Stormwater and Outflow Planning Controls for Waterway Healthy: Applying the Urban Streamflow Impact Assessment (USIA)

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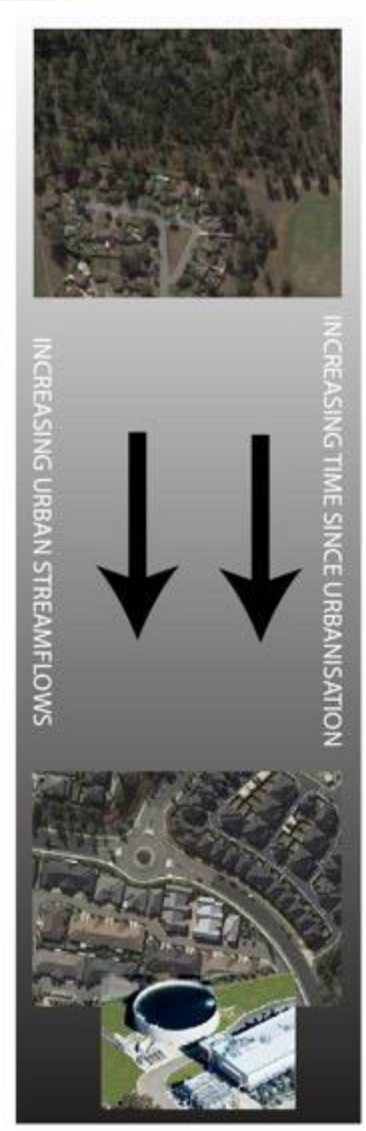
Sydney WATER

CTENVIRONMENTAL
ECOSYSTEM MANAGEMENT AND MONITORING

What is the problem?



DECREASING SOCIAL, ECOLOGICAL AND GEOMORPHIC VALUES

~$10 M per kilometre

What is lost?

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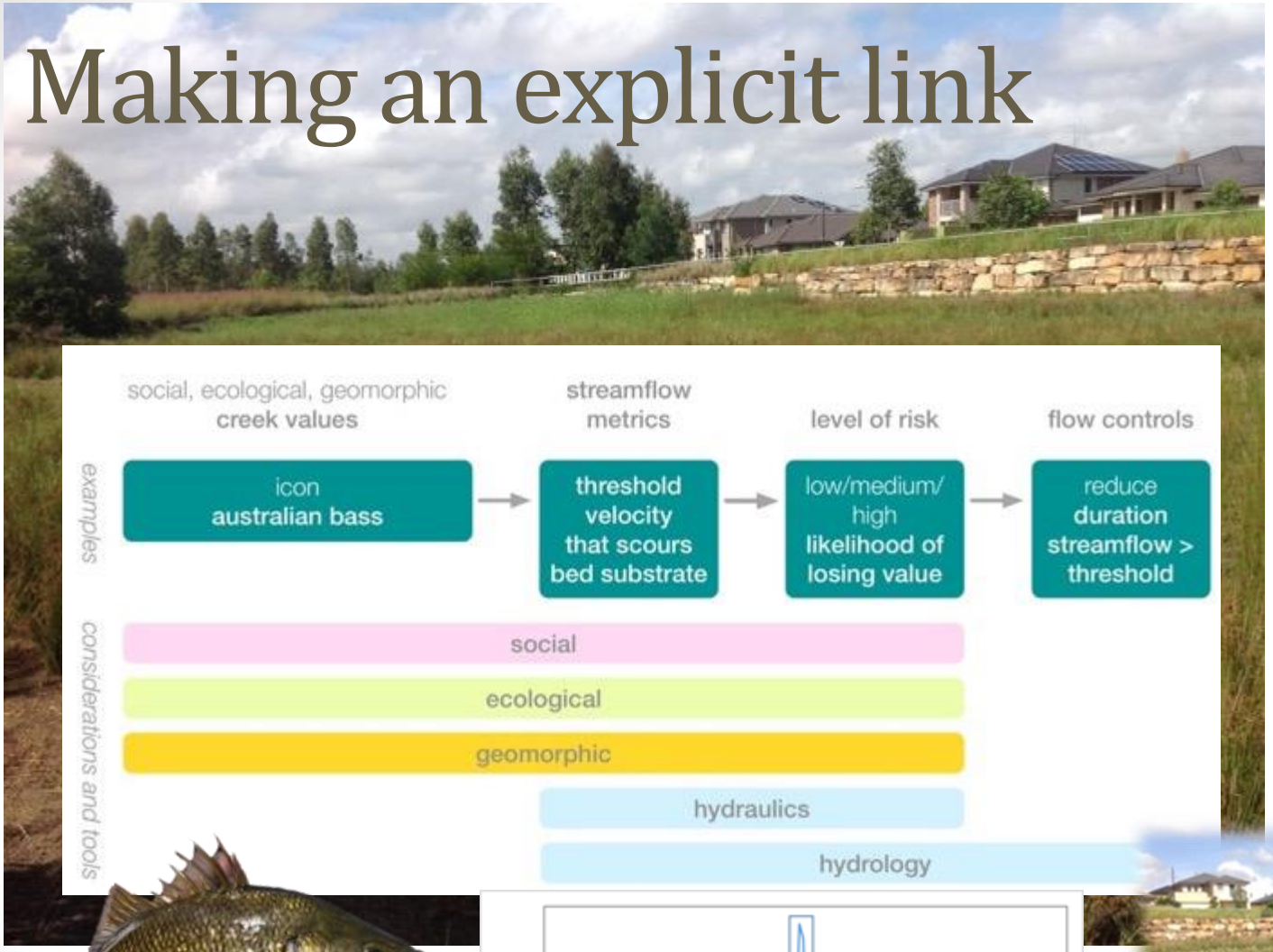
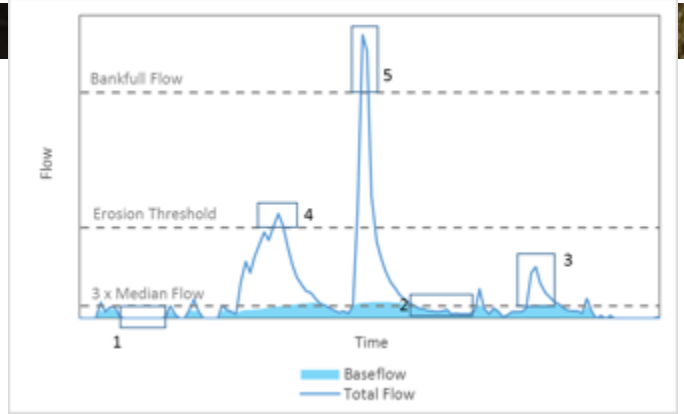
Making an explicit link



	social, ecological, geomorphic creek values	streamflow metrics	level of risk	flow controls
examples	icon **australian bass**	**threshold velocity that scours bed substrate**	low/medium/ high **likelihood of losing value**	reduce **duration streamflow > threshold**
considerations and tools	social			
	ecological			
	geomorphic			
		hydraulics		
		hydrology		



The USIA method

stage 1

identify south creek catchment values
social, ecological, geomorphic

delineate sub-catchments
sub-catchment and waterway study reach

collect data and review
information for sub-catchment and waterway reach (ecology, geomorphology, hydrology and social)

select assessment sites
identify assessment site/s using the protocol

stage 2

hydrological scenarios
hydrology data to test development scenarios

hydraulic modelling
develop hydraulic models for the study reaches

geomorphic assessment
desktop and field assessment to determine geomorphic character and condition

assess ecology
field based assessment to determine current ecological condition and likelihood of identified stream values being present

stage 3

technical panel workshop
checking social, ecological and geomorphic values and linking to flow metrics

refine metrics
refine metrics and acceptable ranges that relate waterway and riparian values to flows

assess risk
identify potential loss of values for the hydrological scenarios (low/medium/high risk)

outputs
- 'traffic light' risk matrix
- metrics for informed waterway protection

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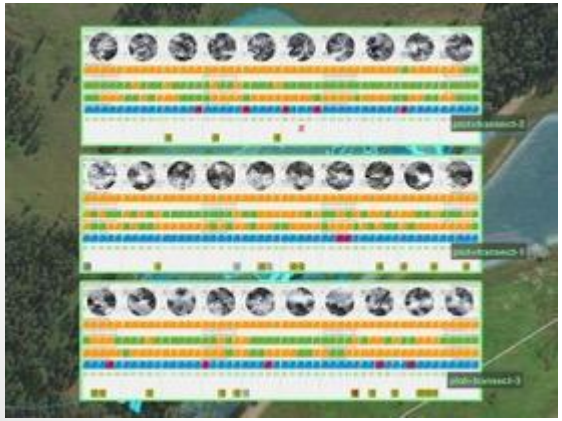
Identifying ecological values and predicting impacts

Methods of ecological survey include:

- Riparian vegetation condition assessment
- Biometric vegetation survey
- Fauna survey
- Water quality sampling
- Macroinvertebrate sampling
- Diatom sampling
- Key Fish Habitat assessment
- Threatened species mapping
- Vegetation mapping
- Likelihood of occurrence



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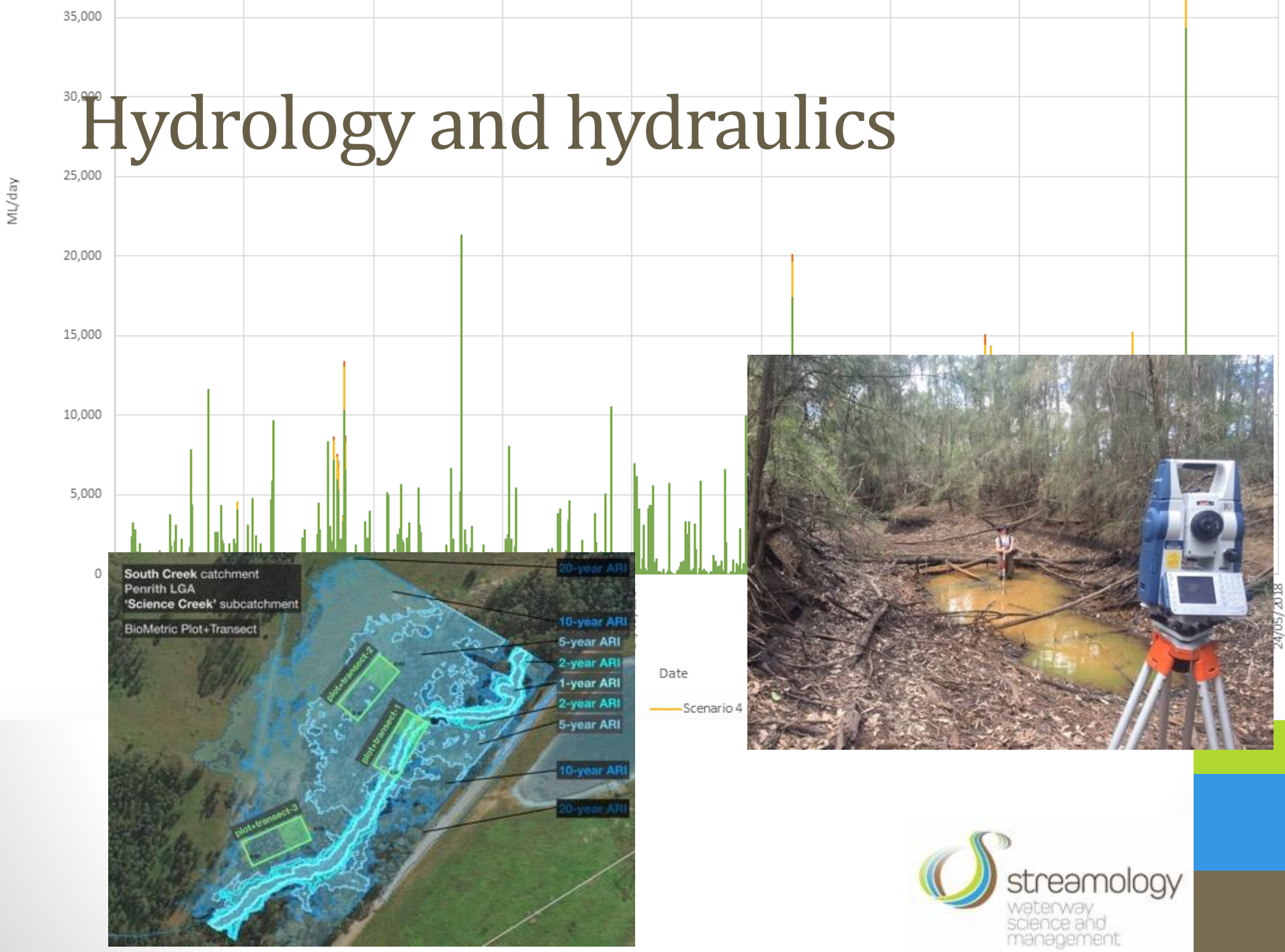
Hydrology and hydraulics



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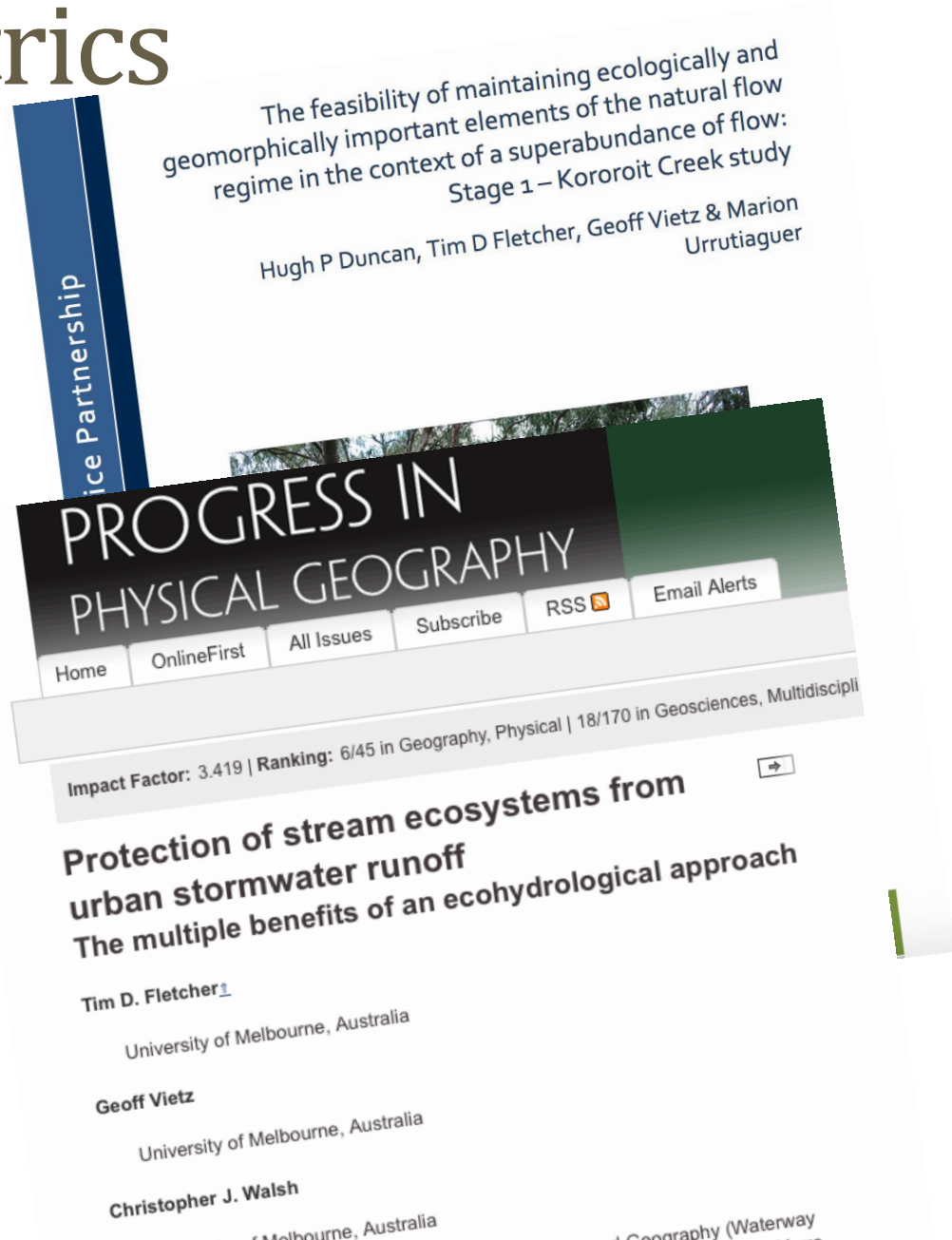
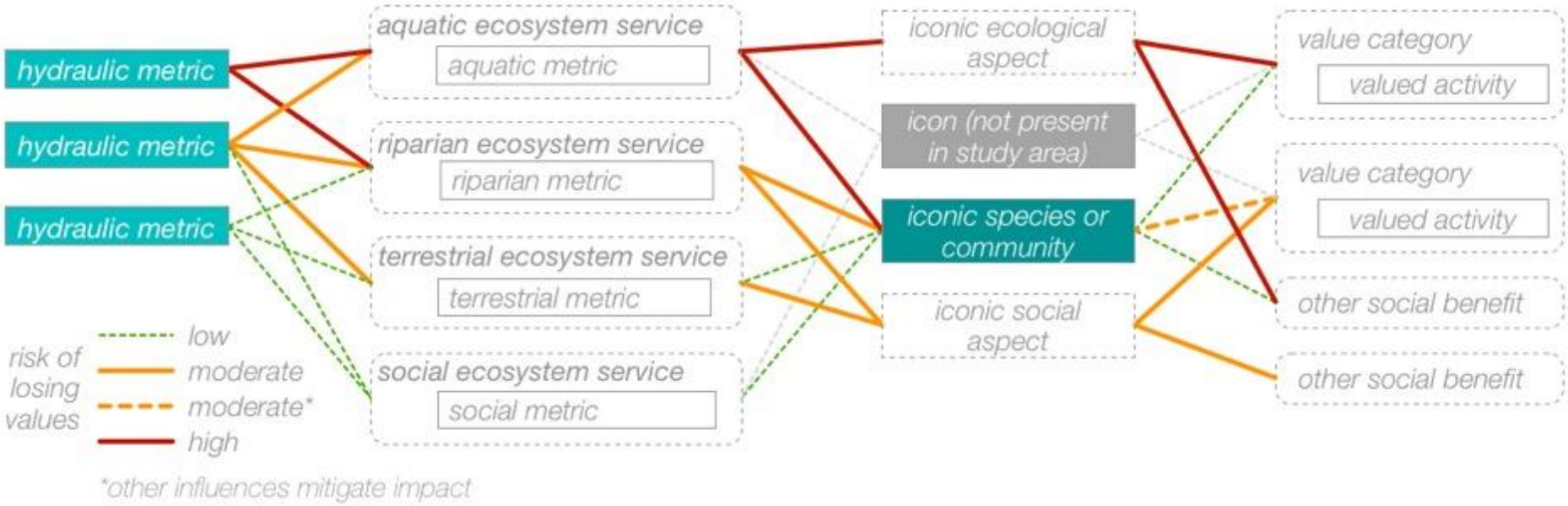
Relating to physical changes

Hydrologic Metrics

Annual flow	Mean annual flow volume
Zero flows	Mean duration of zero flow periods
Zero flows	% of time flow is zero
Baseflow	Baseflow index (Baseflow/Total Flow)
Freshes	Events/year > 3 x baseline median flow
Freshes	% of time > 3 x median flow
Erosion threshold	% of time > bank/matrix mobilisation threshold
Erosion threshold	% of time > bed mobilisation threshold
Floodplain engagement flows	Events/year > bankfull discharge
Floodplain engagement flows	% of time flow > bankfull discharge



Linking metrics to values



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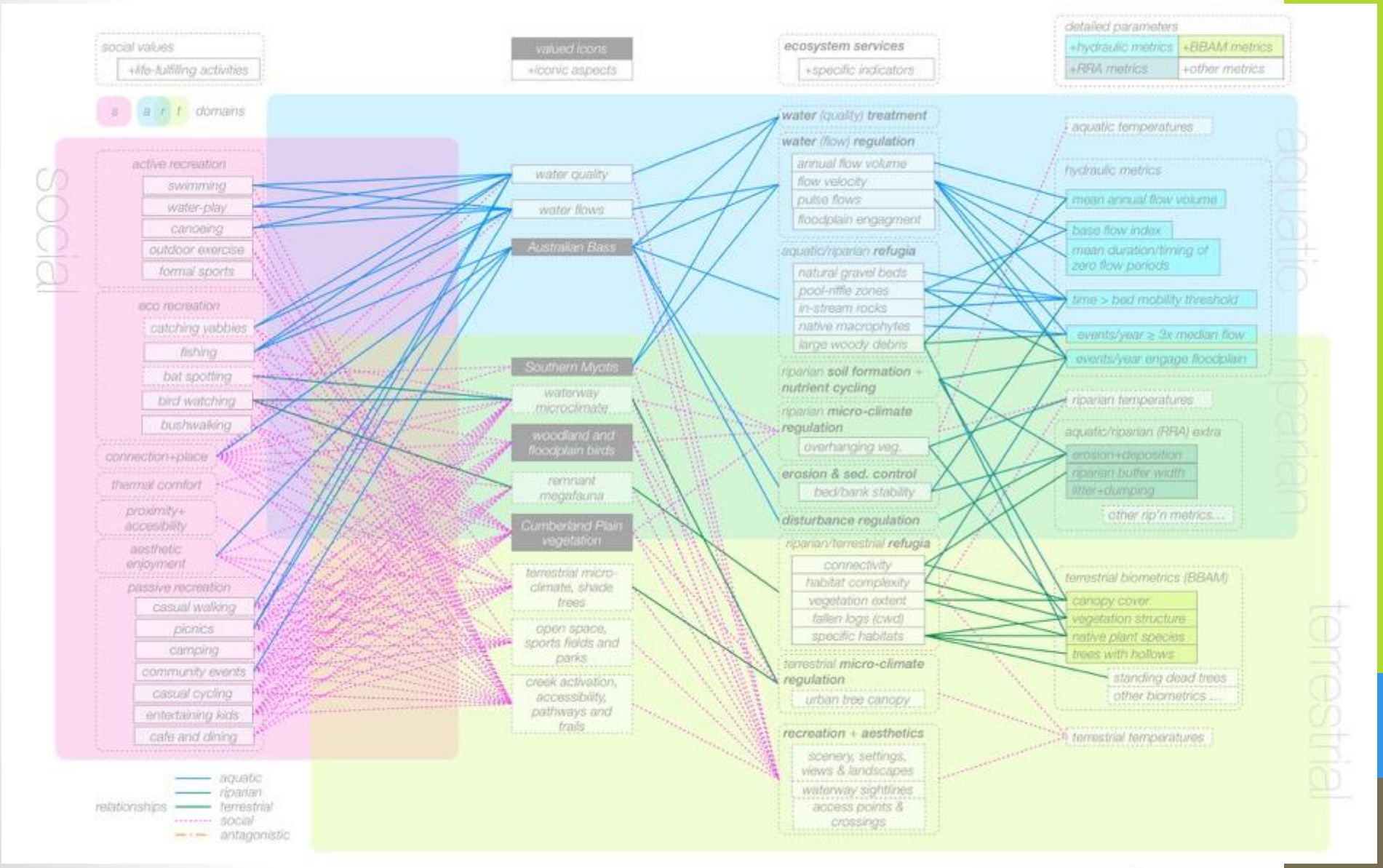
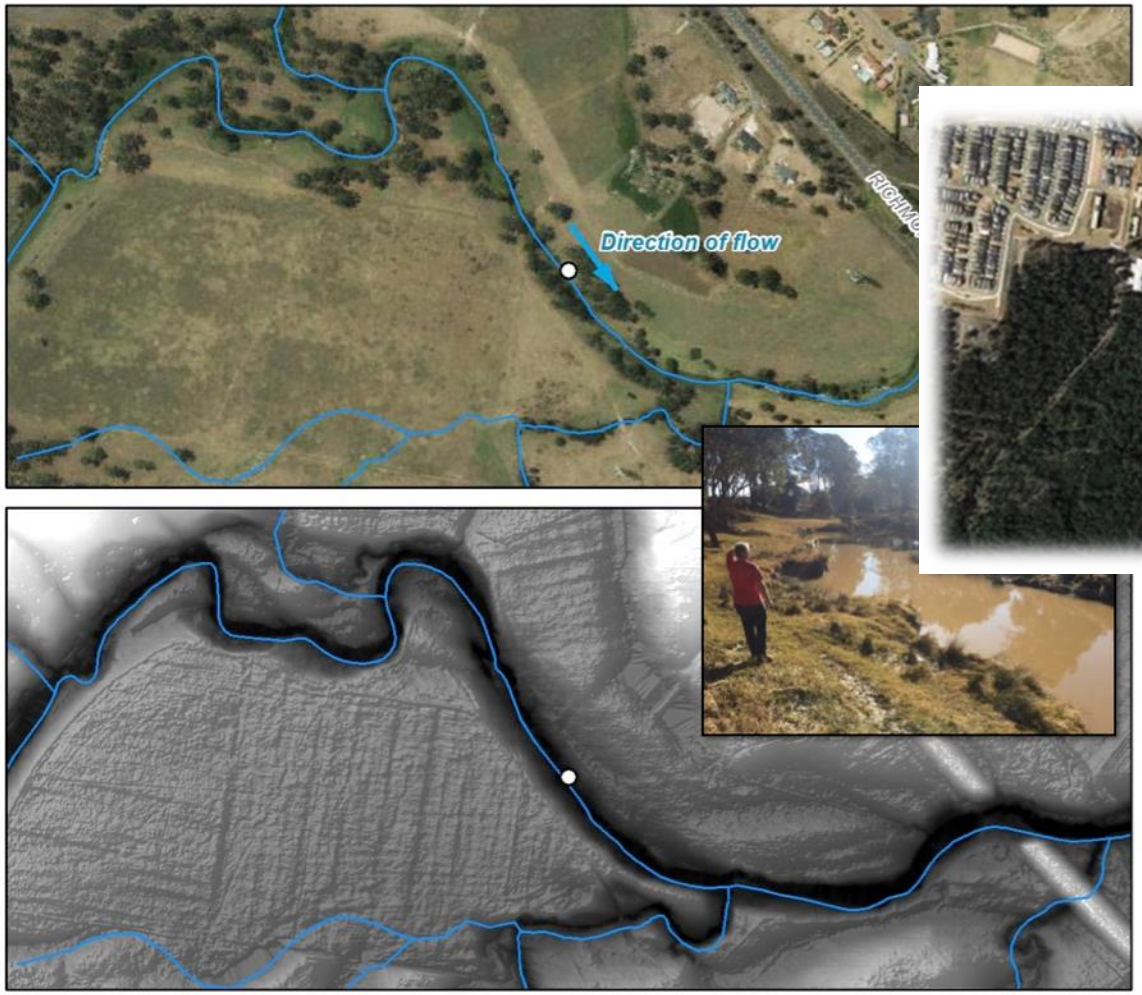
Linking socio-ecological values to flow metrics



Application to a lowland river



South Creek, Sydney

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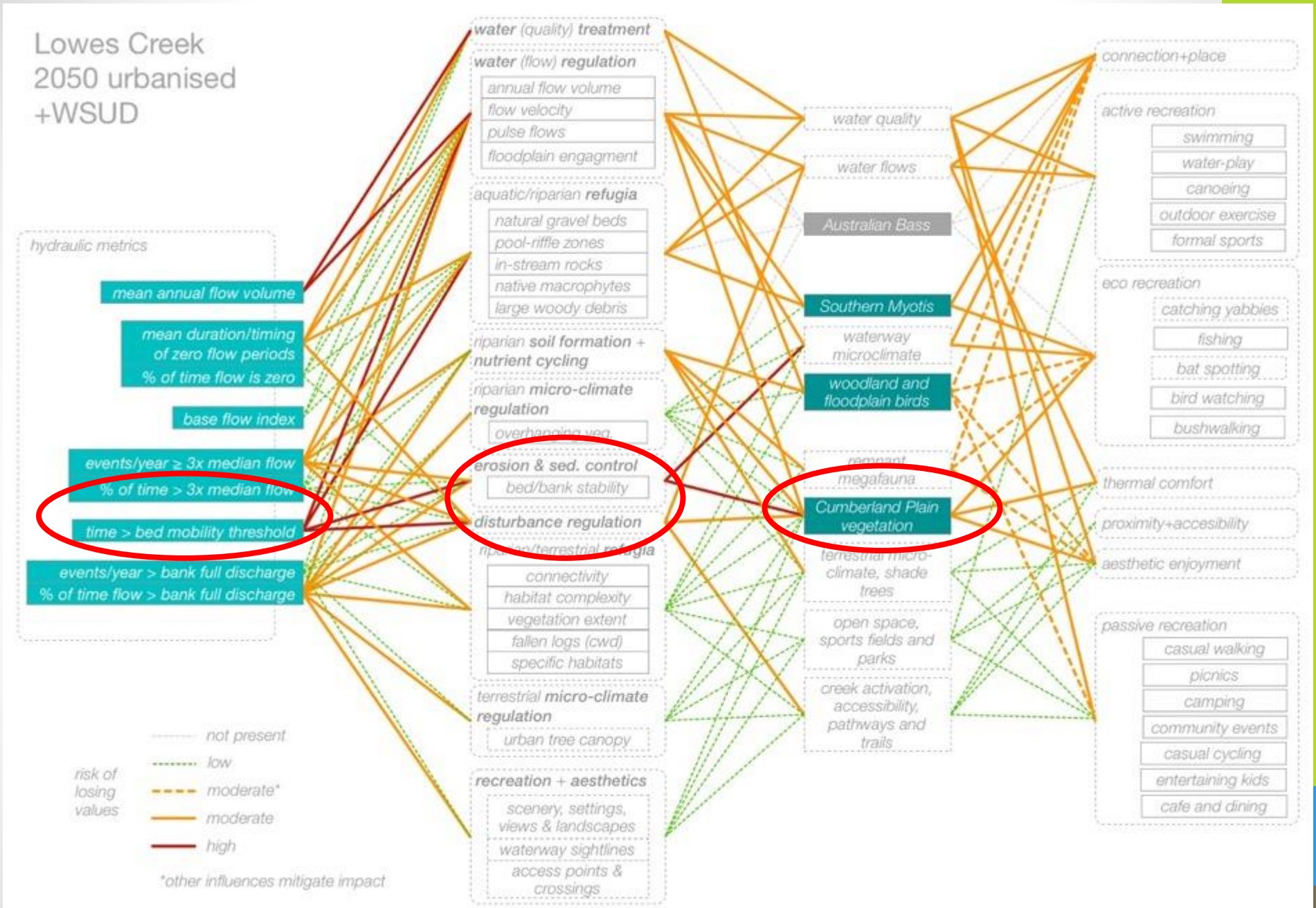
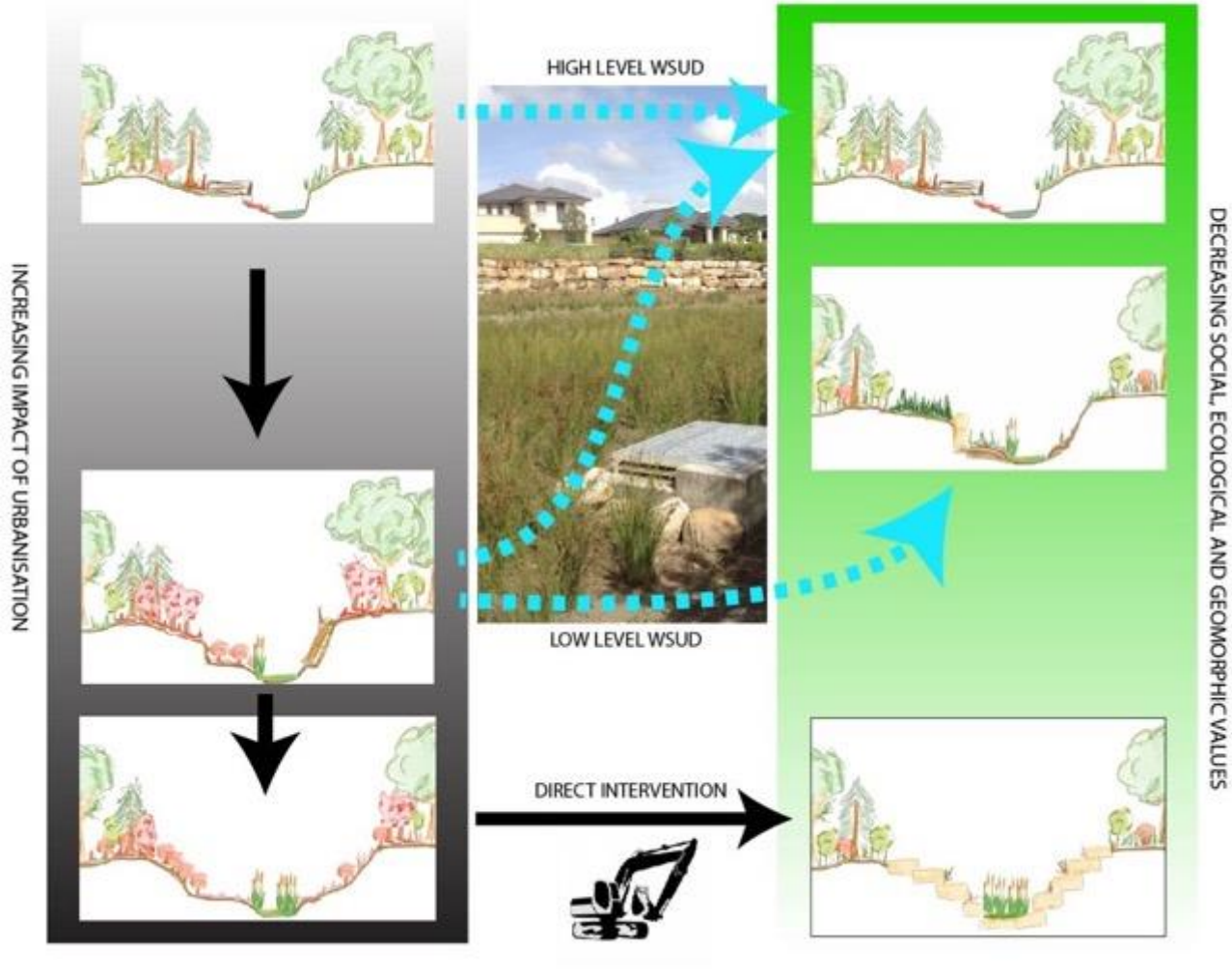
Risk to values by scenario

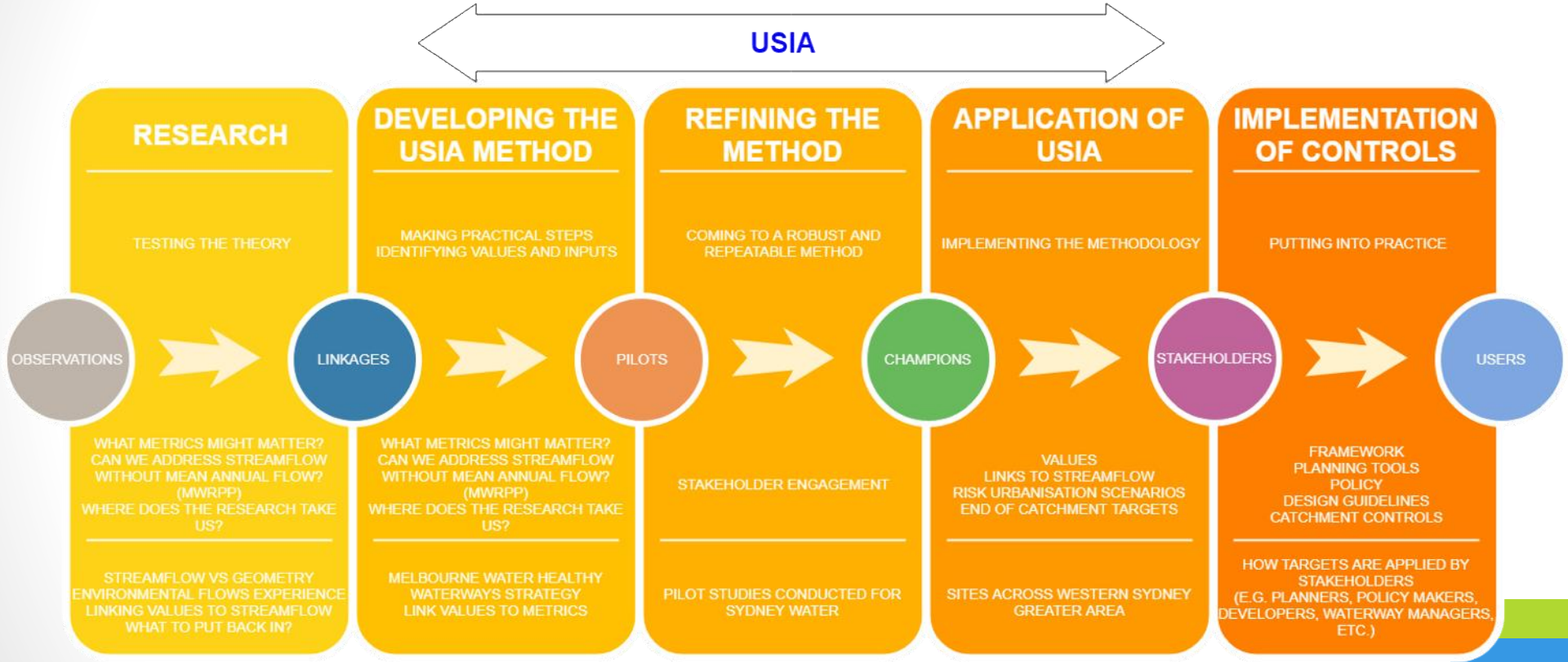
Flow type	Flow metric	Threshold value
Annual flow	Mean annual flow volume	N/A
Zero flows	Mean duration of zero flow periods	0.001 ML/d
Zero flows	% of time flow is zero	0.001 ML/d
Baseflow	Baseflow index (Baseflow/Total Flow)	$\alpha = 0.975$
Freshes	Events/year > 3 x baseline median flow	119 ML/day
Freshes	% of time > 3 x median flow	119 ML/day
Erosion threshold	% of time > bank/matrix mobilisation threshold	585 ML/day
Erosion threshold	% of time > bed mobilisation threshold	1000 ML/day
Floodplain engagement flows	Events/year > bankfull discharge	4354 ML/day
Floodplain engagement flows	% of time flow > bankfull discharge	4354 ML/day


Lowes Creek
2050 urbanised
+WSUD
hydraulic metrics
mean annual flow volume
mean duration/timing of zero flow periods
% of time flow is zero
base flow index
events/year ≥ 3x median flow
% of time > 3x median flow
time > bed mobility threshold
events/year > bank full discharge
% of time flow > bank full discharge
water (quality) treatment
water (flow) regulation
annual flow volume
flow velocity
pulse flows
floodplain engagment
aquatic/riparian refugia
natural gravel beds
pool-riffle zones
in-stream rocks
native macrophytes
large woody debris
riparian soil formation + nutrient cycling
riparian micro-climate regulation
overhanging veg
erosion & sed. control
bed/bank stability
disturbance regulation
riparian/terrestrial refugia
connectivity
habitat complexity
vegetation extent
fallen logs (cwd)
specific habitats
terrestrial micro-climate regulation
urban tree canopy
recreation + aesthetics
scenery, settings, views & landscapes
waterway sightlines
access points & crossings
water quality
water flows
Australian Bass
Southern Myotis
waterway microclimate
woodland and floodplain birds
remnant megafauna
Cumberland Plain vegetation
terrestrial micro-climate, shade trees
open space, sports fields and parks
creek activation, accessibility, pathways and trails
connection+place
active recreation
swimming
water-play
canoeing
outdoor exercise
formal sports
eco recreation
catching yabbies
fishing
bat spotting
bird watching
bushwalking
thermal comfort
proximity+accesibility
aesthetic enjoyment
passive recreation
casual walking
picnics
camping
community events
casual cycling
entertaining kids
cafe and dining
risk of losing values
not present
low
moderate*
moderate
high
*other influences mitigate impact

An opportunity to address the cause



Guiding development and planning controls



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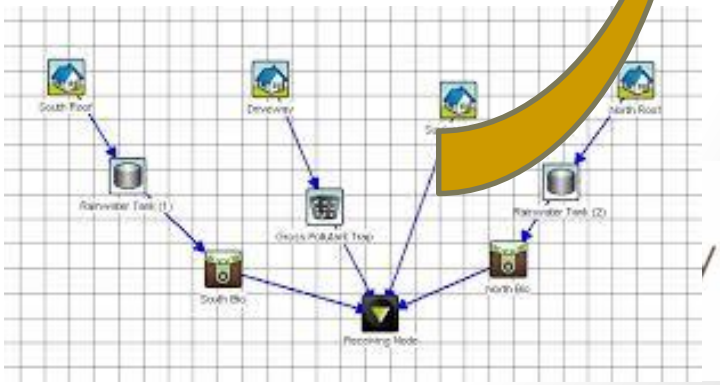
How are USIA outputs used?

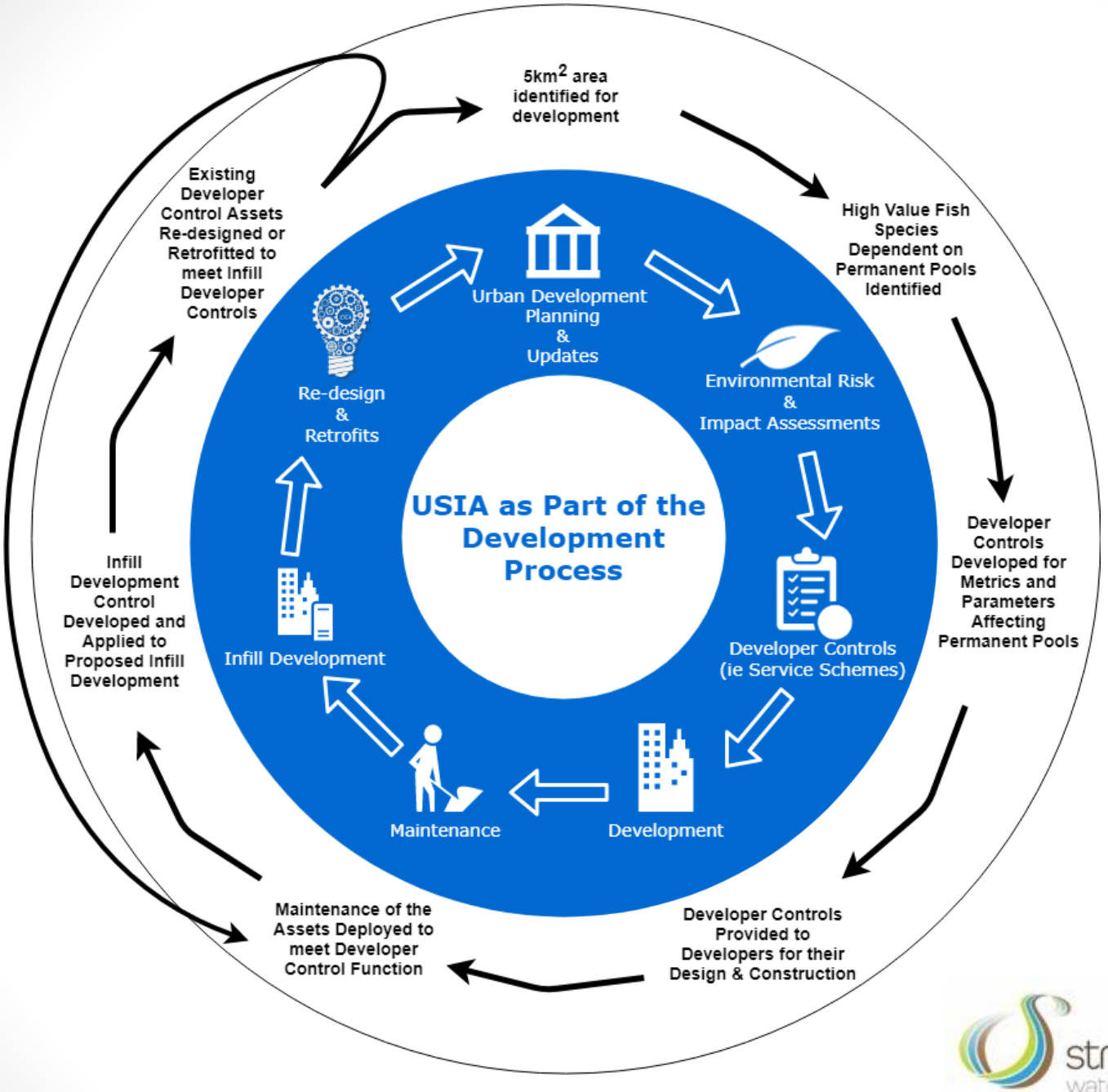
Waterway Authority

Monitoring/Learning

Planners

Developers/Consultants





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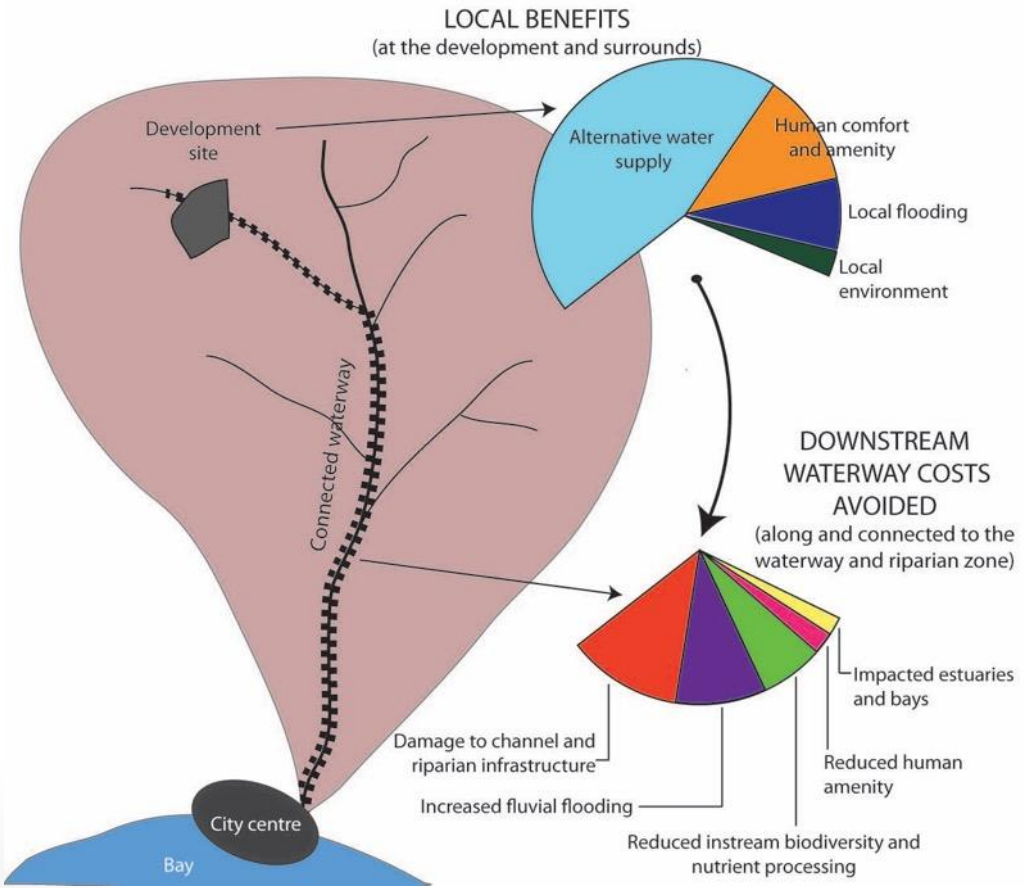
But we can't stop the flow!

- 24,000 waterways across Melbourne
- Naturalisation for 8,000 'main' waterways
- $40,000,000,000



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USIA Development Team

Urban Streamflow Impact Assessment (USIA) team:
Carl Tippler (CTEnvironmental), Kathy Russell (Streamology), Professor Tim Fletcher (Melbourne University), Dr Marlene van der Sterren , Dr Stephanie Kermode and Phil Birtles (Sydney Water), Michael Dean (i2i Digital), Nakia Belmer and Ben Green (CTEnvironmental), Lucas McKinnon (Ecoplanning)
…and the many more who helped initiate, develop and review the project.

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