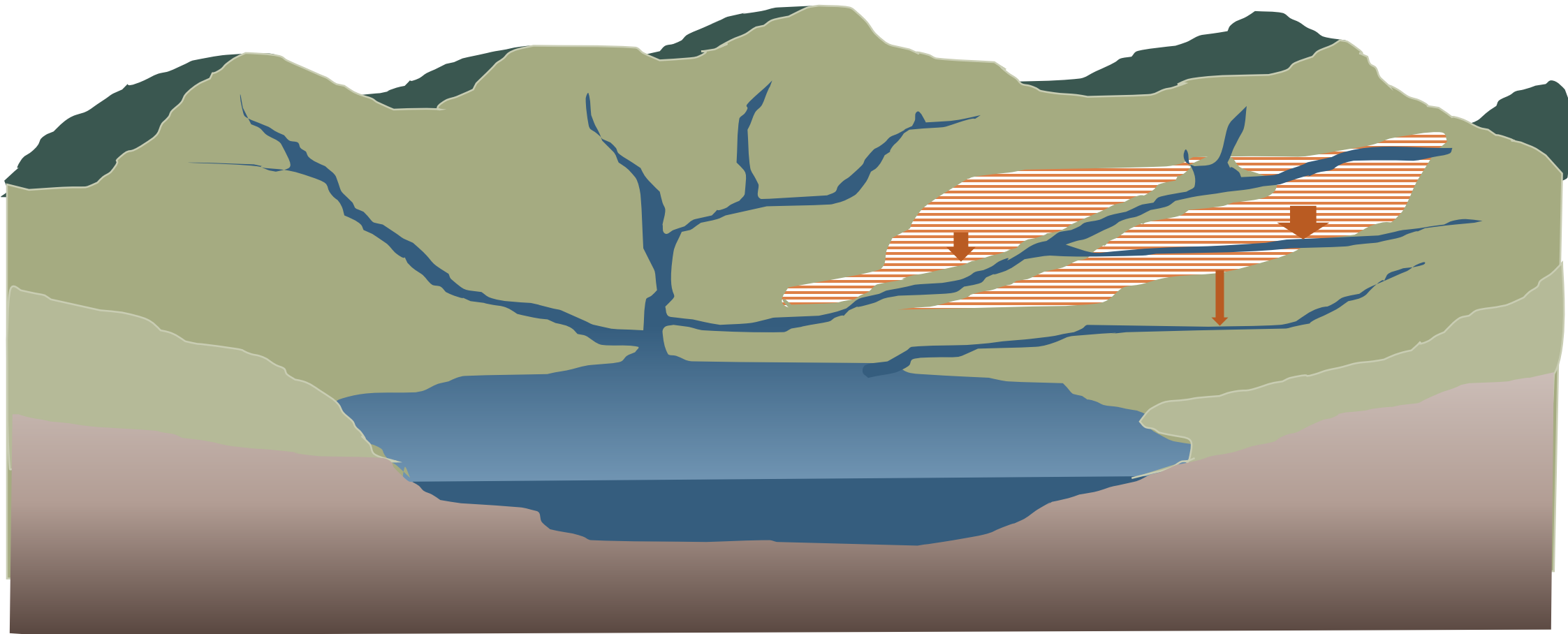


Erosion control & sediment retention



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Service

&

Benefits

1. Limiting the area of degraded/transformed landscape that generates excess sediment

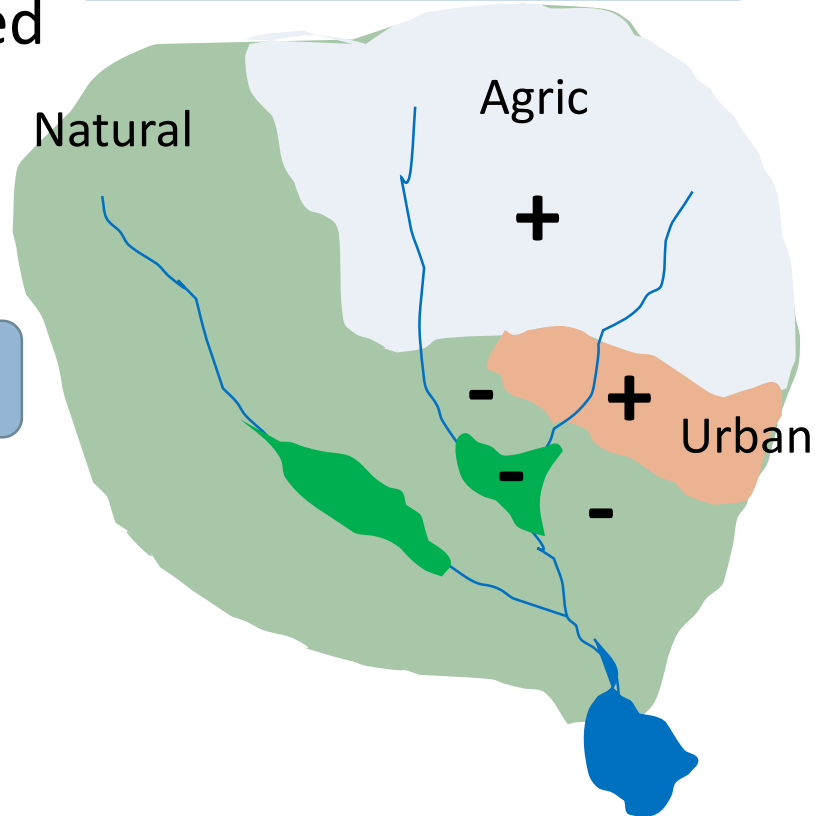
the passive service

1/disservice of degradation

2. Trapping some of the loads generated

the active service

+ = generates excess sediments
- = captures excess sediments



Downstream ecosystem/
reservoir/HEP
station/canal/harbour

1. Reduced impacts on infrastructure

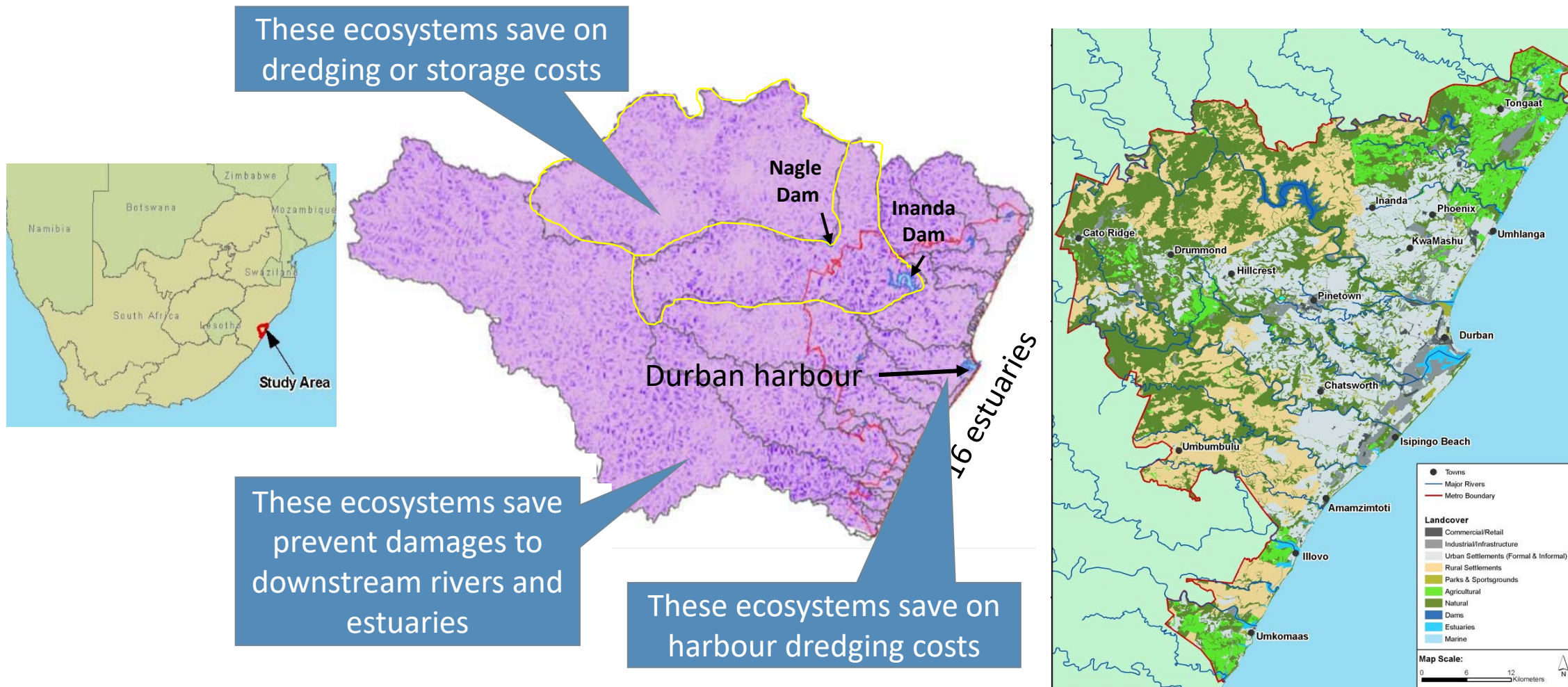
final service

2. Reduced impacts on other downstream aquatic ecosystem services

intermediate service

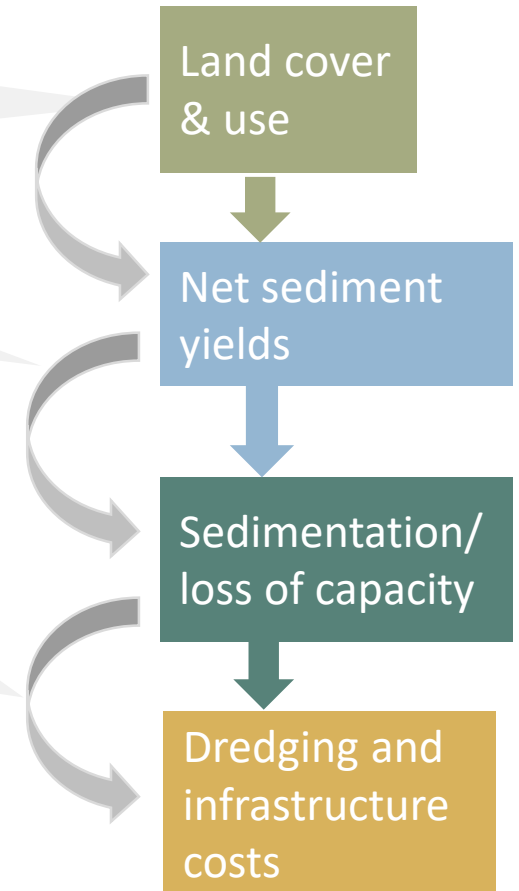
Durban case study (eThekweni Municipality)

- Included active (sediment trapping) and passive (no LULC change) aspects;
- Included final (avoided dredge/storage costs) and intermediate (estuary ES) values



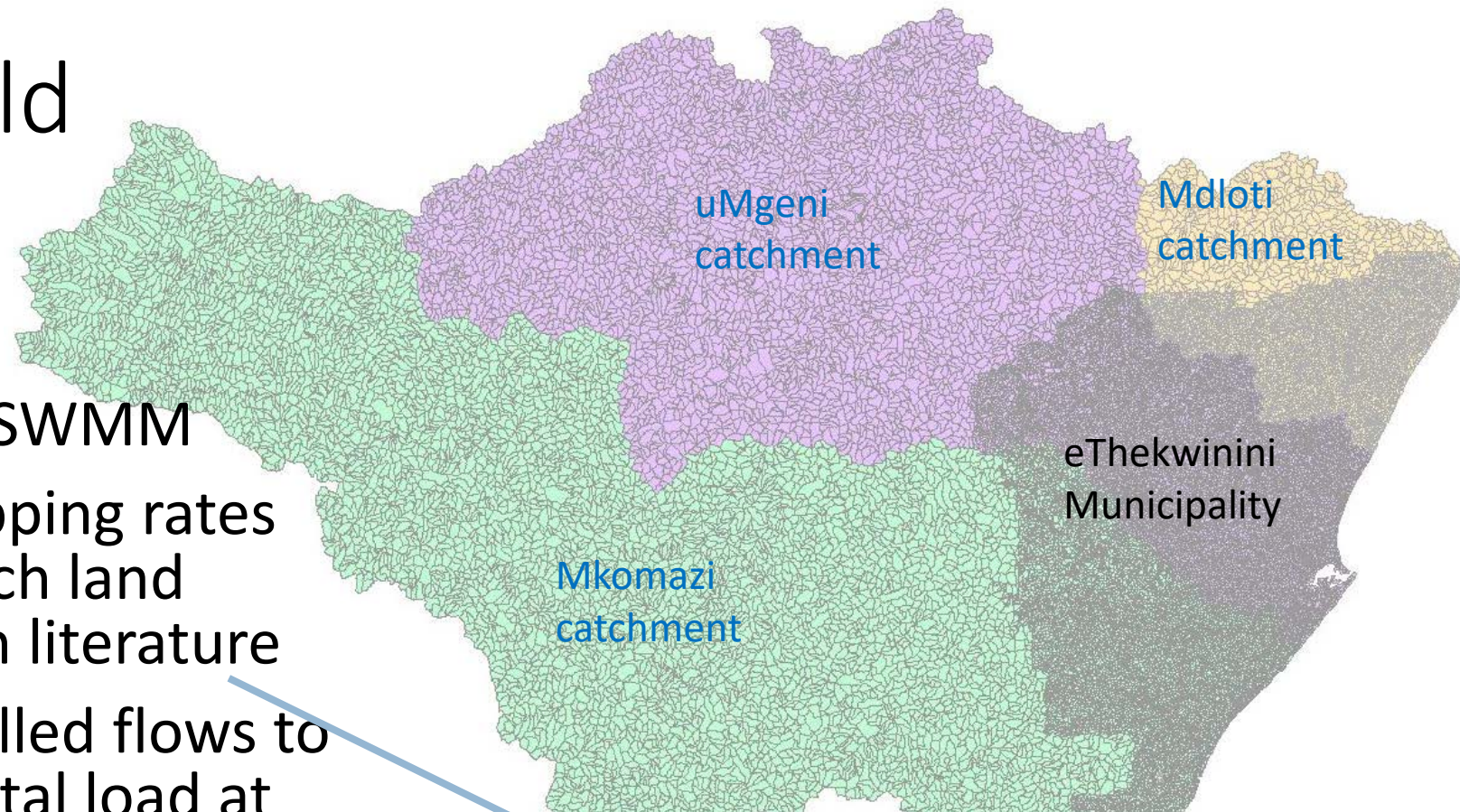
3-stage valuation process

- Model sediment yield
 - Difference in sediment load at each point of interest with and without service (tonnes/year)
- Estimate loss of reservoir capacity
 - with vs without service (m³/year)
- Valuation (avoided costs approach)
 - Value avoided sedimentation at points of interest (\$/year):
 - reservoir storage replacement costs
 - avoided harbour dredging costs
 - Map value to source areas (\$/ha/year)
 - Based on physical model coefficients



Sediment yield

- Modelled using PC-SWMM
- Production and trapping rates of sediments for each land cover type based on literature
- Coupled with modelled flows to estimate TSS and total load at relevant points.
 - TSS adjusted by a factor of 1.25 to include bed load (Msadala *et al.* 2010, Rooseboom 1992)
- Calibrated with TSS data from >40 monitoring stations.



Event mean concs for 0.5y RP	TSS (mg/l)
Settlement - urban	100
Commercial / Retail / Institutional	166
Industrial / Road & Rail	166
Extractive / Utility	166
Farming / plantations & woodlots	201
Recreational open space	201
Settlement - rural	201
Natural vegetation (D'MOSS)	70
Settlement - informal	497

A vertical strip on the left side of the slide shows a dense forest with tall trees and green foliage.

Defining the baseline (without service)

- Two scenarios were set up in the hydrological model:

1: removal of trapping capacity of natural habitats

quantifies the
active service

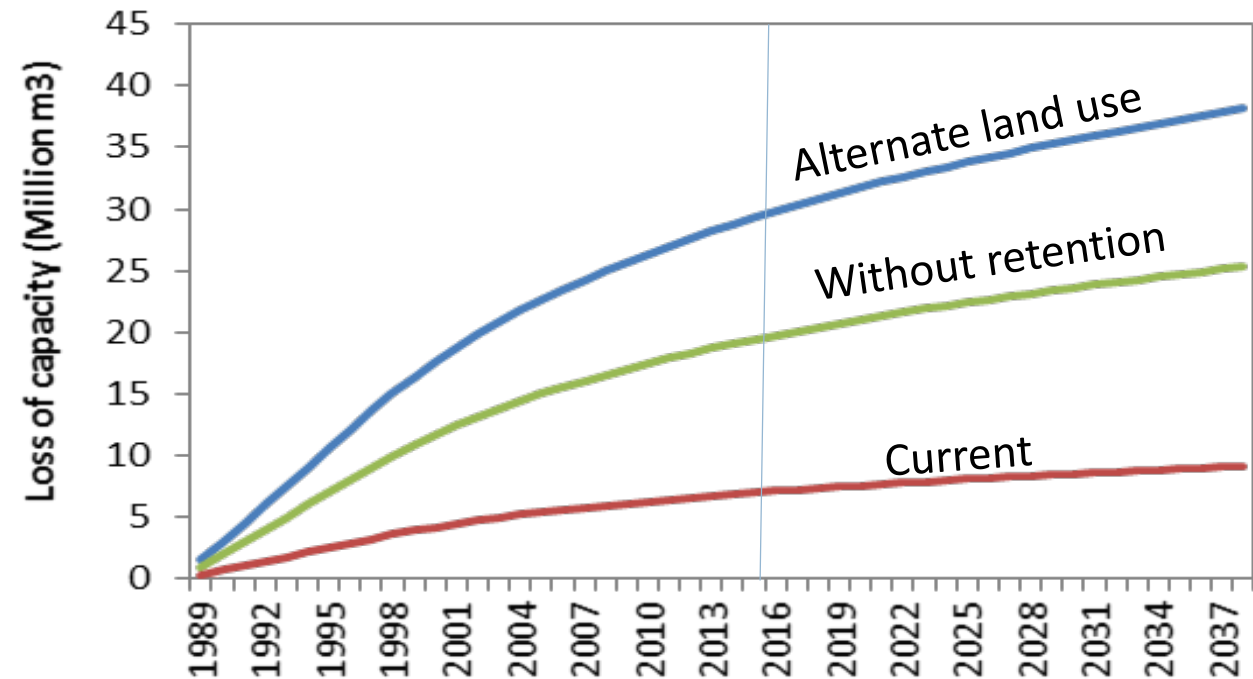
2: replacing natural habitats with dense rural settlement as a likely alternative land use

quantifies the
active + passive
services

- These provided lower and upper bound estimates of the magnitude of the service, depending on what is considered as the service

Impact on reservoir capacity

- Current rate of sedimentation estimated using average sediment yields, starting reservoir capacity and measured current (2015) capacity,
 - using Rooseboom (1975) model
- % change in rate of sedimentation under each scenario was taken from the PC-SWMM model.
- Calculated difference in loss of capacity over time based on the capital replacement costs of the dams (NPV)



	Avoided storage replacement cost NPV 20y from 2015, 6% (R millions)	
REs	Vs no retention	Vs transformed land use
Inanda	9.09	16.31
Hazelmere	3.01	16.33
Nungwane	0.15	0.38
TOTAL	12.25	33.02

Impact on harbour

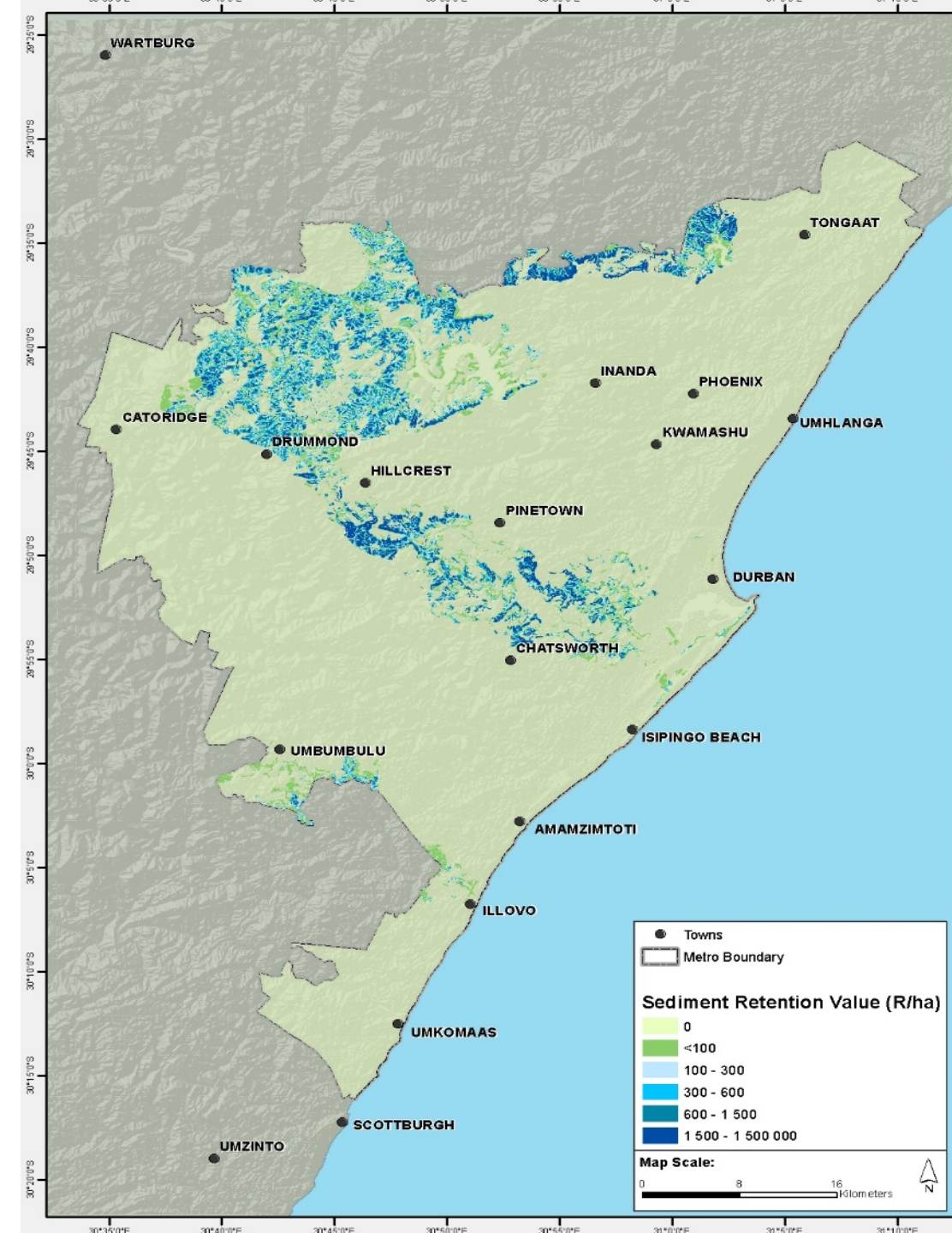
- % change in rate of sedimentation under each scenario taken from the PC-SWMM model
- Cost per m³ was estimated using dredging data provided by Transnet



Durban Harbour	Average dredging cost (R/m ³)	Change in annual TSS load (m ³)	% change in annual TSS load	Annual dredging costs avoided (R millions)	NPV
Lower bound	229	4 511	195%	1.033	11.85
Upper bound	229	5 029	206%	1.152	13.21

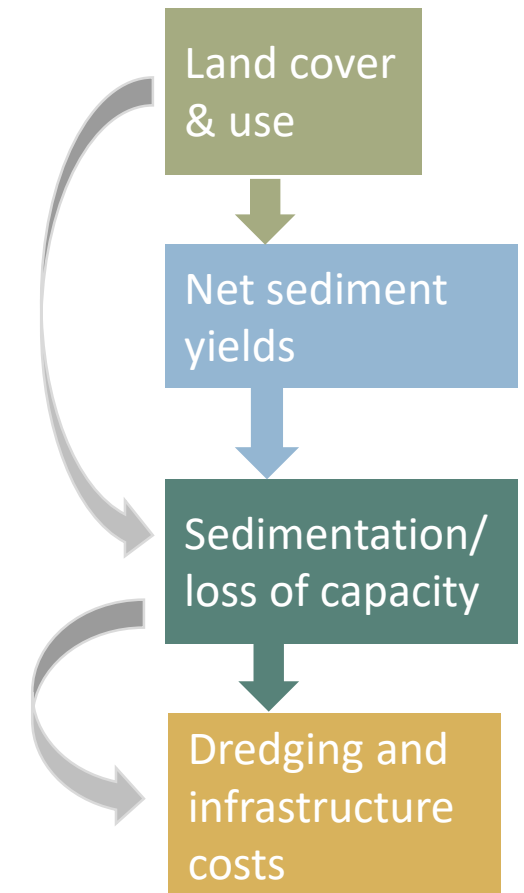
Mapping value

- Values were mapped back to the catchment areas based on the physical model of sediment retention
- Large range of uncertainty, mainly from physical modelling and service (baseline) definition



Discussion

- Models need better calibration with empirical estimates.
 - Now embarking on this in SA for physical aspect
- Two stage valuation probably best, since expenditures will be sporadic
 - empirical analysis of expenditure in relation to land cover would be difficult
- Rethink attribution of values to ecosystems
 - Rather attribute negative value to sources of erosion than positive value to natural land cover. Then:
 - Only the active service is mapped to the natural ecosystems
 - Externalities of production areas are internalised



• Thank you!

