost (R/m ³)	WRMC (R/m ³)	Total income	Catchment mgmt income	WRMC as % Cost
2017	409887	R5.33	R3.66	R0.44	R0.016	R2 187 000 000	R8 197 740	0.37%
Scen 1	409887	R5.33	R3.66	R0.44	R0.05	R2 187 000 000	R20 494 350	0.9
Scen 2	409887	R5.33	R3.66	R0.44	R0.10	R2 187 000 000	R42 471 750	1.8
Scen 3	409887	R5.33	R3.66	R0.44	R0.50	R2 187 000 000	R211 141 240	9.75

Irrigation (1000m ³)	Irrigation Cost (R/m ³)	Irrigation Income
72 000	R0.02	R1 173 600.00

Conclusions

- ▶ Huge under-investment in Green Infrastructure relative to benefits
- ▶ Investment in Green Infrastructure reliant on external sources of funding
 - ▶ User pays verses subsidies and external funding?
- ▶ Cost-Benefit analysis suggest significant benefits for relatively low expenditure
 - ▶ What discount rate should be applied to NBS?
- ▶ Working with water utility to build a case and sustainable financial model