CRC for Water Sensitive Cities

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Business Cooperative Research Centres Programme

Economics project results

David Pannell, UWA

Who? When?

- Teams at UWA and Monash
- Mid 2013 to June 2016

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Background

- Investments in green infrastructure, WSUD, water conservation measures, etc. (“water-sensitive practices”)
- A range of benefits
  - Tangible, financial, market, priced benefits
  - Intangible, non-financial, non-market, unpriced benefits

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Background

- In some cases, business cases for these investments are not compelling based only on market benefits
- Non-market benefits may get them over the line
- Harder to measure – limited evidence
- A core aim = create a portfolio of case studies

Measuring non-market values: option 1

- Environmental values built into house prices
- Observe many house sales
- Apply multiple regression to tease out the various factors affecting house prices
- Captures private benefits to local residents, but not benefits to others
  - Ecological improvements
  - Downstream flood mitigation

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Non-market values (house prices)

- Conversion of drain to “living stream” (Bannister Creek)

Data

- Single-family homes sold 1990-2013
- 16,553 sales of 8,088 properties
- 5020 sold 2 to 7 times
- 339 sales within 200m of the restoration site
- 175 after 2000
- Includes data about land area, no bedrooms, no bathrooms, no car spaces, construction, pool, suburb, house age, year, quarter

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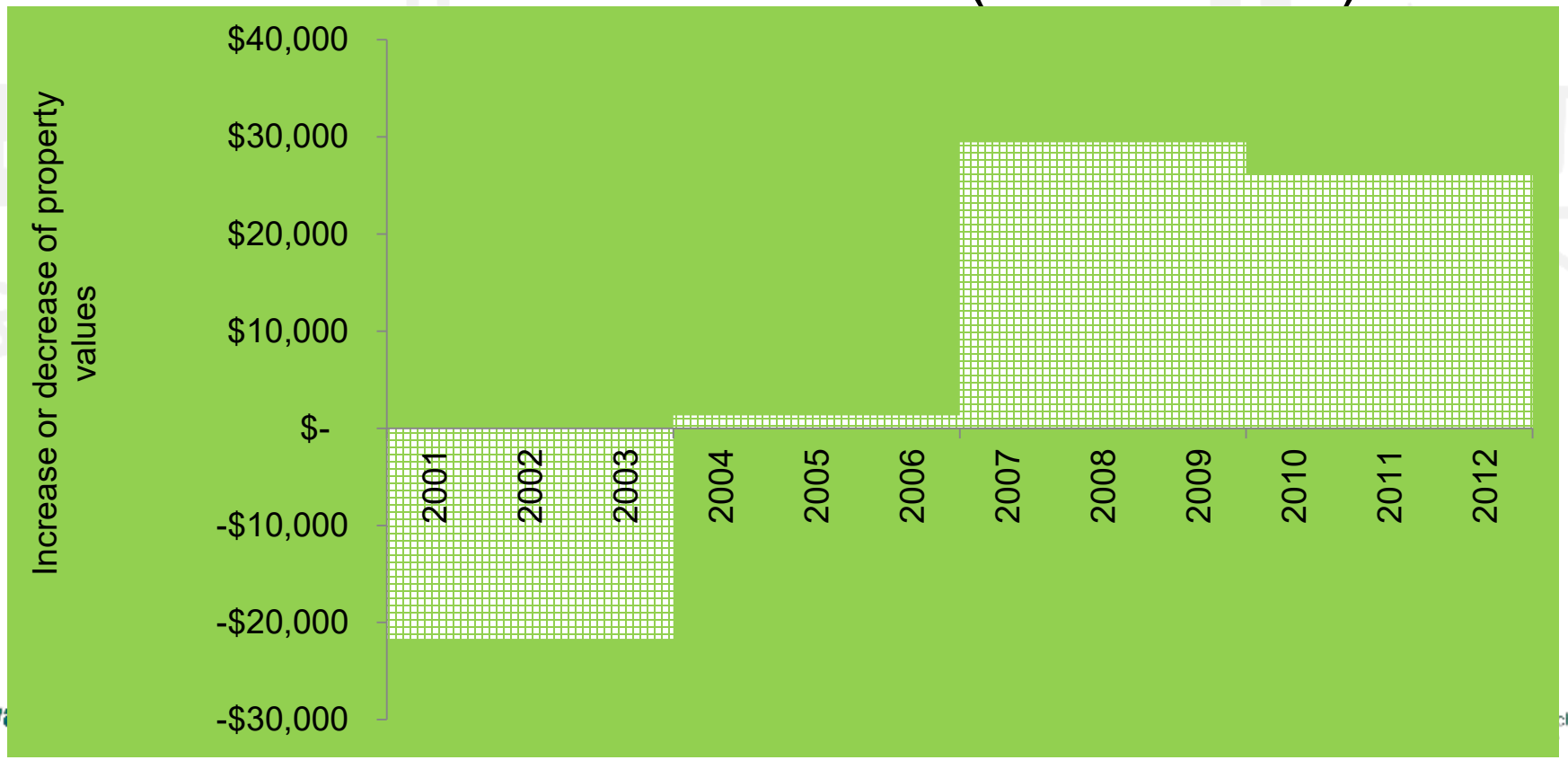
Non-market values (house prices)

- +3.9 to 4.7% within 200 m (eventually)
- Benefit: Cost Ratio 1.6 to 4.2 (best bet 2.8)



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Non-market values (house prices)

- Valuation of different garden types (low vs high water using)
  - Part of a broader study on nutrient management
  - Conversion of some lawn to native can be a win-win
  - As area of natives grows, the marginal benefit falls

Non-market values (house prices)

- Rainwater tanks in Perth
- Savings of water ~$650 over 15 years
- House price premium $18,000
- Well in excess of private costs ($2500 + time)

Non-market values (house prices)

- Value of street trees
- 5606 single family homes sold in 2009 in Perth
- Large verge trees increase property value (e.g. +$14,000)
- Decreases value when on own property or adjacent property near boundary (e.g. −$6,000)

Non-market values (house prices)

- Green space: Parks, trees, backyards and other urban green areas (Joe Rossetti)
- Measured by “enhanced vegetation index” based on surface reflectances from satellites
  - 2.6 million transactions nationally over 2000-2009.
  - One standard deviation increase in EVI increased housing prices by 8.6 to 15.6%

Measuring non-market values: option 2

- Surveys of general public: Choice experiments
- Put various hypothetical scenarios to people
- Ask which they prefer
- Tease out the trade-offs using statistics
- Advantages
  - Captures use and non-use values
- Disadvantages
  - Hypothetical rather than actual
  - Relies on people understanding the issues

Non-market values (surveys)

- Ecological values of the Swan River ($/person/yr)

 Foreshore vegetation in good condition	$129-170
 Average frequency of significant fish kill events	$55
 Health of dolphin population	$55-113

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Non-market values (surveys)

- Various water-related benefits (Sydney and Melbourne)
  - improvements in stream health (AU$160 ± AU$77 /year)
  - reduction in water restrictions (AU$145 ± AU$74 /year)
  - cooler summer temperatures (AU$53 ± AU$30 /year) – in Sydney only, not Melbourne
  - reduction in flash flooding (low values)

Non-market values (surveys)

- Waste-water treatment plant: Community preferences for land-use options in buffer zone

Non-market values (surveys)

- Wastewater treatment plant results
- Compared to commercial land use, local residents would pay about $8 ($5-$11) per year per household for 1% expansion of natural conservation land uses within the buffer zone
- $4 ($2-$7) for 1% expansion of recreation areas
- $1($0-$3) for 1% expansion of agricultural areas

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Least-cost strategies to reduce N & P in the Canning River

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Evidence of ecosystem degradation in the Canning

Year	Date start	No. dead fish	Location	After storm
2003	03/06/2003	200	Canning	yes
2006	01/04/2006	unknown	Kent St Weir	
2007	08/05/2007	39238	Kent St Weir	yes
2007	19/11/2007	250	Riverton, Shelly bridge	
2009	14/04/2009	2	downstream Kent St Weir	
2010	25/03/2010	17	CAS Canning	yes
2015	13/05/2014	1000-5000	Canning estuary at Bywater Park	
2015	23/06/2015	80-100	Wilson Wetlands	

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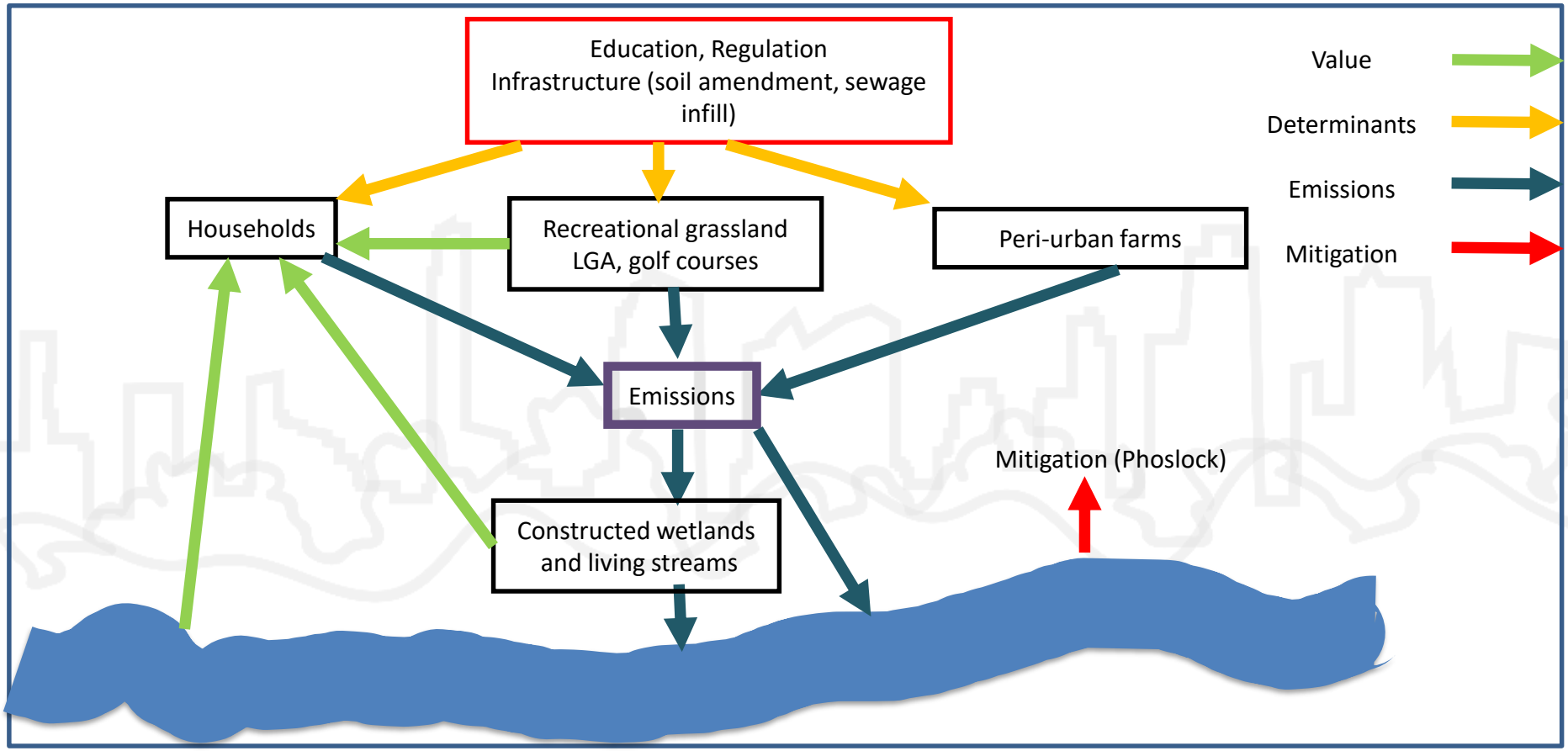

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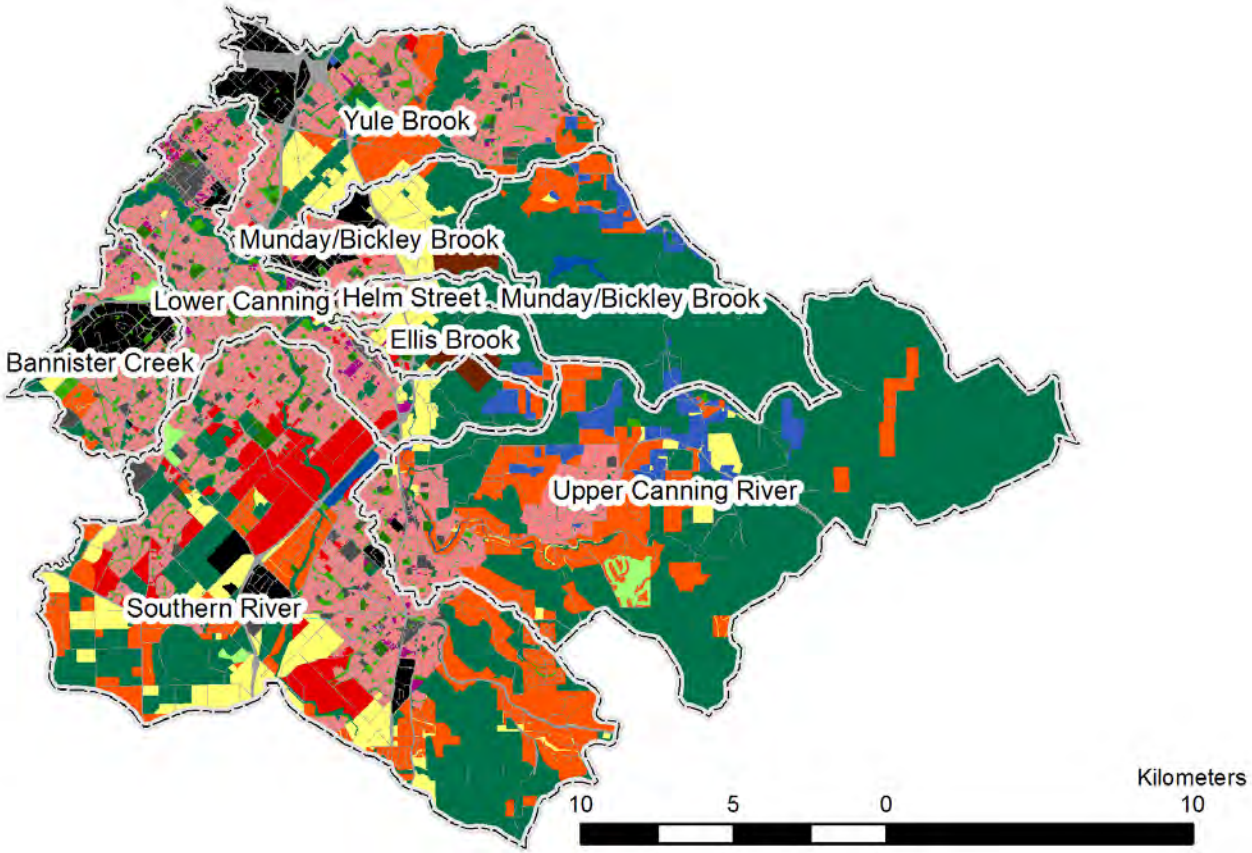
Study area

area__ha
21062
961
1787
23
357
1142
1907
461
1036
6245
2978
317
5323
7322

Land uses

- bush
- commercial
- development
- drain
- golf course
- horticulture
- industrial
- mining
- park
- rural residential
- rural
- sport
- transportation
- urban residential
- urban residential unitts
- water



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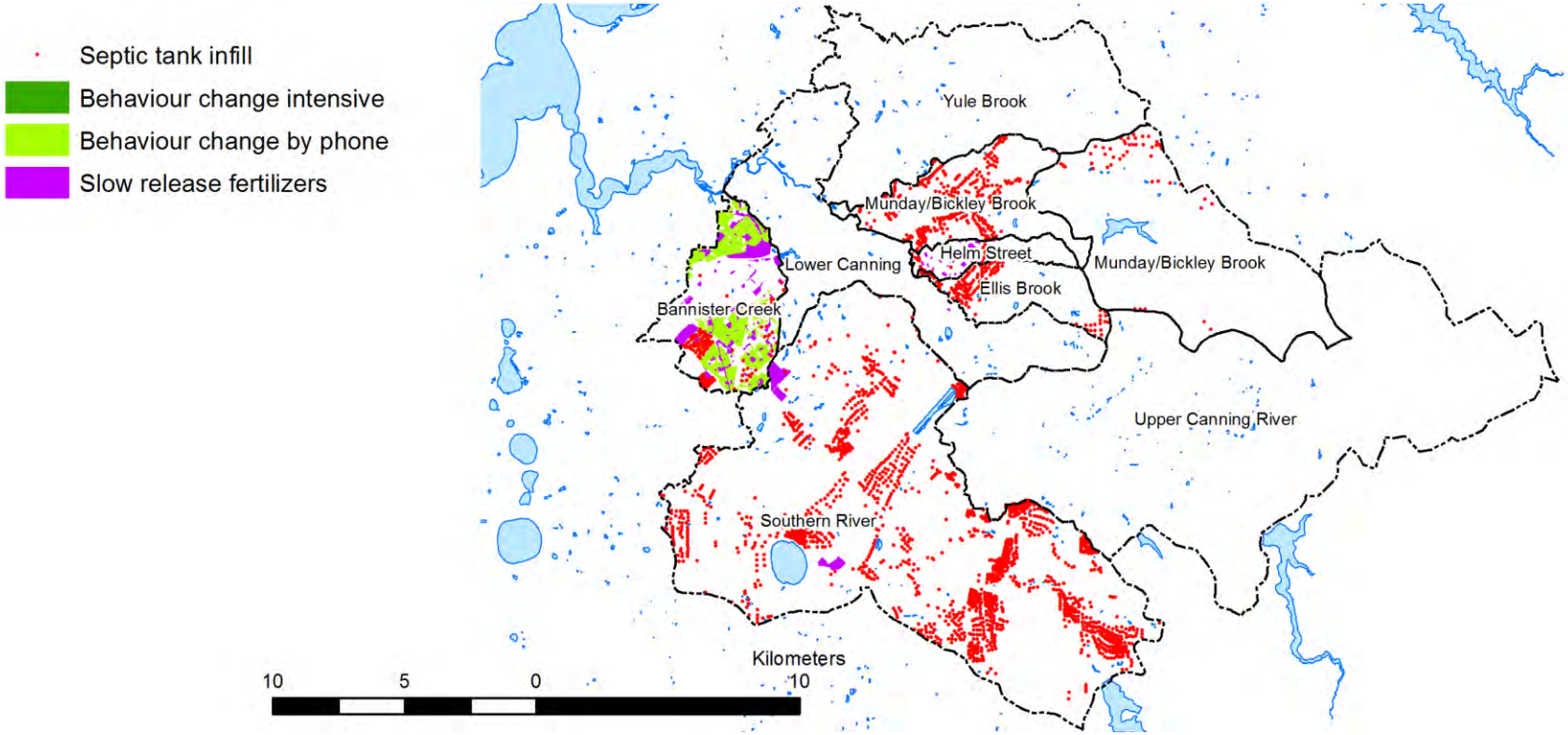
Base case scenario 20% of target (41%↓N, 30%↓ P)



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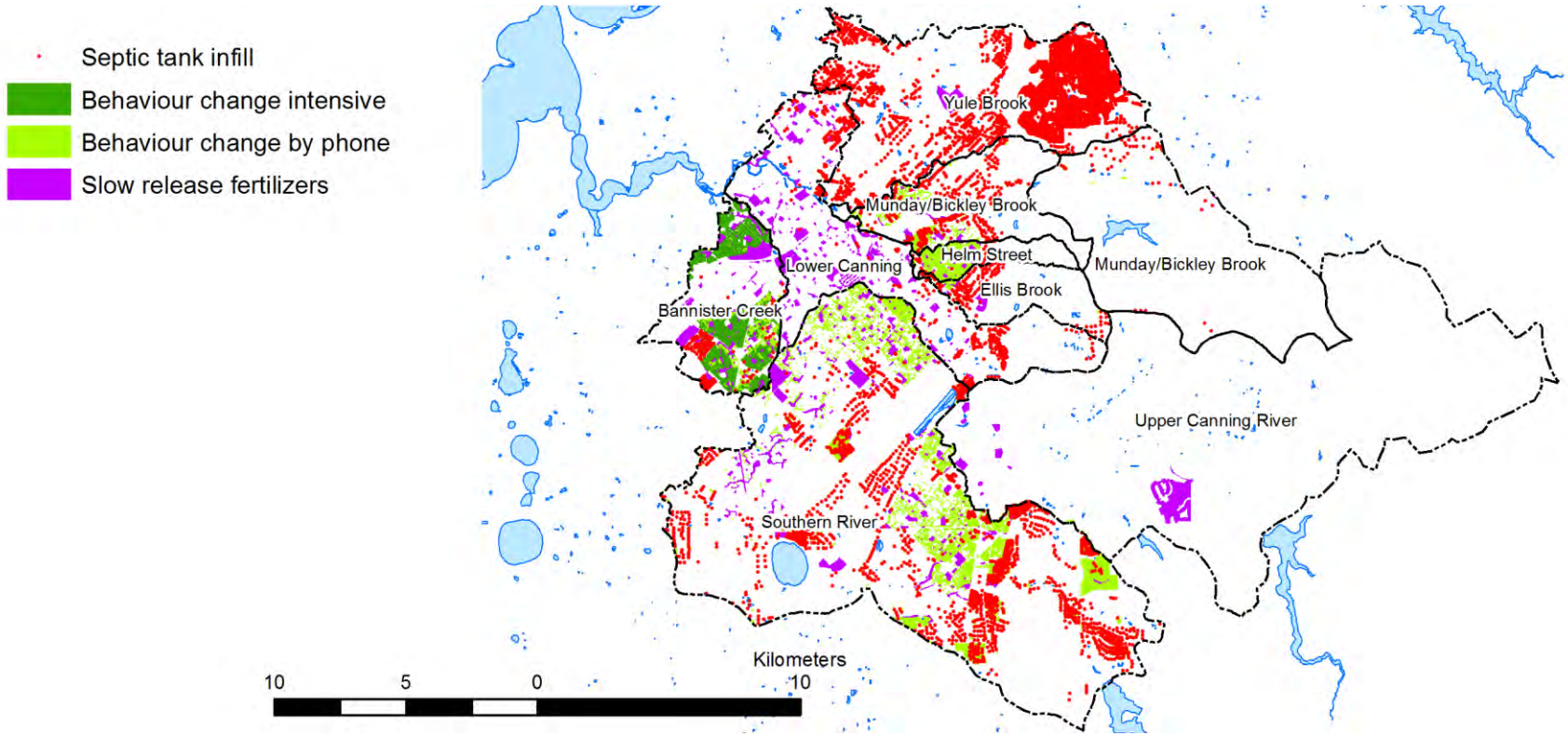
Base case scenario 40% of target



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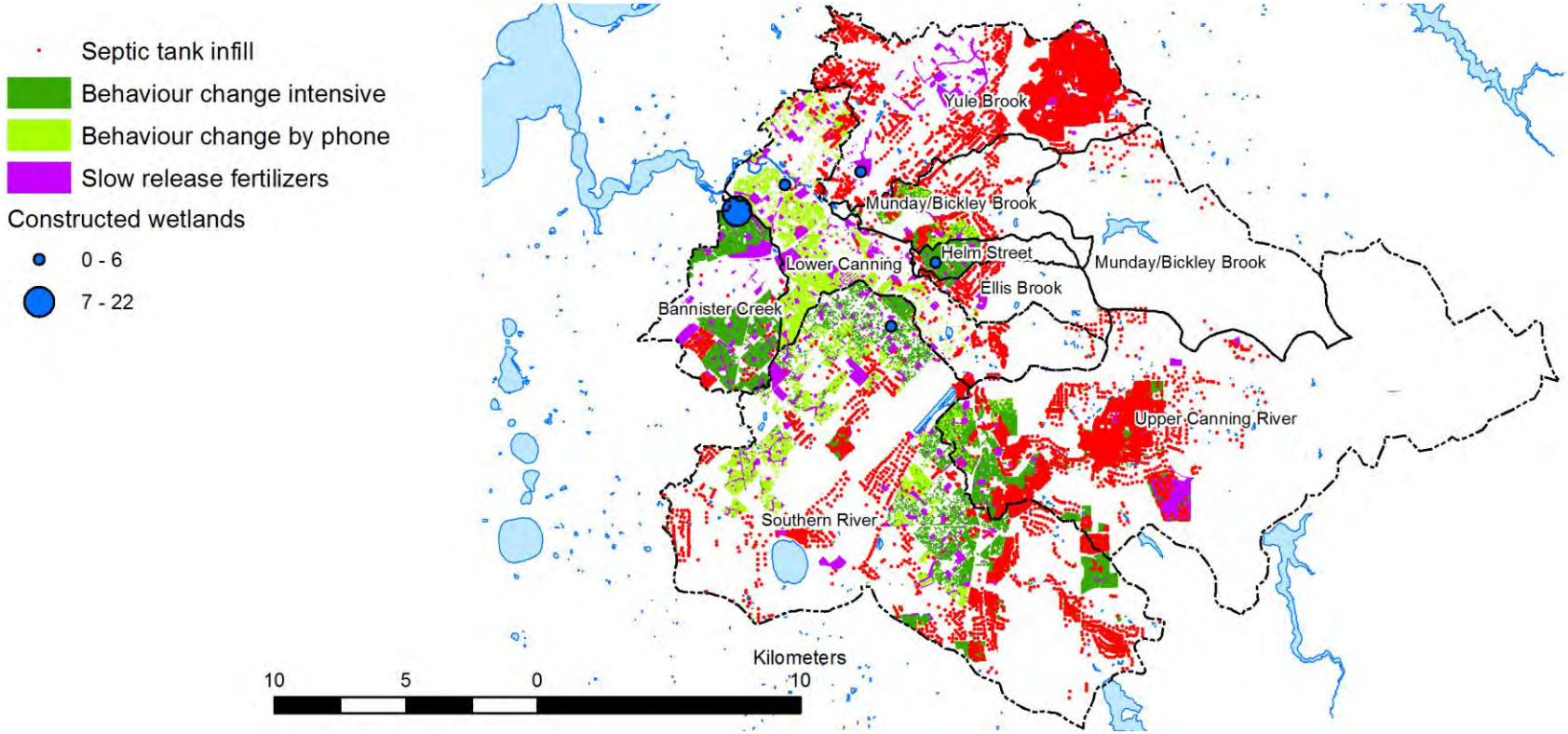
Base case scenario 60% of target



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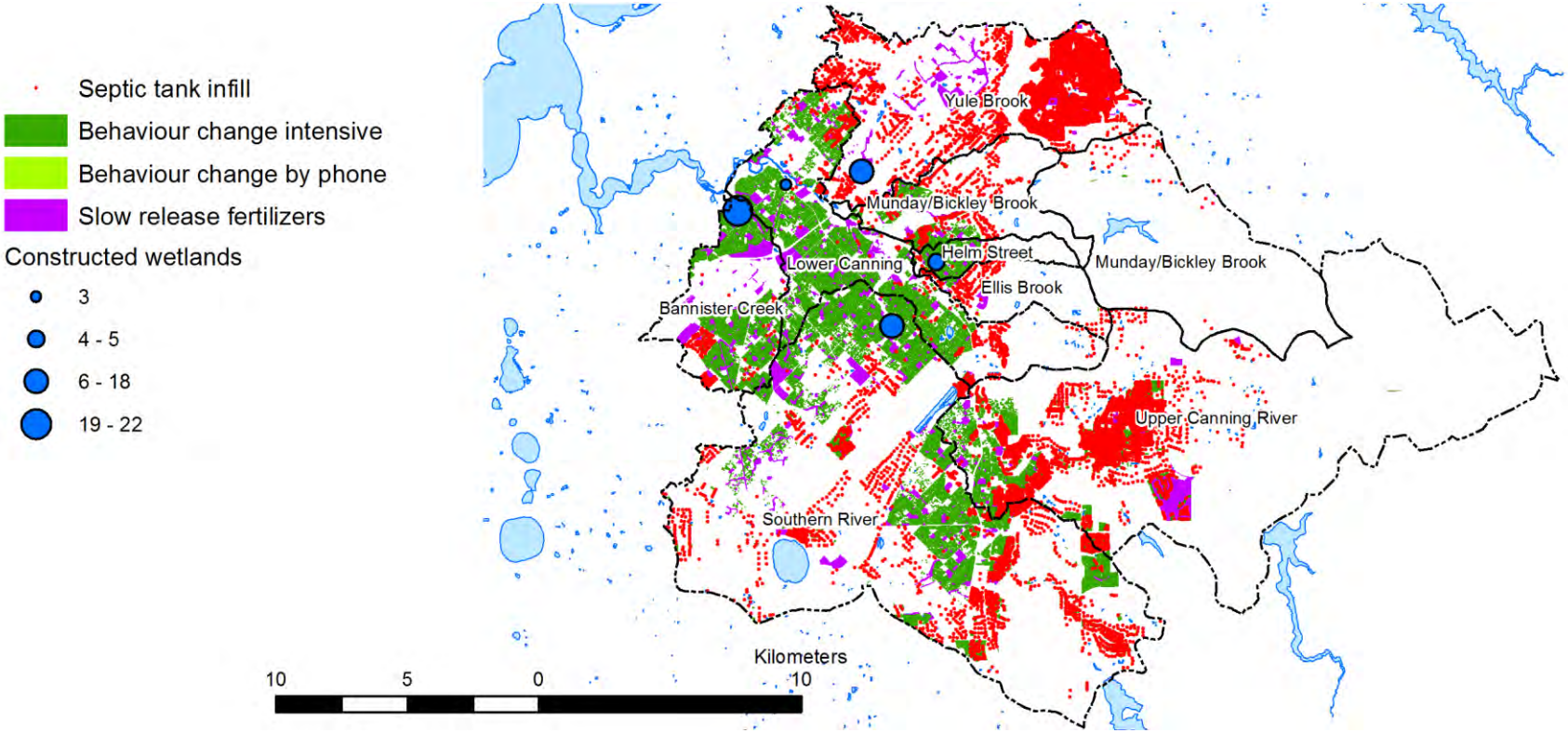
Base case scenario 80% of target



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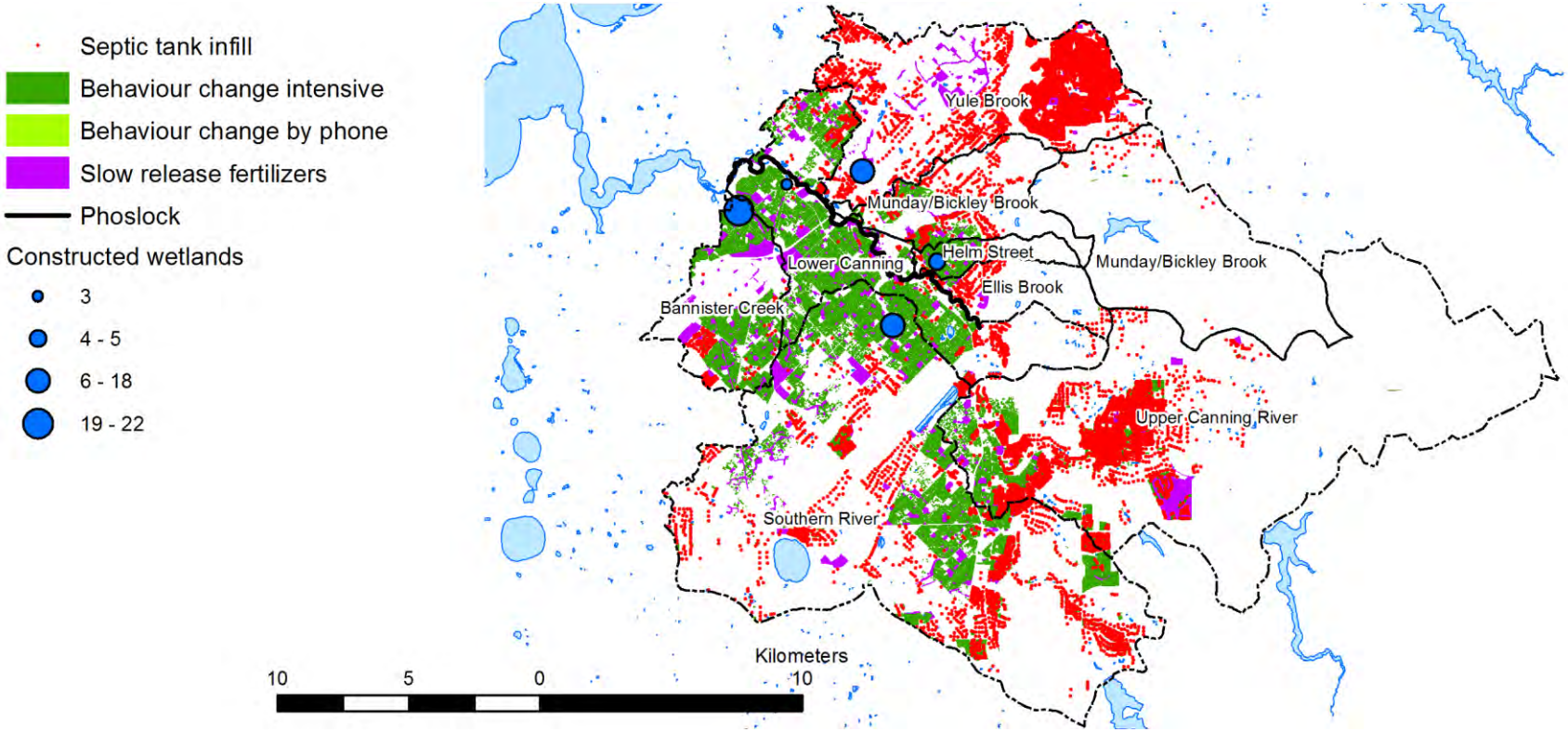
Base case scenario 90% of target



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Results

- Most cost-effective = infill of septic tanks and slow release fertilisers
- Priority areas: Bannister Creek & Southern River
- 60% of target for N and P reductions
- Cost: $290M (over long term)
- Benefits: $440M ($22M/year)
- When we include option of banning regular fertilisers, it is possible to achieve 100% of target reductions at a cost of $488M

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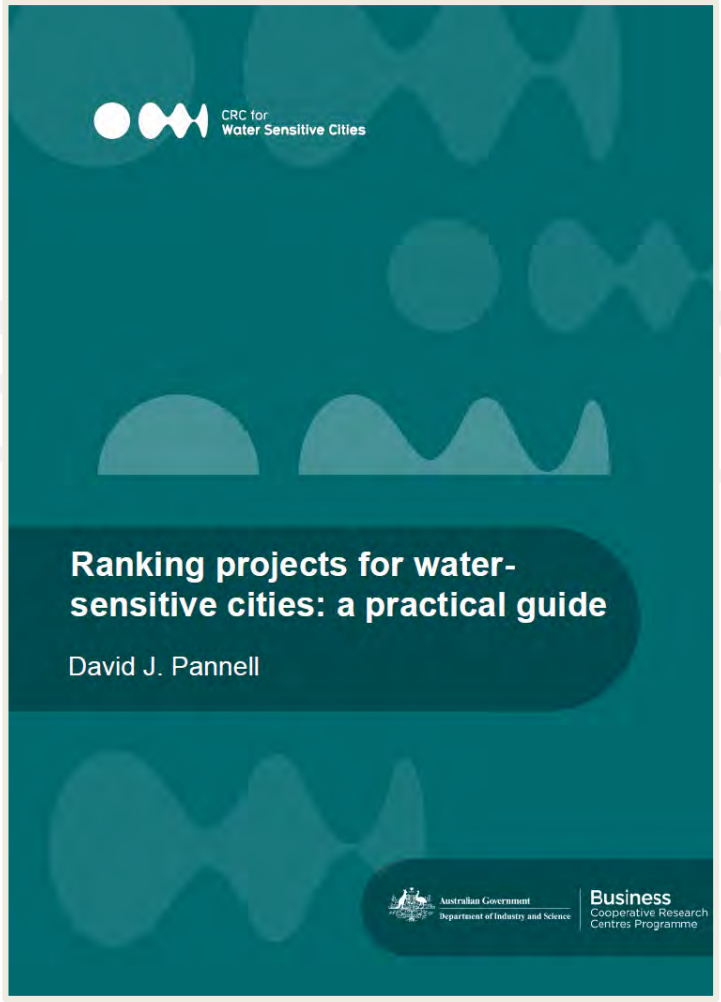
Benefit: Cost Analysis

- Guidelines on ranking water-sensitive projects



Other – cost of reduced water allocations

- Economic impact of groundwater allocation reduction strategy in WA (Department of Water)
- $ impact on horticulturalists from 25% reduction
- 14-22% reduction in net returns

Other – efficient irrigation

- Masters student Sonia Mennen (UWA) The most cost-effective ways to maintain public open space with less water in Perth
  - Six irrigation methods
  - Substantial differences in cost per kilolitre water saved

The future: Integrated Research Project 2

- Just approved
- Three years, 2017-2019
- The team
  - Core team at UWA
  - Support from Nigel Tapper's group at Monash (urban heat)
  - Economic consultant (RMCG)
  - Mark Siebentritt (stakeholder engagement strategy)
  - Project steering committee

Key outputs 1

- A tool to identify and monetise non-market benefits from various types of investment in water-sensitive cities. Incl. benefits related to
  - ecology
  - water quality
  - recreation
  - aesthetics
  - urban heat (affecting mortality, health, power costs, economic productivity and comfort)

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Key outputs 2

- Comprehensive tool for Benefit: Cost Aanalysis of investments in water-sensitive cities
  - non-market benefits
  - market benefits
  - bio-physical effects
  - behaviour change
  - risk and uncertainty
  - time delays
  - costs (full life-cycle)
- Flexible and scalable

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Key outputs 3

- Advice on finance models and policy approaches to foster investment in water-sensitive cities where benefits are not necessarily captured by those who bear the costs

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Key outputs 4

- A diverse set of case studies where the tools are applied, tested and adapted
- Selection of case studies still evolving

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Greening the pipeline in Melbourne

- Key stakeholders: Melbourne Water, Wyndham City Council, VicRoads, City West Water
- Key issues / Research or Management questions:
  - How to best improve liveability & environmental outcomes through restoration and parkland construction along a 27km linear section of the heritage-listed Main Outfall Sewer.
  - Assess the economic, environmental, and social benefits of an on-ground liveability improvement pilot project – Williams Landing.
  - Provide quantifiable economic justification for investment spending that targets activities that improve liveability.

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Strategic Water Resource Precincts

- Key stakeholders: Water Corporation, City of Nedlands, WESROC group of local governments (Municipalities of Nedlands, Subiaco, Cottesloe, Peppermint Grove, Claremont, Mosman Park), Department of Water, WA Planning Commission/Department of Planning
- Key issues / Research or Management questions:
  - What are the costs & benefits (market and non-market) of land-use options (nature conservation, sport/recreation, horticulture and agriculture, commercial and industry).
  - What are the available funding and policy tools (e.g. development / infrastructure contribution schemes, differential rating) to support equitable implementation.

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Converting an open drain into a living stream

- Key stakeholders: Shire of Mundaring, Developer – Taliska Securities Pty Ltd (TBC),
- City of Swan (TBC), Department of Water (TBC), Water Corporation (TBC), Department of Parks and Wildlife (Rivers and Estuaries Division) (TBC)
- Key issues / Research or Management questions:
  - How can a main drain conversion to Public Open Space via a living stream be incorporated into a future residential development.
  - How best to allocate the cost and liabilities given drainage and flood mitigation, and nutrient legacy issues
  - Governance arrangements

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Arden Macaulay Urban Redevelopment

- Key stakeholders: City West Water, Melbourne Water, City of Melbourne City of Moonee Valley, Victorian Government (via Victorian Planning Authority).
- Key issues/Research or Management questions:
  - assess a range of plausible water sensitive / liveability options, including non-market values

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Case study Idea	Potential Location
Value of urban trees (mental health)	
Value of irrigation of public open space (social cohesion) - Irrigated versus non-irrigated parks - Cost of alternative water sources for irrigation of public and private spaces	Wyndam, Kalamunda, White Gum Valley, Brabham, Pinjar
Restoration of degraded waterways (actual improvement of water quality)	
Analysis of decision making process (post-hoc analysis)	
Flood protection (stormwater harvesting, risk aversion, risk transfer)	
Cost of maintaining vegetated WSUD assets across a local government – work with a local government to assess the costs and benefits of its vegetated assets (tree pits, biofilters, living streams, swales, detention basins)	City of Subiaco or City of Armadale
Assessment of different land use strategies for reduction in nutrient loads	
Conversion of drainage infrastructure (including basins) into functional open space and opportunities for water quality, flood protection and potentially water harvesting in addition to amenity and liveability gains, including an assessment of maintenance (operational) costs.	
Legislative requirement of putting rain water tank in new developments (design stormwater capture option)	Brisbane
Different land-use or landscape designs (green space)	WA / SA
Urban infill - Test strategy against the 30 Year Plan for Greater Adelaide	Adelaide
Transition / restoration of Sunshine employment centre (infill/ greenfill) - 2100 hectares, waterways challenges	Melbourne
Restoration of Cooks River (Cooks River alliance)	NSW
Restoration of Breakout creek in SA*	SA
Benefit-cost analysis of South Creek Living Waterway Corridor in Sydney*	Sydney
WESROC Recycled Water Managed Aquifer Recharge for Public Open Space and Other Social Benefits*	WA
Site 1 - North Stoneville and/or Site 2 - North Parkerville (2 separate developments – potentially 2 different projects)*	WA
City-wide costs and benefits of rainwater harvesting*	Brisbane
Economic value of urban climate improvement: Sub-tropical case study*	Brisbane

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