CRC for
Water Sensitive Cities

Enabling water sensitive urban development: planning and governance opportunities for Perth

IRP3: Guiding integrated urban and water planning

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Enabling water sensitive urban development: planning and governance opportunities for Perth
Guiding integrated urban and water planning (IRP3)
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Executive summary

Through the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) research project, *Guiding integrated urban and water planning* (IRP3), an Action Learning Partnership was established with the Department of Communities, Department of Water and Environmental Regulation, and Peet Limited. The partnership, commencing in March 2019, sought to provide a collaborative forum to test, navigate and influence planning processes to deliver a sustainable integrated water solution for a staged greenfield residential development in Perth's north-east growth corridor.

Regular interactions with water and urban planning practitioners in Perth revealed some challenges and opportunities around the operation of the Western Australian planning framework for greenfield urban development. The current state-level planning and policy system comprehensively articulates a wide range of water-related goals and could be considered nation-leading. However, some issues exist in implementation, particularly the tendency to defer key water servicing decisions to subsequent stages of urban planning when spatial scales and timeframes limit the ability to consider solutions beyond business as usual.

Achieving policy goals is further constrained by the lack of mandated controls for delivering integrated water management (IWM) outcomes. Unclear assessment and authorisation procedures, and uncertain service delivery models hinder the proposed innovation considered in this report—using subsoil drainage water for irrigating public open space. This is partly tied to issues with defining and distinguishing subsoil drainage water from groundwater, and insufficient resourcing of agencies to support appropriate detail in regional and corridor level water planning. Further, the developer-led design process typically prioritises timeliness and cost efficiency over delivering often complex IWM outcomes.

These insights support the need to more strongly integrate urban and water planning. Eggenberger and Partidário (2000) offer a practical way for planners to analyse the extent of integration, by considering five interrelated dimensions:

- **substantive** – integrating interconnected issues across relevant scales
- **methodological** – integrating different assessment approaches, tools and language
- **procedural** – integrating and coordinating planning and approvals across different government sectors
- **policy** – integrating and aligning policy and decision making to advance water sensitive city principles
- **institutional** – integrating organisational knowledge, capabilities, roles and responsibilities to effectively respond to policy goals.

The analysis in this report highlights areas for improvement across all five integration dimensions, to support the delivery of water sensitive urban development in Perth. The *Waterwise Perth action plan* and the planning reforms program currently underway in Western Australia provide a unique opportunity to strengthen integrated urban and water planning processes within state land use and water planning systems.

This report proposes 11 planning and governance opportunities to tackle identified constraints by improving each integration dimension. These 11 opportunities were identified through the research process and have no organisational commitment or status in government policy:

1. Undertake corridor level water planning as part of state government's integrated strategic planning and urban development program
2. Mandate the assessment of non-potable water supplies for public open space in the new State Planning Policy for water, and elevate status of *Better urban water management* to an operational policy
3. Rename urban zone for land with shallow groundwater (for example, 'Urban – shallow groundwater') that requires appropriate environmental management of shallow groundwater as part of the land's future urban development

4. Incorporate building material palette in Design WA project through the Residential Design Codes (R-Codes) Volume 1 reforms which are universally applicable through local planning schemes
5. Determine the cost of providing non-potable water to public open space at the Perth metropolitan scale and apply it to all rateable properties as a water resources charge
6. Mandate integrated water management standards or targets for urban development on the Swan Coastal Plain in local planning schemes, supported by *Better urban water management* as an operational policy
7. Have an agency or servicing authority complete regional water planning and resource assessments that specify service outcomes for water supply (potable and non-potable), surface and groundwater use and management (including protection of environmental assets, flooding, inundation and water quality), and wastewater management
8. Have servicing authority plan water system services at a corridor scale and develop business cases for regional and sub-catchment servicing schemes (including infrastructure that local government will own and operate)
9. Ensure local structure plans establish land uses and integrate infrastructure, as identified in servicing schemes, including funding and ownership arrangements
10. Consider local governments' role as a determining authority for local structure plans and local water management strategies
11. Require collaborative project planning, assessment and infrastructure delivery as part of corridor planning and structure planning processes.

Each proposed opportunity has the potential to contribute to multiple actions identified in the *Action plan for planning reform* (Actions A1, A3, A4, B1, C1, C6 and C9) and the *Waterwise Perth action plan* (Actions 19, 23, 26, 27 and 29), as well as to address multiple dimensions of integration. Since the dimensions are interrelated, implementing one or more opportunities targeting, for example, policy integration will have implications for other dimensions, such as procedural and institutional integration. Further analysis and evaluation would be needed before any opportunities are formally adopted as intra- and cross-organisational policies, strategies and programs.

The well-established and active Water Sensitive Transition Network has a broad and extensive pool of expertise actively involved in delivering integrated urban and water planning within Western Australia. This group provides a key platform for exploring these opportunities and advocating for change as part of its efforts in creating more sustainable and liveable Perth communities.

1. Introduction

Perth aspires to be an innovative 21st century city that supports liveable and sustainable communities. The *Perth and Peel @ 3.5million* suite of strategic documents produced by the Western Australian Planning Commission (WAPC) seeks to guide the future growth and development of the Perth and Peel regions to accommodate an extra 1.5 million people by 2050. The strategy sets an ambitious vision for Perth as a liveable, prosperous, sustainable, collaborative and connected city.

While state-level documents such as *Perth and Peel @ 3.5million* and its predecessors (*Metroplan* in 1990 and *Directions 2031 and Beyond* in 2010) have increasingly recognised that population growth and environmental constraints require different land use planning responses, on-ground practices still largely reflect a 'business-as-usual' (BAU) approach to urban development. The BAU approach—involving largely greenfield urban growth expanding the metropolitan footprint and conventional 'single dwelling on a lot' built form—places pressure on the fragile Swan Coastal Plain environment.

The aspirations in *Perth and Peel @ 3.5million*—for liveable and sustainable cities that promote the health and prosperity of its citizens, without compromising the natural environment—require integrated approaches to urban planning that promote cross-sectoral collaboration and recognise the interlinks between water and urban systems. This report supports these aspirations by outlining planning and governance opportunities to improve integrated urban and water planning in Western Australia, discussed in relation to the unique development pressures in the north-east growth corridor of Perth.

The report draws on the ideas, discussions and feedback generated by stakeholders during a series of workshops on the Brabham development project, along with eight interviews involving 10 planning and development practitioners from state government, local government and industry. This work is part of a research case study on the Brabham development project by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) *Guiding integrated urban and water planning* (IRP3) project. More information on the case study methodology and outcomes can be found in the companion report, *Brabham Action Learning Partnership: Case report*.

The thinking in this planning and governance opportunities report was developed as part of a research process and has no organisational commitment or status in government policy. The discussion is intended to seed the development of intra- and inter-organisational policies, strategies and procedures. Further analysis and evaluation will be required before any opportunities are adopted.

1.1 Brabham Action Learning Partnership

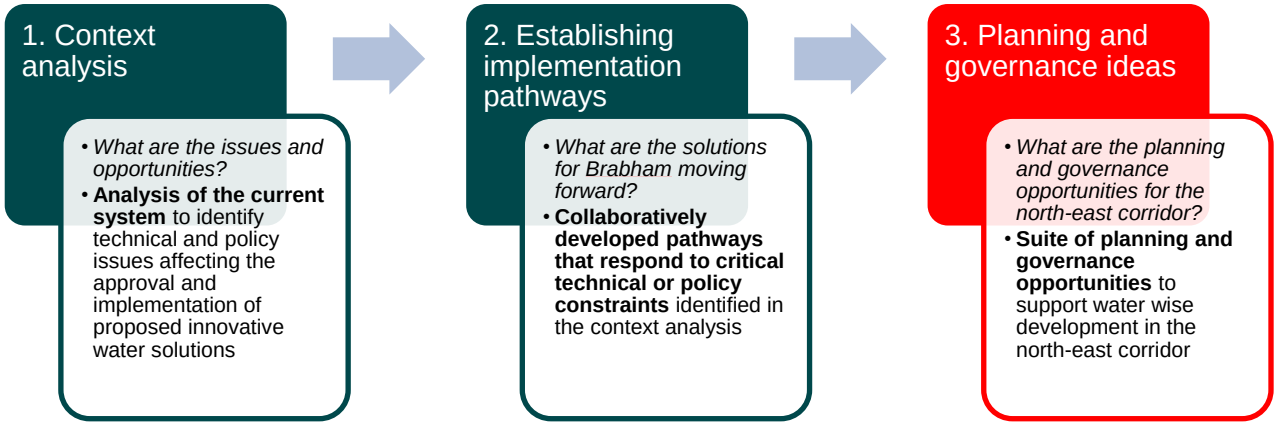
The case study research formed part of the Brabham Action Learning Partnership between the CRCWSC and the Department of Communities, the Department of Water and Environmental Regulation (DWER), and land developers Peet Limited. The partnership, established in March 2019, provided a forum to test, navigate and influence the planning process to deliver a sustainable and innovative integrated water solution for a staged greenfield residential development.

A three-stage research program was undertaken to address a central question:

> *How can we achieve sustainable development solutions in areas affected by high groundwater tables in Western Australian cities and towns?*

Following a contextual analysis identifying key technical and policy challenges, four collaborative workshops were held with key government and industry stakeholders over a nine-month period to generate ideas, options, possible solutions and implementation pathways. See the companion report, *Brabham Action Learning*

Partnership: Case report, for a summary of the outcomes of the first two stages. This document is an output of the last stage of the research program. It outlines a series of planning and governance opportunities for the WA Government and development industry to consider.



1.2 Integrated urban and water planning

The CRCWSC's *Guiding integrated urban and water planning* research project recognises that achieving innovative, water sensitive outcomes requires an integrated approach to land use and water planning processes. The academic literature has shown that all too often, the interlinkages between land use planning and water resource management are ignored or superficially recognised, leading to detrimental environmental outcomes, such as groundwater contamination as a result of inappropriate urban development (Carter et al., 2005).

The policy aspirations for sustainable, liveable and resilient communities, viewed in relation to the complexity of current development challenges (that is, increasing urbanisation in a context of resource scarcity, climatic shifts and changing economies) suggest land use planning must be more anticipatory to enable alternative servicing options, improve cross-sectoral coordination, and ultimately achieve more holistic development outcomes. In other words, planning must be able to better manage change and uncertainty, which can only be achieved if *integration* underpins planning practice as a guiding principle (Eggenberger and Partidário, 2000).

The push for integration has long pervaded the planning literature, but has been difficult to implement in practice (see Holden, 2012). Many factors have challenged integration attempts, including limited management and relational capacity, lack of knowledge and skills, inappropriate and changeable institutional arrangements, and an absence of clearly defined goals, supporting objectives and measurable targets (Carter et al., 2005; Holden, 2012).

1.2.1 Research approach

This project recognises that land use and water planners need practical ways of analysing and applying 'integration' within their context. During the case study research delivered through the Brabham Action Learning Partnership, workshop participants explored five interrelated dimensions of integration (adapted from Eggenberger and Partidário, 2000) in September 2019 (Table 1). The activity guided participants to operationalise 'integration' and unpack this complex concept by breaking it down into components and systematically considering and applying them to the Perth context. For each dimension, workshop participants were asked to rate Perth's performance against a series of questions, and award an average score (between 1 [poor] and 5 [excellent]) for each dimension (Table 1). Participants rated most dimensions between fair (2) and good (3), with the workshop discussion highlighting areas for improvement across all dimensions (see summary in Appendix 1).

This report picks up where the discussions left off, by developing some of the proposed ideas for change. Research insights from the workshops and interviews were combined with tacit knowledge and experiences in urban planning to formulate 11 planning and governance opportunities for Perth, focusing on the unique contextual conditions for water sensitive growth in the north-east corridor.

The next section summarises the specific challenges and opportunities for development in the north-east, with reference to Brabham as a microcosm of development in this growth corridor (Section 2). It then describes the constraints within the Western Australian planning framework (Section 3), and discusses the 11 opportunities for improving uptake of alternative water solutions in the urban environment (Section 4). This discussion uses examples from New South Wales and Victoria, where relevant, to illustrate how some of the proposed ideas have been implemented in practice.

Table 1. Summary of evaluation results for each integration dimension

Integration dimension	Evaluation questions	Score for Greater Perth 1 *Poor* – 5 *Excellent*
Substantive – integrating interconnected issues across relevant scales	Within current policies, planning and practice, how well are: • interconnected physical/biophysical, social and economic issues addressed • emerging issues, such as urban heat, addressed • issues addressed across scales, from national, through to regional and local?	2.1
Methodological – integrating different assessment approaches, tools and language	How holistic are current assessment approaches? How well do they integrate technical and financial feasibility, with social and environmental assessments? How well are the longer-term cumulative impacts assessed across a catchment or corridor? How consistent are the tools, methods and language/terminology used to undertake assessments?	1.8
Procedural – integrating and coordinating planning and approvals across different government sectors	How well integrated are water authorisation procedures with land use planning procedures? How well do current decision making procedures provide avenues for affected stakeholders to influence decision making? How well integrated are professionals through interdisciplinary teams?	2.5
Policy – integrating and aligning policy and decision making to advance water sensitive city principles	How embedded are water sensitive city principles or goals in planning policy? How aligned are strategies, policies and regulation? To what extent is there accountability for policy implementation?	2.2
Institutional – integrating organisational knowledge, capabilities, roles and responsibilities to effectively respond to policy goals	How clearly defined are the roles and responsibilities of key agencies involved in water and land use planning? How capable are organisations in coping with emerging issues? How well is knowledge and information shared between different agencies?	2.6

2. Water sensitive growth in the north-east

2.1 The problem

The Brabham site is located on the Swan Coastal Plain in the north-east growth corridor of the Perth Metropolitan Area. Characterised by flat land, a predominant sandy soil geology, shallow groundwater and a hot summer Mediterranean climate, the area has a mean rainfall of around 691 millimetres a year (RPS, 2019) and usually long dry summer and autumn seasons. However, the local environment of the eastern Swan Coastal Plain, particularly areas near the Darling Scarp, is very wet, because of its low-lying nature, soil structure and shallow groundwater. Significant surface water exists within both the Brabham site and the growth corridor in the winter season, following rain events.

The presence of shallow groundwater in Brabham and the wet local environment means fill (sand) must be imported for urban development. In this report, 'shallow groundwater' refers to areas where the local depth to groundwater is less than two metres, which could arise as a result of either a perched local system or proximity to the superficial aquifer. Perth has used significant amounts of fill to cover the shallow groundwater, and increase the separation between groundwater levels, drainage infrastructure and slab on ground buildings at surface. But, this wholesale approach to fill importation and land sculpting has significant impacts on the natural environment, and ultimately cumulative impacts on ecosystems through changes to the water cycle, soil quality, water quality, native vegetation, local amenity and liveability.

Greenfield development in growth corridors generally follows the rezoning of rural land to urban land. This process of defining land use provides an opportunity for future development to restore and repair the natural environment, particularly waterways, as part of the land's physical transition from farming activities to urban land. But the general practice of importing fill to address shallow groundwater, undergrounding of drainage systems and grouping of infrastructure assets that remove water from the urban landscape, has also removed the holistic consideration of the role of water in the urban environment.

Incorporating water sensitive urban design (WSUD) in the earliest stages of planning for urban development can improve ecological outcomes and realise the potential for water sensitive communities. Making water visible within the urban landscape by retaining drainage systems and their environments and incorporating water sensitive streetscapes and appropriate urban form are all components of WSUD that support a more sustainable urban environment. This approach to precinct or structure planning reduces the need for significant amounts of fill, increases the potential for alternative water solutions, and supports the implementation of various housing typologies.

Perth's limited rainfall, dry climate and access to groundwater has led to the irrigation of public open space (POS) to maintain vegetated 'green space' within the public realm. Historically in the northern growth corridor, the city has irrigated POS using the superficial aquifer via localised bores (licensed by DWER, which controls groundwater abstraction) as an additional and separate source of water from scheme water (drinking water). This groundwater resource is a low-cost source (pumping cost only) of non-potable water, which provides a watering supply to POS throughout the dry months (8–9 months) of the year. Perth's situation is different from that of other Australian states that have more frequent rainfall and temperate climates; they typically do not water POS and only provide watering options to active sportsgrounds during drought or intensive summer use.

Focused development in Perth's northern growth corridors has reduced availability within the superficial aquifer groundwater system for POS irrigation. Although state planning scheme amendments and district structure plans (for example, *Swan Urban Growth Corridor sub-regional structure plan 2009*, *Albion District structure plan* adopted in 2009) highlighted this declining availability, there has been limited strategic water planning to address water source limitations for POS irrigation in the north-east corridor. While stakeholders were long aware of diminishing groundwater licences, no alternative water sources were established to service POS across the

corridor. This approach resulted in unirrigated POS and consequently unacceptable levels of landscaping, amenity and liveability for future residents, further disadvantaging growth area communities. The current urban planning process calls for the provision of non-potable water for POS irrigation to be demonstrated at the local structure plan stage rather than at the earlier amendment stage. It assumes an appropriate water source will be available for irrigating POS, if and when required. This is consistent with other Australian states because only the provision of essential urban services (potable water, sewer, electricity and gas) must be determined at the earlier stage of strategic planning to enable broad urban zoning to be applied to land. The need to consider or require irrigation of POS, as outlined above, is particular to a state and locality, and consequently is only required at the local planning level.

In accordance with the current planning policy and water strategies that apply to development in Perth, some key questions arise:

1. How do we deliver water sensitive urban form and built form in shallow groundwater conditions without large-scale application of fill?

2. How do we protect and enhance water-dependent environments in urbanised areas while providing adequate flood protection and useable POS?

3. How do we source water for maintained POS within the north-east corridor, in the absence of state government intervention?

4. What planning tools, mechanisms or instruments help implement alternative and water sensitive solutions through the existing or future planning framework?

These questions recognise the importance of planning controls in delivering integrated water solutions, as well as the limitations and issues with current controls and their implementation. With an opportunity to scope reforms through the Brabham Action Learning Partnership, there is a prospect to move beyond the short-term solution proposed for the case study and look to a long-term strategic approach to Perth's broader IWM issues.

2.2 Ideas for Brabham

Shallow groundwater within Brabham and the BAU approach to importing significant amounts of fill as a solution, presents a clear water challenge for sustainable urban development. The need for innovative stormwater and groundwater management strategies that protect downstream environments and incorporate WSUD, including providing a water source for POS irrigation, is a key issue facing greenfield development in the north-east growth corridor. Given these water challenges, the CRCWSC was invited in 2018 to run a co-design process to help generate ideas to solve these complex problems.

Prior to establishing the Brabham Action Learning Partnership, the CRCWSC held a synthesis workshop in June 2018 with key stakeholders to explore innovative solutions to the water challenges. This synthesis workshop resulted in a discussion paper *Ideas for Brabham*, which identified six ideas for the water issues facing this site (CRCWSC, 2018):

1. **Staging** – time development to allow continued testing of shallow groundwater solutions and introduction of alternative building typologies that respond to local context

2. **Village in a wetland** – accept water in the landscape and provide building typologies that respond to shallow water tables and do not require fill to enable building and development

3. **Minimal fill objective** – deliver water service infrastructure differently, by pursuing alternatives to gravity sewers and varying the parameters for subsurface drainage

4. **Harvesting the additional recharge for reuse** – harvest the additional water discharged by urban development (non-permeable surfaces) as a local water source

5. **Expand the non-potable water network** – use supplies from treated wastewater, rainwater, surface drainage, managed aquifer recharge and other sources as they become available

6. **Governance for innovation** – pursue fit-for-purpose solutions that result in innovation for the project and wider adoption for future developments, expanding BAU.

The overlap between the ideas clearly indicates the intrinsic relationship between land and water that requires an integrated and holistic approach to development solutions. While the Brabham Project has touched on staging, alternative urban and built form and governance for innovation, the Brabham Action Learning Partnership has focused on the opportunity to harvest a low-cost alternative water source for irrigating POS. The proposal to harvest rejected recharge (which would normally be conveyed via subsurface drainage to a discharge point as part of the urban water management system) could address the non-potable water shortage for POS locally by developing new infrastructure systems.

The partnership undertook a collaborative process with decision making authorities and developers, to discuss establishing a new non-potable water supply system. This raised new questions and process issues around the current definition and compartmentalisation of water planning and management functions, and evaluated the proposed solution within the current planning policy framework.

3. Constraints within the WA planning framework

The *Planning and Development Act 2005* is the primary legislation in Western Australia governing land use planning and development. This Act empowers the WAPC and all local governments to administer relevant planning policies and planning schemes. In simple terms, the planning framework comprises four key components that operate at the state, regional and local levels (Figure 1).

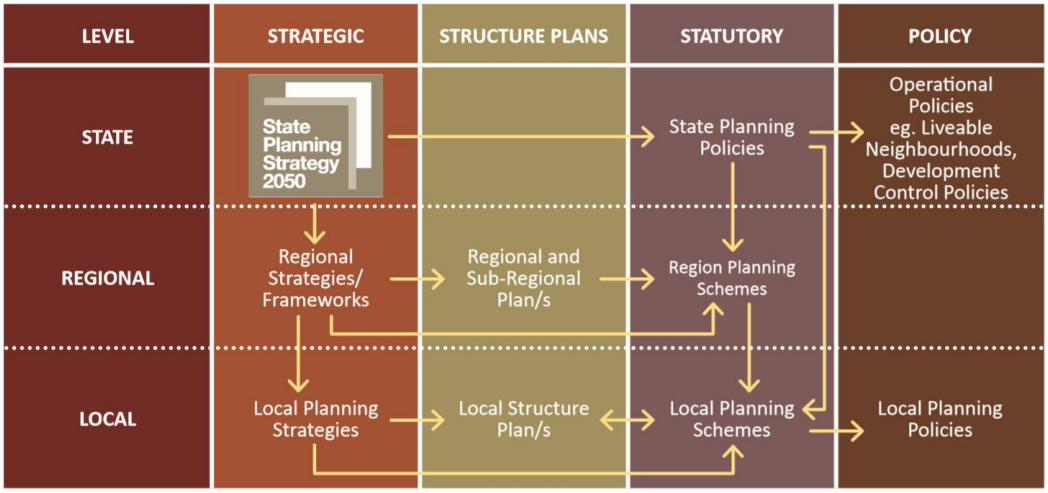


Figure 1. Overview of Western Australian planning system (Source: WAPC, 2014, p. 8)

Consequently, decision making for planning strategy, policy and land use predominantly remains with the state government in the form of the WAPC. The WAPC delegates development control to local government in accordance with their local planning scheme and local planning policies. While decision making for structure plans, subdivision and associated water management reports remains with the WAPC, local governments provide clear recommendations to the WAPC for determination.

The Western Australian planning system is in the process of implementing a planning reforms package. The August 2019 release of the *Action plan for reform of the Western Australian planning system* (WA Government, 2019a) ('the action plan') sets the context for change at the state government level, with implementation also at the local level. The reforms are built around three key themes for improving planning systems: consistency and efficiency, accountability, and transparency.

The action plan sets out 19 reform actions to be delivered over the next three years. These actions seek to instil strategically led and focused state policies, which are a product of collaborative planning and agency coordination. The reduction in state planning policies, and the consistent approach to local planning schemes through a suite of standard zones and fit-for-purpose precinct planning tools, are examples of the actions aimed at delivering an efficient and streamlined planning system. This action plan provides great opportunity for reform delivery and process review. It also provides a potential pathway for ideas and opportunities discussed in this report to facilitate change and influence policy development.

3.1 State planning

The *State Planning Strategy 2050* (WAPC, 2014) sets the strategic planning policy for Western Australia and includes a strategic approach to water planning and management. The state strategic direction for water is:

> *'To support population growth and development by sustainably managing the availability and quality of water.'* (WAPC, 2014, p. 112)

While the strategic direction focuses on growth and development, the text states, 'It is essential to ensure water efficiency is promoted and alternative water supplies are integrated in such places to minimise reliance on potable water supply for non-drinking uses' (WAPC, 2014, p. 73). Key components of the policy position are ensuring water efficiency is implemented by using appropriate fit-for-purpose water, and new urban development is water sensitive as a development standard.

State planning policies (SPP) created under Part 3 of the Planning and Development Act address specific principles related to development in WA, which planning authorities must have 'due regard to' when making planning decisions. SPP 2.9 Water Resources (WAPC, 2006a) requires water to be considered within the planning system, including at the strategic level and within the preparation and assessment of structure plans. It specifically defines water resources as:

> *'… water in the landscape (above and below ground) with current or potential value to the community and the environment.'* (Schedule 1, SPP 2.9)

While the SPP does not specifically list subsoil drainage water, it is implied in the definition, and the policy specifically requires 'data on supply sources' as a recommended minimum requirement of Schedule 1.

The guideline document *Better urban water management* (WAPC, 2008) assists implementation of SPP 2.9. *Better urban water management* seeks to achieve integrated urban water cycle management based on WSUD principles. The *Better urban water management* process aims to minimise the impact of urbanisation by ensuring water resources are considered in planning, design and construction phases of urban development, by being undertaken concurrently, rather than independently and consecutively.

As an implementation guideline for SPP 2.9, *Better urban water management* requires that water forms an integral part of the planning process, and clearly defines water management strategies at specific levels (Figure 2). These consist of a regional water management strategy (RWMS), a district water management strategy (DWMS), a local water management strategy (LWMS), and an urban water management plan (UWMP).

These documents set the direction for implementing WSUD across Western Australia. All reports should address surface water and groundwater flows and quality (via modelling and monitoring), land use and site analysis, water balance modelling and water conservation, water dependent ecosystems and ecological health, optimising infrastructure delivery, and fit-for-purpose water usage at levels appropriate to each stage of planning.

There is duplication between these strategies. In some instances, while they were completed as required through the planning process, they don't significantly vary in detail and this limits the decision maker's ability to make an informed decision about specific outcomes. In part, this is because detailed information about water management is not generated until site planning is well underway to support subdivision. This stage of planning, which includes analysis of land capability, topographical constraints, and service capacity, allows subdivision layout to be tested through detailed water systems infrastructure planning and earthworks modelling.

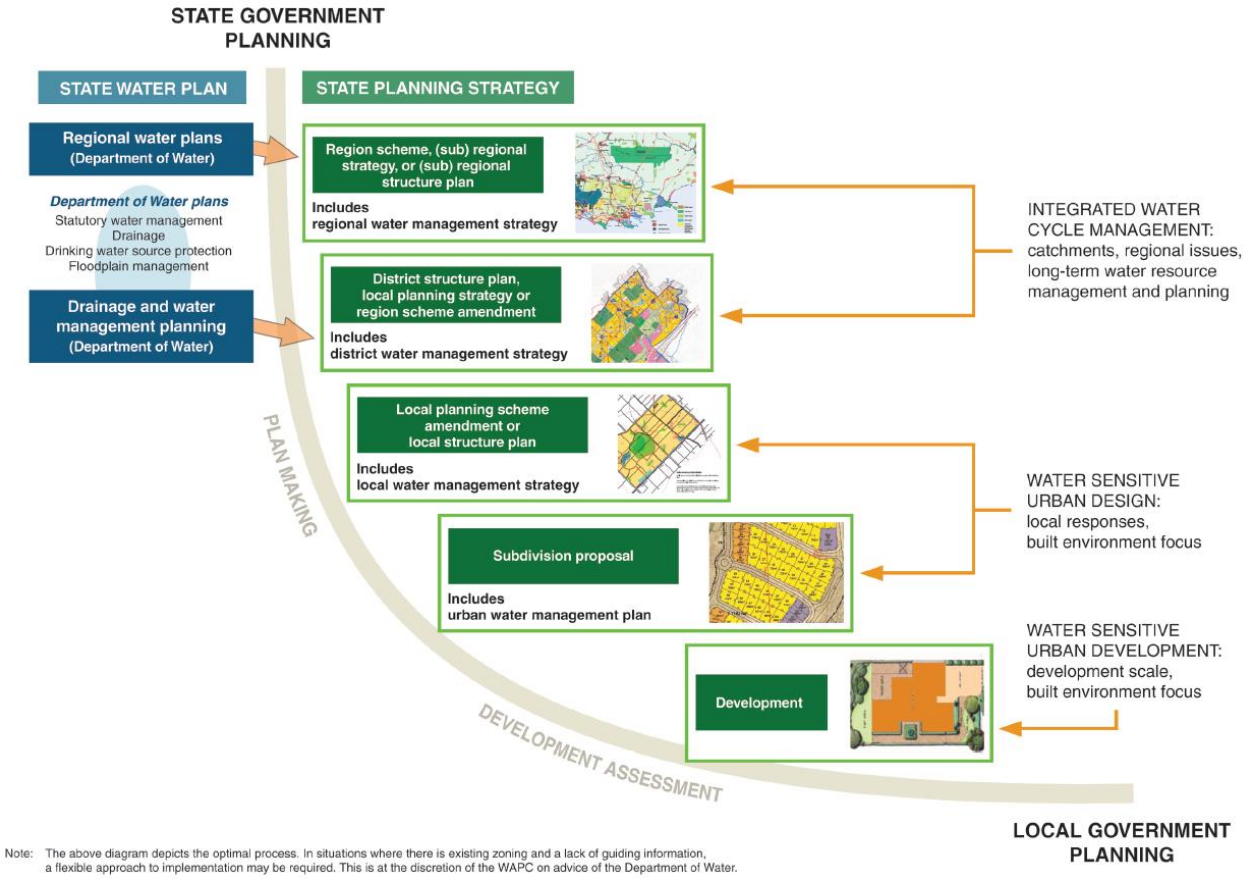


Figure 2. Integrating water planning with land planning processes (Source: WAPC, 2008, p. 14)

The DWER assesses the first three stages of regional/sub-regional, district and local water resource planning, in consultation with local government and the Department of Biodiversity, Conservation and Attractions (DBCA) where relevant. Their assessments consider potential impacts of the proposed land use and development, both on and from water resources. Local government usually assesses the final stage of information that supports subdivision or development, and it will request post-development monitoring to help with future maintenance.

Although resolving the LWMS involves the local government, it comes late in the planning process when the ability to influence integrated water outcomes is often constrained by previously made decisions, and opportunities to explore cost sharing or economies of scale in water infrastructure across a corridor have passed. A holistic view of IWM for the locality is difficult to instigate and the authority ultimately managing any new urban water assets—the local government (or possibly Water Corporation)—may experience an unfair cost burden as their ability to determine the infrastructure assets they will eventually own and manage is limited by their advisory role in the decision making process, via recommendations to the WAPC as the ultimate determining authority.

In addition, SPP 3 Urban Growth and Settlement (WAPC, 2006b) applies to structure planning and large redevelopment sites. SPP 3 incorporates Section 5.4 Liveable Neighbourhoods and defines its principle as ‘an integrated approach to the design of open space and urban water management …’ (WAPC, 2006b, p. 1070). This adds weight to the operational policy of Liveable Neighbourhoods, which applies to all planning schemes as part of the deemed provisions in accordance with the Planning and Development (Local Planning Scheme) Regulations 2015. Accordingly, any structure plan should be prepared in line with the application information guide listed in the Liveable Neighbourhoods policy. But as a guideline document, most of the applicable content in

Element 1 (Community Design), Element 4 (Public Parklands) and Element 5 (Urban Water Management) remains discretionary since compliance with objectives via requirements is mostly flexible given the language of 'should' rather than 'must'. The exception is under Element 4 where an Open Space Schedule 'must' be provided, and under Element 5 where an UWMP 'shall' be required.

Liveable Neighbourhoods is an extensive operational policy and provides a thorough guide for local government to facilitate sustainable communities through the structure planning process, but its discretionary approach and flexible implementation has resulted in this operational policy being placed under review as part of the Design WA project.

3.2 Regional planning

Perth and Peel @3.5 million (WAPC, 2018a) is the regional framework covering the four growth regions within the Perth Metropolitan Area. This strategic document seeks to enable sustainable planning for Perth's future growth by outlining the components that need to be considered in each region. It details the key issues facing urban expansion and how to provide adequate servicing for new urban areas.

Water-related principles focus on both environmental management and servicing provision. Non-potable water supplies for irrigation purposes are discussed under private self-supply. Here it is recognised that 'water use for private, non-potable purposes such as public open space, industry and agriculture has historically relied on cheap, readily-available local groundwater' (WAPC, 2018a, p. 65). This indicates the past approach to non-potable water supply and the need to shift to alternative water sources, particularly recycled wastewater for POS irrigation.

The North-East Sub-regional Planning Framework (WAPC, 2018b), which applies to the City of Swan, includes implementation actions that require local governments to prepare a local planning strategy and planning scheme amendments that reflect the sub-regional strategy and include a water and drainage management plan. But it does not outline specific actions on non-potable water sources. Other implementation actions include preparing and implementing water management strategies in accordance with the North-East Sub-regional Water Management Strategy and *Better urban water management* framework as part of the district, local and urban water management strategies, which the WAPC, DWER and local government will undertake.

3.3 Local planning

Each local government in Western Australia is responsible for preparing and administering a Local Planning Scheme (LPS) and strategy in accordance with the Planning and Development Act. The LPS is a legal document that sets out policies and controls for the use and development of land within a local government area. Local planning for the Brabham community, which sits within the City of Swan local government area, exemplifies typical local planning requirements within the north-east corridor.

The Brabham site is zoned 'Urban' in the Metropolitan Regional Scheme (MRS) and largely 'Special Use 10' (Albion) in LPS17 in the City of Swan. LPS17 requires a local structure plan to be approved prior to developing all or part of the land and includes a requirement for a water management plan. The local structure plan and associated local water management strategy (LWMS) must be consistent with any district structure plan (DSP) approved by the WAPC. In this case, the Albion DSP and associated LWMS sets a clear direction for water management, by requiring any local structure plan to:

> *'… address drainage and water management consistent with the approved District Structure Plan (Section 4.2 & Local Water Management Strategy), State Planning Policy 2.9 and Better Urban Water Management to the specification of the Department of Water.'* (City of Swan and WAPC, 2009, p. 7)

The *First stage Brabham local structure plan* (First stage LSP) has been lodged with the WAPC and the City of Swan. Stages two and three are expected to follow. An LWMS prepared by the RPS Group, which indicates how water resources will be managed, supports the First stage LSP. This First stage LSP also indicates that future stages of the Braham development will require alternative and innovative water solutions in the form of subsoil drainage water, to achieve an ongoing water supply for irrigating POS. The LWMS states:

> *'This strategy is a total water cycle management solution with the aim of the residential development becoming its own water supply catchment.'* (Department of Communities and Peet, 2019, p. 41)

This clearly implies the need to implement an IWM solution at the development stage, from individual lots up to regional waterways, so water is collected, stored and managed in a holistic manner to enable ongoing POS irrigation. The *Alternate water supply assessment* produced by RPS Group (2019) forms the basis of the City of Swan and DWER's current consideration of a non-potable water source for POS within the Brabham site.

In addition to the provisions of the LPS17, the City of Swan has two key local planning policies (LPP) that apply to creating POS and integrating WSUD: POL-LP-1-12 POS and Community Buildings, and POL-C-104 Environmental Planning. The POS and Community Buildings LPP (City of Swan, 2017) guides developers in delivering new POS, including the following specific measure about water for ongoing irrigation:

> *'Water allocations for proposed public open spaces are to be identified during the structure planning process and the licence must be transferred to the City via the Department of Water at a time of open space handover following the agreed maintenance period.'* (s 8, POL-LP-1-12)

The Environmental Planning LPP provides detailed guidance for IWM, including specifying the information to be provided in water management reports. This should include, but is not restricted to, water management modelling, mitigation and management measures, extraction and allocation rates, whole of life cycle costs, and strategies that go beyond the structure plan area. It also outlines the City of Swan's position on the use of alternative water sources, particularly for POS, public facilities, primary schools and households, such as reuse systems, recycled water and reduced potable water use.

Using rejected recharge as an alternative approach for irrigating POS, tabled in the RPS Group's *Alternate water supply assessment* report on behalf of Peet and the Department of Communities, is new in Western Australia and spans beyond the BAU approach to urban development by providing non-potable water for irrigation purposes. While the data provided to date indicate that a water source exists, its ability to service the POS allocation year-round and its longevity over time is the subject of ongoing discussions with the DWER and the City of Swan. Operational components of this system, storage facilities, maintenance costs, relationship to managed aquifer recharge (MAR) and ongoing management by the City of Swan, as the ultimate owner, are also outstanding at the time of writing. But it does appear this proposed subsoil drainage water source can be accommodated within the existing planning framework, provided it is detailed as required in accordance with the LWMS and the UWMP submitted to the City of Swan as part of the local structure plan and subdivision application respectively.

4. Enabling alternative water solutions: opportunities for change

The Brabham Action Learning Partnership has shown there is significant knowledge, understanding and practice in advancing water sensitive outcomes. The willingness of various stakeholders to engage, seek to change the practice of importing fill to address shallow groundwater, and pursue an alternative water source for irrigating POS in greenfield development has been encouraging, and reflects the Western Australian culture to embrace change and progress a solution. This is also clear in the state government's *Waterwise Perth action plan* and vision for Perth as a 'leading waterwise city by 2030' (WA Government, 2019b).

Yet enabling alternative water solutions within the urban environment requires solutions that address the identified hurdles across policy implementation, resulting from the separation of planning and water management functions, the scale at which development occurs, and processes of governance. Western Australia is not alone in this struggle, and yet the potential impact is significant due to diminishing rainfall and a drying climate (Bureau of Meteorology and CSIRO, 2018), limited access to continued non-potable water sources for new urban developments, and increasing development in challenging locations (that is, shallow groundwater). Historically, water was considered a constraint or limitation to development, to be managed with drainage and infrastructure solutions, rather than as an opportunity to have it incorporated into the landscape and future urban form through appropriate contextual design.

The *Waterwise Perth action plan* and the planning reforms program underway in Western Australia provide a unique window in which to strengthen integrated urban and water planning processes within state land use and water planning systems. The following discussion seeks to support this goal by systematically exploring planning and governance opportunities that could generate improvements across the substantive, methodological, procedural, policy and institutional dimensions of integrated urban and water planning (as described in section 1.2) within Perth. Each opportunity is aligned with relevant actions identified in the *Action plan for planning reform* and the *Waterwise Perth action plan*, to maximise the scope for influence. The discussion draws on examples from Victoria and New South Wales to illustrate how some of the ideas proposed are operating in practice. This section also includes questions that prompt readers to think about the issue raised and what's coming next.

4.1 Scale and context

Through the Brabham Action Learning Partnership and discussions, stakeholders expressed constant frustration with the deferment of decision making on water sources and solutions (as a result of insufficient information) through the different stages of the planning process. A significant component of this deferment appears to relate to costs and resourcing associated with completing the required water planning and water modelling at a time and scale large enough to inform strategic planning decisions.

Traditionally, detailed analysis for urban development has been instigated and driven by the development industry, at a scale reflecting land ownership and a user pays approach. The need to consider land outside of the landowner's site is generally based on potential benefits to the land or, if negotiations are underway to purchase adjoining land and add to the holdings. Consequently, site capability investigations and assessments are confined to the site so costs can be recovered through lot apportionment and land sales at the end of the project. Water modelling is an example of this. While catchment analysis must extend beyond an individual site, the water resource modelling required to determine groundwater management solutions, drainage systems, and water and wastewater infrastructure is generally confined to the site and designed at this scale. Costs associated with wider, catchment-scale water management and modelling are significant and would need to apply across several landholdings and owners (provided access to data is available). The current system does not provide for regional- or catchment-based water planning to deliver economies of scale.

How do you split the costs and who benefits from this approach?

This practice is not exclusive to Western Australia. Over recent years, state government interventions in Victoria and, to a lesser extent, New South Wales have resulted in state governments undertaking corridor level or sub-regional level water modelling to determine and define land use planning decisions and strategic water outcomes prior to local structure planning. This approach in Victoria has changed the institutional landscape for water by predetermining expectations and targeting outcomes for greenfield developments as they relate to IWM. The development industry in Western Australia recently echoed calls for this method through the Urban Development Institute of Australia (UDIA) draft position paper, *Alternative water source: irrigation of the public realm* (UDIA WA, 2019). This paper advocates for sustainable sources of water being identified at the appropriate level of land use planning prior to approval for future urban development areas.

State agencies undertaking corridor level water planning should seek to manage cumulative environmental impacts, water supply and infrastructure delivery, by controlling urban development fronts through regional scheme amendments. By setting clear strategic direction earlier in the integrated water planning process, local water planning can progress within this framework. While this will require more collaborative planning between DWER and the Department of Planning, Land and Heritage (DPLH) in land use decision making, it will align urban growth with water resource planning and management as directed by state government policy.

Implementing the four levels of water resource planning as required under *Better urban water management* duplicates information, increasing time and costs. While it does require state agencies to re-engage with local government and the development industry, the additional detail provided for integrated water cycle planning and decision making in the DWMS (a scale of > 300 hectare) is limited. But this is the critical stage at which land use change is determined (through scheme amendments) and corridor level water planning needs to take place to inform future land use. If water cycle management is not adequately considered and water supply is an issue, strategies for alternative water solutions need to be determined and authenticated at this point. Alternatively, future urban areas need to be limited to less marginal land, to achieve water planning and water cycle management.

The need to set strategic plans in place earlier is highlighted in *Modernising Western Australia's planning system – green paper concepts for a strategically-led system*, which acknowledges the developer-led focus of the current system has resulted in reactive planning: 'Planning efforts need to shift from development-led to a strategically-led system in which strategic planning is the centrepiece' (WA Government, 2018, p. 4). To create a fair, transparent and understandable planning system capable of timely and effective decisions, it focuses on strategic plans being set in place early so that a framework for future development is defined to '… improve the timeliness of later development steps because … the important and difficult decisions can be resolved prior to development and rezoning proposals' (WA Government, 2018, p. 5).

This approach has now been reinforced by the recently released action plan in accordance with Action B1: Planning is strategically-led (WA Government, 2019a), as well as Action 29 in the *Waterwise Perth action plan* (WA Government, 2019b). Notably, Action B1 seeks to deliver an outcome where 'Strategic planning is elevated to become the guiding platform and approach to inform plan making and decision making…' (WA Government 2019a, p. 13). It also supports the current review and consolidation of the six water-related SPPs into one, so that water planning is more strategically aligned with urban planning. Action 29 supports Action B1, through the delivery of 'IWM planning at district, catchment or corridor scale to support land planning and development in priority areas' (WA Government, 2019b, p. 19).

The DWER has led corridor level water planning exercises in the past, typically focused on a specific issue such as drainage or water supply. For example, the Byford drainage and water management plan provided the design criteria and management strategies for the arterial drainage scheme for the Byford townsite area. Similarly, the North West Corridor water supply strategy was developed in partnership with local governments and developers in response to the limited availability of water for irrigating POS. A similar exercise was attempted for the north-east growth corridor, but limited commitment from water users resulted in no resolution on a water supply

strategy. While some strategies were prepared for key strategic development areas, the ad hoc and issue-specific nature of water planning highlights the need for a state agency to lead a holistic total water cycle approach to corridor level water planning.

By comparison, the Victorian Government has instigated a statewide collaborative IWM approach through the Integrated Water Management Framework for Victoria. Given no single organisation is responsible for managing the total urban water cycle, IWM forums have now been established to integrate the activities of water corporations, local governments and catchment management authorities. The IWM forums recognise the complexity of the water cycle, its management, organisational functions and various agency accountabilities within the urban environment, and seek to bridge the gap across institutions and organisational priorities to achieve holistic water planning.

Opportunity #1	Alignment with WA Government initiatives
Undertake corridor level water planning as part of state government's integrated strategic planning and urban development program	*Action plan for planning reform*: Action B1. Planning is strategically led (Lead agency: WAPC and DPLH) *Waterwise Perth action plan*: Action 29. Deliver integrated water management planning at district, catchment or corridor scale to support land planning and development in priority areas (Lead agency: DWER)

The *Better urban water management* process outlines the information that is required at each planning stage to demonstrate that water resources are being adequately considered and managed. It specifically references 'non-drinking water sources for fit-for-purpose uses ...' (WAPC, 2008, p. 17) and 'potential water sources for drinking water and other uses, including irrigation of public open space …' (WAPC, 2008, p. 21) at both the regional and district planning level prior to the rezoning of land for urban purposes.

Better urban water management Appendix 1 Checklists for water management strategies also require fit-for-purpose non-potable water sources at the regional, district and local water management strategy stages. So, while the rezoning of land from a land use planning perspective can take place without confirmation of an irrigation supply for POS, *Better urban water management* does require this water source to be addressed. The UDIA WA (2019) has recently advocated for more effective integration of non-potable water supply planning into land use planning, which should be considered as part of the pending review of *Better urban water management*.

However, the *Better urban water management* 'founding principles' are specific to the local level since they state 'only issues that are relevant to the site and its surrounds require investigation …' (WAPC, 2008, p.15). This defers decision making if a resolution isn't available at some point in time '… or propose a strategy to address them at a later stage if appropriate' (WAPC 2008, p. 16). This discretionary approach has proved frustrating for resolving whole of water cycle management in a contextual manner, since decision making can be deferred to the last stage of urban development (that is, the application for subdivision and UWMP).

While the guideline framework is extensive and users appear to be complying with the process, a lack of regulatory targets makes it difficult to attain desired outcomes. The priority is still to step through the framework and complete each stage in order to progress to the next, rather than achieve strategic water outcomes through an integrated and mandated system at a broader catchment scale.

The review of the six water-related SPPs as part of the current streamlining planning reforms agenda creates an opportunity for mandating outcomes within state planning policy. This approach provides a direct line of sight back to the *State planning strategy 2050* and the state strategic direction for water as outlined in section 3.1, related to integrating alternative water supplies for non-potable uses.

Opportunity #2	Alignment with WA Government initiatives
Mandate the assessment of non-potable water supplies for public open space in the new State Planning Policy for water, and elevate status of Better urban water management to an operational policy	*Waterwise Perth action plan*: Action 19. Determine feasibility of alternative water supplies for public open space in areas without groundwater available, including the north-east corridor (Lead agency: DWER/Water Corporation) Action 26. Initiate a review to consolidate, streamline and improve the suite of water policies, guidance and technical advice to drive waterwise outcomes (Lead agency: DWER) Action 27. Consolidate, streamline and improve water-related state planning policy, guidelines and associated processes to strengthen waterwise outcomes at all levels of land use planning (Lead agency: DPLH)

4.1.1 Catchment-scale water planning

Victoria has embedded IWM in the planning process at the catchment level, by undertaking catchment-scale water planning prior to local structure planning to determine future urban land boundaries, protect natural waterways, determine large scale stormwater drainage needs, and integrate alternative water sources (via purple pipe for non-potable water). Creating sub-regional water infrastructure assets through land acquisition (by Melbourne Water) and designating land for flood storage and treatment is cost effective at the sub-regional level. This approach also clearly defines the parameters in which the development industry and local governments can integrate local structure planning.

In Victoria, the state government funded this catchment-scale work through the Victorian Planning Authority and the Department of Environment, Land, Water and Planning (DELWP). It is part of its strategic policy for balanced urban growth through defined targets of housing supply at 70 per cent in established areas and 30 per cent in greenfields (DELWP, 2017a). This approach removes the expectation of cost recovery, compared with a user pays system, since the work is completed in the public interest of Melbourne's existing and future community. It ensures potential cumulative impact and strategic planning policy is delivered at the local level, in part, by the state government.

In addition, changes to the Victorian Planning Provisions introduced in 2006 required IWM to be considered as part of all residential subdivisions through clause 56.07 (see section 4.1.4). Therefore, applicants have to consider IWM plans as part of greenfield local structure planning to specify how water is to be integrated into residential lots, created via a structure plan. The result is mainstreamed delivery of recycled wastewater to new greenfield lots for non-potable use via purple pipe, including sports fields (active open space), and the standard rollout of wetland systems and treatment trains as part of new greenfields water infrastructure.

Similarly, in New South Wales, the state government has taken a green infrastructure approach to raise the value of waterways by defining them as infrastructure assets in planning policy. Using district plans prepared by the state government, the integration of water and land use planning is based on catchment planning as '… water quality and waterway health is best managed at a catchment and sub-catchment level' (Greater Sydney Commission, 2018a, p. 108). This enables strategic land use planning to be guided from a catchment level and addresses the 'cumulative impact of development and land management decisions across catchments to improve water quality and waterway health' (Greater Sydney Commission, 2018a, p. 110). These district plans provide the context and direction for strategic land use planning at a district scale (covering between four and nine local government areas). And, while they are prepared by the state government, responsibility for the majority of actions listed for implementation via each 'planning priority' remains with local government at a local level.

The current work of DPLH indicates that the WA government is now implementing a broader strategic approach to greenfields planning. Given recent work being undertaken in 'planning investigation areas', the DPLH is commissioning large scale water modelling and catchment analysis to inform sub-regional/district scale urban land use decisions. This approach removes the need to defer decisions to a later stage in the planning process and removes the reliance on the development industry to undertake catchment-scale water planning and seek to cost recover through the future local community.

4.1.2 Importing fill

Importing fill is a standard practice in the WA development industry for greenfield development where shallow groundwater exists. The standard 'cut and fill' approach to producing flat land for housing lots must also enable the installation of gravity-fed sewers, and create a drainage system that will effectively drain the land and provide adequate separation from groundwater levels to avoid non-reactive soils and facilitate BAU slab on ground housing construction. Importing fill has significant environmental impacts for natural waterways and biodiversity because it substantially alters landform, soil and hydrological characteristics. The *Ideas for Brabham* report noted the need to limit this approach to delivering infrastructure, to reduce development costs (CRCWSC, 2018).

Better urban water management acknowledges that importing fill in shallow groundwater areas is likely to require drainage systems that control groundwater levels. This approach to a drainage solution is detailed in the requirements of the RWMS as '… preliminary assessment of the general drainage strategy, including the need for subsoil drainage and land fill requirements' (WAPC 2008, p. 17) and the DWMS as work required to support recommendations in the strategy: 'Determine need for controlling the groundwater level and/or to import fill' (WAPC, 2008, p. 22). This approach to fill importation is now considered BAU and trialling other solutions is often dismissed as not cost effective.

Greenfield development costs are often a trade-off between construction costs, drainage assets and infrastructure versus fill importation, land sculpting and net developable area. Choosing a strategy based on lowest cost does not generally factor in environmental costs (that is, loss of vegetation, loss of fauna, rising water table, acid sulphate soils, reduction in evapotranspiration, reduction in rainfall, loss of amenity, heat island effect etc.) or cumulative impacts as a holistic approach to groundwater control and drainage. Given these decisions are made at the local level (development scale) and are site-specific, consideration of the bigger picture and the greater implications of the costs and benefits for Perth is generally beyond a individual developer or single structure plan.

Should land with shallow groundwater be rezoned for urban purposes?

The practice in the WA development industry to achieve a net developable area (NDA) of 90 per cent (with 10 per cent for open space) leaves little opportunity to accommodate environmental constraints or incorporate WSUD within a structure plan at a local level, once land has been rezoned. To accommodate land with shallow groundwater, development would need to accept water in the landscape as an opportunity rather than a constraint, as discussed in *Ideas for Brabham* (CRCWSC, 2018). This approach would require delineation of any site areas where shallow groundwater is close to surface level or above, and its retention and remediation as a functioning part of the Swan Coastal Plain and its local context. This comes at a loss of NDA, but provides significant environmental, liveability and resilience benefits to future communities and cost recovery through value creation in placemaking, community branding, and lot pricing.

This method of accepting water in the urban landscape can be seen in growth areas in Melbourne where NDA targets are 65–75 per cent (with 10 per cent for open space) to cater for water treatment or storage, arterial road networks, road widening, and other infrastructure provision (see example land use budget in Table 2). This approach to NDA adopted and implemented by the Victorian Planning Authority, maintains a consistent approach to including WSUD, conservation areas and community infrastructure. Consequently, the development industry can be assured of a reliable and dependable approach to NDA regardless of location or market.

Table 2. Example summary land use budget for greenfield PSP in Victoria (Source: VPA 2017, pp. 14–15).

DESCRIPTION	PSP 1055 MCPHERSON		
	HECTARES	% OF TOTAL	% OF NDA
TOTAL PRECINCT AREA (HA)	952.49		
TRANSPORT			
Arterial road – including existing/widening/flaring/landscaping	25.4	2.66%	4.05%
Non-arterial road – existing/landscape buffer (gas easement)	6.67	0.70%	1.07%
Sub-total transport	32.06	3.40%	5.12%
COMMUNITY AND EDUCATION			
Future government and non-government schools	22.71	2.36%	3.58%
Local community facility and indoor recreation (ICP land)	5.10	0.53%	0.81%
Sub-total community and education	27.51	2.90%	4.40%
OPEN SPACE			
SERVICE OPEN SPACE			
Conservation area 36 (Growling Grass frog)	3.15	0.33%	0.50%
Waterway and drainage	56.75	5.96%	9.06%
Waterway and drainage reserve	71.30	7.49%	11.38%
Heritage reserve – post contact	2.07	0.22%	0.33%
Utilities easements	17.84	1.87%	2.85%
Redundant road reserve (local park)	0.05	0.01%	0.01%
Landscape values	0.11	0.01%	0.02%
Sub-total service open space	151.28	15.88%	24.14%
CREDITED OPEN SPACE			
Local sports reserve and local park (ICP land)	63.71	6.70%	10.17%
Sub-total credited open space	63.71	6.70%	10.17%
REGIONAL OPEN SPACE			
Sub-total regional open space	50.01	5.30%	7.98%
TOTAL ALL OPEN SPACE	**265.00**	**27.80%**	**42.29%**
OTHER			
Utilities sub-stations/facilities required by state agencies	1.32	0.14%	0.21%
Sub-total other	1.32	0.14%	0.21%
TOTAL NET DEVELOPABLE AREA (NDA) HA	**626.59**	**65.78%**	
NET DEVELOPABLE AREA– RESIDENTIAL (NDAR) HA	**626.59**	**65.78%**	

RESIDENTIAL LOCAL OPEN SPACE (EXPRESSED AS % OF NDAR)	HECTARES	% OF NDAR
Local sports reserve (ICP land)	40.00	6.38%
Local park (ICP land)	23.71	3.78%
TOTAL OPEN SPACE	**63.71**	**10.17%**

In Sydney, district plans (discussed in section 3 of this report) advance the integration of water into urban development through 'directions' that specify planning priorities and actions. The direction, 'A city in its landscape' in the *Western City district plan* requires a catchment-scale management approach to solve numerous water issues such as '… catchment condition and water scarcity, or water quality impacts on aquifers, estuaries …' (Greater Sydney Commission, 2018, p.110). These approaches to managing water in the landscape, through contextual design and planning of urban development, seek to improve the health of catchments and waterways, manage cumulative impacts, and enhance sustainability and liveability for new communities.

This holistic approach to water in the urban landscape is implied in the intent of managing water-dependent ecosystems (WDE) as part of implementing *Better urban water management* through the WA planning system, where land use changes are proposed. By supporting '… in-stream areas of rivers, riparian vegetation, springs, wetlands, floodplains, estuaries, karst systems and groundwater-dependent terrestrial vegetation …' (Department of Water, 2013, p.1) as part of WDE, water in the landscape is supported in the urban planning process. The hydrology and hydrogeology of WDE in urban development is indicated in Figure 3, with the expectation that pre-development conditions are maintained or improved and WDE are appropriately managed. This is provided via the LWMS prepared by the proponent to the satisfaction of DWER, the Department of Biodiversity, Conservation and Attractions (DBCA) and the Swan River Trust as appropriate.

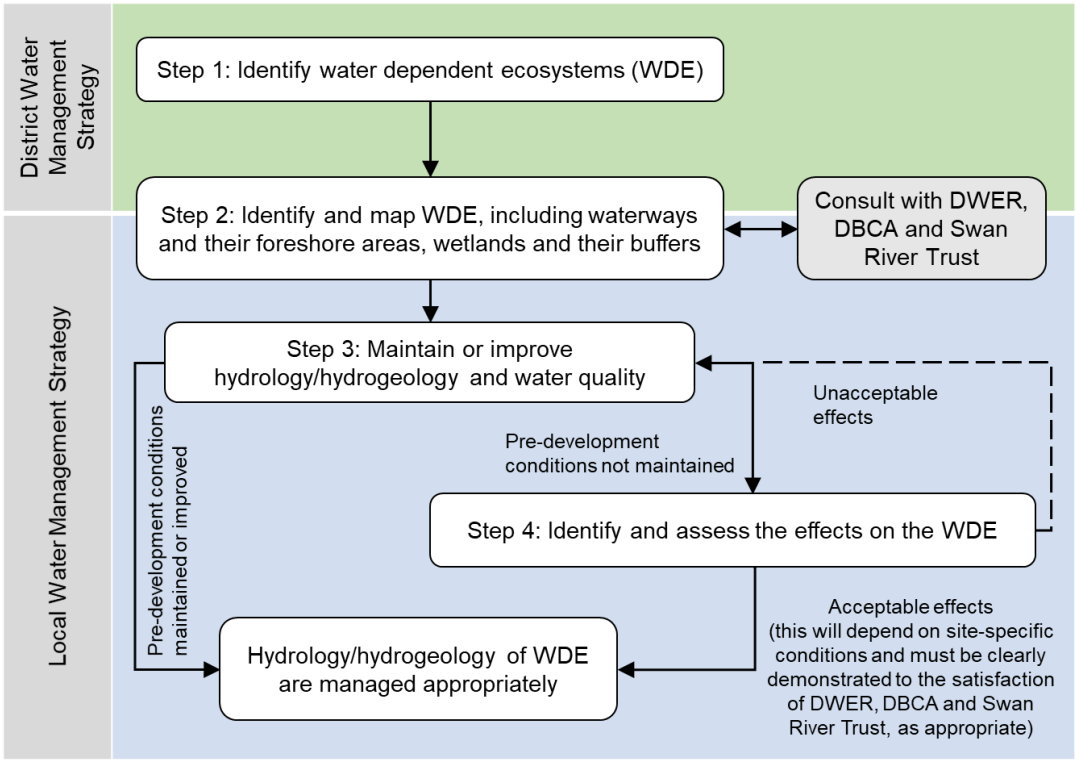


Figure 3. Process for managing the hydrology or hydrogeology of WDE in urban development (Source: Adapted from Department of Water, 2013, p. 2)

However, as a guidance note to *Better urban water management*, these provisions are also flexible and broad in their application. Consequently, maintaining or improving waterways or floodplains at this local level is too late, because once the land is rezoned and urban growth decisions are made in the DWMS, preparing local water strategies to improve waterways and accept water in the landscape fall victim to NDA. This results in the loss of opportunities to integrate water into urban form and the undermining of water values in the landscape, which ultimately affect the achievement of WSUD. Given Perth's diminishing water supplies, rezoning rural land to urban where shallow groundwater exists has cumulative environmental implications for the future health of Perth's

waterways and resultant liveability, and should be considered only where appropriate environmental management of shallow groundwater is in place.

The WA Government's current planning reform agenda includes reviewing and simplifying its suite of land use zones. Opportunities exist to rename and redefine existing urban zonings to reflect environmental considerations of the land's future development and guide integrated urban and water planning from conception stage.

Opportunity #3	Alignment with WA Government initiatives
Rename urban zone for land with shallow groundwater (for example, 'Urban – shallow groundwater') that requires appropriate environmental management of shallow groundwater as part of the land's future urban development	*Action plan for planning reform*: Action C1. Local planning schemes are more consistent (Lead agency: DPLH) *Waterwise Perth action plan*: Action 27. Consolidate, streamline and improve water-related state planning policy, guidelines and associated processes to strengthen waterwise outcomes at all levels of land use planning (Lead agency: DPLH)

In addition to standardised drainage infrastructure, which is a known cost within the project management framework for the development industry, construction costs for housing development (the ultimate object of sale) relate to site classification for building construction. Importing fill is also driven by this desire to limit engineering costs associated with standard and affordable, slab on ground construction. This style of construction is embedded in built form expectations and the housing culture of Perth, because alternatives to brick are anecdotally considered of a lower quality and value. This is particular to Western Australia and South Australia, since, historically, housing was constructed from locally sourced materials of stone and clay. By the turn of the 20th century, brick manufacturing had become the most affordable material for the everyday builder, thus enshrining its status as the WA building material of choice. This contrasts with the eastern states where abundant supplies of lumbered timber were available, making timber buildings and housing common and characteristic of these towns and cities.

How do you address cultural housing expectations?

The WA Government's current planning reforms package includes opportunities through the Design WA project and its associated policies to raise and address both housing construction styles and building materials. While these documents focus on apartment and mixed-use developments rather than detached dwellings, they do not specifically discuss the benefits of using a varied building material palette to provide diverse built form typologies. The design principles are strong and address WSUD, total water cycle management and future proofing for a growing WA community by requiring the provision of a 'mix of dwelling types … choice for different demographics … and budgets …' (Design Principle 9, WAPC, 2019, p. 11). But the discussion on material use and construction style is not included at this point. This may be an opportunity for future policies to lead on alternative building material choice in housing typologies that showcase the benefits of lightweight building materials which are easily adapted to shallow groundwater environments, as opposed to slab on ground construction that requires non-reactive soils, achieved through significant fill importation.

Opportunity #4	Alignment with WA Government initiatives
Incorporate building material palette in Design WA project through the Residential Design Codes (R-Codes) Volume 1 reforms which are universally applicable through local planning schemes	*Action plan for planning reform*: Action A4. Good design is required and design excellence encouraged (Lead agency: WAPC and DPLH) *Waterwise Perth action plan*: Action 23. Explore mechanisms to encourage good practice and innovative waterwise urban development (Lead agency: DWER)

4.1.3 Harvesting recharge for reuse

To enable the use of non-potable water for ongoing irrigation of POS within the Brabham project (and potentially the entire north-east growth corridor), the Brabham Action Learning Partnership facilitated discussion on how subsoil drainage water is defined, quantified and managed, including how it relates to the existing legislative framework of the *Rights in Water and Irrigation Act 1914*, administered by DWER.

The DWER defines subsoil drainage water or rejected recharge as shallow groundwater that would otherwise be lost to evapotranspiration (RPS Group, 2019). In general terms, where subsoil drains are installed at or above the pre-development average annual maximum groundwater level, subsoil drainage discharge can be considered 'excess water' and is therefore available for harvesting. While this water may already exist in urban environments as part of the subsurface drainage system, the opportunity for a developer to collect and use it as a non-potable water source for irrigating POS as part of a local structure plan has only been explored to date as part of the Brabham project.

Through the Brabham Action Learning Partnership, questions on how to assess, authorise and govern this subsoil drainage water source were the subject of much discussion. The approach to delivering POS that will ultimately result in the City of Swan owning and managing this asset requires the City to accept and endorse the water source as a sustainable supply of irrigation for the POS allocation. But the City of Swan cannot assess or authorise the collection and use of the subsoil drainage water because this is a decision for DWER as the state's water resource manager.

At time of writing, consideration of subsoil drainage water falls outside the Rights in Water and Irrigation Act, because it does not fulfil the definition of groundwater. Therefore, no groundwater licence is required to take the water, but the form of authorisation required for its use is being considered. As defined by DWER, this water would have been lost to evapotranspiration, so its impact on the existing natural water system is not readily quantifiable. This approach means the authorisation and governance of this water source remains undefined. In the immediate scenario, DWER has established interim criteria for assessing subsoil drainage water based on separation between the water table and building foundations, draw down on the aquifer on- and off-site, and the effect on downstream environmental receptors.

4.1.4 Climatic context

The desire for and provision of lush green landscapes in place of textured dry landscapes for most of the year needs to be considered in relation to Perth's current and future climatic conditions. Projections for increased surface temperatures and declining average rainfall suggest that the requirement to provide additional water sources to ensure the ongoing provision of green POS may be a community aspiration that is not deliverable in the future policy and climatic environment.

The present perception within the broader WA community that groundwater is plentiful and freely available to be consumed does not accurately reflect this finite resource. While a shift in water supply or storage provision via MAR or scheme water may make available a water source for POS irrigation, this will ultimately result in a user pays system, managed by local government, which is currently not a palatable solution in Western Australia.

Water Corporation's 50-year strategic policy *Water forever: towards climatic resilience* sets clear targets for reduced water consumption, increased water reuse/recycling, and securing support to develop new water sources (Water Corporation, 2009). With a target of increasing the volume of total wastewater recycled to 30 per cent by 2030, Water Corporation is actively promoting wastewater recycling as a resource for industry, POS and agriculture use. As an additional water source, recycled water provides a competitive product where non-potable water is limited or not available. But, this comes at a cost and will ultimately equate to the value the community places on creating and maintaining 'green' infrastructure.

What is a reasonable cost for POS irrigation and who in the community pays?

Discussion within the Brabham Action Learning Partnership workshops indicated Water Corporation is currently estimating costs for recycled scheme water to irrigate future POS for a population of 3.5 million. These estimates consider both the amount that an individual ratepayer could pay per year within the City of Swan, versus what an individual ratepayer could pay per year in the Perth/Peel region. This analysis indicates substantial additional volumes of water would be required to service a population of 3.5 million—almost double the amount of water used in the Perth/Peel region today.

It was noted that the local governments within the north-east growth corridor have limited available groundwater because of the position east of the Swan Coastal Plain, which means less rainfall, limited permeability and less storage capacity, and consequently unequal distribution of groundwater. This groundwater use raises the issue of equity within the broader Perth community and whether a single water-diminished community should be required to pay for irrigating POS when others do not. The issue of cost allocation was also raised in the UDIA WA's *Alternative water source: irrigation of the public realm* position paper, which highlighted the need to level the playing field by distributing the costs for decentralised recycling schemes across Perth's residential customer base (UDIA WA, 2019).

Opportunity #5	Alignment with WA Government initiatives
Determine the cost of providing non-potable water to public open space at the Perth metropolitan scale and apply it to all rateable properties as a water resources charge	*Waterwise Perth action plan*: Action 19. Determine feasibility of alternative water supplies for public open space in areas without groundwater available, including the north-east corridor (Lead agency: DWER/Water Corporation)

Perth's long dry summers within a 'warm temperate' climatic zone do not naturally support a continuous green landscape, which explains the desire for irrigated POS. But examples of a return to the drier natural landscape can be seen in many local governments' shifting approaches to integrated water solutions for non-irrigated or passively irrigated POS. For example, the City of South Perth is undertaking hydro-zoning and eco-zoning POS to create waterwise and native-based gardens that collect and conserve water and introduce biodiversity and aesthetic variety into local parks and reserves (City of South Perth, 2019). This POS program showcases natural landscapes that reflect local climatic conditions while remaining engaging and desirable open spaces for the local community to use and enjoy.

Variations in topography, soil and vegetation across the Perth Metropolitan Area highlight the need to make local context a key consideration in determining water assets such as swales, wetlands and bio-retention systems. This

suite of WSUD solutions remain dry for much of the year, but their water quality benefits are only realised when water passes through them. These assets also provide other often unrecognised benefits to the community, such as shade, habitat and enhanced streetscapes. Whether these assets function to convey, treat or store water, their productivity depends on continued rainfall. In a dry climate where rainfall is limited to around five months of the year, the rain, when it arrives, can be so intense some water assets can't accommodate the quantity. This can damage the water assets and leave them unable to deliver the desired outcomes; they then require regular maintenance for limited benefit in this dry climate.

Are integrated water assets (wetlands, swales, rain gardens etc.) delivering on IWM targets?

Greenfield areas in the western suburbs of Melbourne have experienced similar limitations in productivity of IWM assets. This is especially so where designs were not adequately adjusted for differences in soil profiles and climate, particularly less frequent rainfall events and higher summer temperatures. Such climatic and environmental variations have resulted in Melbourne's growth areas achieving different levels of IWM at the local level. Consequently, liveability indicators in the western growth suburbs are not as high as those in the south-eastern growth suburbs. DELWP and the Victorian Planning Authority are investigating this issue through a modelling exercise under the CRCWSC project: *Strengthening the delivery of integrated water management in precinct structure planning.* By modelling the environmental and liveability impacts of greenfield developments in Melbourne's west under different climate and development scenarios, this project seeks to determine how effectively WSUD assets are delivering on state-mandated IWM targets at the local level, in drier climatic conditions.

The interviews held through the Brabham Action Learning Partnership highlighted constraints with delivering IWM as part of the development process in Western Australia, particularly the absence of mandated standards or targets. The WA land use and water planning framework allows the development industry to navigate through the planning process without resolving specified outcomes. This can be attributed to a lack of clearly defined, targeted outcomes within urban planning policy, undermining the delivery of integrated water solutions. Given this, the opportunity to mandate controls should be considered. Mandating outcomes at the local level through the objectives in the LPS was indicated as a potential option to drive adoption of water sensitive development. This approach has been successful in Victoria through the Victorian Planning Provisions, which require IWM to be implemented as part of all residential subdivisions (see Figure 4), under clause 56.07, of each LPS.

A similar approach could be implemented in Western Australia if the desire for change is strong enough, particularly in more environmentally sensitive areas, such as the Swan Coastal Plain. But, even in Victoria, the results can vary depending on the willingness of local government to own and operate WSUD assets. The Victorian example does highlight that mandating policy is acceptable to the development industry where it is consistently applied and maintains a level playing field for all developers within the market.

Opportunity #6	Alignment with WA Government initiatives
Mandate integrated water management standards or targets for urban development on the Swan Coastal Plain in local planning schemes, supported by Better urban water management as an operational policy	*Action plan for planning reform*: Action C1. Local planning schemes are more consistent (Lead agency: DPLH) *Waterwise Perth action plan*: Action 27. Consolidate, streamline and improve water-related state planning policy, guidelines and associated processes to strengthen waterwise outcomes at all levels of land use planning (Lead agency: DPLH)

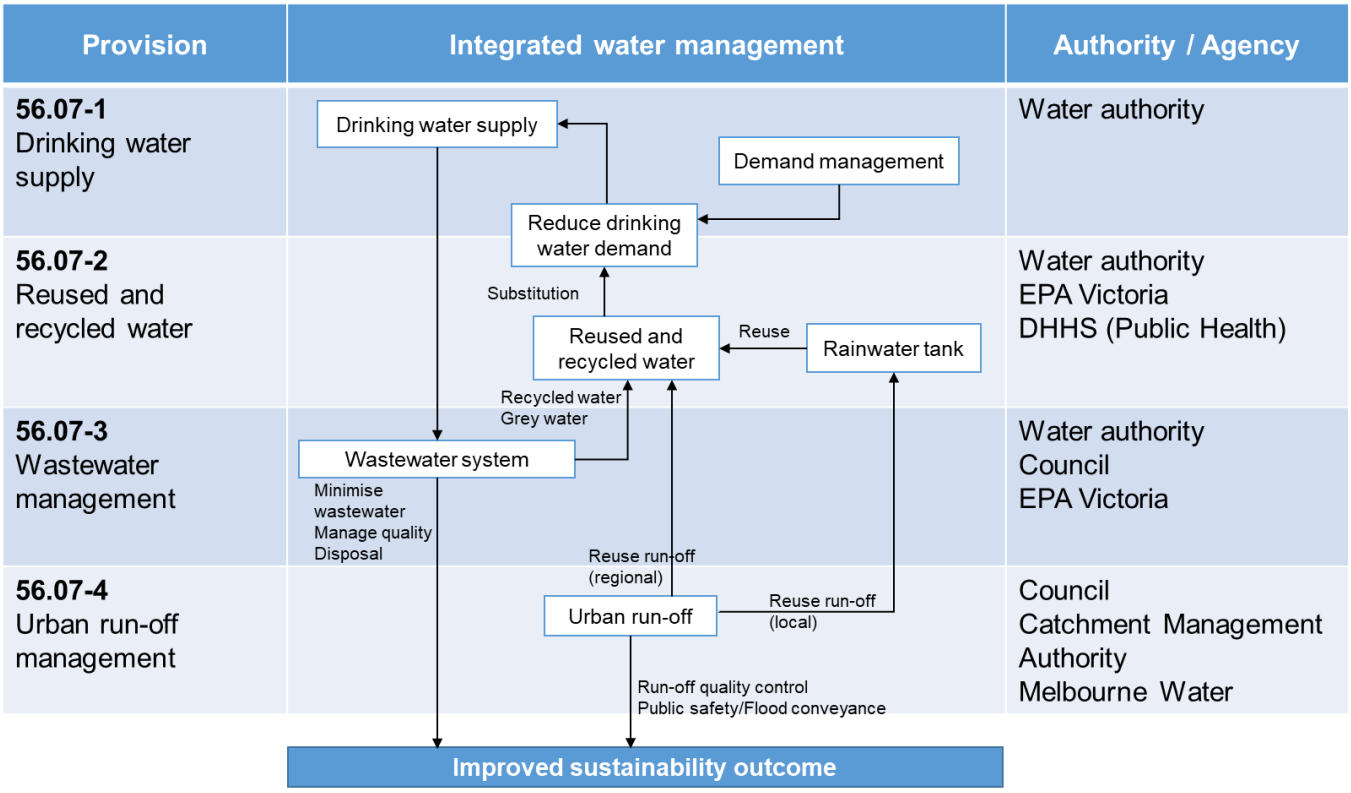


Figure 4. Overview of Victoria's IWM requirements set out in Clause 56.07 (Source: Department of Sustainability and Environment, 2006, p. 3)

4.2 Governance and implementation

Governance and decision making related to water resource planning is spread across multiple agencies and undertaken at scales and points in time that are not always aligned with the land use planning process. Although the developer is responsible for proposing solutions to manage stormwater and groundwater, state agencies undertake planning for wastewater and water supply at different stages in the urban development process. As described earlier, this can mean detailed water planning is deferred to the local level, late in the process, when opportunities for change from BAU are limited.

The WA system of water resources management is predominantly overseen by the DWER, which also acts as a regulatory body that responds to requests for water allocations and licensing (see Table 3). Consideration of water servicing requirements by the DPLH and the City of Swan as part of the urban planning process is based on the assessment, advice and direction provided by the DWER as the agency that plans, manages and regulates water resources.

In its final workshop, the Brabham Action Learning Partnership discussed existing institutional arrangements, which it rated as fair to good. This reflects the clearly defined and legislated roles and responsibilities of agencies, including the DWER. But IWM issues often intersect multiple organisational boundaries and a narrow interpretation of roles and responsibilities can limit how well agencies can address emerging issues or pursue more complex IWM related outcomes, particularly when resources are constrained. This discussion also suggested that DWER's assessment and licensing functions could take priority over regional water resource planning for urban growth. DWER's functions are time-bound and resource-intensive, and a failure to meet assessment and approval timeframes results in development delays and escalation of issues within government.

Participants highlighted the need for the state government to undertake corridor planning of water servicing at a greater level of detail spatially, and acknowledged that this requires a greater level of resources, people and skills than presently available. These current limitations in implementing strategic water planning suggests there may be scope for change in governance structures to minimise competing functions (for example, regulator and policymaker), support processes at the appropriate scale of management, and improve resourcing and efficiency.

Table 3. Water governance and service delivery in Perth

<table>
<tr><th colspan="2">Whole of government
Water strategy</th></tr>
<tr><td rowspan="3">Department of Water and Environmental Regulation
Water policy
• Access to water
• Water resource assessment and planning
• Protecting water resources
• Compliance and enforcement
• Waterway management guidance
Water planning
• Water supply planning
• Water allocation planning
• Flood planning and mapping
• Drainage and water management planning
• Water quality improvement planning
Assessments
• Groundwater investigations
• Assessment of urban water management strategies and plans
• Waterway health assessments
• Water monitoring
• Catchment modelling
Water regulation
• Water licences, permits and trading
• Regulation of water service provision</td><td>Local government (e.g. City of Swan)
Asset management
Local drainage services
Public open space irrigation</td></tr>
<tr><td>Water Corporation
Service delivery
Potable water supply
Arterial drainage
Wastewater services</td></tr>
<tr><td>Department of Biodiversity, Conservation and Attractions
Water and land management
Management of the Swan Canning Riverpark
Management of conservation lands and waters
Management of Ramsar and CALM Act wetlands
Wetlands policy</td></tr>
<tr><td></td><td>Department of Planning, Lands and Heritage
Water policy as it relates to urban development and land use planning</td></tr>
</table>

In Perth, state-level water policy recognises a BAU approach will not achieve sustainability and liveability goals in an environment of increasing water scarcity and a warming climate. While existing planning frameworks and institutional roles provide for regional and corridor level water planning, as described in section 3, this may need to be undertaken more collaboratively and in greater detail to enable innovative servicing solutions. A state government agency or servicing authority is best placed to undertake this role in the public interest. In Melbourne and Sydney, water authorities, guided by state policy agencies, perform this role. This is consistent with the Council of Australian Governments' water reform agenda, which seeks separation of government policy, regulatory and service delivery functions. This removes a considerable burden of planning from state policy and regulatory agencies, and better enables them to focus on core functions.

Opportunity #7	Alignment with WA Government initiatives
Have an agency or servicing authority complete regional water planning and resource assessments that specify service outcomes for water supply (potable and non-potable), surface and groundwater use and management (including protection of environmental assets, flooding, inundation and water quality), and wastewater management	*Waterwise Perth action plan*: Action 29. Deliver integrated water management planning at district, catchment or corridor scale to support land planning and development in priority areas (Lead agency: DWER)

Under this scenario, an agency or service authority that strategically manages and directs water servicing via detailed corridor strategies would determine all infrastructure required to meet service outcomes in growth areas, rather than the landowner or developer in relation to their local development requirements. Developers would then undertake final design and construction of infrastructure for their individual land parcels to meet the corridor strategy and adopted service requirements. Developers should be able to engage with the agency or service authority on the adopted scheme and have the opportunity to seek changes to the scheme proposal where they can demonstrate better outcomes or wish to provide higher levels of service (with agreement of responsible authorities).

Opportunity #8	Alignment with WA Government initiatives
Have servicing authority plan water system services at a corridor scale and develop business cases for regional and sub-catchment servicing schemes (including infrastructure that local government will own and operate)	*Action plan for planning reform:* Action A3. Land use and infrastructure planning is coordinated (Lead agency: WAPC and DPLH) *Waterwise Perth action plan:* Action 19. Determine feasibility of alternative water supplies for public open space in areas without groundwater available, including the north-east corridor (Lead agency: DWER/Water Corporation)

This approach generally reflects the governance and servicing arrangements for urban growth in New South Wales and Victoria, where an IWM approach to corridor level planning was advanced in response to continued growth and expanding urban areas. While institutional arrangements vary across these jurisdictions, Melbourne Water and Sydney Water generally develop servicing schemes based on corridor strategies. For Melbourne Water, this includes planning for waterways, drainage and floodplain management to meet agreed or mandated service levels including assets that local government will eventually own and operate. Melbourne Water collects developer contributions to fund this infrastructure and then ‘hands over’ some assets to local government after construction (where assets service catchments of less than 60 hectares). These servicing schemes are developed with landowners and local government and subsequently form part of the local structure planning process and require agreement before being adopted.

This approach to water resource planning has been reinforced by the planning framework for growth area implementation in Melbourne, via the DELWP and the VPA. Corridor level water planning was completed before the last expansion/review of the Urban Growth Boundary, and as part of preparing the Growth Corridor Plans for

Metropolitan Melbourne's four growth corridors (VPA, 2012). This strategic water planning enabled future urban development to progress within an adopted water resource framework, such that all precinct structure plans must now implement the corridor level water planning through their local IWM plans, as facilitated by the Victorian Planning Authority, and in consultation with Melbourne Water and local government.

Opportunity #9	Alignment with WA Government initiatives
Ensure local structure plans establish land uses and integrate infrastructure, as identified in servicing schemes, including funding and ownership arrangements	*Action plan for planning reform:* Action C1. Local planning schemes are more consistent (Lead agency: DPLH) Action A3. Land use and infrastructure planning is coordinated (Lead agency: WAPC and DPLH) Action C6: Structure and precinct planning tools are fit-for-purpose (Lead agency: DPLH)

The approach in Melbourne highlights the critical role service authorities and local governments play in delivering key water infrastructure. In Western Australia, the rollout of subsurface drainage infrastructure to supply POS irrigation requires local government support in delivering (in association with the development industry), managing and monitoring these assets. This requires considerable resourcing, budget allocation and forward planning. But local governments' ability to lead and determine integrated water outcomes is limited by their advisory role within the WA planning system. The local government's authority for local structure plans should be reviewed, given local government is responsible for managing infrastructure and assets for their future community.

Alternatively, local governments could be made responsible for assessing supporting water management reports (LWMS) and providing advice to the WAPC. This would enable a greater resolution of water modelling and detailed analysis to take place in consultation between local government, state agencies and service providers, at a stage in the development process where decisions can be made and outcomes are determined. The WA Government's action plan generally supports this approach, which seeks to ensure the WAPC focuses on its strategic planning role through changes to its structure, functions and operations, to increase transparency, efficiency and strategic planning outcomes.

Opportunity #10	Alignment with WA Government initiatives
Consider local governments' role as a determining authority for local structure plans and local water management strategies	*Action plan for planning reform*: C9: The WAPC is more efficient and strategically focused (Lead agency: WAPC)

4.2.1 Collaboration

Collaboration at the corridor level is a key mechanism for bringing together stakeholders in the planning process to consider alternative water servicing solutions for urban development. This approach is not unusual in Western Australia, but formal collaborative processes are mostly confined to state priority projects. For example, the current METRONET program announced by the WA Government includes a defined and formal collaboration approach to decision making involving relevant state authorities and local governments. This collaborative approach has also been reinforced through the WA Government's action plan, with its first action A1:

Collaborative planning delivers district-level priorities (WA Government, 2019a) requiring collaboration across government where strategic planning priorities need to be met.

This is consistent with the approach taken across many Australian cities for priority urban development projects and infrastructure delivery. An example is the Greater Sydney Commission's Collaboration Areas, which are 'a place-based, multi-stakeholder approach to solving complex urban issues' (Greater Sydney Commission, 2018b). In Victoria, the Department of Jobs, Precincts and Regions (DJPR) delivers state significant areas through designated Priority Precincts (DJPR, 2019).

Formal collaborative governance arrangements are less common across Australia for greenfield urban growth planning and exist only in New South Wales and Victoria. Consequently, attempts to adopt innovative or water sensitive development solutions are often led by practitioners who champion alternative solutions within the confines of BAU governance arrangements. The innovation may then fail to be implemented, or such projects become special 'one off' examples without ongoing efforts of capable champions to counter the effects of BAU inertia. Mainstreaming innovative water sensitive solutions for shallow groundwater greenfield development in Perth is expected to require an extended period of more formal collaboration, including a greater role for the servicing authority and local government in future corridor planning.

As introduced earlier, the Victorian Government has recently pioneered the systematic application of a collaborative IWM approach at a statewide scale by introducing the *Integrated water management framework for Victoria* (DELWP, 2017b). Under this framework, DELWP established catchment-based IWM forums, which bring together organisations that influence all elements of the water cycle, such as water corporations, local governments and catchment management authorities. Since no single organisation is responsible for managing the total urban water cycle, a collaborative planning approach is essential for effectively recognising water cycle complexities, addressing water management functions where accountabilities are not clear (that is, stormwater harvesting and POS management), and bridging siloed institutional structures to realise integrated opportunities.

In the case of Metropolitan Melbourne, five IWM forums were established to explore, prioritise and oversee opportunities across five major catchments (Werribee, Maribyrnong, Yarra, Dandenong, and Western Port). The forums have identified a range of outcomes to be delivered through IWM initiatives, captured in 'strategic directions statements'. Place-based IWM plans are being developed to establish indicators and measures related to these outcomes, which will eventually become the basis for target setting and prioritising actions.

Throughout the planning process, DELWP plays a supportive and facilitative role, working with urban water organisations to build capability, share data, provide guidance on IWM planning and analysis, and facilitate co-investment and cost-sharing. Organisations are expected to incorporate relevant IWM opportunities in their own planning systems, with the outcomes of the IWM forum process ultimately informing state level urban water policy. While the IWM planning process is a voluntary one, the strong push by the Victorian Government and the added value promised through the delivery of better community outcomes have been demonstrated to incentivise widespread organisational commitment. Establishing an annual funding program to support IWM projects across the state (which amounted to $4 million in 2018–19) (DELWP, 2019) has also assisted.

Structure planning processes traditionally require consultation and engagement with state departments, agencies, service providers and local governments. This standardised model of referral and individual consultation is supported by most government departments across Australia, because it provides the required government position on any relevant development matter. But, the process remains slow, poorly integrated and often results in a collection of piecemeal decisions. At the fourth Brabham Action Learning Partnership workshop, participants discussed current levels of procedural integration in Western Australia, and rated them fair to good. But participants indicated that current referral processes do not enable stakeholders to influence decision making beyond their scope (responses are only provided for referrals considered relevant/important to an agency's role), resulting in a lack of holistic consideration. This approach to engaging with state departments can result in disjointed advice to development proponents and poor understanding of how cumulative decisions affect strategic goals and priorities.

To circumvent a disjointed approach to greenfield planning and decision making and ensure the timely delivery of urban land in Metropolitan Melbourne, the Victorian Planning Authority (formally the Growth Areas Authority) was established in 2006. In an attempt to streamline the local structure planning process, the authority took on the facilitation role, in place of the development industry, to deliver state government urban development decisions. This enabled the standard referral processes to be confined to a direct exchange across one level of government, the delivery of strategic state policy at the local planning level, and the establishment of a collaborative planning process for delivering local structure plans.

Opportunity #11	Alignment with WA Government initiatives
Require collaborative project planning, assessment and infrastructure delivery as part of corridor planning and structure planning processes	*Action plan for planning reform:* Action A1. Collaborative planning delivers district-level priorities (Lead agency: WAPC and DPLH) Action A3. Land use and infrastructure planning is coordinated (Lead agency: WAPC and DPLH)

The ability to create and drive change at the local government level is not confined to planning provisions and planning policy alone. As discussed, the opportunity to drive outcomes that achieve IWM requires local government officers and agency staff to be versed in integrated water solutions and able to operate effectively within existing governance arrangements. This is where individual champions along with well-established internal and external staff collaborations are critical. As expressed in the practitioner interviews, experienced staff who are well rounded in their approach to decision making and have established connections and relationships within both local and state governments, are important to the successful implementation of alternative water solutions.

5. Conclusion

The *Waterwise Perth action plan* and the planning reforms program underway in Western Australia provide a unique opportunity to strengthen integrated urban and water planning processes within state land use and water planning systems. This report has sought to advance this goal by exploring 11 planning and governance opportunities for the WA Government and development industry to consider. The 11 opportunities are designed to tackle constraints in policy implementation by improving each integration dimension. Each opportunity has the potential to contribute to multiple actions identified in the *Action plan for planning reform* (Actions A1, A3, A4, B1, C1, C6 and C9) and the *Waterwise Perth action plan* (Actions 19, 23, 26, 27 and 29). Further analysis and evaluation would be needed before any opportunities are formally adopted as intra- and cross-organisational policies, strategies and programs:

1. Undertake corridor level water planning as part of state government's integrated strategic planning and urban development program
2. Mandate the assessment of non-potable water supplies for public open space in the new State Planning Policy for water, and elevate status of *Better urban water management* to an operational policy
3. Rename urban zone for land with shallow groundwater (for example, 'Urban – shallow groundwater') that requires appropriate environmental management of shallow groundwater as part of the land's future urban development
4. Incorporate building material palette in Design WA project through the Residential Design Codes (R-Codes) Volume 1 reforms which are universally applicable through local planning schemes
5. Determine the cost of providing non-potable water to public open space at the Perth metropolitan scale and apply it to all rateable properties as a water resources charge
6. Mandate integrated water management standards or targets for urban development on the Swan Coastal Plain in local planning schemes, supported by *Better urban water management* as an operational policy
7. Have an agency or servicing authority complete regional water planning and resource assessments that specify service outcomes for water supply (potable and non-potable), surface and groundwater use and management (including protection of environmental assets, flooding, inundation and water quality), and wastewater management
8. Have servicing authority plan water system services at a corridor scale and develop business cases for regional and sub-catchment servicing schemes (including infrastructure that local government will own and operate)
9. Ensure local structure plans establish land uses and integrate infrastructure, as identified in servicing schemes, including funding and ownership arrangements
10. Consider local governments' role as a determining authority for local structure plans and local water management strategies
11. Require collaborative project planning, assessment and infrastructure delivery as part of corridor planning and structure planning processes.

The Water Sensitive Transition Network (WSTN) is a key avenue for championing alternative water policies and practices. In 2016, a number of leaders from stakeholder organisations spanning state and local government, research, private industry and community sectors formed the WSTN—a strategic network aimed at guiding the transition of Perth towards a water sensitive city. The WSTN operates as an informal, self-organising community of practice. Members are connected by a shared vision and mutual desire to work collaboratively to achieve beneficial outcomes for Perth and are not constrained by any formal obligations. This flexibility allows the WSTN to proactively influence strategic activities in Perth in response to emerging opportunities for advancing water sensitive practices. The WSTN could provide a useful forum to explore, trial and advocate for the opportunities identified in this report before an approach or mechanism is codified.

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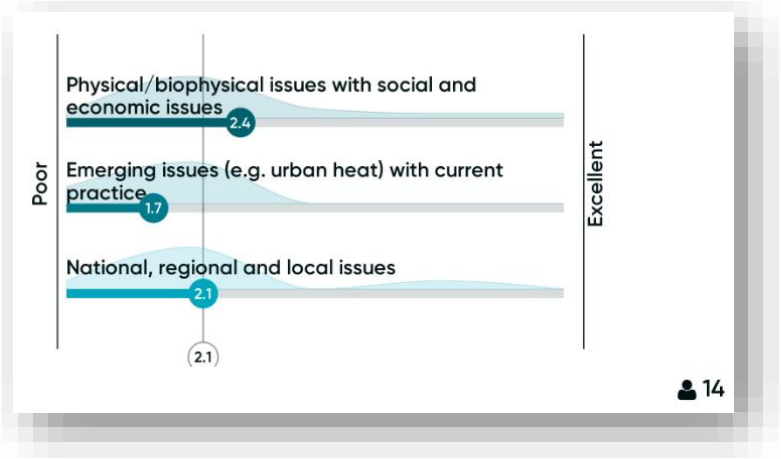
Appendix 1. ‘Dimensions of integration’ assessment of Perth

The ‘Dimensions of integration’ framework was tested for the first time with workshop participants in September 2019. Participants were asked to consider each dimension of integration and use the live voting tool ‘Mentimeter’ to rate Perth’s performance in relation to a series of questions, with an average score (between 1 [poor] and 5 [excellent]). The discussion that followed each poll was wide ranging, and is summarised below. The commentary under each dimension mirrors the issues covered in the discussion rather than a strict alignment of observations to the relevant dimension.

Substantive: Integration of interconnected issues across relevant scales



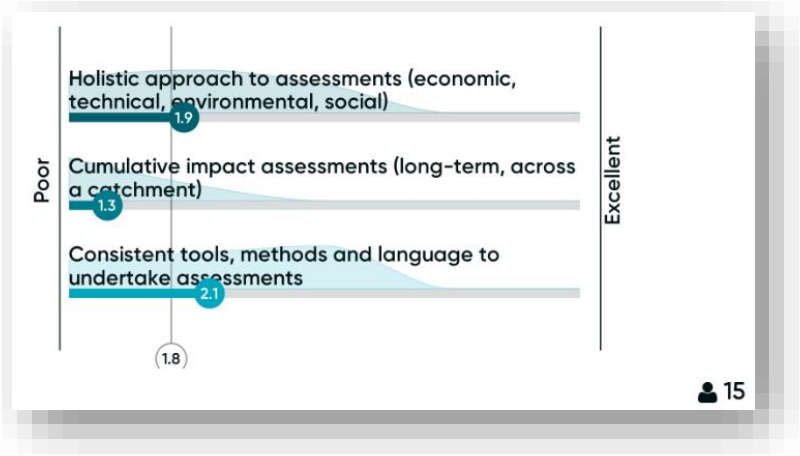
Participants considered that Perth ranked quite low (2.1 on average) for substantive integration. Direction is generally provided through single-issue policy (for example, bushfires) and there is limited guidance on how multiple, interconnected issues should be integrated or prioritised. This reduces the ability for decision makers to understand the unintended consequences of how decisions about one issue may affect another. It was felt that a collaborative process may be able to influence what is usually a binary decision making process—where one issue ‘wins’ over another.

Consideration of emerging issues, such as urban heat, often occurs through the formulation of reactive, single-issue policy, which can initially result in poor outcomes from unintended consequences. Participants also noted that relying on a process to deliver an outcome has risks, because it is often a product of the skills of the decision maker to understand technical information and make connections to state-level policies. This process can be strengthened, however, through a collaborative process that provides a safe space in which to share information and ask questions. Technical experts must also seek to express information in a context that supports planning decision making, and multidisciplinary teams are generally considered effective at delivering a cost-effective and practical outcome.

Methodological: Integration of different assessment approaches, tools and language

Participants ranked methodological integration a very low average of 1.8. Although a holistic approach to assessment generally considers social, environmental and economic outcomes, the final product is often driven by the need to meet the requirements of approval agencies. Participants suggested a greater focus on more detailed planning at a corridor or catchment level could facilitate a more comprehensive consideration of cumulative impacts and benefit–cost, and deliver the most appropriate outcomes. Planning agencies at the state level are best placed to lead this type of planning.

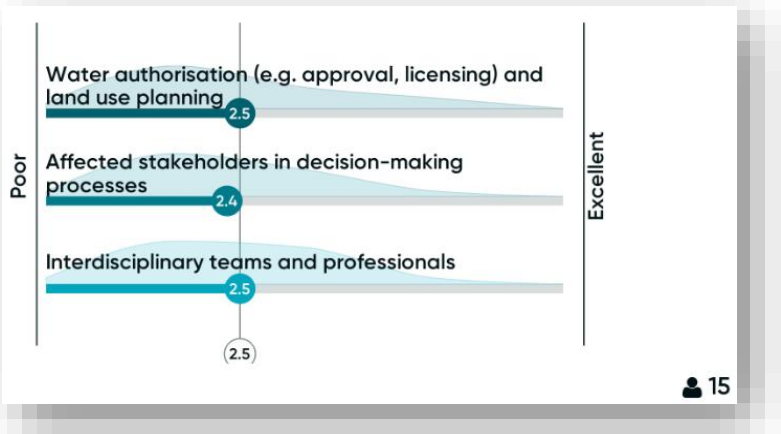
As noted in the previous discussion, participants felt people within a discipline used consistent tools and language, but there is a wide variability in many technical professions and a general lack of understanding across disciplines. Since people were generally able to conceptualise spatial or visual information, participants suggested presenting corridor level planning in spatial format (for example, clearly defined plans), with less text. Current conventions must also be challenged, to facilitate different outcomes. For example, participants



questioned assumptions around importing fill for new development. Similarly, the long-held position that only 10 per cent public open space is required to support urban development (that is, the remaining 90 per cent of land is developed for urban purposes) appears to be constraining new urban forms and limiting opportunities for WSUD based on land take. There is a need to challenge the perception that 'urban' is just residential housing, as opposed to industrial and commercial land, because this doesn't deliver a healthy community longer term.

Procedural: Integration and coordination of planning and approvals across different government sectors

Procedural integration was ranked the second highest of the dimensions at an average of 2.5, but it was felt that the current application of policy and procedures generally do not enable affected stakeholders to influence decision making. Standard referral processes are generally followed which limit the scope of referrals to agencies (so they receive only those which are considered important to their role), resulting in a lack of holistic consideration where 'unimportant' issues are ignored. This 'divide and conquer' approach results in disjointed advice with no framework within which to consider priorities and cumulative impacts.



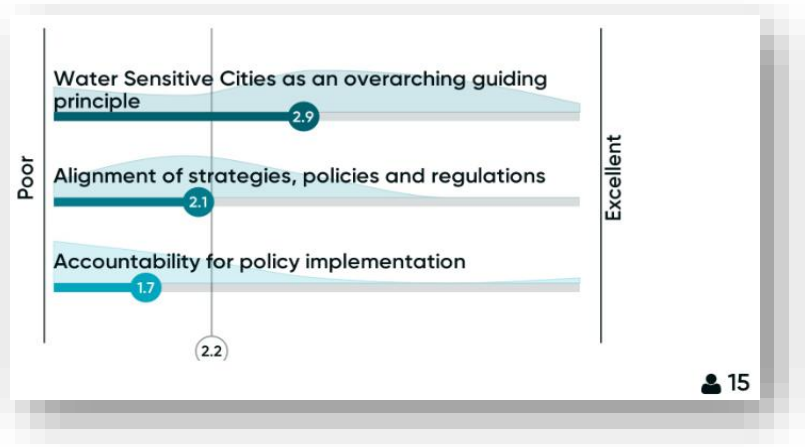
Industry also needs to recognise the procedures that are set in legislation or regulation are bigger than just a process and aim to achieve the intent of the legislation. For example, the groundwater allocation process is often challenged on a piecemeal basis with a lack of understanding that the underlying intent is to ensure the sustainability of the resource. It was also recognised, however, that the successful application of processes relies heavily on the level of resources (both people and skills) that are available.

Part of the room also felt procedural change was required to facilitate different outcomes, recognising that following the same process is likely to result in the same type of outcomes. An alternative view suggested that current processes are adequate, but that state-level policies need to clearly drive more integrated consideration and prioritisation of issues and outcomes, which would in turn create more effective procedures. This would rely on good relationships within and between proponent teams and regulatory agencies, so there was no need for top-down approaches which often resulted in resources being used in a reactionary and inefficient manner. Participants also suggested the need for greater clarity about what information was required to support the various planning decisions and why.

Policy: Integration and alignment of policy and decision making to advance water sensitive city principles

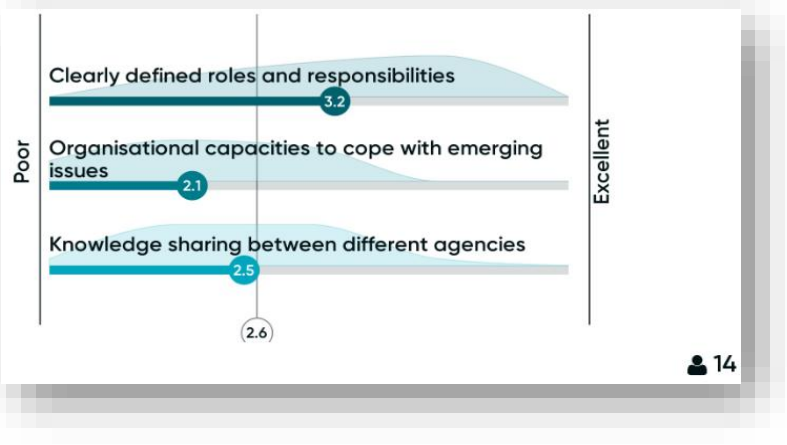
Participants noted Western Australia has one of the strongest policy frameworks for water sensitive cities (scored 2.9), but implementation was lacking in many areas. This could be attributed to a lack of consistency in policy interpretation, which partly reflects the limited capacity among planners to deliver site-specific outcomes that require discretion or technical judgement. Inexperience, a lack of technical support in decision making, and a preference for known maintenance costs and processes, often leads to a 'tick the box' approach to approvals. Where a 'deemed to comply' approach was required, participants suggested it should stipulate requirements that are 'higher' than standard practice and support a performance-based approach with additional technical justification where necessary.

The discussion of accountability for implementation ranged from being solely the responsibility of the policy author, to the proponent team developing the response, to the ultimate 'owner' of the created community, which is the local government. Participants did not reach consensus on this point. The ranking of accountability at 1.7 brought the average for the dimension to 2.2.



Institutional: Integration of organisational knowledge, capabilities, roles and responsibilities to effectively respond to policy goals

The institutional dimension was voted the strongest, at an average of 2.6. Participants felt roles and responsibilities were clearly defined by legislation, but narrow interpretations often restrict the ability of agencies to consider emerging issues or pursue related state outcomes, particularly in times of scarce resources. For example, although there was a desire for more strategic consideration of issues and planning for liveable communities, responsible actors are restricted to planning within their boundaries. This provided additional support for state government to undertake corridor planning at a greater level of detail and prescribe the urban form outcomes to be achieved spatially.



Participants also noted that a lack of resources and the time pressure to provide input often hampered knowledge sharing between agencies. This also reduced organisational capacity to cope with emerging issues.

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