Cooperative Research Centre for
Water Sensitive Cities

Research and Adoption Plan for Western Australia 2016-2020

Western Regional Advisory Panel
February 2016

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1 INTRODUCTION

This Research and Adoption Plan has been prepared by the Western Regional Advisory Panel (WRAP) to assist in Western Australia's transition towards water sensitive cities and towns.

Western Australia is committed to working towards achieving a water sensitive future for our cities and towns. This is evidenced by the significant financial contribution in the order of $750,000 each year that the WA partners make to the Cooperative Research Centre for Water Sensitive Cities (CRCWSC). The WA partners have been heavily active in contributing to the CRCWSC Tranche 1 research projects in order to ensure the research addresses key industry needs. The WA partners will continue this level of involvement in Tranche 2, anticipating that the program will meet our identified needs to deliver and apply the knowledge, tools, products, and capacity required to support a city scale transition to water sensitive practices.

1.1 Vision

The Vision for Perth as a water sensitive city is one of stewardship, wellbeing, engagement and sustainability.

A vision for Perth's towns and cities was developed by a range of WA stakeholders through a series of 5 workshops held in 2015. The workshop series was part of CRCWSC Project A4.2 'Mapping Water Sensitive City scenarios' and the outcomes are reported in *Shaping Perth as a Water Sensitive City* (CRCWSC, 2015).

The vision comprises four themes and associated desired outcomes, visuals, and guiding principles of practice (Figure 1). The Vision themes that were established are:

- Fostering stewardship of the system;
- Protecting and enhancing the wellbeing of people and the environment;
- Integrating end engaging with the built and natural; landscape; and
- Sustaining the long term use of Perth's resources.

Each theme is supported by a narrative that expands on the desired outcome, exploring the vision in greater detail.

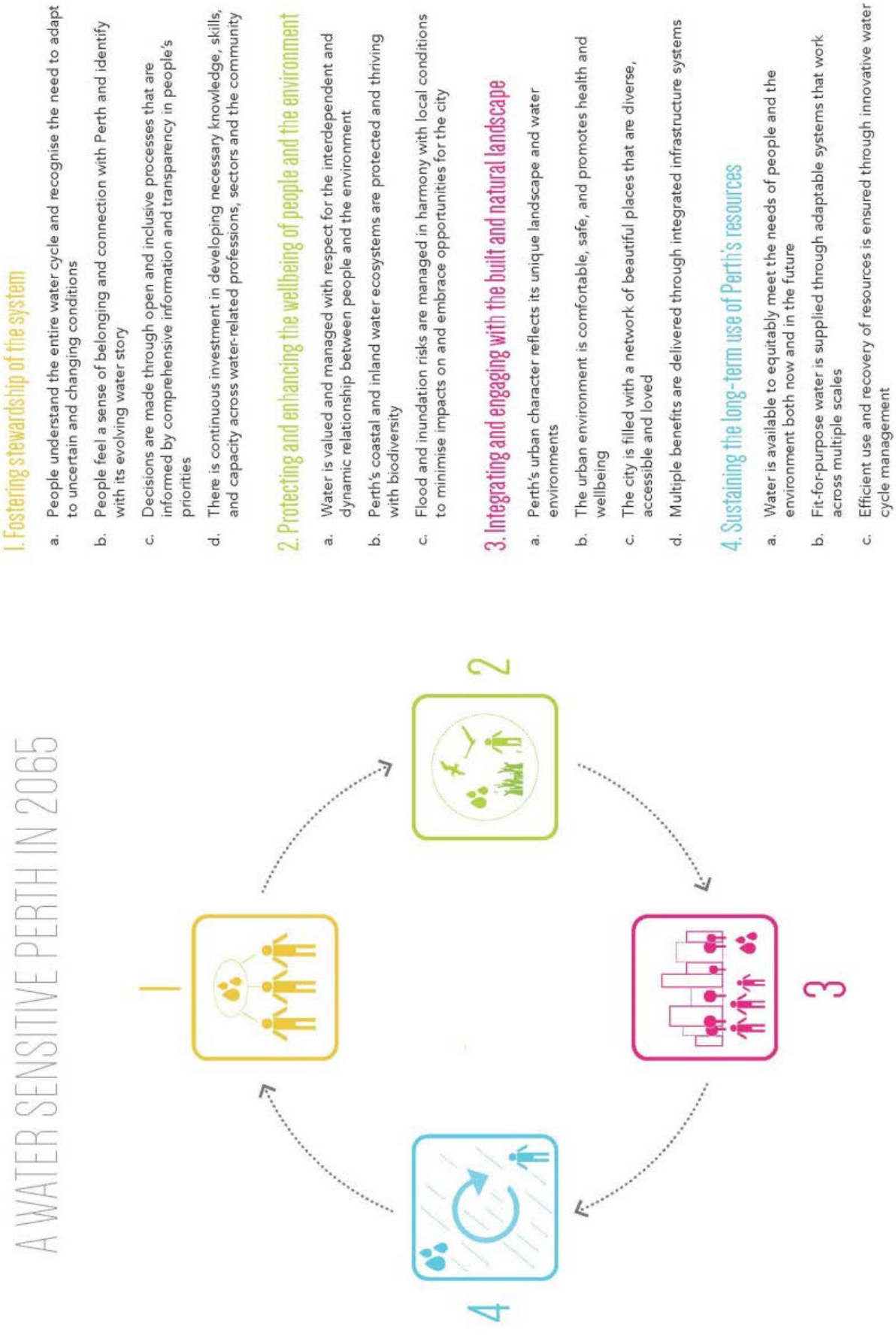

Figure 1: A vision for a water sensitive Perth in 2065 (Source: CRCWSC, 2015)

1.2 Scope of the plan

The Plan proposes a suite of projects which are recommended to be completed as part of the second tranche of the CRCWSC research program beginning in 2016. It has been prepared to provide a key input into the second Project Development Workshop on 15 February 2016.

The level of CRCWSC involvement proposed in each project is tailored towards optimising the contribution and expertise of CRCWSC researchers, as many projects are proposed to be led by industry. This demonstrates the significant level of commitment from WA stakeholders to the delivery of CRCWSC strategic outcomes.

The Plan consolidates work completed by CRCWSC partners and stakeholders in WA to identify transition priorities and opportunities. It considers the national CRCWSC program and makes recommendations to maximise impact and benefits in Western Australia and across the country over the next four years.

Implementation of the plan will also contribute to the broader WA Government strategic direction of providing for liveable communities.

1.3 Preparation of the plan

Preparation of the Research and Impact Plan for Western Australia involved substantial consultation with industry and stakeholders as part of a number of CRCWSC activities and stakeholder workshops. This includes:

- WA stakeholder's science and adoption priorities for water sensitive cities and towns 2015;
- The outcomes of CRCWSC project A4.2: Mapping Water Sensitive City Scenarios (July-November 2015);
- Perth Needs and Opportunities workshop, 22 & 23 November 2015;
- Project Development Workshop, 2 & 3 December 2015, Melbourne;
- Research Outputs of Tranche 1 (CRCWSC, 2015);
- Tranche 2 Project Prioritisation Process - Draft 14 January 2016; and
- Technology-focused Needs and Opportunities Workshop, 28 January 2016, Melbourne.

Key outcomes and inputs to this Plan are summarised in Section 2.

2 CONTEXT

2.1 Strategic context for urban growth in WA

Liveable communities are a shared vision of many state and local government agencies, reflecting the aspirations of the people of WA. Liveable, vibrant cities are also a national priority, evidenced by the recent appointment of a Federal Minister for Cities and the Built Environment.

Liveability is underpinned by sustainability, so that the quality of life of Western Australians in the future is as good or better than that of today. This requires consideration of the whole development lifecycle, including planning, design and construction of housing and ongoing costs and benefits associated with living and providing community needs and services into the future.

There are a number of challenges that we face; however, in our quest to achieve this vision of sustainable, resilient, productive and liveable communities. These are outlined below.

2.2 Drivers and challenges

2.2.1 Population growth

The population of Perth is anticipated to double in the next 30 years. *Perth and Peel at 3.5 million* (WAPC, 2015) outlines a strategy for providing for 800,000 new homes in the Perth-Peel region to accommodate an extra 1.5 million people over the next 35 to 40 years. It proposes a 'connected city' scenario to provide sufficient suitable land for future housing to accommodate our projected population growth to 2050. The report states that as a connected city, Perth and Peel will have integrated land and water management that provides social amenity, environmental protection and resilience to climate change for a more liveable city into the future, through better urban water management, water sensitive urban design and green infrastructure. Implementation of this strategy and delivery of its vision will require the successful transition of Perth and Peel to a truly water sensitive city.

2.2.2 Climate variability

There are serious challenges facing Perth in the future which result from climate change.

Declining inflows, falling water levels and pollution of our drains and waterways are impacting the liveability of our cities. Beside human use, water resources are required to sustain important environmental and ecological values. Overall Perth's groundwater resources are under increasing pressure from our drying climate, demand for private and public water supplies and changing land uses.

Climate change is also leading to hotter temperatures in Perth and more frequent and severe heatwaves. This impacts on vegetation health and greenery in our cities, as well as human health, particularly the health and wellbeing of vulnerable sectors of the community.

2.2.3 Water availability

Population growth and climate change are putting significant pressure on our existing drinking water supplies. Recent predictions suggest that there will not be enough water from existing sources to meet public water supply demand in 2031. The gap between future demand and supply beyond 2031 requires effort to deliver secure water supplies for households and the private sector at an affordable price and without regular restrictions. Planning is well advanced for future supply including increased desalination, expanded groundwater abstraction and climate-resilient sources such as recycled wastewater for recharging groundwater. Following the successful completion of the 3 year Groundwater Replenishment Trial at the end of 2012, and the State Government's approval in August 2013, construction of Stage 1 (14GL/yr) of a full-scale Groundwater Replenishment Scheme is currently underway and on track for completion by towards the end of 2016. With ultimate capacity of 28 GL/year, this scheme will be a significant contributor to bridging the gap between 2020 and 2031.

Efficiencies, requiring behavioural change, will also play an important part of the solution. Water forever 2012 has an efficiency target of a 15% reduction in per person scheme water use by 2030, from 2007/08 levels. This equates to Perth households and businesses reducing per person water use from 147 kilolitres a year to 125 kilolitres a year by 2030. For households this means a per person target of 85 kilolitres a year by 2030.

Around 500 GL of water was used in our urban areas across Western Australia in 2014, not including heavy industry which used a further 100 GL in 2014 (Figure 1). About 70% of urban water is supplied through the Water Corporation's Integrated Water Supply Scheme. This drinking water is used largely by households with a significant proportion of that outside of the home. Local governments, the private sector and individuals are responsible for supplying the remaining 30% of the state's urban water needs through their own groundwater bores, rainwater tanks and distribution infrastructure.

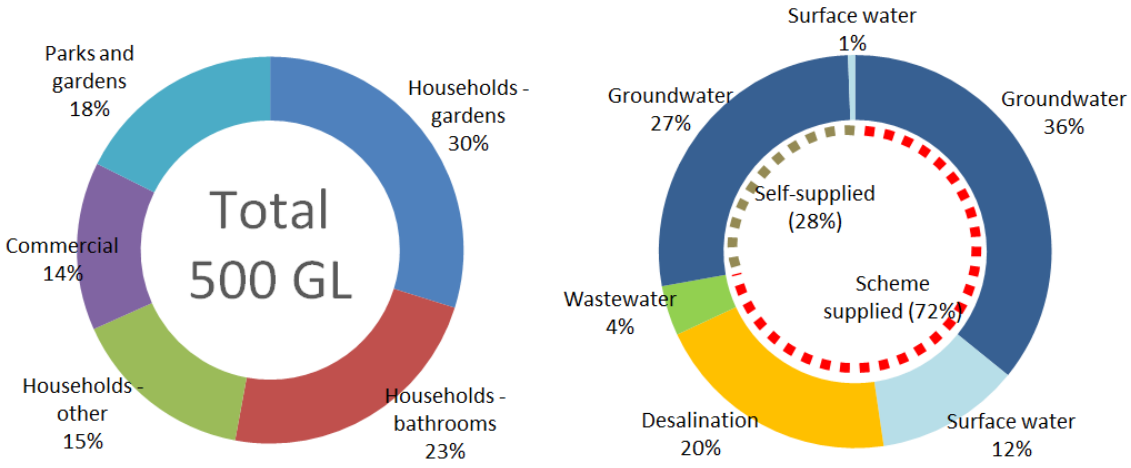

Figure 2: Urban water use in 2014; Urban water sources in 2014 (Source: DoW, 2015)

Perth relies on groundwater to meet nearly 2/3 of our urban water needs. The reduced availability of groundwater in the future will significantly affect water supplies for public open space, public water supply, horticulture and industry, which all rely on cheap, local groundwater.

This is particularly evident in Perth's north-west and north-east corridors, where there is limited or no groundwater available for allocation for use (abstraction) in the future.

Transition to alternative water sources such as recycled wastewater is required, as well as improved design of quality public open space and public realm to maximise the broad range of benefits while minimising water use.

2.2.4 Water quality

Pollution in our drains and waterways is impacting the recreational, aesthetic and biodiversity values of our water bodies. The water quality of the Peel-Harvey Estuary in particular has been highlighted as a significant consideration in the future urbanisation of our city in the recently released *Perth and Peel Green Growth Plan for 3.5 Million* (draft, Government of WA, 2015). Improved mitigation and management actions at both catchment and development scale are required for all our estuaries and waterways including the Swan and Canning rivers to reduce pollutant inputs from urban areas.

2.2.5 Urban development in high groundwater environments

Many areas in the southern Perth and Peel regions are flat, water logged, flood prone and have legacy nutrient issues and acid sulfate soils. These conditions are particularly challenging for urban development. They are also compounded in some areas where there is limited groundwater availability. Traditional land development approaches, such as importing large volumes of sand fill are expensive and sand supply is becoming increasingly limited. Subsoil drainage installed to drain these water-logged landscapes can mobilise nutrient rich water and transport it to our waterways and estuaries.

2.3 Inputs to the plan

2.3.1 WA stakeholder's science and adoption priorities for water sensitive cities and towns 2015

The WA stakeholder's science and adoption priorities for water sensitive cities and towns 2015 were developed initially from the Department of Water's *Towards a Water Sensitive City: Overview of the stormwater science plan for better urban water management*, 2010, then by the NWW Research Forum in 2012, which fed into the initial proposal to join the Cities and Water Supply Catchment program and later the CRCWSC. The persisting and emerging priorities were updated in 2015 by WA stakeholders and are summarised as follows:

Science needs
1. Urban hydrology, particularly in catchments with shallow groundwater • Run-off coefficients and infiltration rates of different land uses • Separation distances and fill requirements • Subsoil drainage modelling and mounding • Smart ways of building in areas with shallow groundwater to reduce fill requirements

Science needs
2. Understanding how stormwater and pollutants move through urban catchments, how to manage this water and improve quality, and how to use this water as a resource under different conditions • WSUD design and performance (living streams, swales, etc.) • Subsoil drain water treatment • Soil amendment • Sources, bioavailability, mitigation measures and treatment options of organic nutrients • Urban catchment management measures to protect receiving environments
3. Water availability and reuse – innovative water solutions, technologies, approvals, governance and economics • Water options for irrigating POS • Integrated / multi-source / total water cycle systems • Stormwater/drainage water and wastewater treatment and recycling/reuse • Decentralised/local scale water supply and servicing – governance, charging and staging
4. Impacts of infill, higher density and small lots on environment and liveability • How to manage runoff from small lots/high density developments • Runoff coefficients and infiltration rates • Soakwells/disconnection versus lot connections • Stormwater capture and reuse • Strategies to manage urban heat in high density developments
5. Climate change and heat island • Designs, tools and resources to supply water to urban canopy and other green spaces, especially in regions that experience long dry periods (linked to 3 above) • Responses and resilience to climate change
6. Science to improve wastewater management – Deep sewerage, performance of ATUs in situ, leakage, maintenance, impacts, governance
7. Water sensitive built form • What is good design? • What does alternative construction really cost?
Economic and institutional priorities
8. Governance and statutory arrangements to facilitate water sensitive cities and towns • Framework for managing drainage and waterways for public good • Alternative service provision models and risk management • Address inconsistencies in water management objectives and criteria between local governments, DoW, Water Corporation, etc.
9. Transparent cost benefit information and frameworks • Maintenance and life cycle costs of WSUD and alternative water supply technologies vs traditional approaches • When are smaller, decentralised or privately owned alternative water supply solutions cost-effective? • Value of land versus holistic value of water (e.g. in P2 & P3 water source protection areas)
10. Coordinated vision and action • Including how to achieve community buy-in to drive changes in water management

Science needs
11. Establish and maintain a coordinated ecological and water quality and quantity monitoring program
Adoption priorities
12. Capacity building for water sensitive cities • For example more training required in disruptive systems/approaches
13. Decision support tools
14. Water sensitive urban design demonstration sites and proof-of-concept

2.3.2 Shaping Perth as a Water Sensitive City

During July to November, 2015, the CRCWSC facilitated a process with 30 key stakeholders to create a shared vision for the Perth metropolitan area in 2065 and develop strategies to overcome the challenges facing our city. The workshops were part of CRCWSC Project A4.2: Mapping Water Sensitive City Scenarios, led by Dr Briony Rogers.

Workshop participants developed a vision of Greater Perth as a water sensitive city in 2065, as described in section 1.1 above.

The workshop participants also identified a number of transition challenges:

- Lack of a compelling vision and narrative
- Lack of alignment in organisational objectives, responsibilities and capacities
- Fragmented and uncoordinated structures and processes
- Risk averse culture and lack of transparency in options analysis
- Lack of capacity in professionals
- Lack of interest from the community

A wide range of strategies were developed in response to the perceived persistent challenges that focus on how to overcome them and how to implement the guiding principles of practice. The strategies were further explored in the workshops to create a detailed list of actions that could be assigned responsibilities and timeframes. From the collective set of strategies and actions, a suite of six overarching and mutually reinforcing critical strategies were identified in each of the key areas of change.

1. **Shared vision and message** - Develop and communicate a unifying vision and message about the need for and value of Greater Perth as a future water sensitive city

2. **Community mandate** - Build community support for water sensitive outcomes that provides the mandate for driving change in water-related policy and practice

3. **Leadership** - Foster broad political and industry support and inspire leadership at all levels to set a clear direction, drive change and model the behaviours needed to achieve water sensitive outcomes

4. **Governance** - Strengthen governance arrangements to address gaps, remove barriers, clarify ambiguities and provide incentives for water sensitive practice

5. **Professional culture and capacity** - Develop strong capacity and enabling organisational cultures for fostering collaboration and innovation towards water sensitive practice

6. **Research and technology** - Establish mechanisms and commit resources to ensure impact-oriented research and development, including its translation to influence water sensitive policy and practice.

The outcomes of the workshop series have been documented in the report *Shaping Perth as a Water Sensitive City*, and form a key input to the development of this plan.

2.3.3 Perth Needs and Opportunities workshop

The WA Industry Needs and Opportunities Workshop was held on 23 – 24 November, 2015 at the Chamber of Commerce and Industry of WA, in East Perth. The aim of the workshop was to identify priority needs and opportunities that would support the transition of WA cities and towns to be more water sensitive, which would then be considered as part of the development of the second tranche of the CRCWSC research program.

Needs

Workshop participants discussed WA's needs using the transition pathways framework which categorises actions as (i) water sensitive practices, (ii) enabling structures and (iii) social capital. The following needs were identified and voted on by participants (votes indicated in brackets).

On-ground practices

- Engage citizens to improve awareness, knowledge and behaviour towards a WSC vision (18)
- Frameworks and evidence to support full life-cycle cost benefit analyses that also consider non-monetary values (22)
- Guidance on how to use urban and water system design to deliver multiple benefits (13)
- Efficient and effective operations and maintenance systems to achieve WSC outcomes (13)
- Integrated planning across sectors, agencies and water systems (24)
- Integrated monitoring and evaluation through better data sharing (6)
- Coherent understanding of groundwater systems and interactions with surface waters (20)

Enabling structures

- Incentives for implementing water sensitive practices (13)
- Effective and sustainable funding mechanisms for water sensitive practices (drainage and whole water cycle) (28)
- Coordinated and aligned legislation, regulation and policy for driving water sensitive outcomes (38)
- Develop, communicate and translate a shared vision and narrative for different target audiences (12)
- Integration and improved collaboration across organisations and sectors (31)

- Improved frameworks for evaluation of costs, risks and performance of water sensitive practices (13)

Social capital

- Create networks for communication, capacity building and influencing (11)
- Better translation of scientific knowledge into practice and policy outcomes (31)
- Build practitioner capacity through knowledge sharing, demonstration and networks (18)
- Support/build leadership capacity of individuals and organisations to lead change (12)
- Improve water literacy beyond water savings to help drive change (21)

Opportunities

The following opportunities were also identified by workshop participants.

Partnerships to build capacity and community engagement and water literacy

- Capacity building & national network
- Community behaviour change for water sensitive communities - build on existing "Switch your thinking" Program

Partnerships with proactive & willing developers

- White Gum Valley – demonstration of water sensitive infill housing
- Pinjar proposed urban and industrial development
- Swan Valley Development Area
- Wanju District Structure Plan –1,200 ha greenfield development, Shire of Dardanup
- Hester Park Revitalisation Project, City of Gosnells
- East Perth Development (Powerhouse), Swan River
- Muchea Employment Node
- City of Canning Town Centre Redesign
- Batavia Coast Marina Stage 2, Geraldton
- Wungong Living Stream project
- Nambeelup Industrial Area

Creating the enabling environment: Embedding water sensitive cities principles into policy, planning, governance and funding

- Input to design policy reviews (R codes , & Urban Design State Planning Policy)
- Strategic Assessment Perth Peel Region at 3.5 million – Structure Planning Stage
- River Protection Strategy – Drainage governance
- Busselton Drainage Reform
- Kwinana rural drain upgrade – Vesting change from Water Corporation to Town of Kwinana
- Traditional drainage design vs Living streams – Cost benefit analysis

Partnerships to trial innovative technologies and approaches

- Western Suburbs Aquifer Recharge Project
- Broome non-potable water supply for public open space

- Water efficiency improvement on the Gnangara Mound – alternative water management approaches for peri-urban horticulture
- Monitor and evaluate Urban Waterways Renewal Program – WSUD project sites
- Stormwater harvesting and salinity management, Merredin

Continue and build on Tranche 1 projects

- Implement A4.2 Plan to Transition Greater Perth to a Water Sensitive City by 2065
- Extend project to better understand interactions between surface water and groundwater; how water moves in the urban landscape, risks to the aquifer and approaches to manage contamination and use water
- Build on current monitoring and evaluation projects (e.g. North Forrestdale greenfield development)

2.3.4 Project Development Workshop, 2 & 3 Dec 2015, Melbourne

The Project Development Workshop was held in Melbourne on 2 and 3 December 2015. It was attended by CRCWSC researchers and partners from across the country. Workshop participants discussed the outcomes of the stakeholders Needs and Opportunities workshops held in Perth, Melbourne, Sydney, Adelaide and Brisbane. A set of combined needs were derived as follows.

Enabling structures

1. Strengthening and aligning policy, legislation and regulation in support of water sensitive cities
2. Creation of a shared vision and narrative for water sensitive cities that connects with community values , which can then drive decision making
3. New financial model and incentives that recognise the values and benefits of water sensitive cities
4. Robust and inclusive decision making frameworks
5. Governance frameworks that enable coordination and collaboration across agencies and sectors
6. Holistic evaluation frameworks to support water sensitive city investments

On-ground practices

7. Guidance on how to develop context-specific solutions and asset management regimes
8. Achieving multiple benefits through integrated planning, and design of water systems and the urban form
9. Next generation of flood risk assessment frameworks and tools for a water sensitive cities approach
10. Monitoring and evaluation for improved system design and performance
11. Efficient and effective operations and maintenance systems to achieve water sensitive city outcomes
12. Coherent understanding of groundwater systems and interactions with surface waters

Social capital

13. Influencing water sensitive city outcomes through leadership, collaboration and networks
14. A culture of learning and innovation
15. Translation and sharing of water sensitive cities knowledge
16. Building community and industry connection and engagement
17. Building capacity to deliver a water sensitive cities

Consideration of the combined needs led to the definition of preliminary research clusters which aim to ensure the delivery of multidisciplinary projects and outcomes. The preliminary research clusters are as follows:

- Steering transitions
    - Guiding and influencing
- Integrated planning and implementation
    - Coordinated and aligned decision making
- Context specific solutions
    - Green/grey/brownfield (infill)
    - Flood/heat/groundwater/climate change
    - Social and cultural context
- Monitoring and performance optimisation
    - Performance of technical, natural and management systems
    - Optimisation and design
- Socio-economic evaluation frameworks
    - Believable narrative for macro and micro-level audiences

It is understood that these clusters will be used to organise the program of T2 research.

2.3.5 Summary of Research Outputs (Tranche 1, 2012/13 – 2016/17)

A Summary of Research Outputs (Tranche 1, 2012/13 – 2016/17) has been prepared which presents a summary of the research outputs delivered by the CRCWSC during its first phase or tranche 1 from 2012/13 through to 2016/17. The summary was developed to provide CRCWSC participants and future end users, including government, water utility and industry groups with a quick guide of the key research outputs and how they relate to some of the key issues facing practitioners in delivering water sensitive city outcomes (CRCWSC, 2015).

The summary has been considered as part of the development of this Plan.

2.3.6 Tranche 2 Project Prioritisation Process - Draft 14 January 2016

Consideration has also been given to some preliminary information provided by the CRCWSC executive to assist in the identification and prioritisation of projects to be considered for Tranche 2. This includes key principles and selection criteria.

The key principles for Tranche 2 projects, endorsed by CRCWSC Board are:

1. Enable the transition of cities and associated organisations towards water sensitive cities;
2. Maximise the effective adoption of Tranche 1 project outputs and recommendations;
3. Establish interdisciplinary and integrated platforms for projects (research-industry links); and
4. Maintain the cohort of world class researchers of the CRCWSC to support industry needs and execute (1) to (3) above.

The Project Prioritisation Criteria have been used to rank each project and are addressed in the following sections. The Project Prioritisation Criteria are considered to have equal weighting and have been rated on scale of 1-5, 5 being highest. The criteria are:

1. Degree of alignment to the city/region WSC transition strategies/needs
    a. Contribution to addressing key needs identified in a regional context
    b. Proposed engagement with industry/end-user participants
2. Strategic significance and alignment to CRCWSC Strategic Plan
    a. Alignment with existing knowledge and outputs from Tranche 1 projects
    b. Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17
3. Transferability and potential for project outcomes to create significant impact
    a. Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities
    b. Potential for influencing policy, planning or practice and/or commercialisation.
4. Track record of project team/members
    a. Current/past performance in delivering industry-related project outcomes
    b. Demonstrated successful and effective stakeholder engagement
5. Project risk, benefits and costs;
    a. Sound project risk - reward/benefits profile, including effective project management approach
    b. Cost efficiency, including contributions from CRCWSC participants and external leveraging

2.3.7 Technology-focused Needs and Opportunities Workshop, 28 January 2016, Melbourne

A Technology-focused Needs and Opportunities Workshop was held on 28 January 2016, in Melbourne. The objective of the workshop was to capture particular needs and opportunities relating to technology developments and implementation required to transition to Water Sensitive Cities, and to identify possible research ideas in relation to these needs.

Key technology needs identified by Western Australian partners included:

- Water recycling technologies;
- Monitoring and mapping of green infrastructure;
- Irrigation methods, instrumentation and control and weather technologies;
- Simple water quality tests for EHOs;
- Environmental monitoring of MAR and aquifer health - instrumentation, monitoring and control;

- Affordable auto-samplers and telemetry systems;
- Integrating infrastructure artistically;

These needs were recognised particularly in session 1 and are reflected in the following needs clusters:

1. Analysis, interpretation & utilisation of complex and real time data;
2. Innovative water supply options through diversified and integrated technology solutions; and
3. Smart monitoring and sensing.

3 PROJECT DESCRIPTIONS

The following suite of projects is provided for consideration by the CRCWSC as part of the development of Tranche 2. These projects are considered critical to the successful transition of Greater Perth towards a water sensitive city. They aim to build on the findings of Tranche 1 projects and mainstream adoption of outputs and recommendations, addressing identified needs and filling critical gaps in knowledge and research. These projects also recognise the importance of integrated and interdisciplinary delivery processes and aim to strengthen industry and research partnerships.

The following projects are proposed to be considered for implementation in Tranche 2.

1. Advancing the Vision (Transition Strategy);
2. Knowledge brokering and building capacity;
3. Governance, regulatory, policy and delivery frameworks in WA;
4. Local scale water supply and servicing;
5. WSUD Science in WA;
6. Responsive urban form;
7. Improved frameworks for evaluation of costs, risks and performance of water sensitive practices;
8. Research synthesis and application in WA; and
9. Regional Manager position and project management.

The projects are described in a manner which is largely consistent with the project outline template; however, it is recognised that these projects will be further developed by the CRCWSC in the establishment Tranche 2.

3.1 Advancing the Vision (Transition Strategy)

3.1.1 Project summary

This project will prepare and implement a strategy for transitioning Greater Perth into a Water Sensitive City in line with the vision, guiding principles of practice, and strategies and actions outlined in *Shaping Perth as a Water Sensitive City* (CRCWSC, 2015). It will address Perth's transition challenges and focus areas for change, proposing a comprehensive action plan to be implemented by Government, industry and the community.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
Project lead to be nominated at workshop on 4 March 2016 CRCWSC - Dr Briony Rogers	Implementation/ application Adoption	Department of Water Housing Authority City of Canning City of Gosnells City of Subiaco City of Nedlands EMRC LandCorp DPaW Rivers and Estuaries Division Water Corporation Essential Environmental GHD	Department of Planning Department of Sport and Recreation Department of Health City of Perth SJ Shire UDIA Perth Region NRM WALGA AILA Calibre Consulting Wallis Consulting & Development

3.1.2 Project aims and objectives

This project will result in the preparation of a Transition Strategy to deliver the vision, critical strategies and actions outlined in *Shaping Perth as a Water Sensitive City.* It will build on the outcomes of CRCWSC Tranche 1 projects and optimise utilisation of outputs and tools such as the Water Sensitive Cities Index.

The strategy will contain an action plan that outlines agreed roles, responsibilities and timing for delivery of identified needs to facilitate Perth' transition towards a water sensitive city. This plan will also provide an overarching framework for the delivery of T2 projects over the next 4 years, and identify a range of activities beyond the scope and resources of the CRCWSC.

3.1.3 Identified transition needs and knowledge gaps

This project, which focusses on advancing the vision of a water sensitive city, addresses the following identified needs in WA.

Enabling structures

- Strengthening and aligning policy, legislation and regulation in support of water sensitive cities
- Creation of a shared vision and narrative for water sensitive cities that connects with community values , which can then drive decision making

	• Governance frameworks that enable coordination and collaboration across agencies and sectors
On-ground practices	• Achieving multiple benefits through integrated planning, and design of water systems and the urban form • Establish mechanisms and commit resources to ensure impact-oriented research and development, including its translation to influence water sensitive policy and practice • Integrated planning across sectors, agencies and water systems
Social capital	• Building capacity to deliver a water sensitive cities • Building community and industry connection and engagement • Translation and sharing of water sensitive cities knowledge • Influencing water sensitive city outcomes through leadership, collaboration and networks

3.1.4 Research questions and approach

The following is a preliminary list of research questions. The delivery approach will be determined on agreement of project scope.

a) What is the most effective way to develop and communicate a unifying vision and message about the need for and value of Greater Perth as a future water sensitive city?
b) What strategies are required to build community support for water sensitive outcomes that provides the mandate for driving change in water-related policy and practice?
c) How can broad political and industry support be obtained which inspires leadership at all levels to set a clear direction, drive change and model the behaviours needed to achieve water sensitive outcomes?
d) What changes are required to governance arrangements to address gaps, remove barriers, clarify ambiguities and provide incentives for water sensitive practice?
e) What capacity building activities are required to enable organisational cultures which fostering collaboration and innovation towards water sensitive practice?
f) What mechanisms are appropriate to provide adequate resources to ensure impact-oriented research and development, including its translation to influence water sensitive policy and practice?

Key CRCWSC project linkages are:

T1 projects	Project A2 – Societal innovation and behaviour change Project A3 – Governance and regulatory reform Project A4 – Social-technical transitions Project B2 – Planning, design and management to protect and restore receiving waters Project B3 – Water sensitive urban design and urban microclimate Project B5 - Statutory planning for water sensitive urban design Project C4.1 – Integrated multi-functional urban water systems Project D3 – Influencing water sensitive cities policy Project D5.1 – Urban intensification and green infrastructure: Towards a water sensitive city Project D6 – Water sensitive cities impact and assessment
T2 projects	2. Knowledge brokering and building capacity 3. Governance, regulatory, policy and delivery frameworks in WA

4. Local scale water supply and servicing
5. WSUD Science in WA
6. Responsive urban form
7. Improved frameworks for evaluation of costs, risks and performance of water sensitive practices
8. Research synthesis and application in WA -

3.1.5 Project outcomes, adoption and impact

This project will develop clear water policy direction for Perth as a water sensitive city. It will facilitate continued cross-organisational meetings, processes and other forums to develop alignment of goals, objectives and actions, resulting in stakeholder commitment to a strategic framework that is formally endorsed by water and planning -related organisations.

This shared basis for setting goals and objectives will support agreed targets for achieving the water sensitive vision for Perth, building on the outcomes of the "Shaping Perth as a water sensitive city" visioning process. These targets will be achieved through the implementation of an agreed action plan which assigns responsibilities and timeframes to the actions.

Development and implementation of the plan will result in communities that are engaged by water and urban planning sectors in the development of strategies for the delivery of services. Industry will lead the on-ground implementation of WSUD interventions underpinned by rigorous industry standards, based on WSUD principles and approaches contained in policy and growth plans.

3.1.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	WRAP CRCWSC - Dr Briony Rogers and A4.2 team
Key industry inputs	202020Vision Australian Institute of Landscape Architects AWA Calibre Consulting ChemCentre City of Canning City of Gosnells City of Joondalup City of Mandurah City of Melville City of Nedlands City of Subiaco City of Wanneroo Department of Health Department of Housing Department of Planning Department of Sport and Recreation

	Department of Water DPaW Rivers and Estuaries Division Eastern Metropolitan Regional Council Engineers Australia Essential Environmental GHD Institute of Public Works Engineers LandCorp Metropolitan Redevelopment Authority Perth Region NRM Planning Institute of Australia (WA) SERCUL SJ Shire Stormwater WA University of Western Australia UDIA Urban Quarter WALGA and Local government Water Corporation WESROC
Research cluster involvement	• Steering transitions
End user targets	• State Government, particularly Department of Planning, Water, Housing, LandCorp • Local government – planners, engineers, landscape, asset management • Industry – developers, consultants • Community
Project delivery risks	Maintaining high level commitment from stakeholders Developing an implementation strategy which has funding and commitment for deliver Engagement of other stakeholders and the community
Timing and milestones	Commence 2016, 12 months for strategy, 4 years for delivery of action plan.

3.1.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$ 100,000	$ 60,000	$ 40,000	$ 40,000
	Scholarships	$ 30,000	$ 30,000	$ 15,000	$ 15,000
	Operating	$ 20,000	$ 10,000	$ 10,000	$ 10,000
Industry partners	Cash				
	In-kind (FTE)	1.5	1.5	1.5	1.5
Universities	In-kind (FTE)				

3.1.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	4
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	5
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, including contributions from CRCWSC participants and external leveraging	3
	Total	22

3.2 Knowledge brokering and building capacity

3.2.1 Project summary

This project aims to mainstream water sensitive cities practices by building knowledge and capacity through influence, impact and collaboration. It is a critical component of the delivery of CRCWSC long term outcomes.

It is proposed that knowledge brokering and capacity building needs are coordinated by the existing WA program, New WAter Ways Inc. New WAter Ways delivers capacity building through a range of knowledge broker activities which are broadly categorised as knowledge sharing; transfer through demonstration and synthesis, tools and frameworks; and partnerships and collaboration. New WAter Ways aims to provide easy access to best practice and supporting WSUD information and facilitate the upskilling of WSUD practitioners to deliver improved water sensitive outcomes for Western Australia based on trusted and reliable science. New Water Ways assists in establishing and maintaining the frameworks which implement water sensitive practices in a range of changing contexts.

The provision of additional resources to New WAter Ways will allow the extension of current activities to incorporate CRCWSC outputs and findings, and develop new actions to enhance the knowledge and skills needed from people and organisations to facilitate improved on-ground outcomes. These activities may include, for example, specialist, technical and practical workshops; in-house sessions for individual agencies to develop cross-agency commitment and participation; cross-agency forums to discuss recent findings and their implications for practice; and release of fact sheets and case studies which provide easy access to contextually relevant research outcomes.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
NWW Chair, Mark Batty CRCWSC – Fiona Chandler	Implementation/ application Adoption	Department of Water DPaW Rivers and Estuaries Division Essential Environmental EMRC Water Corporation UWA	Local government Department of Planning UDIA WALGA 202020Vision AILA AUDRC AWA Curtin University ECU Engineers Australia IPWEA Murdoch University Perth Region NRM Planning Institute of WA SERCUL SRT River guardians Stormwater WA Switch your Thinking

3.2.2 Project aims and objectives

There is a need to capture the learnings from CRCWSC research to build a community of practice around water sensitive cities which, through improved service delivery, leads to enhanced liveability, sustainability and resilience within our cities and towns.

This project will increase access to effective tools and products within locally relevant contexts. It aims to facilitate improved understanding, backed by practical knowledge, of requirements for planning, design, construction and maintenance of WSUD options.

Key areas of focus are likely to be:

- options for management of groundwater quality and levels in an urban context;
- preparation and assessment of supporting information and documentation;
- sharing latest findings with respect to WSUD science on the Swan Coastal Plain;
- maintenance of WSUD assets, as it is critical that information on requirements, timing and costs is gathered and disseminated effectively to local governments to improve current attitudes towards maintenance; and
- engaging the community in the identification and delivery of the WSC Vision for Perth.

3.2.3 Identified transition needs and research gaps

This project, which focusses on knowledge brokering and building capacity, addresses the following identified needs in WA.

Enabling structures	• Trusted cost benefit information and frameworks
On-ground practices	• Guidance on how to use urban and water system design to deliver multiple benefits
Social capital	• Building capacity to deliver a water sensitive cities • Building community and industry connection and engagement • Translation and sharing of water sensitive cities knowledge • Influencing water sensitive city outcomes through leadership, collaboration and networks
Research gaps	• Maintenance information (tasks, costs, funding and delivery frameworks) • Community behavior change program for WSC • Stakeholder needs assessment post T1

3.2.4 Research questions and approach

The key research questions for this project are:

a) What outcomes of T1 will be the most effective in strengthening support for the identification, planning, design, construction and maintenance of WSUD solutions and opportunities?
b) What critical outcomes from T1 will assist in upskilling practitioners?
c) What are the current capacity building needs and preferred delivery mechanisms for stakeholders post T1?
d) What tools will improve maintenance delivery?
e) How can WSC practices be better incorporated into University education?

f) How can you best engage the community in the delivery of the WSC Vision for Perth?

It is proposed that the project is delivered through New WAter Ways which will have both a delivery and coordination role. Key activities include:

- Knowledge sharing of research findings and outcomes through reporting in e-newsletters and links to resources on the New WAter Ways website, as well as effective presentations of research findings and outcomes that are targeted at practitioner needs;
- Knowledge brokering of information which successfully brings together particular information to address specific stakeholder knowledge needs or issues;
- Transfer of knowledge through incorporation of findings into training sessions;
- Demonstration of on-ground outcomes through demonstration tours, and preparation of case studies and fact sheets – sharing successes and failures to assist learning of how future water sensitive initiatives can be improved;
- Development of practical workshops on research findings or technologies which incorporate advances in processes, principles and/or criteria and mainstream implementation of water sensitive practices;
- Use of New WAter Ways industry networks to engage with a greater number of stakeholders to increase impact across a wide range of disciplines and influence management, planning and development processes through identification, concept, design, construction and implementation phases;
- Provide input into CRCWSC planning, programs, projects and activities so that they are more responsive to industry needs and current issues,
- Collaborate with other stakeholders and industry associations to share a common message of how to transition towards a water sensitive city;
- Work with universities to optimise integration of WSC practices into engineering degrees; and
- Identify partners, and coordinate design and delivery of community behaviour change program for water sensitive communities. Possible delivery partners include Switch Your Thinking, .SRT River Guardians, SERCUL, Water Corporation and 202020Vision.

Key CRCWSC project linkages are:

T1 projects	All project outputs provide content for the program Assistance with delivery provided through: • Project A2 – Societal innovation and behaviour change • Project A3.3 - Strategies for influencing the political dynamics of decision making • Project D3.2 - Influencing water sensitive cities policy) • Project D4.1 – Strengthening educational programs to foster future water sensitive cities leaders • Project D5.1 – Urban intensification and green infrastructure: Towards a water sensitive city
T2 projects	All project outputs will provide content for the program

3.2.5 Project outcomes, adoption and impact

A partnership between New WAter Ways and the CRCWSC will facilitate access for Government and industry to a world class workforce with the capacity and capability to develop and implement water sensitive cities. The delivery of capacity building activities will greatly enhance the ability of industry to lead the on-ground implementation of WSUD solutions.

New WAter Ways is able to work with its significant practitioner networks to raise awareness of recent developments and showcase new findings and outputs which are relevant to Perth and WA. It is recognised that the improved uptake and use of CRCWSC research outcomes and tools is a critical component to improve our ability to transition towards a water sensitive city.

This project will focus on new areas of knowledge brokering and capacity building in WA which include engagement with the community; increased focus on inclusion of WSC practices in university education; and facilitating better maintenance practices. These activities are directly transferrable across the country.

Delivery of this project will ensure that all stakeholders are actively engaged and supported with targeted information and educational support to encourage shared knowledge of Perth's water narrative and to promote individual and collective responsibility and capacity as water stewards. The inputs of different stakeholders into water-related initiatives will be facilitated with appropriate timing and with respect for their influence, capacity and needs and clear and consistent messages will be communicated to the community and other stakeholders.

It is considered that without significant capacity building, current practices will not improve and less than optimal outcomes become reasons why uptake is diminished. New WAter Ways is able to share information regarding on-ground implementation of solutions to address issues with implementation and build confidence that WSUD can be done and will work in WA.

3.2.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	New Water Ways Inc Board members CRCWSC - Fiona Chandler's team
Key industry inputs	202020Vision Australian Institute of Landscape Architects Australian Urban Design Research Centre AWA Engineers Australia Institute of Public Works Engineers Perth Region NRM Planning Institute of WA SERCUL SRT River guardians Stormwater WA Switch your Thinking UDIA

	WALGA and Local government Water Corporation WRAP
Research cluster involvement	• Steering transitions • Socio-economic evaluation frameworks
End user targets	• State Government, particularly Department of Planning, Water, Housing, LandCorp • Local government – planners, engineers, landscape, asset management • Industry – developers, consultants • Community
Project delivery risks	Resource limitations will reduce the effectiveness of program delivery. One of the capacity building areas of least experience for New Water Ways is that of the community. Accordingly, a more experienced delivery partner will be sought for this objective.
Timing and milestones	Commence 2016, delivered consistent with an annual business plan which will be approved each year by the Board. Community engagement likely in Y3 and Y4 after design of program in Y2

3.2.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$20,000	$100,000	$20,000	$20,000
	Scholarships				
	Operating	$100,000	$100,000	$200,000	$200,000
Industry partners	In-kind Cash	$55,000	$55,000	$55,000	$55,000
	In-kind (FTE)	1.5	1.5	1.5	1.5
Universities	In-kind (FTE)				

3.2.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	5

Note: The projects, priorities, costs and responsibilities have not been agreed by any agency

	Criteria	Score
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	4
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, including contributions from CRCWSC participants and external leveraging	4
	Total	**23**

3.3 Governance, regulatory, policy and delivery frameworks in WA

3.3.1 Project summary

It is being increasingly understood that the delivery of water sensitive cities is often impeded by governance frameworks including misaligned or conflicting regulatory and policy requirements and objectives; ambiguous roles and responsibilities; and lack of coordination regarding decision-making and implementation.

Shaping Perth as a Water Sensitive City (CRCWSC, 2015) identifies the need to strengthen governance arrangements in WA to address gaps, remove barriers, clarify ambiguities and provide incentives for water sensitive practice as one of the key focus areas for change.

This project will build on the significant body of work completed in Tranche 1, and address transition challenges relating to the need for better aligned and coordinated organisational objectives, structures and processes.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
Greg Claydon - Department of Water CRCWSC – Yvette Bettini	Knowledge Implementation/ application	Department of Water Housing Authority City of Canning City of Gosnells City of Joondalup City of Mandurah City of Melville City of Subiaco City of Wanneroo Eastern Metropolitan Regional Council LandCorp DPaW Rivers and Estuaries Division Water Corporation	Department of Planning Department of Sport and Recreation Department of Health WALGA UDIA Planning Institute of Australia IPWEA Stormwater WA Australian Institute of Landscape Architects

3.3.2 Project aims and objectives

This project aims to improve the regulatory environment in which our cities are developed to ensure that their planning and development is consistent with WSC principles. It will facilitate improved integration and improved collaboration across organisations and sectors.

This project will focus on the range of delivery frameworks which include legislative, regulatory, policy and/or guideline criteria in order to facilitate an environment which encourages innovation and the delivery of water sensitive cities outcomes in Perth.

Key objectives are to:

- Improve the implementation of *State Planning Policy 2.9: Water Resources* and *Better Urban Water Management* (WAPC, 2008) including support for innovation and application to infill and small-scale development;
- Streamline drainage governance to deliver water sensitive cities outcomes;
- Address inconsistencies in water management objectives and criteria applied by State and local governments as part of planning and design approvals through an improved understanding of real and perceived risks and technically rigorous assessment of management and mitigation responses;
- Facilitate rationalisation of approval requirements for of fit-for-purpose water supply systems which are practical and reflective of the level of risk;
- Identify effective incentives for application of WSC practices and scope mechanisms for their introduction; and
- Clear and agreed roles and responsibilities for stakeholders involved in regulation and management of the water cycle and WSUD solutions.

3.3.3 Identified transition needs and knowledge gaps

This project, which focusses on governance, regulatory, policy and delivery frameworks, addresses the following identified needs in WA.

Enabling structures	• Governance and statutory arrangements to facilitate water sensitive cities and towns • Strengthening and aligning policy, legislation and regulation in support of water sensitive cities • Address inconsistencies in water management objectives and criteria • Integration and improved collaboration across organisations and sectors • Governance frameworks that enable coordination and collaboration across agencies and sectors
On-ground practices	• Integrated planning across sectors, agencies and water systems • Guidance on how to use urban and water system design to deliver multiple benefits • Achieving multiple benefits through integrated planning, and design of water systems and the urban form
Social capital	• Develop enabling organisational cultures for fostering collaboration and innovation towards water sensitive practice • A culture of learning and innovation
Research gaps	• Application of T1 findings in a WA context • Incentives which support application of WSUD practices

3.3.4 Research questions and approach

The following is a preliminary list of research questions. The delivery approach will be determined on agreement of project scope.

a) Consider the findings and outputs of
    - Project A 3.1: Better governance for complex decision-making;
    - Project A3.2 Better regulatory frameworks for water sensitive cities; and

- Project A3.3 : Strategies for influencing the political dynamics of decision making;

and identify specific strategies and actions for WA, including changes which could/should be made to key legislative, regulatory, policy and/or guideline criteria to foster innovation and the delivery of water sensitive cities outcomes in Perth.

b) How do the recommendations in *Becoming a Water Sensitive City: A Comparative Review of Regulation in Australia* (Project A3.2 Milestone Report) apply to Perth's urban water regulatory frameworks?

c) What is an optimal framework for drainage governance in Perth and what steps are required to implement it?

d) How can additional support be provided to innovative projects to facilitate their adoption through regulatory processes? Can the CRCWSC underwrite the technical risk of new technologies so facilitate their implementation?

e) Which design criteria require further refinement and technical justification?

f) Have the objectives of *State Planning Policy 2.9: Water Resources* and requirements of *Better Urban Water Management* (WAPC, 2008) been met as part of the approval of planning proposals since 2008? How can the intent and requirements of SPP 2.9 be better communicated to industry? How can the assessment and compliance with policy requirements be improved to facilitate innovative and improved outcomes?

g) Water quality entering the Swan and Canning systems continues to be a problem. What structural changes are required to ensure that water quality is improved? What are the opportunities for catchment scale landscape planning for WSUD, particularly retrofitting for WSUD?

h) How can local government be assisted in incorporating water sensitivity into Strategic Community Plans?

i) What mechanisms and financial incentives are effective to encourage risk sharing and collaboration towards innovation for water sensitivity and how can they be implemented?

Key CRCWSC project linkages are:

T1 projects	Project A3 – Governance and regulatory reform Project A4 – Social-technical transitions Project B5 - Statutory planning for water sensitive urban design Project D3 – Influencing water sensitive cities policy Project D6 – Water sensitive cities impact and assessment
T2 projects	1. Advancing the Vision (Transition Strategy) 2. Knowledge brokering and building capacity 4. Local scale water supply and servicing 5. WSUD Science in WA 6. Responsive urban form 7. Improved frameworks for evaluation of costs, risks and performance of water sensitive practice 8. Research synthesis and application in WA -

Opportunities to "road test" and apply some of the research findings and new approaches may be provided by the following strategic, planning and development projects:

- Bentley Regeneration project – Housing Authority
- Wungong Urban Water Project – Metropolitan Redevelopment Authority
- Perth and Peel Green Growth Plan for 3.5 Million - Government of WA
- City of Canning Town Centre Redesign – City of Canning
- River Protection Strategy – DPaW Rivers and Estuaries Division
- East Wanneroo Structure plan – Department of Planning
- Pinjar South development – LandCorp and Housing Authority

3.3.5 Project outcomes, adoption and impact

Implementation of this project will clarify optimal governance arrangements and clearly define roles and responsibilities for all aspects of the water cycle. It will facilitate improved delivery frameworks which encourage innovation while ensuring social, environmental and economic sustainability in all decisions and investments.

Decision-makers across water-related sectors will be better coordinated and aligned so that decisions are made in the context of a shared vision and evolving narrative for a water sensitive Perth. Water systems planning and urban planning will be integrated and guided by outcome-focused standards that consider both local and regional actions, objectives and priorities.

This project will help regulatory agencies and proponents to meet clear and common goals and foster a shared sense of purpose for the delivery of water sensitive cities. It will establish mechanisms and incentives to encourage risk sharing and collaboration towards innovation for water sensitivity, facilitating improved planning and management of the water cycle and water sensitive cities infrastructure.

3.3.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	DoP, DoW, WC, WALGA CRCWSC – Yvette Bettini, Brian Head, Graeme Hodge, Matthew Laing, Linda Choy, Barnaby McIlrath
Key industry inputs	Aquest Australian Institute of Landscape Architects AWA Busselton Water Department of Health Department of Housing Department of Planning Department of Sport and Recreation Department of Water DPaW Rivers and Estuaries Division Eastern Metropolitan Regional Council

	Engineers Australia Institute of Public Works Engineers LandCorp Perth Region NRM Planning Institute of Australia (WA) Stormwater WA UDIA WALGA and Local government Water Corporation
Research cluster involvement	• Steering transitions • Integrated planning and implementation • Socio-economic evaluation frameworks
End user targets	• State Government, particularly Department of Planning, Water, Housing, LandCorp • Local government – planners, engineers, landscape, asset management • Service providers • Industry – developers, consultants • Community
Project delivery risks	• Level of commitment to the project by politicians and senior decision-makers • Ability of recommended improvements to be implemented within timing, cost and risk constraints
Timing and milestones	Y1: Scope regulatory/policy improvements including drainage governance – implement Y2-4 Y2: Scope incentives – implement Y3 -4 Y2: assess implementation of BUWM – implement Y3 Y3: Scope LG needs – implement Y4

3.3.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$ 150,000	$ 150,000	$ 100,000	$ 80,000
	Scholarships	$ 30,000	$ 30,000	$ 30,000	$ 30,000
	Operating	$ 5,000	$ 5,000	$ 20,000	$ 5,000
Industry partners	In-kind Cash		$ 20,000		
	In-kind (FTE)	1.5	1.5	1.5	1.5
Universities	In-kind (FTE)				

3.3.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5

Note: The projects, priorities, costs and responsibilities have not been agreed by any agency

	Criteria	Score
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	5
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	4
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, including contributions from CRCWSC participants and external leveraging	4
	Total	**23**

3.4 Local scale water supply and servicing

3.4.1 Project summary

The continued development of WA, in terms of both population and the economy, means that demand for water is increasing, despite demand management actions. To continue to meet the demand for water, alternative water supplies are needed to supplement existing resources (*State Water Recycling Strategy*, Government of WA, 2008).

Although water and wastewater are effectively supplied by the Water Corporation and other service providers in many cities and towns across Western Australia, there are limited opportunities for provision of alternative or local scale water, particularly non-drinking water, and wastewater services within these networks.

Government and industry have been working to address some of the key barriers to alternative service provision and it is considered that cost and governance are the most significant success factors for these projects. Issues associated with the assessment and approvals process; environmental impacts and benefits; pricing; and technical solutions are no longer significant impediments.

Although most alternative supply schemes are assessed on the basis of the benefits (and costs) that are directly attributable to a project, the implementation of a local-scale solution can result in benefits observed outside the project area which are generally not considered, much less quantified. These may include lower carbon emissions from localised distribution systems where there is no need to pump water over great distances, reduced wastewater discharges from ocean outfalls or reduced need for desalination with its high energy requirement and hypersaline discharges. Other benefits include the potential to delay the requirement for source augmentation and/or development of new potable water sources (and the environmental impacts that result from these activities), as well as improved protection and maintenance of ecosystems that are dependent on our groundwater resources for survival.

This project will consider costs and benefits beyond the project scale to assess benefits to the wider community to assist preliminary discussions and feasibility assessment. It will identify a range of technologies, governance, charging and staging solutions which can be utilised in a range of circumstances in WA to optimise delivery of local scale drinking water, non-drinking water and wastewater services.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
Department of Housing Prof Dave Pannell (UWA)	Demonstration Implementation/ application	Water Corporation Department of Water LandCorp City of Wanneroo City of Subiaco City of Nedlands	Department of Planning Department of Health UDIA City of Swan WESROC

3.4.2 Project aims and objectives

The aim of this project is to optimise opportunities for local scale integrated water cycle planning (drinking water and non-drinking water) and delivery (servicing) in WA.

In order to deliver local-scale water servicing in an urban context, this project will consider the range of water recycling systems and fit-for-purpose options that exist for urban (residential, commercial and industrial) use. These include wastewater recycling, greywater systems, groundwater bores and stormwater harvesting at a range of scales from individual on-site systems such as rainwater tanks to residential estate-scale and city-wide systems. These systems offer a range of use and non-use (external) advantages, disadvantages and costs that will be estimated, recognising that they are largely dependent on the characteristics of the site, the development and the existing and planned infrastructure.

This project will quantify the risks associated with non-potable schemes and other alternative water systems, aiming to influence the deeply embedded professional culture which supports traditional water management approaches and develop the skills required to manage an integrated water system. It will aim to support water utilities and/or private operators so that they have the capacity, and are willing, to operate water sensitive cities infrastructure and technologies.

This industry-led project will showcase the delivery of total water cycle technologies and systems so that the investment and decision making (business case) processes for urban development and water management adopt water sensitive urban design principles.

3.4.3 Identified transition needs and knowledge gaps

This project, which focusses on local scale water supply and servicing, addresses the following identified needs in WA.

Enabling structures	• Governance and statutory arrangements to facilitate water sensitive cities and towns • Trusted cost benefit information and frameworks • Local scale water supply and servicing – governance, charging and staging • Address inconsistencies in water management objectives and criteria
On-ground practices	• Water availability and reuse – technologies, approvals and governance • New technologies - Integrated and total water cycle systems • Efficient and effective operations and maintenance systems to achieve WSC outcomes • Frameworks and evidence to support full life-cycle cost benefit analyses that also consider non-monetary values • Guidance on how to develop context-specific solutions and asset management regimes • Achieving multiple benefits through integrated planning, and design of water systems and the urban form
Social capital	• WSUD demonstration sites and proof-of-concept • Develop strong capacity and enabling organisational cultures for fostering collaboration and innovation towards water sensitive practice • Influencing water sensitive city outcomes through leadership, collaboration and networks

	• Better translation of scientific knowledge into practice and policy outcomes
Research gaps	• Water availability and reuse – technologies, approvals and governance • Service delivery models for multiple service providers • Life cycle cost comparisons of various sources of drinking water and non-drinking water within a total water cycle context

3.4.4 Research questions and approach

The following is a preliminary list of research questions.

a) What options exist for governance, charging and staging arrangements which can be utilised in a range of circumstances in WA to optimise delivery of local scale drinking water, non-drinking water and wastewater services?
b) How can costs and benefits beyond the project scale including benefits to the wider community be assessed to assist preliminary discussions and feasibility assessment?
c) How can alternative service provision be satisfactorily demonstrated and practically delivered through the planning approvals process?
d) Is sewer-mining an economically viable option for the supply of non-drinking water for public open space irrigation in areas where groundwater is over-allocated in comparison to scheme water (consider the cost-benefit of wastewater lost to groundwater replenishment vs the cost of desalination)?
e) What are the conditions (e.g. site, source, use) for successful MAR projects? What are the requirements and design specifications for injection and measurement infrastructure?
f) What efficient irrigation technologies, including instrumentation and control, can be cost effectively implemented by industry?
g) What simple testing protocols and tools are available for environmental health officers to facilitate improved compliance assessment and reporting?

It is proposed that the delivery of this project is undertaken as a research project, but with significant inputs into and learnings from a number of demonstration projects. These developments are already being delivered by a range of agencies and provide a variety of opportunities to inform the delivery of this project as follows:

Project	Opportunity/demonstration	CRCWSC input
Pinjar proposed urban and industrial development (LandCorp, Housing Authority)	Alternative source of water for POS irrigation (no GW available)	Assistance with cost-benefit analysis
Brabham development - Swan Valley (Housing Authority)	Alternative source of water for POS irrigation (no GW available)	Assistance with cost-benefit analysis
Western Suburbs Groundwater Restoration and Reuse project (WESROC)	Investigations and design specifications for MAR projects	Identification of options for governance, charging and staging
Broome non-potable water supply for public open space (Shire of Broome, Department of Water)	Delivering NDW in regional areas (without a WWTP)	Identification of options for governance, charging and staging
WGV Project in White Gum Valley (LandCorp)	Monitoring of NDW use	Monitoring and analysis

Project	Opportunity/demonstration	CRCWSC input
Batavia Coast Marina Stage 2 (LandCorp, City of Greater Geraldton)	Stormwater harvesting in regional areas	Identification of options for governance, charging and staging
Nambeelup Industrial Area (LandCorp)	Management of flood risk, wetlands and water availability and reuse in an Industrial context	Identification of options for governance, charging and staging

Key CRCWSC project linkages are:

T1 projects	Project A1 - Economic modelling and analysis Project A3 – Governance and regulatory reform Project C1 - Innovative technologies for fit-for-purpose water production Project C3.1 – Managing interactions between decentralised and centralised water systems Project C4.1 – Integrated multi-functional urban water systems Project C5.1 – Intelligent urban water systems
T2 projects	1. Advancing the Vision (Transition Strategy) 2. Knowledge brokering and building capacity 3. Governance, regulatory, policy and delivery frameworks in WA 5. WSUD Science in WA 6. Responsive urban form 7. Improved frameworks for evaluation of costs, risks and performance of water sensitive practice 8. Research synthesis and application in WA -

3.4.5 Project outcomes, adoption and impact

This project will result in fit-for-purpose schemes which integrate with the broader water system to provide reliable and adaptable configurations to suit different contexts and conditions. This will increase confidence in the ability to deliver decentralised systems in site specific contexts and support improved understandings of approval requirements, governance frameworks and capital and ongoing costs. The outputs of this project are transferrable across Australia.

This project will encourage infrastructure planning and development which is coordinated and integrated to deliver multiple benefits. Holistic consideration will be given to community and environmental benefits both at local and wider city-scales, supporting the delivery of systems that are seen as opportunities to integrate multi-functional green networks.

This project will assist developers and service providers to supply fit-for-purpose water via adaptable systems that work across multiple scales. Water systems will be managed as part of the whole water cycle within their catchment and the broader urban system, and water infrastructure will be managed to deliver agreed levels of service that are reflective of service risks.

This project will demonstrate that local-scale drinking water, non-drinking water and wastewater can be safely and efficiently supplied at a local scale, improving the confidence of industry in this

critical element of water sensitive cities. It will address a significant issue currently facing large areas of developing Perth and provide alternatives for irrigation of important green space.

3.4.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	Housing Authority, LandCorp CRCWSC - Dave Pannell, David McCarthy, Zhiguo Yuan
Key industry inputs	Aquest AWA Busselton Water Curtin University Department of Health Department of Planning Department of Sport and Recreation Department of Water DPaW Rivers and Estuaries Division Eastern Metropolitan Regional Council Institute of Public Works Engineers Irrigation Australia Regional NRM groups Planning Institute of Australia (WA) UDIA UWA Water Science WALGA and Local government Water Corporation WESROC
Research cluster involvement	• Steering transitions • Integrated planning and implementation • Socio-economic evaluation frameworks
End user targets	• Service providers • Industry – developers, consultants • State Government, particularly Department of Planning, Water, Housing, LandCorp • Local government – asset management
Project delivery risks	Information to undertake cost/benefit assessment may be difficult to source Application of project learnings to other areas may be limited by site circumstances
Timing and milestones	Y1: Options assessment Y1: Pinjar & Brabham cost benefit assessment Y1: Efficient irrigation instrumentation Y2: Identification of options for governance, charging and staging Y2: WESROC assessment Y3: Regional non-potable options Y4: Sharing the learnings

3.4.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$ 80,000	$ 80,000	$ 60,000	$ 60,000
	Scholarships		$ 30,000	$ 30,000	$ 30,000
	Operating	$ 10,000	$ 5,000	$ 5,000	$ 5,000
Industry partners	In-kind Cash	$ 300,000	$ 200,000	$ 200,00	$ 100,00
	In-kind (FTE)	3	4	3	3
Universities	In-kind (FTE)	0.5	0.5	0.5	0.5

3.4.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	5
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	4
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, including contributions from CRCWSC participants and external leveraging	5
	Total	**24**

3.5 WSUD Science in WA

3.5.1 Project summary

A critical element in the adoption of water sensitive cities practices in WA is the degree of confidence of stakeholders in the performance of WSUD systems. A lack of data generated in WA which is reflective of WA conditions has been recognised as a significant barrier to implementation for a number of years. The commitment of the CRCWSC to investigate urban hydrology in WA was a key consideration for many organisations in their decision to join the CRCWSC a number of years ago.

It is recognised that a substantial amount of investigation has occurred as part of Tranche 1, particularly in the area of groundwater/surface water interactions, which has influenced the design of WSUD systems in Greater Perth. As many of the results are preliminary in nature and raise further questions, it is critical that this work continues to expand our knowledge and understanding of hydrological responses to urbanisation and document the performance of water sensitive urban design solutions in WA.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
Malcolm Robb (DoW) and Prof Carolyn Oldham (CRCWSC)	Knowledge	Department of Water Department of Housing DPaW Rivers and Estuaries Division University of Western Australia City of Canning City of Gosnells City of Subiaco City of Mandurah EMRC LandCorp Swan River Trust Water Corporation	Department of Sport and Recreation Department of Health SJ Shire UDIA Perth Region NRM Wallis Consulting & Development

3.5.2 Project aims and objectives

This project aims to address unresolved scientific questions and key knowledge gaps important for achieving the vision of water sensitive Perth. It will provide evidence and on-ground 'proof of concept' that WSUD approaches work under local conditions to facilitate acceptance by industry and approval authorities.

This project will also assist in the generation of data to inform critical policy decisions by resource management agencies to ensure the long term protection and management of our urban water environments (wetlands, waterways and groundwater). Key areas of focus for WA are:

- Effective treatment options for high levels of nutrients (in various forms) in groundwater;
- Performance of swales, tree pits, constructed wetlands, living streams and biofilters;

- Stormwater runoff volumes from different urban typologies with different site conditions including infill;
- Ecological health of receiving environments including prevention of degradation, impacts, tipping points and management; and
- Impact of high water tables on urban microclimates and vegetation/waterway health.

This project will provide critical support for the practices (tools and techniques) used by urban planning, architecture, engineering and water management practitioners to create the physical, social and biological form of cities and implement best practice water sensitive urban design.

3.5.3 Identified transition needs and knowledge gaps

This project, which focusses on WSUD science, addresses the following identified needs in WA.

Enabling structures	• Mechanisms and resources to ensure impact-oriented research and development, including its translation to influence water sensitive policy and practice • Coordinated ecological and water quality and quantity monitoring and access to information/results • Monitoring and evaluation for improved system design and performance
On-ground practices	• Coherent understanding of groundwater systems and interactions with surface waters • Efficient and effective operations and maintenance systems to achieve water sensitive city outcomes • Guidance on how to develop context-specific solutions and asset management regimes
Social capital	• Better translation of scientific knowledge into practice and policy outcomes • WSUD demonstration sites and proof-of-concept
Research gaps	• Urban hydrology – runoff rates, water balance, etc. • Nutrient transport (and other contaminants and pathogens in water) • WSUD performance (structural and non-structural approaches and devices) – integrated monitoring and evaluation • Receiving environments – prevention of degradation, impacts, tipping points and management

3.5.4 Research questions and approach

The following is a preliminary list of research questions. The delivery approach will be determined on agreement of project scope.

- What are the sources, bioavailability, mitigation measures and treatment options (if required) for organic nutrients?
- Should we focus on treating groundwater, as well as treating stormwater? Are different approaches required for treating stormwater compared to groundwater?
- What are the long term metal and nutrient performance of constructed and natural wetlands, living streams, biofilters and swales?
- What recharge rates are measured on-site for various urban form densities and site conditions and which should be used in modelling assumptions?

- What are the impacts of urban catchments on the ecological health of waterways, wetlands and the groundwater?

Key CRCWSC project linkages are:

T1 projects	Project B2 – Planning, design and management to protect and restore receiving waters Project B3 – Water sensitive urban design and urban microclimate
T2 projects	2. Knowledge brokering and building capacity 3. Governance, regulatory, policy and delivery frameworks in WA 6. Impacts of infill, higher density and small lots on environment and liveability 7. Developing in areas of high groundwater 8. Research synthesis and application in WA - 9. Improved frameworks for evaluation of costs, risks and performance of water sensitive practices

3.5.5 Project outcomes, adoption and impact

This project will facilitate improved planning and management of the water cycle and the design, construction and maintenance of water sensitive cities infrastructure through shared confidence in long term performance. It will provide the research base and capacity for Perth-specific evidence and demonstration, which is critical for continued uptake in WA.

Delivery of this project by the CRCWSC will strengthen local research capacities related to water sensitive city objectives and support current policy directions which require implementation of WSUD. It will ensure that the solutions that are proposed are appropriate to specific site conditions and project circumstances, optimising on-ground outcomes.

The outcomes of this research will continue to influence policy and practice through its application in decision making and incorporation into updated policies, tools (such as UNDO) and guidelines. It will provide the evidence considered necessary by many stakeholders to support their continued commitment to the implementation of water sensitive cities practices.

3.5.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	CRCWSC - Prof Carolyn Oldham, Matt Hipsey and A2.4 team University of Western Australia Department of Water
Key industry inputs	DPaW Rivers and Estuaries Division Institute of Public Works Engineers LandCorp SERCUL Stormwater WA UDIA WALGA and Local government Wallis Consulting & Development

Research cluster involvement	• Context specific solutions • Monitoring and performance optimisation
End user targets	• Service providers • Industry – developers, consultants • State Government, particularly Department of Planning, Water, Housing, LandCorp • Local government – asset management
Project delivery risks	Degree of monitoring required to obtain trusted results (scope and duration) Ensuring research questions are linked to industry needs Access to results by industry Translation of outcomes into policy and guidelines in a timely manner
Timing and milestones	TBA

3.5.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$330,000	$350,000	$365,000	$380,000
	Scholarships	$60,000	$60,000	$60,000	$60,000
	Operating	$100,000	$100,000	$100,000	$100,000
Industry partners	In-kind Cash	$150,000	$150,000	$150,000	$150,000
	In-kind (FTE)	4	4	4	4
Universities	In-kind (FTE)	4	4	4	4

3.5.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	5
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	5
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, contributions from CRCWSC participants and external leveraging	5
	Total	**25**

3.6 Responsive urban form

3.6.1 Project summary

The delivery of Perth and Peel @ 3.5 million will require significant infill development and a commitment to increased density. Smaller lots and larger houses result in very little room for gardens and trees or the conventional detention of stormwater on site. Innovative solutions are therefore required to optimise stormwater management and provide the green infrastructure which is vital for liveable cities.

Infill development is also an important strategy for a more compact city; however this often results in the removal of vegetation and greater areas of imperviousness, which puts pressure on existing drainage and open space networks. New approaches to the provision of the public domain which integrate grey and green infrastructure are critical to optimise performance of drainage, water and wastewater infrastructure and provide necessary shade and habitat for biodiverse and healthy communities.

The delivery of water sensitive urban form is complicated in many areas of the Swan Coastal Plain by the presence of shallow groundwater. There are a number of issues associated with development under these conditions which require consideration and improved responses. These issues, such as separations required from groundwater; opportunities for alternative urban form responses and the identification and management of risks, will also be explored by this project.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
Western Australian Planning Commission Joerg Baumeister (AUDRC) and Prof Carolyn Oldham (CRCWSC)	Knowledge Synthesis Demonstration Implementation/ application	Department of Water Housing Authority City of Canning City of Gosnells City of Subiaco EMRC LandCorp DPaW Rivers and Estuaries Division Water Corporation	Department of Planning Department of Sport and Recreation Department of Health WALGA and local governments UDIA PIA Stormwater WA IPWEA AILA AUDRC HIA Property Council 202020 Vision Curtin Uni's Sustainability Policy Institute (CUSP) UWA's Centre for the Built Environment and Health

3.6.2 Project aims and objectives

This project aims to provide practical development /redevelopment solutions for increased density and infill residential, commercial and industrial development which optimise water sensitive city approaches and outcomes over a range of site conditions including in areas of shallow groundwater. The solutions should challenge conventional planning, design and engineering requirements and responses, demonstrating how better outcomes can be achieved. This will require significant engagement with local government to advocate for new methods and techniques which support water sensitive cities practices. The solutions should therefore be based on an assessment of on-ground opportunities and case studies, so that they are practical and relevant to WA contexts.

Key areas of investigation and required guidance include:

- management of stormwater on lots less than 300m2 in sand, sandy clay and clay soils and in areas with high groundwater;
- landscaping and water management/conservation opportunities for apartments;
- public domain improvements which integrate grey and green infrastructure;
- urban designs, drainage and water management systems and alternative housing designs and construction that reduce the amount of sand fill necessary to enable development in high groundwater areas, improve housing affordability, and achieve ecological and social benefits;
- infill development which optimise stormwater management, green infrastructure and fit-for-purpose water; and
- optimising water sensitive cities outcomes in activity centres (addressing drainage; green infrastructure; heat island effects; and provision of water, wastewater and non-drinking water services and supplies).

This project will ensure that guidelines are available for context specific water cycle solutions, with associated design, operational and asset management information, to support delivery of water sensitive cities best practice including in urban water services. The purpose of this guidance is to empower local government decision-makers to discuss alternatives to conventional solutions that will deliver agreed outcomes.

3.6.3 Identified transition needs and knowledge gaps

This project, which focusses on the impacts of infill, higher density and small lots on environment and liveability, addresses the following identified needs in WA.

Enabling structures	• Strengthening and aligning policy, legislation and regulation in support of water sensitive cities • Improved frameworks for evaluation of costs, risks and performance of water sensitive practices • Governance frameworks that enable coordination and collaboration across agencies and sectors • Local scale water supply and servicing – governance, charging and staging • Guidance on how to develop context-specific solutions and asset management regimes

On-ground practices	• Impacts of infill, higher density and small lots on environment and liveability • Alternative construction and water sensitive built form • Development in areas of shallow groundwater • Coherent understanding of groundwater systems and interactions with surface waters • Monitoring and evaluation for improved system design and performance • Achieving multiple benefits through integrated planning, and design of water systems and the urban form
Social capital	• Governance and statutory arrangements to facilitate water sensitive cities and towns • Strengthening and aligning policy, legislation and regulation in support of water sensitive cities • Influencing water sensitive city outcomes through leadership, collaboration and networks • Better translation of scientific knowledge into practice and policy outcomes • Build practitioner capacity through knowledge sharing, demonstration and networks
Research gaps	• Urban hydrology – runoff rates, water balance, etc. • WSUD asset performance (structural and non-structural approaches and devices) • Climate change and mitigating urban heat, esp. during long dry spells • Water availability and reuse – technologies, approvals and governance

3.6.4 Research questions and approach

The following is a preliminary list of research questions. The delivery approach will be determined on agreement of project scope.

- How can development be better integrated into the natural landscape so that value is placed on retention of biodiversity, natural systems and landforms at the local scale?
- How should the requirements of *State Planning Policy 2.9: Water Resources* be applied in infill development?
- What are the impacts of infill/high density on the urban water balance under different scenarios (e.g. sand, clay, high groundwater)? What are the opportunities available for local governments to manage the extra runoff? How can they be implemented?
- What is an optimal design solution (lot shape and configuration, building design, open space design and stormwater management design) for stormwater management and vegetation retention/inclusion on lots less than 300m2 under a range of site conditions including shallow groundwater?
- Is MAR a practical, local-scale solution for management of high groundwater?
- How can the alignment of services within road reserves be optimised to provide room for green infrastructure? How much space is actually required for trees in a range of street typologies? How do you retrofit street trees into existing areas?
- What amount/type of open space/green infrastructure is required to provide community amenity and recreation needs in medium to high density development areas? How can sufficient management of flood events be provided for in areas of high groundwater where sport spaces are likely to require greater separation from groundwater than surrounding areas (i.e. cant be used for flood detention)?

- Can building-scale green walls be used for greywater treatment and reuse in a Mediterranean climate and what is an optimal governance/delivery framework?
- What are the key WSUD elements of better apartment design, including mitigation of urban heat, that should apply in WA?
- What is the range of water sensitive cities solutions (addressing drainage; green infrastructure; heat island effects; and provision of water, wastewater and non-drinking water services and supplies) that are appropriate for WA activity centres and how can they be funded and serviced?

It is proposed that the delivery of this project is undertaken as a research project, but with significant inputs into and learnings from a number of demonstration projects. These projects are already being delivered by a range of agencies and provide a variety of opportunities to inform the delivery of this project as follows:

Project	Opportunity/demonstration	CRCWSC input
Groundwater separation distance guidelines	Separation criteria for the design of new urban developments and guidance for predicting groundwater mounding	Testing of criteria and adjustment of parameters
East Perth Development (Powerhouse), Swan River	Infill, medium to high density development	Synthesis project
City of Canning Town Centre Redesign (City of Canning)	Activity centre and infrastructure optimisation	Design options
Bentley Regeneration project (Housing Authority)	Trial of the performance and cost of using green walls to treat greywater and provide a NDW source	Monitoring and analysis of trial results
Redevelopment of Bassendean Oval (EMRC)	Infill, medium density development	Synthesis project
WGV Project in White Gum Valley (LandCorp)	Infill, medium density development	Monitoring and analysis of results
Wanju District Structure Plan – (Shire of Dardanup)	Residential development in area of shallow groundwater	Identification of new approaches (Synthesis)
Hartfield Park MAR trial (Shire of Kalamunda)	Share their learnings	Assessment of application to other site conditions
Nambeelup Industrial Area (LandCorp)	Residential development in area of shallow groundwater	Feasibility assessment for MAR
Land use scenarios for WWTP buffers (Water Corporation)	Complementary land uses around waste water infrastructure	Options assessment

Key CRCWSC project linkages are:

T1 projects	Project B3 – Water sensitive urban design and urban microclimate Project B5 - Statutory planning for water sensitive urban design Project C1 - Innovative technologies for fit-for-purpose water production Project C4.1 – Integrated multi-functional urban water systems Project C5.1 – Intelligent urban water systems Project D5.1 – Urban intensification and green infrastructure: Towards a water

	sensitive city
T2 projects	1. Advancing the Vision (Transition Strategy) 2. Knowledge brokering and building capacity 3. Governance, regulatory, policy and delivery frameworks in WA 4. Local scale water supply and servicing 5. WSUD Science in WA 7. Improved frameworks for evaluation of costs, risks and performance of water sensitive practice 8. Research synthesis and application in WA

3.6.5 Project outcomes, adoption and impact

This project will significantly assist in the delivery of Perth and Peel @ 3.5 million as it will challenge conventional practices and requirements in the pursuit of improved outcomes for the community in terms of liveability, resource optimisation and healthy environments. It will provide key tools for regulators and industry which are currently lacking.

Application of the research questions to current projects will foster increased confidence in the ability to deliver innovative solutions, and linkages with Project 2 will enable transfer of learnings across the city.

Delivery of this project will result in an urban environment that is comfortable, safe, and promotes health and wellbeing. Landscape elements such as water-harvesting green roofs, green walls and shaded streets will be better integrated within the built environment. Innovations in materiality and the built form will reduce the urban heat island effects and minimise heat-related deaths and stress incidents. A network of high quality spaces will be established throughout the city which provide physical health benefits and improved mental wellbeing and social amenity. This will include intact ecosystems, playground areas, sport spaces, walking paths, and other features that suit the needs for all people at different ages and stages of life.

Project outcomes, particularly those relating to infill and high density development, are also transferrable to other cities around Australia and will assist in the greening of our cities, consistent with State and Commonwealth government priorities. This will be ensured through the creation of visualisations to assist in the formation of shared understandings of desired outcomes.

3.6.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	CRCWSC –Joerg Baumeister, Carolyn Oldham, Ana Deletic WALGA, LandCorp, Departments of Water and Planning
Key industry inputs	202020Vision Australian Institute of Landscape Architects Australian Urban Design Research Centre Curtin Uni's Sustainability Policy Institute (CUSP)

	Department of Health Department of Sport and Recreation DPaW Rivers and Estuaries Division Eastern Metropolitan Regional Council Engineers Australia Housing Authority Institute of Public Works Engineers Perth Region NRM Planning Institute of Australia (WA) SERCUL Stormwater WA UWA's Centre for the Built Environment and Health UWA Water Science UDIA Local government Water Corporation
Research cluster involvement	• Integrated planning and implementation • Context specific solutions • Monitoring and performance optimisation
End user targets	• Industry – developers, consultants • Local government – asset management • Service providers • State Government, particularly Department of Planning, Water, Housing, LandCorp
Project delivery risks	Level of engagement with industry leading to a lack of support or perceived practical application Lack of supporting research on site specific responses (including infiltration capacities)
Timing and milestones	Y1: Infill guidance (incl small lots) and green wall trial Y2: Green streets guidance (service alignments and trees) – design and retrofit T3: Green apartments guidance Y4:Activity centre guidance

3.6.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$120,000	$350,000	$120,000	$120,000
	Scholarships	$30,000	$60,000	$30,000	$30,000
	Operating	$20,000	$100,000	$20,000	$20,000
Industry partners	In-kind Cash	$250,000	$200,000	$100,000	$100,000
	In-kind (FTE)	4	4	3	3
Universities	In-kind (FTE)	2	2	2	2

3.6.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

Note: The projects, priorities, costs and responsibilities have not been agreed by any agency

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	5
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	5
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, including contributions from CRCWSC participants and external leveraging	4
	Total	**24**

3.7 Improved frameworks for evaluation of costs, risks and performance of water sensitive practices

3.7.1 Project summary

There is wide agreement that transparency of costs and benefits should underpin options analysis, however it is difficult to establish these true costs and benefits due to the complex interactions and impacts around the water cycle and conflicting organisational methods and incentives. It is also difficult to understand and quantify the non-market benefits of water sensitive initiatives and, in turn, to broaden the narrow approach to analysing options that currently dominates. These challenges mean evidence advanced in support of decisions and decision-making processes is sometimes perceived to be ambiguous (CRCWSC, 2015).

This project will provide evidence to support full life-cycle cost benefit analyses that also consider non-monetary values. It will seek to address the existing risk averse culture and lack of transparency of options analysis through generation of improved frameworks for evaluation of costs, risks and performance of water sensitive practices.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
WRAP CRCWSC - Dr David Pannell	Knowledge Demonstration Implementation/ application	Department of Water Housing Authority UWA City of Canning City of Gosnells City of Joondalup City of Mandurah City of Melville City of Nedlands City of Subiaco City of Wanneroo Eastern Metropolitan Regional Council LandCorp DPaW Rivers and Estuaries Division Water Corporation	CSIRO Department of Planning Department of Sport and Recreation Department of Health UDIA Perth Region NRM SERCUL WALGA and local governments Local Government Insurance Services

3.7.2 Project aims and objectives

One of the most critical success factors for the implementation of WSUD practices is confidence in the long term financial performance of the system and transparent costs and benefits in both monetary and non-monetary forms. A key objective of this project is to address this need and:

- provide evidence to support full life-cycle cost benefit analyses that also consider non-monetary values;

- prepare new financial models and incentives that recognise the full range of values and benefits of water sensitive cities;
- develop guidance on preparation of a business case for WSUD; and
- engage with local government to identify perceived and actual risks to local government and the community from implementing and/or not implementing WSUD and undertake a risk assessment.

This project will assist investment and decision making (business case) processes for urban development and water management to adopt WSUD principles. It will aim to encourage stakeholder organisations to be open to taking managed risks for innovating towards water sensitivity through the quantification of costs and benefits of solutions to support options analysis and encourage investment in water conservation, efficiency, water quality improvement and other water sensitive approaches.

3.7.3 Identified transition needs and knowledge gaps

This project, which focusses on improved frameworks for evaluation of costs, risks and performance of water sensitive practices, addresses the following identified needs in WA.

Enabling structures	• Holistic evaluation frameworks to support water sensitive city investments • Robust and inclusive decision making frameworks • Governance frameworks that enable coordination and collaboration across agencies and sectors • New financial model and incentives that recognise the values and benefits of water sensitive cities • Effective and sustainable funding mechanisms for water sensitive practices (drainage and whole water cycle)
On-ground practices	• Frameworks and evidence to support full life-cycle cost benefit analyses that also consider non-monetary values • Efficient and effective operations and maintenance systems to achieve water sensitive city outcomes • Guidance on how to develop context-specific solutions and asset management regimes
Social capital	• Better translation of scientific knowledge into practice and policy outcomes • Support/build leadership capacity of individuals and organisations to lead change
Research gaps	• Trusted cost benefit information and frameworks • Local scale water supply and servicing – governance, charging and staging • Decision support tools • WSUD performance (structural and non-structural approaches and devices) • Receiving environments – prevention of degradation, impacts, tipping points and management

3.7.4 Research questions and approach

The following is a preliminary list of research questions. The delivery approach will be determined on agreement of project scope.

- How do we value/calculate non-monetary benefits of WSUD?
- What elements should be costed when undertaking cost-benefit analysis? How can this incorporate avoided costs?
- How do life cycle costs of WSUD assets compare with conventional ones?
- What management and mitigation measures are available to reduce risks to acceptable levels?
- What are the most cost effective management measures or policy mechanisms to address adoption of water-sensitive practices by individuals and agencies to reduce pollution of receiving environments? Consider
    - investment in new infrastructure and technologies by agencies and utilities;
    - Non-market valuation of key, locally significant case study areas; and
    - Further development of land use strategies to reduce urban nutrient loads by the A1.3 team to include additional case study areas in WA and Victoria.

Key CRCWSC project linkages are:

T1 projects	Project A1 - Economic modelling and analysis Project A3 – Governance and regulatory reform Project A4 – Social-technical transitions Project D3 – Influencing water sensitive cities policy Project D5.1 – Urban intensification and green infrastructure: Towards a water sensitive city
T2 projects	1. Advancing the Vision (Transition Strategy) 2. Knowledge brokering and building capacity 3. Governance, regulatory, policy and delivery frameworks in WA 4. Local scale water supply and servicing 5. WSUD Science in WA 6. Responsive urban form

3.7.5 Project outcomes, adoption and impact

This project addresses a key need which has been identified as a priority across Australia.

The creation of improved frameworks for evaluation of costs, risks and performance of water sensitive practices will increase transparency of decision making and provide evidence of the long term benefit of WSUD solutions. This will increase level of uptake, through

- a better understanding within the development industry of design and construction costs;
- greater willingness by local government to accept long term maintenance of assets; and
- increased awareness within the community of the monetary and non-monetary benefits of water sensitive approaches.

Development of improved risk assessment and costing tools will also foster increased investment in developing necessary knowledge, skills and capacity across water-related professions, sectors and the community. Innovative approaches will be supported and encouraged in an enabling environment and driven by transparency, collaboration and competition throughout the sector.

3.7.6 Project delivery

The following recommendations for project team, industry inputs, research cluster involvement, end user targets, project delivery risks, timing and milestones are preliminary only. It is anticipated that these will be refined during preparation of the detailed project plan.

Project team	CRCWSC - Dr David Pannell, Ben White and A1.2 team Department of Water, WALGA, Water Corporation, EMRC
Key industry inputs	202020Vision Australian Institute of Landscape Architects Australian Urban Design Research Centre CSIRO ChemCentre City of Canning City of Gosnells City of Joondalup City of Mandurah City of Melville City of Subiaco City of Wanneroo Department of Planning Department of Sport and Recreation DPaW Rivers and Estuaries Division Institute of Public Works Engineers LandCorp Metropolitan Redevelopment Authority Perth Region NRM Planning Institute of Australia (WA) SERCUL SJ Shire University of Western Australia UDIA WALGA and Local government
Research cluster involvement	• Integrated planning and implementation • Monitoring and performance optimisation • Socio-economic evaluation frameworks
End user targets	• State Government, particularly Department of Planning, Water, Housing, LandCorp • Local government – planners, engineers, landscape, asset management • Industry – developers, consultants • Community
Project delivery risks	Lack of available cost information Complexity of issues to be covered and ability to develop a framework which meets a wide variety of needs and priorities
Timing and milestones	Y1: document life cycle cost evidence (monetary and non-monetary) and undertake risk assessment Y2: develop financial model for use in feasibility, regulatory approval and asset management Y3: guidance for business case Y4: engage with the community

3.7.7 Resources

The following resources are proposed.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$120,000	$120,000	$120,000	$120,000
	Scholarships	$30,000	$30,000	$30,000	$30,000
	Operating	$5,000	$5,000	$5,000	$5,000
Industry partners	Cash				
	In-kind (FTE)	1	1	1	1
Universities	In-kind (FTE)	1	1	1	1

3.7.8 Ranking

The following criteria have been provided by the CRCWSC for ranking of projects. Each criteria is equally weighted and scored on scale of 1-5, 5 being highest.

	Criteria	Score
1	Degree of alignment to the city/region WSC transition strategies/needs • Contribution to addressing key needs identified in a regional context • Proposed engagement with industry/end-user participants	5
2	Strategic significance and alignment to CRCWSC Strategic Plan • Alignment with existing knowledge and outputs from Tranche 1 projects • Contribution towards achieving the critical long-term outcomes of the CRCWSC Strategic Plan 2014/15 - 2016/17	5
3	Transferability and potential for project outcomes to create significant impact • Quality and effectiveness of proposed end-user communication/uptake/adoption strategies and activities • Potential for influencing policy, planning or practice and/or commercialisation.	5
4	Track record of project team/members • Current/past performance in delivering industry-related project outcomes • Demonstrated successful and effective stakeholder engagement	4
5	Project risk, benefits and costs; • Sound project risk - reward/benefits profile, including effective project management approach • Cost efficiency, including contributions from CRCWSC participants and external leveraging	4
	Total	**23**

3.8 Research synthesis and application in WA

3.8.1 Project summary

Input from CRCWSC researchers into development projects, strategies and plans has enormous benefit for individual activities. The CRCWSC is able to bring a wealth of knowledge and expertise to bear in considering how each project is able to best deliver water sensitive cities outcomes. This value has been recognised by the CRCWSC as it is proposed that a number of Synthesis reviews are undertaken as part of Tranche 2.

It is also considered that this type of input can be extended to other critical strategy and policy activities being undertaken by State and local government in WA.

This project outlines a number of opportunities which have been identified as having the potential to significantly benefit from CRCWSC expert review and advice.

A summary of proposed project lead, project type and participating organisations for this project is provided below.

Project lead and Research leader	Project type	CRCWSC - WA partners	Possible other participating organisations
WRAP Chair CRCWSC – Jamie Ewert	Synthesis	Department of Water Housing Authority LandCorp City of Nedlands City of Gosnells City of Subiaco EMRC	Department of Planning Department of Health Shire of Broome WESROC

3.8.2 Project aims and objectives

This project will deliver a number of Synthesis workshops as well as the provision of independent expert review and advice on key strategic policy, strategy and guidelines.

This will ensure that WSC principles and approaches recognised in all national and state policy and growth plans. Implementation of this project will also improve the practices (tools and techniques) used by urban planning, architecture, water management practitioners to create the physical, social and biological form of cities implement WSC best practice.

3.8.3 Identified transition needs and knowledge gaps

This project, which focusses on research synthesis and application, addresses the following identified needs in WA.

Enabling structures	• Strengthening and aligning policy, legislation and regulation in support of water sensitive cities • Creation of a shared vision and narrative for water sensitive cities that connects with community values , which can then drive decision making

On-ground practices	• Establish mechanisms and commit resources to ensure impact-oriented research and development, including its translation to influence water sensitive policy and practice • Guidance on how to develop context-specific solutions and asset management regimes • Achieving multiple benefits through integrated planning, and design of water systems and the urban form • Integrated planning across sectors, agencies and water systems
Social capital	• Building capacity to deliver a water sensitive cities • Building community and industry connection and engagement • Translation and sharing of water sensitive cities knowledge • Influencing water sensitive city outcomes through leadership, collaboration and networks • A culture of learning and innovation
Research gaps	

3.8.4 Delivery approach

It is recognised that the scheduling and delivery of Synthesis workshops is to be determined by the CRCWSC outside the development of the Tranche 2 work program. Accordingly, it is considered not necessary to complete all the project outline requirements and so project outcomes, delivery, resources and ranking has not been completed.

It is considered; however, that it is important to establish the linkages between the other T2 projects and the Synthesis opportunities that have been identified. These linkages are outlined in the table below, together with an assessment against the criteria for Research Synthesis projects, the WRAP priority and potential year of delivery.

It is anticipated that four Synthesis projects are undertaken in WA each year.

Table 1: Proposed research synthesis projects

WA project	RAP project linkages	Criteria for case studies that are well suited to Research Synthesis				RAP Priority and delivery year
		Potential for innovation at the precinct scale	Industry partners committed to delivering the project, open to collaboration and welcome new ideas	Sufficient scope to incorporate new ideas into options analysis and concept planning	Specific constraints or opportunities for improved urban water cycle management	
Western Suburbs Groundwater Restoration and Reuse project (WESROC)	4, 5, 7	✓	✓ Need support from Dept of Health.	✓✓	✓✓	2016
Pinjar urban and industrial development (Housing Authority, LandCorp)	3, 4, 6, 7	✓	✓✓	✓✓	✓✓	2016
Brabham development - Swan Valley (Housing Authority)	3, 4, 6, 7	✓	✓✓	?	✓✓	2016

WA project	RAP project linkages	Criteria for case studies that are well suited to Research Synthesis				RAP Priority and delivery year
		Potential for innovation at the precinct scale	Industry partners committed to delivering the project, open to collaboration and welcome new ideas	Sufficient scope to incorporate new ideas into options analysis and concept planning	Specific constraints or opportunities for improved urban water cycle management	
Hester Park Revitalisation, (City of Gosnells)	4, 7	?	✓✓	✓	?	2016
Bassendean Oval redevelopment (EMRC)	4, 6	✓	✓	✓✓	✓✓	2017
East Perth Development (Powerhouse), Swan River	4, 6, 7	✓	✓	✓	✓✓	2017
Nambeelup Industrial Area (LandCorp)	4	✓	✓✓	?	✓	2017
Swan Valley Development Area (Department of Planning)	4, 6	✓	✓	✓	✓✓	2017
Muchea Employment Node (Department of Planning)	4, 6	✓	Lacks CRCWSC partners. DoP supportive.	✓	✓	2018
Broome non-potable water supply for POS (Shire of Broome, DoW)	3, 4		✓ (Broome not a CRCWSC partner)	✓	✓	2018
Wanju District Structure Plan (Department of Planning)	4, 6	✓	✓✓	✓✓	✓✓	2019
East Wanneroo Structure plan (Department of Planning)	4, 6	✓	Wanneroo yet to be consulted	✓	✓✓	2019

3.8.5 Resources

It is anticipated that he Synthesis workshop activities will be funded independently of this proposal. The following resources are proposed to facilitate the input by CRCWSC experts on critical strategy and policy activities being undertaken by State and local government in WA.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$100,000	$100,000	$100,000	$100,000
	Scholarships				
	Operating	$100,000	$100,000	$100,000	$100,000
Industry partners	Cash	$20,000	$20,000	$20,000	$20,000
	In-kind (FTE)	0.6	0.6	0.6	0.6
Universities	In-kind (FTE)	0.1	0.1	0.1	0.1

3.9 Regional Manager and project management

It is recognised that the following information differs to the projects described previously. It has been included here; however, so that the linkages to the delivery of Tranche 2 projects and the resources that are required can be considered as part of the 2nd project development workshop.

3.9.1 Project summary

A Regional Manager is required to coordinate delivery of the funded T2 projects. The regional manager will provide support to the WRAP Chair, and will in turn, be supported by a part-time administrative assistant.

The Regional Manager will establish and maintain linkages between researchers and industry so that the outcomes of the T2 projects directly respond to the identified research needs.

It is recognised that the CRCWSC would prefer a strong co-contribution (possibly in-kind) from the key stakeholders to provide the resources for this role to ensure that they are strongly embedded in the local "CRC participants' community". However, it is felt that this could potentially restrict the range of applicants and success of program delivery. The program Manager must have some knowledge of the CRCWSC and have worked in the delivery of WSUD projects. They will desirably have a wide contact network in WSUD planning, development and maintenance.

3.9.2 Scope of role

Key aspects of the role will be to:

- Provide support to WRAP Chair and WRAP;
- Establish linkages and maintain relationships between researchers and industry;
- Undertake project management of CRCWSC T2 projects;
- Identify additional project opportunities and potential partners;
- Maintain open and transparent communication of findings and outputs;
- Report to CRCWSC Board on delivery of projects and outcomes; and
- Facilitate flexible and adaptive delivery of outcomes.

It is understood that the CRCWSC is developing a role description to assist in the appointment of the Regional Manager.

3.9.3 Resources

The following resources are required.

		2016/17	2017/18	2018/19	2019/20
CRCWSC cash	Salaries	$230,000	$240,000	$255,000	$270,000
	Scholarships				
	Operating	$50,000	$50,000	$50,000	$50,000
Industry partners	Cash	$20,000	$20,000	$20,000	$20,000
	In-kind				
Universities	In-kind				

4 REFERENCES

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DoW, 2015a, *Department of Water Strategic Plan 2015-2020*, Department of Water, Perth.

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Government of WA, 2015, draft *Perth and Peel Green Growth Plan for 3.5 Million*, Department of the Premier and Cabinet, Perth WA.

APPENDICES

Current WA partners

Department of Water (Essential Participant)

Department of Housing (Essential Participant)

The University of Western Australia

ChemCentre

City of Canning

City of Gosnells

City of Joondalup

City of Mandurah

City of Melville

City of Nedlands

City of Subiaco

City of Wanneroo

Department of Parks and Wildlife, Rivers and Estuaries Division (formerly the Swan River Trust)

Eastern Metropolitan Regional Council (EMRC)

GHD

LandCorp

Metropolitan Redevelopment Authority (MRA)

Water Corporation

Essential Environmental (SME Associate)

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Client: Cooperative Research Centre for Water Sensitive Cities

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft for comment	V2	SSh	WRAP	Electronic	14 Jan 16
Draft for comment	V3	SSh	WRAP	Electronic	3 February 2016
For consideration by CRCWSC	V4	SSh	WRAP	Electronic	8 February 2016

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