

# Better Urban Water Management

October 2008



Department of Water  
Government of Western Australia



Australian Government

Department of the Environment, Water, Heritage and the Arts



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Published by the  
Western Australian Planning Commission  
Albert Facey House  
469 Wellington Street  
Perth Western Australia 6000

Published October 2008

ISBN O 7309 9974 2

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# Acknowledgement

This document has been formulated as part of the strategy for implementing water sensitive urban design on the Swan Coastal Plain, with particular regard for the Swan-Canning and Vasse-Geographe catchments. The strategy is a sub-program of the Coastal Catchments Initiative (CCI) for the Swan-Canning and Vasse-Geographe catchments. The development of the document is a partnership between the Departments for Planning and Infrastructure and Water, the Western Australian Local Government Association and the Australian Government Department of the Environment, Water, Heritage and the Arts.

The document has been prepared by a stakeholder reference group which comprises representatives from the following organisations.

- Department for Planning and Infrastructure (DPI)
- Department of Water (DoW)
- Western Australian Local Government Association
- Water Corporation (WC)
- Department of Environment and Conservation (DEC)
- Swan River Trust
- Swan Catchment Council
- GeoCatch
- Shire of Busselton
- Shire of Capel
- City of Armadale
- City of Bayswater
- City of Swan
- Urban Development Institute of Australia
- Planning Institute of Australia
- Institution of Engineers Australia, Society for Sustainability and Environmental Engineering
- Institute of Public Works Engineers

This document is based on the outcomes of two key water sensitive urban design demonstration projects – in Southern River and the Peel-Harvey coastal catchment. Both projects are significant partnerships with all stakeholders dedicated to improving the achievement of water sensitive urban design on the ground.

Agencies that have contributed significantly to the development of this strategy prior to the CCI program, include the Australian Government Department of the Environment, Water, Heritage and the Arts, DPI, DoW, Department of Agriculture and Food, WC, Peel Development Commission, City of Gosnells, City of Armadale, Peel-Harvey Catchment Council, Essential Environmental Services, APP, Parsons Brinckerhoff and GHD.

Thank you to all individuals for continually providing constructive comments.



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# Executive Summary

This document provides guidance on the implementation of *State Planning Policy 2.9 Water Resources* (Government of WA, 2006), which is a requirement of the *State Water Strategy for Western Australia* (Government of WA, 2003).

It is designed to facilitate better management and use of our urban water resources by ensuring an appropriate level of consideration is given to the total water cycle at each stage of the planning system. The document intends to assist regional, district and local land use planning, as well as subdivision and development phases of the planning process. It should be applied to both new greenfield and urban renewal projects where residential, commercial, industrial and rural residential uses and development are proposed, including in rural townsite areas. It is not intended to apply in brownfield or infill circumstances or to small scale subdivision or development proposals unless significant water management issues<sup>1</sup> are present.

This document provides a framework for how water resources should be considered at each planning stage by identifying the various actions and investigations required to support the particular planning decision being made. It also identifies the agencies responsible for provision of water resource information. Information derived at each planning stage can then be carried through to inform the subsequent planning stage(s). This will enable holistic planning decisions that are underpinned by informed consideration of the total water cycle.

Application of the recommended approach will ensure consideration of issues which are relevant to the site at a level of detail which is

appropriate to the planning decision being made and the degree of risk associated with the proposal, in terms of ecological and community impacts.

The planning process outlined in this document is the ideal process. In some cases, the planning actions undertaken for a proposed development may not follow the ideal process and the

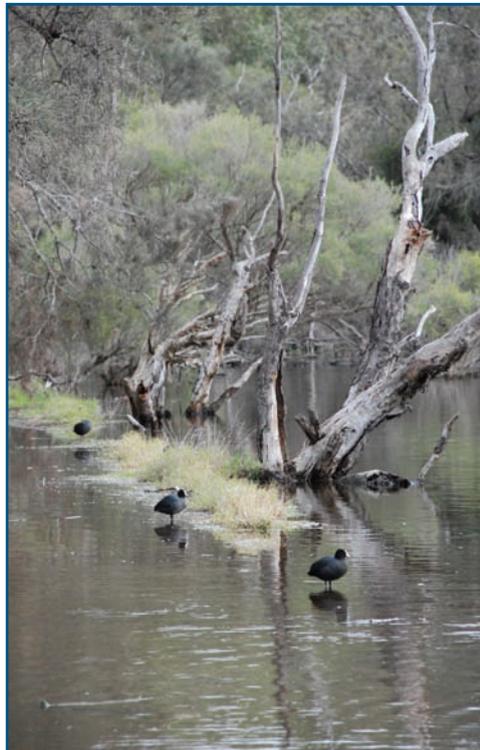
requirements for water planning should adjust accordingly.

This document recognises the need for a flexible approach to its implementation, particularly in areas of land use pressure where regional and district level information is not available, and where urban zoning exists. It identifies water quantity and quality design objectives that can be implemented in such cases.

If the planning process is conducted as recommended, the plans prepared will be consistent with the *State Water Plan (2007)*, the *State Water Strategy (2003)*, the

*State Planning Strategy (1997)*, *Liveable Neighbourhoods (2007)*, and *State Planning Policy 2.9 Water Resources (2006)*.

The proposed process and accountability for stages of the process is summarised in Table 1.



(courtesy of Swan River Trust)

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<sup>1</sup> see glossary in section 1.5

**Table 1: Summary of the planning process for achieving integrated water cycle management and the accountability for each stage.**

Planning stage/scale	Land planning tool	Water resources report	Summary of actions required at each stage	Responsibility for action
<p><b>1. Regional and sub-regional</b></p> <p>Greater than one local government area</p>	<p>Regional/sub-regional strategy, region scheme or regional/sub-regional structure plan.</p> <p>These documents are endorsed by the Western Australian Planning Commission (WAPC).</p>	<p>Chapter in regional/sub-regional structure plan or strategy supported by a regional water management strategy (as a technical appendix).</p>	<ul style="list-style-type: none"> <li>• Definition of regional objectives for total water cycle management.</li> <li>• Regional/sub-regional surface and groundwater investigations.</li> <li>• Mapping of water resources, watercourse catchments, water dependent ecosystems and existing drainage networks.</li> <li>• Identify significant water dependent environments to be protected.</li> <li>• Desktop historical land use assessment.</li> <li>• Assessment of proposed land use changes.</li> <li>• Water source planning and identification of options for re-use based on regional water balance.</li> <li>• Preparation of regional water management strategy (including strategic drainage plan). The regional water plan should be used as a foundation where available.</li> <li>• Preparation of regional strategic plan, having consideration of regional/sub-regional water resource information and strategy.</li> </ul>	<p>DoW</p> <p>DoW (NRM groups)</p> <p>DoW, DEC (wetlands)</p> <p>DEC, DoW</p> <p>DPI</p> <p>DoW, DEC</p> <p>DoW/WC</p> <p>DoW</p> <p>DPI</p>

Planning stage/scale	Land planning tool	Water resources report	Summary of actions required at each stage	Responsibility for action
<p><b>2. District</b></p> <p>Generally greater than 300 ha (but may not be in inner metropolitan areas), may be greater than one local government area</p>	<p>District structure plan, local planning strategy, region scheme amendment.</p> <p>These documents are endorsed by WAPC.</p>	<p>District water management strategy – separate document that accompanies the district structure plan, local planning strategy or region scheme amendment report.</p>	<ul style="list-style-type: none"> <li>Define catchment objectives and design objectives for water quality, quantity and conservation for local planning and subdivision.</li> <li>Define best planning practice.</li> <li>Determine potential impact of proposed land use change on catchment hydrology.</li> <li>More detailed ecological, surface and groundwater investigations and modelling, focusing on potential risk, including acid sulfate soils.</li> <li>Where required, more detailed mapping of catchments.</li> <li>Identify appropriate sources for drinking water and other uses, including options for re-use based on district scale water balance. Consider approvals required.</li> <li>Refine arterial drainage plan.</li> <li>Define ongoing management arrangements and responsibilities for urban water management.</li> <li>Preparation of district water management strategy which provides input into local planning strategy or district structure plan or region scheme amendment report. Include a chapter on water resource management.</li> </ul>	<p>DoW</p> <p>DPI</p> <p>DoW</p> <p>DoW/ local government</p> <p>DoW/DEC</p> <p>DoW/WC</p> <p>DoW/local government/WC</p> <p>WC/DoW/ local government</p> <p>DoW/ local government</p>

Planning stage/scale	Land planning tool	Water resources report	Summary of actions required at each stage	Responsibility for action
<p><b>3. Local</b></p> <p>Less than 300 ha</p>	<p>Local planning scheme amendment, local structure plan, outline development plan.</p> <p>These documents are endorsed by the WAPC.</p>	<p>Local water management strategy – separate document to accompany a local planning scheme amendment report and local structure plan (summarised in chapter in structure plan).</p>	<ul style="list-style-type: none"> <li>• Results of detailed monitoring and modelling of surface water and groundwater quality and quantity.</li> <li>• Local-scale water balance – options for water re-use and conservation strategy, including required approvals.</li> <li>• Identification of water management infrastructure and strategies required to meet design objectives.</li> <li>• Undertake site investigations, particularly where acid sulfate soils occur and contamination likely.</li> <li>• Define ongoing management arrangements and responsibilities for urban water management.</li> <li>• Preparation of local water management strategy, including requirements for monitoring and urban water management plans.</li> </ul>	<p>Developer with input from local government</p>
<p><b>4a. Subdivision - Application</b></p>	<p>Subdivision application.</p> <p>Approved by the WAPC with or without conditions.</p>	<p>Urban water management plan – separate document to accompany the application for preliminary subdivision approval.<sup>2</sup></p>	<ul style="list-style-type: none"> <li>• Further modelling of groundwater and surface water systems – build on previous results.</li> <li>• Specific best management practices and design of water management system, including stormwater, to meet design objectives.</li> <li>• Further acid sulfate soils/contaminated sites assessment where required.</li> <li>• Preparation of urban water management plan, including management of construction works, monitoring and maintenance arrangements.</li> </ul>	<p>Developer with input from local government</p>

<sup>2</sup> Where an approved local water management strategy exists, the urban water management plan will not need to be lodged with the application for subdivision but will be required to be lodged and approved prior to any site works as a condition of subdivision.

Planning stage/scale	Land planning tool	Water resources report	Summary of actions required at each stage	Responsibility for action
<b>4b. Subdivision – clearance of conditions and construction of subdivision</b>	Certificate of title after WAPC clears all conditions.		<ul style="list-style-type: none"> <li>Necessary clearances for contamination.</li> <li>Completion of subdivision condition requirements.</li> <li>Construction and management consistent with urban water management plan.</li> <li>Acid sulfate soils/contaminated site clearance.</li> </ul>	Developer with input from local government
<b>5. Development</b>	<p>Development application (where required) and building licence.</p> <p>Approved by local government.</p>	Building plans	<ul style="list-style-type: none"> <li>Identification of design requirements via developer covenant.</li> <li>Site works and management consistent with urban water management plan.</li> <li>Compliance with Water Corporation’s Waterwise Land Development Program.</li> <li>Initiation of monitoring program.</li> <li>Acid sulfate soils/contaminated site issues are addressed.</li> </ul>	Developer with input from local government
<b>6. Post-development</b>	N/A	Performance monitoring report	<ul style="list-style-type: none"> <li>Data collection.</li> <li>Data management.</li> <li>Data review: <ul style="list-style-type: none"> <li>Review principles and objectives of regional water management strategy</li> <li>Review objectives and procedures of district water management strategy</li> <li>Review assumptions of local water management strategy</li> <li>Review implemented best management practices</li> <li>Revise all documents as necessary to ensure improved performance of any future development</li> <li>Review groundwater data to detect water quality trend</li> </ul> </li> <li>Remedial action as necessary (identified through written agreements).</li> </ul>	<p>DoW, local government, developer</p> <p>DoW</p> <p>DoW</p>



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# 1 Introduction

Most areas proposed for future development in the Perth, Peel and the South-West regions have significant water resource management issues. Integrated water cycle management has been proposed as the most effective way to manage these resources in an urban development context, to achieve more efficient and effective use of water and better outcomes for the environment and urban form.

*Better Urban Water Management* provides a process for achieving better management of urban water through the application of integrated water cycle management via the planning system of Western Australia.

## 1.1 Integrated water cycle management

The urban water cycle should be managed as a single system in which all urban water flows are recognised as a potential resource and where the interconnectedness of water supply, groundwater, stormwater, wastewater, flooding, water quality, wetlands, watercourses, estuaries and coastal waters is recognised. Water efficiency, re-use and recycling are integral components of total water cycle management.

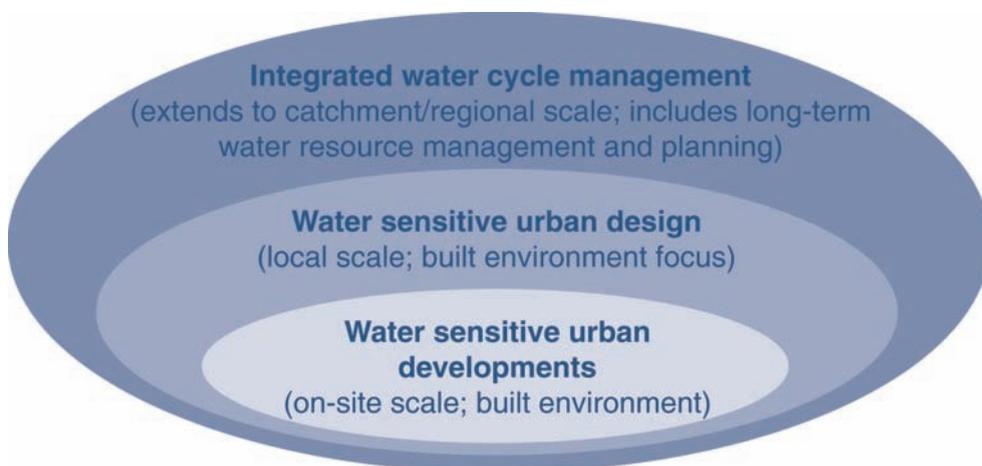
The National Water Commission has defined integrated urban water cycle management as:

*“The integration of water supply, sewerage and stormwater, so that water is used optimally within a catchment resource, state and national policy context. It promotes the coordinated planning, development and management of water, land and related resources (including energy use) that are linked to urban areas and the application of water-sensitive urban design principles in the built urban environment.”*

This is depicted in Figure 1 (from the National Water Initiative).

As outlined in *State Planning Policy 2.9 Water Resources* (Government of WA, 2006), the key principles of integrated water cycle management are:

1. consideration of all water resources, including wastewater, in water planning;
2. integration of water and land use planning;
3. the sustainable and equitable use of all water sources, having consideration of the needs of all water users, including the community, industry and the environment;



**Figure 1: Managing water resources in an urban development context**  
(Source: Adapted from National Water Commission, 2007)

- 
4. integration of human water use and natural water processes; and
  5. a whole-of-catchment integration of natural resource use and management.

Achievement of integrated urban water management may be facilitated through the use of water sensitive urban design techniques employed during planning, design and construction of urban developments. This design, developed in Western Australia in the 1980s for urban planning and design, provides a framework for minimising the impact of urbanisation on the natural water cycle. It addresses water quality, water quantity and water conservation, together with other social and environmental objectives.

General objectives of water sensitive urban design are (adapted from the *Stormwater Management Manual for WA, 2004-2007*):

1. To manage a water regime.
  - Maintain appropriate aquifer levels, recharge and surface water characteristics in accordance with assigned beneficial uses;
  - Manage groundwater recharge sustainably;
  - Prevent flood damage in developed areas; and
  - Prevent excessive erosion of waterways, slopes and banks.
2. To maintain and, where possible, enhance water quality.
  - Minimise waterborne sediment loading;
  - Protect riparian vegetation;
  - Minimise the export of pollutants such as phosphorus and nitrogen to surface or groundwater;
  - Prevent groundwater acidification processes; and
  - Minimise the export and impact of pollution from sewerage.
3. To encourage water conservation.
  - Minimise the import and use of scheme water;

- Promote the sustainable use of rainwater;
- Promote the sustainable re-use and recycling of wastewater;
- Reduce irrigation requirements; and
- Promote opportunities for localised supply.

4. To maintain and, where possible, enhance water-related environmental values; and
5. To enhance water-related recreational and cultural values.

Principles of stormwater management as a component of water sensitive urban design are to (adapted from the *Stormwater Management Manual for WA, 2004-2007*):

- Protect natural systems – protect and enhance natural water systems and their hydrological regimes in urban developments;
- Integrate stormwater treatment into the landscape – use stormwater in the landscape by incorporating multi-use corridors that maximise the visual and recreational amenity of developments;
- Protect water quality – protect from draining from urban development and minimise outputs of phosphorous, nitrogen and other pollutants;
- Manage run-off and peak flows – reduce peak flows from urban developments by using local detention measures and minimising impervious areas; and
- Add value while minimising development costs – minimise the drainage infrastructure cost of development.

## 1.2 Policy basis

The State Government has recognised the need for integrated water cycle management and water sensitive urban design to better integrate land and water planning through policy statements such as:

- *State Water Plan (2007)*
- *State Water Strategy (2003)*

- *Government Response to the Irrigation Review (2005)*
- *A Blueprint for Water Reform in Western Australia (2006)*
- *Draft Healthy Rivers Action Plan (SRT, 2006)*
- *State Planning Policy 2 Environment and Natural Resources (2003)*
- *State Planning Policy 2.9 Water Resources (2006)*
- *State Planning Policy 2.10 Swan Canning River System (2006)*
- *Planning Bulletin 64 Acid Sulfate Soils (2003)*
- *Planning Bulletin 92 Urban Water Management (2008)*

The *State Water Strategy* (Government of WA, 2003) identifies the importance of strategic planning for water resources, together with the need for an increased focus on total water cycle management and water sensitive urban design to improve the management of stormwater and increase the efficiency of the use of water.

### 1.3 Design objectives for water sensitive urban design

The following design criteria are to be used as a guide for development of the urban water management system for strategic planning, subdivision and development, unless other specific objectives have been defined in other approved water management plans/strategies. Demonstration of compliance with these design objectives may be through appropriate computer modelling or other assessment methods acceptable to DoW.

#### **Water Conservation – and efficiency**

##### **Principle**

No potable water should be used outside of homes and buildings with the use of water to be as efficient as possible.

##### **Design objectives**

Consumption target for water of 100 kL/person/yr, (*State Water Plan* target) including not more than 40-60 kL/person/yr scheme water.

#### **Water quantity management**

##### **Principle**

Post-development annual discharge volume and peak flow be maintained relative to pre-development conditions, unless otherwise established through determination of ecological water requirements for sensitive environments.

##### **Criteria**

Ecological Protection - For the critical one year average recurrence interval (ARI) event, the post-development discharge volume and peak flow rates shall be maintained relative to pre-development conditions in all parts of the catchment. Where there are identified impacts on significant ecosystems, maintain or restore desirable environmental flows and/or hydrological cycles as specified by DoW.

Flood Management - Manage the catchment run-off for up to the 1 in 100 year ARI event in the development area to pre-development peak flows, unless otherwise indicated in an approved strategy or as negotiated with the relevant drainage service provider.

#### **Water quality management**

##### **Principle**

Maintain surface and ground water quality at pre-development levels (winter concentrations) and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems in the sub-catchment in which the development is located.

##### **Criteria**

Contaminated sites - To be managed in accordance with the *Contaminated Sites Act 2003*.

All other land - If the pollutant outputs of development (measured or modelled concentrations) exceed catchment ambient conditions, the proponent shall achieve water quality improvements in the development area or, alternatively, arrange equivalent water quality

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improvement offsets inside the catchment. If these conditions have not been determined, the development should meet relevant water quality guidelines stipulated in the *National Water Quality Management Strategy* (ANZECC and ARMCANZ, 2000).

**Drainage** - Ensure that all run-off contained in the drainage infrastructure network receives treatment prior to discharge to a receiving environment consistent with the *Stormwater Management Manual*.

In addition, all outflows from subsoils should receive treatment prior to discharge to the stormwater system.

### **Stormwater modelling criteria**

If it is proposed to use a stormwater modelling tool to demonstrate compliance with design objectives, the following design modelling parameters are recommended.

As compared to a development that does not actively manage stormwater quality:

- At least 80 per cent reduction of total suspended solids
- At least 60 per cent reduction of total phosphorus
- At least 45 per cent reduction of total nitrogen
- At least 70 per cent reduction of gross pollutants

### **Disease vector and nuisance insect management**

To reduce health risks from mosquitoes, retention and detention treatments should be designed to ensure that between the months of November and May, detained immobile stormwater is fully infiltrated in a time period not exceeding 96 hours.

Permanent water bodies are discouraged, but where accepted by DoW, must be designed to maximise predation of mosquito larvae by native fauna to the satisfaction of the local government on advice of the Departments of Water and Health.

## **1.4 Planning and integrated water cycle management**

The planning system has a significant role to play in the achievement of total water cycle management and water sensitive urban design via strategic planning and the statutory approvals process. Better urban water management can be achieved through capacity building and assessing new development to ensure the principles and practices of integrated water cycle management are incorporated into the design and development of new urban and redevelopment areas. The consideration of water issues must be integrated with other planning and development matters, including natural resource management issues, so that land and water planning are undertaken concurrently, rather than independently and consecutively. The consideration of water should be founded on sustainability principles, where a comprehensive range of issues is assessed using a triple-bottom-line approach.

*State Planning Policy 2.9 Water Resources* (Government of WA, 2006) requires land use planning to contribute to the protection and wise management of water resources by ensuring local and regional land use planning strategies, structure plans, schemes, subdivisions, strata subdivision and development applications take into account total water cycle management and water sensitive urban design principles (outlined in schedule 4). It also ensures that development is consistent with current best management practices and best planning practices for the sustainable use of water resources, particularly stormwater, which is currently defined by the content of *State Planning Policy 2.9 Water Resources* and the *Stormwater Management Manual for Western Australia. Liveable Neighbourhoods* (WAPC, 2007) defines best planning practices for urban water management and includes specific requirements in element 5. Element 4 of *Liveable Neighbourhoods* also contains guidance on integrating stormwater into public parkland.

This document is focused on one element of consideration – water. The purpose of this document is to demonstrate how the consideration of water resources can be integrated into the land use planning system to ensure best practice urban water management

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outcomes are achieved on the ground, consistent with the *State Planning Policy 2.9 Water Resources*. The document establishes the information that needs to be generated and available at the appropriate time in order to inform the decision-making process. The level of detail and process timelines required are consistent with those of the land use planning system.

It is recognised, that in order to achieve water sensitive urban design, implementation of the recommended approach must be supported by a broader, complementary program that addresses key issues, assumptions, tools, monitoring,

assessment and learning. This approach is only one facet of the capacity building that will be required to achieve total water cycle management in Western Australia.

It is also noted that the information requirements identified in this document do not constrain DoW or DEC from requesting additional information where it is considered necessary to address a specific environmental issue.



## 1.5 Glossary

It is recognised that some of the terms and abbreviations used in this document are not commonly used in planning decision-making. The following descriptions are provided to aid understanding. Where necessary, clarification may be sought from DoW.

<b>ARI</b>	Average recurrence interval
<b>best management practice</b>	Best management practice for water sensitive urban design techniques may relate to structural and non-structural elements for water quality management, water quantity management and water conservation and efficiency.
<b>best planning practice</b>	Best planning practice to achieve water-responsive design outcomes, and as defined by <i>Liveable Neighbourhoods</i> (2007, element 5, page 2).
<b>controlled groundwater level</b>	The controlled (ie modified) groundwater level (measured in metres Australian Height Datum) at which drainage inverts are set. This level must maintain the hydrologic regimes of groundwater dependent ecosystems, such as wetlands, that are to be protected.
<b>CCI</b>	Coastal Catchments Initiative
<b>DEC</b>	Department of Environment and Conservation
<b>DoW</b>	Department of Water
<b>DPI</b>	Department for Planning and Infrastructure
<b>ecological water requirements</b>	The hydrologic regimes needed to maintain ecological values of water dependent ecosystems at a low level of risk. May be the objective for water dependent ecosystems where current hydrologic regimes are not maintaining ecological values.
<b>hydrologic regimes of water dependent ecosystems</b>	Patterns of water presence and absence, encompassing variations in the timing, frequency, duration, extent, depth, variation, direction and rate of flow.
<b>MRS</b>	Metropolitan region scheme
<b>LGA</b>	Local government area
<b>maximum groundwater level</b>	This level must be determined, through modelling and/or measurement. Where this information is not available from DoW, local studies shall be undertaken and endorsed by DoW. Where the level is at or less than 1.2 m of the surface, the importation of clean fill and/or the provision of sub-surface drainage will be required to ensure that adequate separation of building floor slabs from groundwater is achieved. In such instances, the sub-surface drainage will need to be placed at a DoW/DEC controlled groundwater level.
<b>PRAMS</b>	Perth Regional Aquifer Modelling System
<b>Significant water management issues</b>	In general terms this includes areas containing or adjacent to wetlands, significant vegetation, water source protection areas and waterways, and areas with high or medium risk of acid sulfate soils, high groundwater table, existing or potential for soil or groundwater contamination or high levels of nutrients. The presence of soils with low permeability or high gradients may also require specialist consideration.
<b>SQUARE</b>	Stream Quality Affecting Rivers and Estuaries – DoW model which can be used to assess the impact of land use change on rivers and estuaries
<b>WAPC</b>	Western Australian Planning Commission
<b>water dependent ecosystems</b>	Those parts of the environment, the species composition and natural ecological processes of which are determined by permanent, seasonal or intermittent water or waterlogged soils, including flowing or standing water and water in groundwater aquifers, wetlands and waterways.
<b>water sensitive urban design</b>	The philosophy of achieving better water resource management outcomes in an urban context by using an integrated approach to planning and incorporating total water cycle management objectives into the planning process. The key elements of this design include protection from flooding; management of water quantity and quality to achieve ecological objectives; and water conservation, efficiency and re-use.

## 2 The WA land use planning system

The WA land use planning system involves strategic and statutory planning activities. Strategic planning focuses on the longer-term goal and integrates a wide range of economic, social and environmental issues. Statutory planning is the legal arm of planning, dictated by legislation and regulations, which control the process of land use, land supply and urban development. Statutory applications should be guided by strategic plans and WAPC is unlikely to approve a planning application which is not consistent with, or supported by, an appropriate strategic plan.

### 2.1 Planning tools

The main planning tools are policies, strategies and plans. In general terms, policies provide guidance on how planning actions should be undertaken; identifying principles, key considerations and desired outcomes. Strategies provide a mechanism for implementation of policy and are usually focused on objectives, concepts and principles, which are then represented in a spatial form via a plan.

Strategies and plans are generally undertaken concurrently at each planning scale. This aids the achievement of optimal outcomes which can then be achieved via the land use planning process.

### 2.2 Planning process

The WA planning system is a hierarchical process which generally requires consideration of issues at decreasing scales before planning decisions are made. The following scales of planning are recognised (figure 2).

- state
- regional and sub-regional
- district
- local
- subdivision (a) application, and (b) clearance of conditions and construction
- development of lot

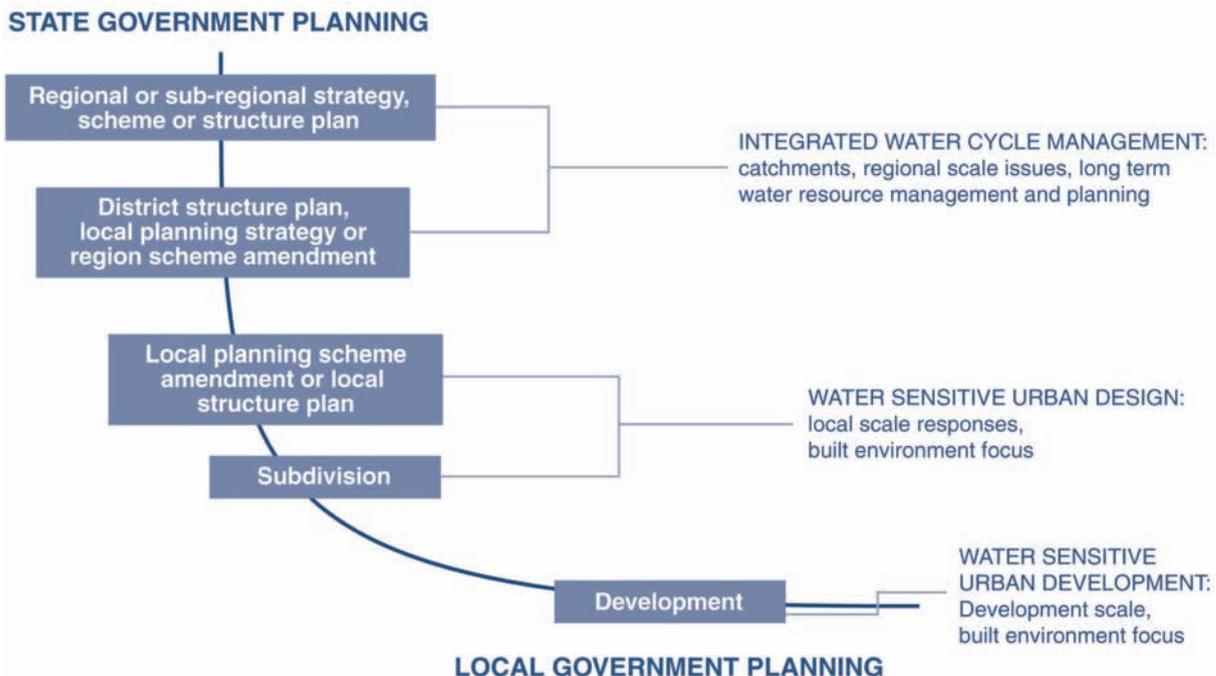


Figure 2: The WA planning system and linkages to water sensitive urban design terms

Ideally, the planning process commences at the state level and becomes more detailed as it progresses through regional, district and local planning to subdivision, through to construction of the subdivision and subsequent lots (housing or development). This is depicted in figure 2 which links the planning stages of the WA system with the terminology proposed by the National Water Initiative (figure 1).

The stage of planning is generally indicated by the area of coverage (scale) and corresponding planning tool (table 2), although it is recognised that individual interpretations may vary from this. The planning stage is also representative of the

type of planning decision being made, as evidenced by the planning tools which are used at different stages of the planning system. The range of planning tools are identified in table 2 and discussed in more detail in sections 2.2.1 to 2.2.6, as well as in sections 4.1 to 4.8.

### 2.2.1 State level

Direction for future land use and development of Western Australia is provided by the *State Planning Policy 1 State Planning Framework*. This framework sets out the general principles for planning and development and brings together existing state and regional policies,

Planning stage/scale	Indicative area of coverage	Strategic planning tool	Statutory planning tool	Responsibility for approval
<b>1. Regional and sub-regional planning</b>	>1 Local government area (LGA)	Regional/sub-regional strategy, regional/sub-regional structure plan	Region scheme	WAPC
<b>2. District planning</b>	Generally > 300 ha (may not be in inner metro areas), may be >1 LGA	District structure plan Development guide plan Local planning strategy	Region scheme amendment Local planning scheme	WAPC
<b>3. Local planning</b>	< 300 ha	Local structure plan/ local area plan/ outline development plan	Local planning scheme amendment Local structure plan/ local area plan/ outline development plan	WAPC/ local government
<b>4. Stage a: application for subdivision</b>	Large > 20 ha Small < 20 ha	Detailed area plan	Subdivision application with conditions Detailed area plan	WAPC
<b>Stage b: construction of subdivision</b>			Clearance of conditions Issuing of title	WAPC/ local government/ DPI
<b>6. Development</b>	Lot		Development application (sometimes) Building licence Developer covenant Local planning policy Local laws	Local government

**Table 2: Scales of the land use planning system and relevant planning tools.**

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strategies and guidelines into a central and comprehensive framework. It provides a context for spatial planning and decision-making by the WAPC, local governments and other responsible authorities. In particular, it informs these authorities of those aspects of state and regional policy which are to be taken into account, and given effect to in order to ensure integrated decision-making across all aspects of planning. It includes the *State Planning Strategy* (WAPC, 1997) which identifies a vision for the State in 2029 and provides a planning response to the challenges and changes likely to be faced in the future.

### 2.2.2 Regional and sub-regional planning

Regional level planning is generally “high level” strategic planning, which provides a broadscale framework for development of an area in the medium to long term (5 to 10+ years). Regional or sub-regional land use planning is usually facilitated by the preparation of a regional strategy or regional structure plan.

These strategies provide the broad framework for planning at the regional and sub-regional level and the strategic context for local planning schemes and region schemes. Regional strategies identify water management resources and issues of regional significance which can be used to underpin planning controls in region and local schemes.

Region schemes provide the statutory mechanism to implement regional strategies, coordinate the provision of major infrastructure and set aside areas for regional open space and other community purposes. The reservation of land for public space or catchment protection is fundamental to protecting and managing significant water resources and acquiring land for public use and enjoyment.

Although *Liveable Neighbourhoods* (WAPC, 2007) groups regional structure plans with district structure plans, the approach outlined in this document proposes to distinguish between

them. Regional structure plans are generally prepared by state government and generally cover more than one local government area. They provide regional guidance in areas where no region scheme exists.

### 2.2.3 District planning

District structure plans are identified in *Liveable Neighbourhoods* (WAPC, 2007) as generally larger than 300 ha. This level of planning is usually attributed to state government. However, table 2 classifies the local planning strategy and local planning scheme, which are both the responsibility of local government, as district-level documents. This is consistent with the area

of coverage of these planning tools, as they tend to apply to a whole local government area which is generally greater than 300 ha in size, with the exception of the inner Perth metropolitan councils. A district structure plan may also apply to an area less than the local government area.

It is recognised that classifying the local planning strategy and local planning scheme as district level tools may confuse some practitioners. Separating this broader level of planning from the more local planning that occurs via local structure plans, is considered to be the more important characteristic. This distinction is depicted more accurately in figure 2.

Local planning strategies set out the general aims and planning directions of local governments to be applied in promoting and controlling growth and change in their areas. The strategy interprets state and regional policies at the local level and provides the rationale for the zones, reservations and planning controls in the local scheme. These strategies will identify regional and local water management issues and help set the objectives and policies for the protection and enhancement of these resources.



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Local planning schemes provide the statutory mechanisms to implement strategies through zonings, reservations and planning controls. These schemes may apply to all or part of a local government area and are changed through an amendment process where supported by strategic planning and the local government.



Following preliminary approval of a subdivision application (with or without conditions), application will be made by the landowner for new titles. These will be granted only after all conditions, if any, have been satisfied. This usually requires the approval of both the detailed engineering

designs for services and roads, and their subsequent construction.

#### 2.2.4 Local planning

Planning at the local level is guided by the “higher level” strategic planning. This level of detail is enhanced via local structure plans and outline development plans, which provide the justification for zones and reserves represented in local planning schemes. They also provide guidance for the future subdivision of land.

#### 2.2.5 Subdivision

The WAPC is responsible for subdivision approval. The careful assessment and determination of planning and subdivision applications is important in ensuring state, regional and local objectives for the management of water are met and plans and policies put into place.

Subdivision is a two stage process; application for subdivision approval, followed by the issuing of titles following clearance of any subdivision conditions. Each phase is recognised distinctly in the document as different agencies are usually responsible for the approvals.

Subdivision applications are accompanied by a plan of subdivision which outlines the detail of lot sizes, streets, public open space and other points of detail. Occasionally this detail is further enhanced by detailed area plans which may be prepared for specific areas of a subdivision. Preparation of structure plans and subdivision applications should be guided by the objectives and requirements of *Liveable Neighbourhoods* (WAPC, 2007).

#### 2.2.6 Development

Planning at the lot level usually involves the design and construction of a dwelling or building. In some instances, this may be controlled by the local government via development application, particularly for industrial and commercial buildings. Few local governments require planning approval for a single house or residence. Building approval is likely to be a requirement and this may provide the opportunity for compliance with developer building covenants, local planning policies or local laws.

Applications for single or grouped dwellings, which are located partly in or abutting the Swan River Trust Development control area, require development approval in accordance with Clause 30A of the Metropolitan Region Scheme (MRS).

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## 3 Applying the approach

The approach outlined in *Better Urban Water Management* should be applied to both new greenfield and urban renewal projects where residential, commercial, industrial and rural residential uses and development are proposed, including in rural townsite areas. It is not intended to apply in brownfield or infill circumstances or to small scale subdivision or development proposals unless significant water management issues are present.

This document outlines the specific actions recommended at each of the six key stages of planning. It also establishes the relevant water management report in which this information will be presented.

It is proposed that reports are appended to the relevant planning reports and a summary provided as a chapter of the planning report. The name of each type of water management report is proposed, consistent with the respective planning report (table 3). These documents should not be confused with water planning documents listed in the *State Water Plan* (Government of WA, 2007) (section 3.1).

The information and investigations required to support each water management strategy and plan are detailed in the following sections. This information, together with an indication of current responsibility for the action, is summarised in table 1. Due to the nature of the investigations and information, it is recommended that all water management strategies and the urban water management plans are prepared and approved by suitably qualified personnel. In particular, hydrological and hydraulic analyses or design of drainage assets is to be undertaken by a design engineer or engineering firm. The design engineer is a person qualified to be a chartered professional engineer and an engineering firm is an organisation which primarily employs engineers.

It is recognised that further changes may be required to structures and governance to achieve efficient planning and management of water resources in WA in the future. These and other matters associated with implementation of the framework, are being addressed by relevant government agencies.

Guidance on the contents of the water management strategies and plans is provided in appendix 1, which contains checklists to aid the preparation of each document. The checklists may also be used as indicative chapter headings.

Further site-specific advice regarding investigations and content should be sought from the DoW, DEC, Water Corporation or the relevant local government, where necessary. DoW will also provide advice to DPI and local government, consistent with the approach outlined in this document, regarding the adequacy of each water management strategy and plan as part of the planning referral process.



**Table 3: Water management information to accompany planning actions**

	Land planning tool	Urban water management question	Water management report	Responsibility for preparation	Responsibility for approval	Responsibility for implementation
<b>Plan making</b>	Regional or sub-regional strategy, region scheme or regional or sub-regional structure plan	What are likely areas for land use change in the future that impact the use and management of water resources?	<b>Regional water management strategy</b> incorporating a strategic drainage plan – summarised in chapter of planning document and attached as technical appendix	State government agencies <sup>3</sup>	WAPC on advice of DoW	Responsibilities to be allocated in the water management strategy/plan
	District structure plan, local planning strategy, region scheme amendment	Is this area capable of supporting urban development and if so, what areas are required for water management?	<b>District water management strategy</b> – summarised in chapter of planning document and attached as technical appendix	State/local government planning agencies, depending on initiator of planning action	WAPC on advice of DoW	Responsibilities to be allocated in the water management strategy/plan
	Local planning scheme amendment, local structure plan	How will the proposed urban structure address water use and management?	<b>Local water management strategy</b> – summarised in chapter of planning document and attached as technical appendix	Landowner/local government, depending on initiator of planning action	WAPC on advice of DoW	Responsibilities to be allocated in the water management strategy/plan
	Subdivision proposal	How will the final urban form use and manage water?	<b>Urban water management plan</b> – accompanies application <sup>4</sup>	Landowner/developer	N/A	N/A
	Subdivision approval with conditions	Does the proposal comply with relevant strategies and plans?	Urban water management plan	N/A	WAPC impose water management conditions on advice of DoW or local government	Landowner or as allocated in the plan
<b>Development assessment</b>	Clearance of conditions and construction of subdivision	How does the lot layout comply with the conditions of subdivision?	Urban water management plan - if required as a condition of subdivision Engineering drawings and specifications - incorporates requirements of urban water management plan	Landowner/developer Landowner/developer	DoW or local government to clear local government	Landowner or as allocated in the plan Landowner or as allocated in the plan
	Development	What will be built on each individual lot?	Evidence of compliance with all relevant water management strategies/plans	Landowner/developer	Local government	Landowner/developer
	Post-development	Does performance of the estate/subdivision meet the design objectives?	Performance monitoring report	Developer	DoW/local government	Developer

<sup>3</sup> Water resource information to be provided by the Department of Water and other relevant agencies.

<sup>4</sup> Where an approved local water management strategy does not exist, an urban water management plan will be required to be lodged with the subdivision application.

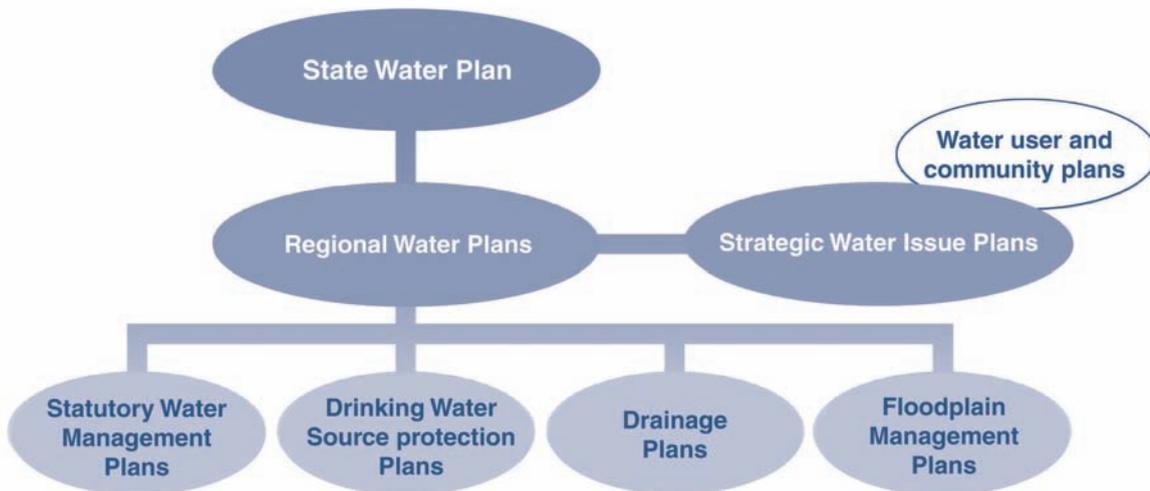
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### 3.1 Linking land and water planning

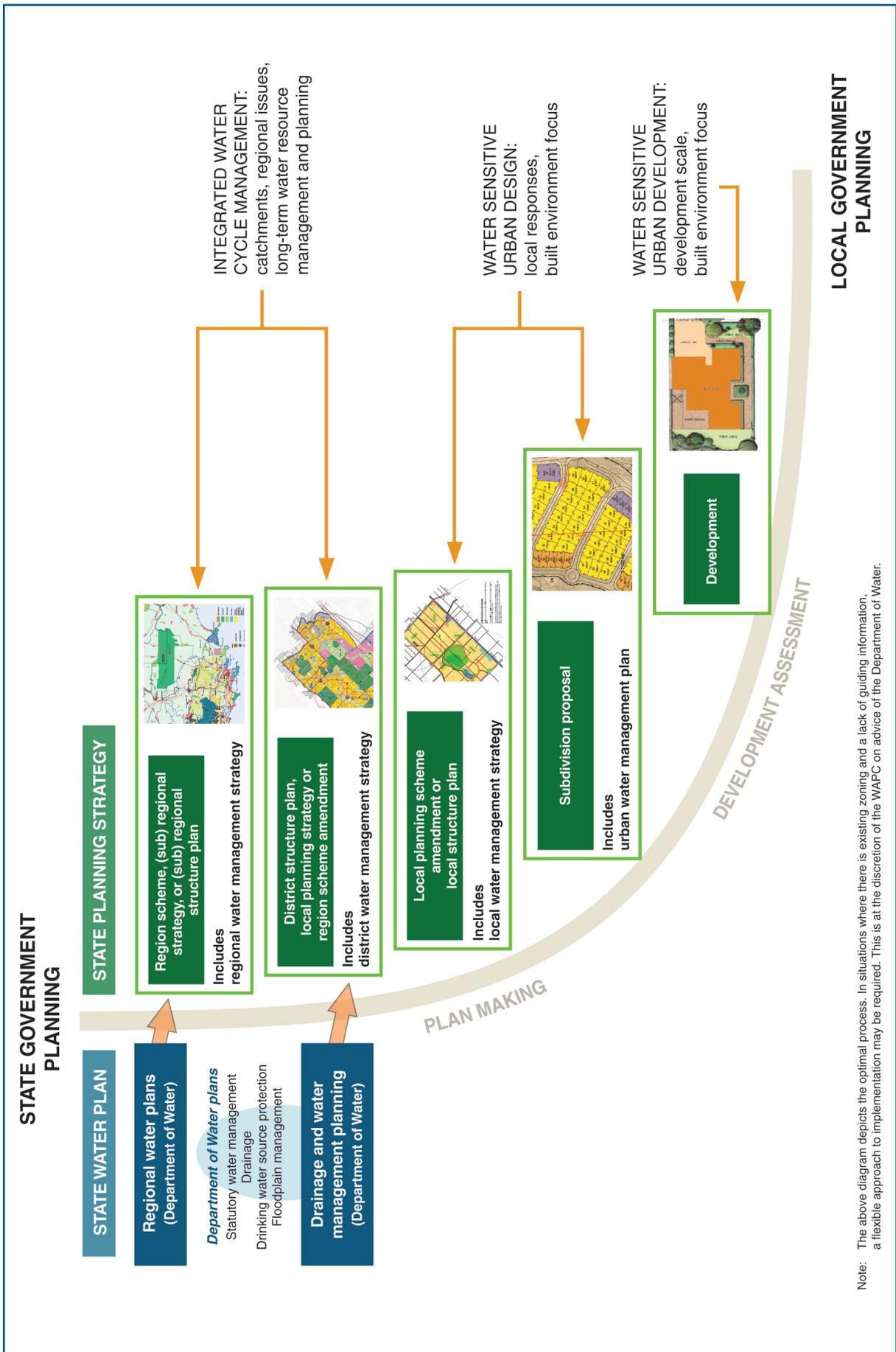
It should be noted that the foundation for this framework is the land use planning system – ensuring that appropriate water information is provided to support the land use decision being made. Strategic guidance will be provided by other water plans developed consistent with the water planning framework outlined in the *State Water Plan* (Government of WA, 2007) (figure 3).

A regional water management strategy, required by this document, does not necessarily correspond to a regional water plan outlined in the state water plan. A regional water plan should be prepared to support a regional or sub-regional land use planning exercise, such as a regional strategy or regional plan.

Similarly, information to guide decision-making at the district level may be contained in a drainage and water management plan prepared by DoW (a combination of the statutory water management plans, drinking water source protection plans, drainage plans and floodplain management plans). These plans are distinct from the district water management strategy which is required to be prepared to support district level planning, consistent with this document. This is outlined in figure 4.



**Figure 3: The water planning framework, as depicted in the State Water Plan (Government of WA, 2007)**



**Figure 4: Integrating water planning with land planning processes**

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## 3.2 Founding principles

Founding principles of the approach outlined in this document provide guidance on how it should be applied. These principles are:

- Informed decision-making – land use planning decision-making should be based on an appropriate level of information;
- Relevance – only issues that are relevant to the site and its surrounds require investigation and discussion, recognising that the planning process may not occur in an orderly fashion and that a practical approach should be applied where regional/district-level information is lacking, particularly in areas of development pressure; and
- Risk management – relevant issues should be investigated at a scale consistent with land use planning decision-making and to an extent that addresses the level of significance of the issue and possible risk to the community and environment.

### 3.2.1 Informed decision-making

The process of investigation, from the regional scale through to the lot level, has been designed to ensure that appropriate information is provided at the particular stage to inform the type of decision being made. At the regional scale, the planning decision should consider the areas likely for land use change in the future and how the land use change would impact the use and management of water resources. At the district scale, the decision is about whether the land is appropriate to be developed, ie zoned for urban (or other) purposes at some stage in the future. At the local scale, the planning decision should consider the urban form and how it will impact water resources and achieve stated design objectives and at the lot level, it is about how the building and landscaping results in better management and use of water resources. The process proposed in this document aims to ensure that planning decisions at all levels and scales are founded on adequate information (table 3).

### 3.2.2 Relevance

This document recommends investigations of varying nature and scale at each of the stages of planning. It is recognised that although some requirements are stated, the actual nature and



extent of investigation will depend on the specific site conditions. Only those matters which are relevant to the site and surrounds need be addressed in each document.

The findings of investigations and analysis undertaken for previous planning stages should be used as the basis for further investigation at subsequent stages. The actions are not intended to be repeated, rather built on and appropriate to the scale of the planning action being taken and responsive to the environmental conditions of the site.

The complete process depicted in figure 4 is the “ideal” case, as it describes the actions that should be undertaken where limited or no planning or development has occurred in the past, or the timing is such that a regional review of land use and future development is to be initiated. It is recognised that this is generally unlikely to be the case, and consequently a flexible approach to implementation of this strategy will be required.

Where some planning has occurred, particularly where urban zoning exists, the expectation is that sufficient information will be gathered to address significant water management issues to an appropriate level of detail to support the planning decision.

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### 3.2.3 Risk management

The approach outlined in this document aims to ensure that key issues are identified as early in the planning process as possible. For those issues unable to be resolved early, but which are not considered “fatal flaws”, a process should be developed which will ensure the issues are addressed at a subsequent stage and to an appropriate level of detail. Any issue identified as a potentially fatal flaw should be addressed at the immediate stage.

- to consider water-related issues in an overall sustainability context, where all issues are considered collectively to ensure the best overall outcome;
- to highlight issues which should be addressed at later stages; and
- the scale and nature of the work should be a direct response to the specific issues of the site and the type of development proposed.

As a guide, where preliminary investigations suggest an enhanced level of risk to the environment, community or water resource, more detailed investigations are suggested and the level of attention paid to an issue should correspond to the associated level of risk and/or significance. Simplistically, each management plan should identify significant water resources and assets as well as areas of risk (“the unknowns”) and address them if the information is available, or propose a strategy to address them at a later stage if appropriate.



(courtesy of Swan River Trust)

Issues should not be deferred until the subdivision stage. By the time a project has been through regional, district and local structure planning processes, the issues should have been fundamentally addressed and should not require resolution at the subdivision stage.

In summary, the key aspects to consider when applying this approach are:

- the need for flexibility and practicality in application, particularly in areas of existing urban zoning;
- to provide information in support of the planning decision being made;

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## 4 Process to integrate water management into the planning system

The proposed process for integrating total water cycle management and water sensitive urban design with the planning system is depicted in figure 4. It must be noted that this figure is only indicative of the process. It recognises that although the ideal process would be to start with regional planning and to work through the system in a timely manner, this does not always occur. Where the preceding documents have not been prepared, or where the information is not available, there is a need to apply the recommended approach in a flexible manner, so that appropriate information is provided to support the planning decision being made. Information is likely to inform other planning actions at larger as well as smaller scales. The following sections outline the work required to address water issues at each planning stage.

### 4.1 Stage 1: Regional and sub-regional land and water planning

A regional or sub-regional land use planning exercise must have consideration of the total water cycle and involve a degree of regional water planning. This includes identification and mapping of the appropriate surface water/river catchments to ensure that a catchment management approach is facilitated. A catchment map should be included in the regional structure plan report or strategy.

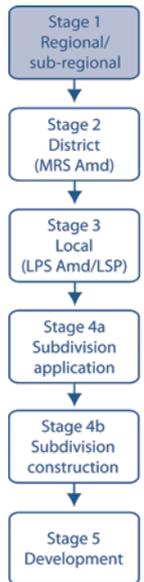
When a significant change in land use is being considered as part of regional or sub-regional land use planning, ie where there is pressure for development, the State Government together with local government should undertake necessary investigations and analysis (modelling) to allow assessment of the potential impact of the proposed land use change on the water resources of the catchment (eg using DoW's SQUARE model). This assessment should provide a key input to the final land use plan for the area and should be one of the first steps in the planning process to ascertain whether the land is suitable for development. This assessment is currently available in the Peel-Harvey coastal catchment and is being

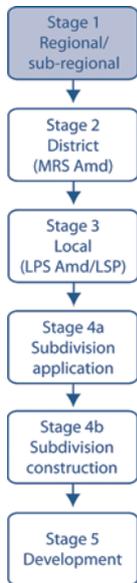
developed as part of a further Federal Government Coastal Catchment Initiative for both the Swan-Canning and Vasse-Geographe coastal catchments.

Where no modelling tool is available, land likely to be rezoned should be identified, having consideration of existing water resource information, and a commitment made as to how the necessary water management information will be obtained and considered as part of the planning process.

It is important to note the interrelatedness of the groundwater and surface water in many parts of Western Australia, particularly on the Swan Coastal Plain. In order to address this linkage, a regional (catchment) water balance should be established which calculates all water available in the catchment and allocates it to existing uses, eg environmental and human uses such as drinking water and irrigation. This will enable a preliminary assessment of how much water will be available for use subsequent to development and aid in the understanding of hydrological regimes of water dependent environments to be protected. It will also provide a preliminary indication of opportunities for non-drinking water sources for fit-for-purpose uses. The DoW's regional water plans may also provide this type of information.

Regional groundwater investigations should consider the range of groundwater levels likely to result from climate scenarios, including wet, long-term average and dry sequences. A groundwater model is likely to be required to undertake this assessment, supported by available groundwater monitoring data. This information should be used to aid the investigation of the hydrological regime of water dependent environments, including surface water and groundwater dependent ecosystems. It should also inform the setting of any controlled groundwater level, and preliminary assessment of the general drainage strategy, including the need for subsoil drainage and land fill requirements. Decisions on these issues are needed as input to development of a strategic drainage plan for the area.





It is anticipated that the regional surface and groundwater investigations, including mapping of the catchment and regionally significant water dependent environments, will be undertaken by the relevant state government agency (DoW and DEC respectively), as part of preparation of a regional water plan. For further information on these plans, refer to the *State Water Plan* (Government of WA, 2007). Where regional water plans have been prepared, they should provide the key input for water planning at a regional level. Further modelling of the results of the investigative work, as outlined in the plan may need to occur to provide benchmarks for future planning and development. Where a plan has not been prepared, wetland mapping may need to be undertaken or reviewed for inclusion in the regional water management strategy.

Natural resource management regional groups may be able to provide information (eg South-West, Peel-Harvey and Swan Catchment Councils). These groups' regional strategies contain information on the natural resources in a region and propose targets for their management. Work undertaken by natural resource management groups is likely to support both regional and district water planning. Opportunities exist to align their projects with water resource information needs through the natural resource management investment planning process.

The regional water management strategy, associated with a regional or sub-regional land use planning exercise, should:

- recognise the principles, objectives and requirements of total water cycle management as outlined in *State Planning Policy 2.9 Water Resources* (Government of WA, 2006), *Liveable Neighbourhoods* (WAPC, 2007) and the *Stormwater Management Manual for WA*, including the decision process for stormwater management (DoW, 2004-2007);
- scope the opportunities for achieving integrated solutions to regional planning issues and commit to a process of integrated assessment and consideration;

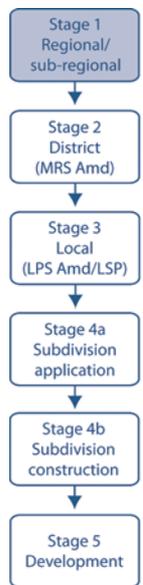


- propose local and regional catchment management objectives and preliminary design objectives for all elements of the total water cycle. Guidance should be obtained from any DoW regional water plan. Generic design criteria are contained in section 1.3. These should be applied in the absence of specific guidance from DoW and DEC;
- undertake necessary groundwater and surface water monitoring to provide sufficient information to build the regional picture and inform the land use evaluation;
- identify and map water resources, including estuaries, waterways, wetlands, groundwater and surface water protection areas, floodplains and foreshores. Also identify areas of native vegetation, environmentally significant areas and existing drainage networks, consistent with the requirements of *Liveable Neighbourhoods* (WAPC, 2007);
- map the surface and groundwater catchments and sub-catchments at a scale consistent with the proposed plan, and where supported by the land use scenario, use the boundaries as a basis for defining planning precincts;
- undertake a desktop analysis of past land use with the potential for contamination, including high levels of nutrients and other contaminants, to inform the land use evaluation;

- assess water sources for drinking water and other water needs, identifying any existing or future proclaimed water source catchments. Consider synergies with management of stormwater, groundwater and wastewater for supply of fit-for-purpose needs. Identify options for water re-use and commence feasibility assessment. Assess major infrastructure needs to maximise the opportunities for achieving integrated water cycle management. Work together with the relevant water service provider when undertaking water supply and wastewater planning. For further guidance see *Developing Alternative Water Supplies in the Perth Metropolitan Area Series* (Water Corporation, 2007);
- evaluate land use change scenarios to avoid or minimise significant surface and groundwater quality and quantity impacts. The use of a computer modelling tool is

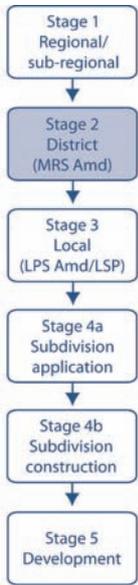
supported at this stage. The final land use scenario should deliver a water quality outcome consistent with relevant objectives;

- depict the location of environmentally significant areas, future conservation reserves, multi-use open space corridors, urban bushland belts and greenways, waterway corridors and wetlands to be protected for conservation; and
- identify future surface and groundwater quality and quantity, and ecological monitoring required, including the identification of responsibilities and required timing, to support more detailed planning, particularly the urbanisation of areas consistent with the assessed land use scenario.



Information needed to develop a regional water management strategy includes:

Surface and groundwater mapping, monitoring and modelling	<ul style="list-style-type: none"> <li>• Identify and map surface and groundwater catchments and/or sub-catchments, water dependent environments, including watercourses, wetlands, native vegetation, environmentally significant areas and existing drainage networks.</li> <li>• Identify areas to be protected for conservation purposes.</li> <li>• Identify baseline pre-development conditions to facilitate assessment of the proposed land use scenario, including groundwater levels and flow direction, natural or constructed drains and/or overland flow paths, wetlands and groundwater and surface water quality conditions at the regional (broad) level.</li> </ul>
Desktop historical land use assessment	<ul style="list-style-type: none"> <li>• Identify existing and past land use with the potential for contamination of soil and/or groundwater, including high levels of nutrients and toxicants.</li> <li>• Identify land having a high risk of acid sulfate soil occurrence consistent with <i>Planning Bulletin 64</i> (WAPC, 2003).</li> </ul>
Water balance modelling – catchment level	<ul style="list-style-type: none"> <li>• Determine pre-development sub-catchment water balance to inform the land use scenario assessment, and identification of options for reducing the need to import drinking water.</li> <li>• Ensure linkages with infrastructure planning programs to optimise opportunities for fit-for-purpose water usage.</li> </ul>



## 4.2 Stage 2: District planning

Rezoning to urban in region scheme areas should be supported by a regional or district structure plan. This plan is prepared by state or local government and should address the objectives and requirements of *Liveable Neighbourhoods* (WAPC, 2007). Consistent with *Liveable Neighbourhoods*, it is recommended that a district structure plan is supported by a district water management strategy. This strategy should be summarised as a chapter in the plan and linked as a technical appendix.

Where a district structure plan is not prepared but rezoning within a region scheme to Urban is proposed, it is recommended that a district water management strategy is also prepared. This is necessary to demonstrate that the land is capable of supporting urban development and able to achieve appropriate urban water management outcomes.

If land is currently zoned Urban Deferred, it is recommended that appropriate information, in the form of a district water management strategy, is prepared to support the lifting of the Urban Deferred zoning. It should be noted that the principles of informed decision making, relevance, and risk management should be applied to ensure that the level of information requested is appropriate.

It is anticipated that some level of water planning, ie broad level monitoring for groundwater and surface water quality and quantity, has occurred at the regional level, documented in a regional water management strategy. This information should be used as the foundation for developing the management strategy, as it will highlight the need for further investigation and identify areas requiring special attention. It is anticipated that the strategy builds on the findings of previous investigations and improves the level of understanding of water

resources at the district level. Where this work has not occurred, sampling and monitoring will be needed to describe the site appropriately.

Wastewater and drinking water planning are undertaken often at the sub-regional scale and often years in advance of detailed infrastructure planning. As infrastructure requirements have a significant influence on the potential for integrated water cycle solutions, liaison should occur between the planning body and the service provider to maximise options for reuse and recycling.

Although it is unlikely that the district structure plan area will conform to catchment boundaries, it is recommended that sub-catchment boundaries as near to and encompassing the district structure plan area are identified.

As at the district planning stage, the potential impact of any proposed land use change on sub-catchments and catchments should be determined. Use of the SQUARE and PRAMS models is supported, using input data generated from regional, sub-regional and district level monitoring. These models may be

used to inform catchment water management objectives and the determination of local-scale design objectives for the proposed land use and development. Generic design objectives are provided in section 1.3. Other design objectives may be identified by DoW through regional water plans or drainage and water management plans.

The district water management strategy should include the agreed arterial drainage network for the area to facilitate future planning for development. This is a key element of the strategy. It is imperative that the criteria and land requirements for drainage, and in particular flood management, are established at this time so appropriate land can be identified and mechanisms put into place to secure the land. It is recognised that from an engineering perspective, wetlands are often an obvious

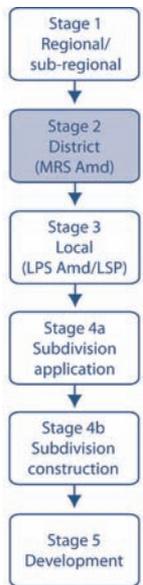


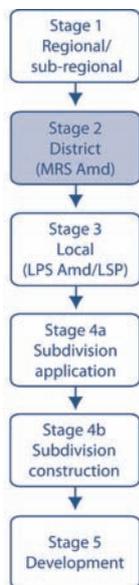
choice as land for flood storage. Therefore wetlands to be protected, as well as their buffers and hydrological regimes, need to be identified prior to identifying land for flood storage, so that wetlands are not considered for flood storage beyond their natural regime.

The district water management strategy, supported by findings at the regional and sub-regional level, should:

- recognise the principles, objectives and requirements of total water cycle management as outlined in the *State Planning Policy 2.9 Water Resources* (Government of WA, 2006), *Liveable Neighbourhoods* (WAPC, 2007) and the *Stormwater Management Manual for WA*, including the decision process for stormwater management (DoW, 2004-2007);
- state the water quantity and quality management objectives to be achieved, which address all elements of the total water cycle. Guidance is provided in section 1.3;
- broadly describe issues likely to influence the water management strategy in the study area due to existing infrastructure, existing land uses, possible groundwater pollution plumes and groundwater capture zones of significant wetlands and other water dependent ecosystems;
- where necessary, undertake more detailed desktop assessment of past land use with the potential for contamination, including high levels of nutrients;
- identify areas affected, or potentially affected, by acid sulfate soils;
- discuss potential water sources for drinking water and other uses, including irrigation of public open space, having consideration of impacts of use/allocation and infrastructure and management requirements, highlighting the preferred options for supply of non-potable water for fit-for-purpose use and giving consideration to major infrastructure needs. For further guidance see *Developing Alternative Water Supplies in the Perth Metropolitan Area Series* (Water Corporation, 2007);

- report broadscale ecological and surface and groundwater investigations (monitoring of at least 18 months, including two winters required for greenfield areas and unmodified ecosystems – this may be provided by comprehensive regional monitoring where available), modelling and analysis to provide:
  - hydrogeological parameters of the study area and relevant catchments, including groundwater level fluctuations over time and regional groundwater flow directions;
  - an assessment of regional groundwater quality, including resident catchment and aquifer conditions;
  - the hydrological regimes (ecological water requirements) of water dependent ecosystems to be protected so that they can be maintained; and
  - an assessment of the recommended land use scenario based on the above elements and any suggested modifications;
- provide an arterial drainage plan which identifies 100 year flow paths and levels, peak flow rates and storage requirements. This should include a discussion of appropriate (and likely) stormwater best management practice options to better manage water quantity and quality, derived from the *Stormwater Management Manual for Western Australia*;
- identify specific issues/areas likely to require specialised investigation and management at later stages of planning;
- demonstrate understanding of appropriate water sensitive urban design best management practices, including for potable and non-potable water usage, as defined in the *Stormwater Management Manual for Western Australia (chapter 4)*, and likely best planning practices to be utilised in the study area;
- provide strategies and recommendations for planning precincts to guide and control land uses and development where necessary;





- recommend strategies and responsibilities for local ecological, surface water and groundwater monitoring, both pre- and post-development, including data analysis, presentation and reporting mechanisms; and
- recommend an implementation framework identifying funding and ongoing maintenance responsibilities, including monitoring and technical review of the district-level strategy.

It is not considered appropriate for land to be rezoned to urban without completion of the district water management strategy, however minor amendments supported by a reduced level of information may be acceptable on advice of DoW and other relevant agencies, including DEC.

Additional guidance on the contents of a district water management strategy is provided in the checklist in appendix 1.

Work required to support the recommendations in the district water management strategy includes:

Water balance modelling – broadscale	Identify pre- and post-development water balances at the district-level scale to inform the determination of hydrologic regimes of water dependent ecosystems to be protected and options for use of potable and non-potable water sources. Identify future infrastructure requirements, options and necessary approvals. For further guidance see <i>Developing Alternative Water Supplies in the Perth Metropolitan Area Series</i> (Water Corporation, 2007).
Hydrological regime of water dependent ecosystems and ecological health	<ul style="list-style-type: none"> <li>• Monitoring of ecological health and hydrological regime of water dependent environments to be protected.</li> <li>• Determination of hydrologic regimes (ecological water requirements and environmental water provisions if necessary) of water dependent environments to be protected, and an indicative buffer. Refer to <i>Guidelines for ecological water requirements for urban water management</i> currently being developed by the DoW for further information.</li> </ul>
Desktop historical land use assessment	<ul style="list-style-type: none"> <li>• Where necessary, further identification and assessment of potentially contaminated sites or areas where high nutrients are likely to be found in groundwater.</li> <li>• Assessment for presence of acid sulfate soils consistent with <i>Planning Bulletin 64</i> (WAPC, 2003).</li> </ul>
Groundwater monitoring and modelling (mainly for high watertable areas)	<ul style="list-style-type: none"> <li>• Assess superficial/surficial groundwater quantity and quality.</li> <li>• Determine need for controlling the groundwater level and/or to import fill.</li> <li>• Identify an approach that avoids impacts on water dependent environments to be protected.</li> <li>• Identify potential for short-term or long-term mobilisation of nutrients and contaminants.</li> </ul>
Surface water monitoring and modelling	<ul style="list-style-type: none"> <li>• Mapping of existing natural and/or constructed drainage system and floodplains.</li> <li>• Identification of arterial drainage network required to support development, including modelling of 100 year flow paths, levels and storages.</li> <li>• Demonstration that potential impacts from development on surface water dependent environments to be protected have been avoided or minimised. Demonstrate that any potential impacts will not have a significant environmental impact.</li> </ul>

### 4.3 Stage 2: Local planning strategy

The scope and strategic nature of the local planning strategy provides the foundation for land use decisions in a municipality for the short and medium term. Local planning strategies are required to be prepared under the *Planning and Development Act 2005*, as part of the process of local planning scheme review, and therefore influence final statutory decisions about land use and development control. The strategy provides the rationale for land use planning decisions by identifying the constraints and opportunities in a local government area and balancing these with the aspirations of the community.

The local planning strategy should identify objectives for water resource management, together with other environmental, social and economic issues in the local government area, and propose strategies to achieve these objectives. Implementation of strategies, together with timing and responsibilities, should be identified and incorporated into the local planning strategy where possible.

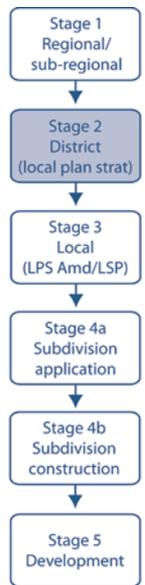
It is recognised that there are limited resources in local government to generate information via investigations which would be required to support development of a water management strategy on a local government scale. It is therefore recommended that the information be obtained from other sources, such as regional or district water management strategies, regional water plans or from state government

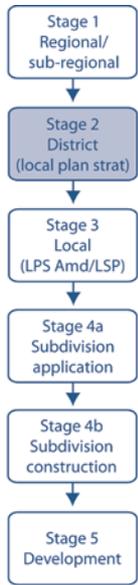


departments. Where the information is not available, advice should be sought from the DoW or other relevant agencies regarding when the information may become available. Preliminary advice may provide sufficient context and information to enable development of an appropriate water management strategy.

As a minimum requirement, the local planning strategy should:

- apply the requirements of state and regional planning policy, including *State Planning Policy 2.9 Water Resources* (2006);
- propose local and regional catchment management objectives and preliminary design objectives for all elements of the total water cycle. Generic design criteria are provided in section 1.3 and should be applied in the absence of any specific objectives from DoW and/or DEC;
- map the surface and groundwater catchments and sub-catchments, including significant water resources such as waterways and wetlands, and identify critical water resource management issues, including water quality;
- undertake a desktop analysis of past land use with the potential for contamination, including high levels of nutrients and develop a strategy to address at an appropriate time;
- discuss water sources for drinking and other water needs, including future settlement needs, identifying any existing or future proclaimed water source catchments and major infrastructure needs, eg waste water treatment plants. Consider synergies with management of stormwater, groundwater and wastewater for supply of fit-for-purpose needs. For further guidance see *Developing Alternative Water Supplies in the Perth Metropolitan Area Series* (Water Corporation, 2007);
- depict the location of future conservation reserves, multi-use open space corridors, urban bushland belts and greenways, waterway corridors and wetlands to be protected; and





- propose a strategy to ensure that surface and groundwater quality and quantity information is available at an appropriate time to inform future land use planning decisions.

Work required to support the recommendations in the local planning strategy includes:

Surface and groundwater mapping	<ul style="list-style-type: none"> <li>Map surface and groundwater catchments and/or sub-catchments, including water source protection areas.</li> <li>Show water dependent environments (eg wetlands, watercourses, estuaries), regionally significant vegetation/ habitat to be protected and indicative buffers.</li> </ul>
Desktop historical land use assessment	<ul style="list-style-type: none"> <li>Identify existing and past land use with the potential for contamination of soil and/or groundwater, including high levels of nutrients.</li> <li>Identify land having a high risk of acid sulfate soils consistent with <i>Planning Bulletin 64</i> (WAPC, 2003).</li> </ul>

Where supported by a regional or district water management strategy, the local planning strategy may address water resource management in more detail, providing an indication of current conditions, identifying risk areas and making recommendations for future action. Where a regional planning strategy/ structure plan has not been undertaken, a local government may wish the strategy to address the issues identified in section 4.2, to provide guidance necessary for future local-level planning consistent with the local planning strategy.



#### 4.4 Stage 3: Local planning – local planning scheme amendment



Where land is proposed to be rezoned prior to preparation of a local structure plan, the preference is to rezone the area to a “residential development” zone or industrial/commercial development zone, which requires preparation of a local structure plan prior to approval of any subdivision application. Subdivision and development are generally required to be “in accordance with” the approved structure plan, dependent on the individual local planning scheme.

The provisions of a residential development zone or industrial/commercial development zone should stipulate the requirements of the local structure plan. It is recommended that the plan requirements include, in addition to the usual requirements for structure plans, detailed information relating to potable and non-potable water use and surface water and groundwater management, outlined in a local water management strategy which should be appended to the local structure plan. The strategy should be consistent with any regional or district water management strategy produced as part of previous planning studies. Details of the recommended requirements of the local water management strategy are outlined in the next section.

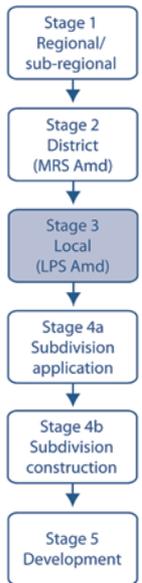
It is appropriate that consideration is given to development and gazettal of specific zone provisions to achieve stated outcomes. This may include, in addition to the local water management strategy stipulations, requirements

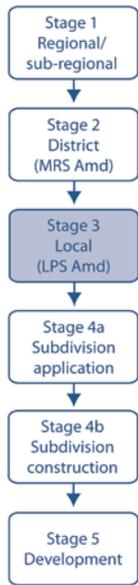
for new houses to be water efficient, to have domestic rainwater tanks plumbed into their water supply or to incorporate lot-level grey water systems. Consideration will need to be given to these sorts of provisions early in the process, to ensure that they are supported by the relevant water service provider and the Department of Health.

The zone provisions should also require advertising of the local structure plan to ensure that adequate public consultation occurs.

Support of the proposed land use change is generally provided by an accompanying local structure plan and local water management strategy (see next section). Where this is not provided, the following information is considered necessary to support amendment of a local planning scheme for urban use. This information should be obtained from the preceding district water management strategy, strengthened with additional investigations where necessary.

- Objectives for total water cycle management to be met through identified mechanisms, including future roles and responsibilities for demonstration of achievement.
- Identification of water dependent ecosystems, final determination and mapping of buffers, and demonstration that changes to the water quality and hydrological regime of water dependent ecosystems to be protected, have been avoided or minimised. Refer to *Guidelines for ecological water requirements for urban water management* currently being developed by DoW for further information.
- Detailed pre- and post-development total water balance, including consideration of imported scheme water, wastewater, stormwater and groundwater and how these interact with the environment, including the ocean (outfall).
- Likely sources and infrastructure requirements for water supply, and infrastructure for wastewater and stormwater management.





- Discussion of existing superficial/surficial groundwater quality and quantity based on a refinement of the regional/district level information. It is anticipated that preliminary site investigative work is undertaken including geotechnical investigation and groundwater sampling.
- A more detailed assessment of past land use in high-risk areas, including soil types and nutrient pathways.
- Description of existing stormwater management infrastructure and natural systems (including wetlands), and its impact on groundwater levels.
- Identification of the capacity of the receiving infrastructure and downstream environment to adapt to the post-development water balance, ensuring pre-development conditions are maintained or improved in water dependent environments to be protected.
- Broad assessment of any requirement for land form modification (fill) based on the above points, including an approach that avoids impacts on water-dependent environments to be protected.
- Description of how the development will meet the criteria in the arterial drainage plan (or DoW drainage and water management plan), supported by additional information indicating land requirements for flood management and how stormwater quality will be addressed.
- Issues to be addressed through local structure planning, subdivision and development.



## 4.5 Stage 3: Local planning – local structure plan



The local structure plan is a key document which guides the nature and form of development of an area. It provides the rationale for development and is a good indication of the developer's intentions for the area. The plan is required to provide detailed information regarding site characteristics and the context of the area. It also outlines constraints and opportunities associated with the site, and proposes mechanisms to deliver the identified outcomes. Detailed guidance on the expected contents of a local structure plan is contained in the model scheme text provisions on structure plans.

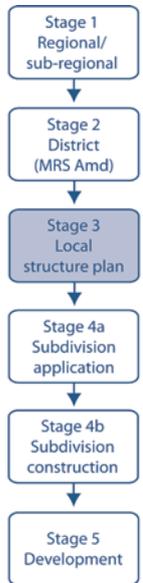
As outlined in section 4.4, the provisions of the residential, commercial or industrial development zone should require the local structure plan to incorporate a local water management strategy, consistent with any regional or district water management strategy. The information contained in the preceding regional/district water management strategy should provide the foundation for development of the local water management strategy, including identification of areas requiring specialised investigation. The findings and recommendations of the regional/district water management strategy should be acknowledged in the local water management strategy.

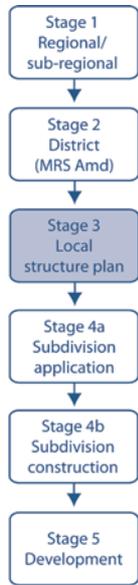
The local water management strategy should address the following:

- principles, objectives and requirements for total water cycle management as outlined in the *State Planning Policy 2.9*

*Water Resources* (WAPC, 2006), *Liveable Neighbourhoods* (WAPC, 2007) and the *Stormwater Management Manual for WA*, including the decision process for stormwater management (DoW, 2004-2007);

- existing site characteristics such as geology, hydrogeology and groundwater characteristics in more detail than the regional or district strategies. It is anticipated that preliminary site investigations are completed including geotechnical analysis and surface and groundwater sampling to identify site conditions which have relevance to the water management design;
- site constraints and opportunities (such as water dependent environments, remnant vegetation, landscape and landform), identifying the critical issues and how they are proposed to be managed;
- demonstration of the capacity of the land to sustain the proposed land uses including any management responses required to address:
  - the likely extent and severity of acid sulfate soils;
  - potential impacts on surface and groundwater quality and quantity;
  - potential impacts on ecosystems and biodiversity;
  - potential impacts on existing land uses in the vicinity;
  - any likely engineering constraints and impacts on infrastructure; and
  - cumulative impacts.



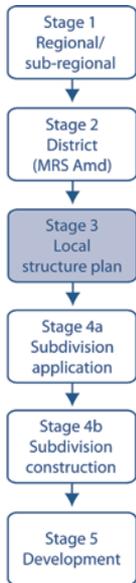


- conceptual urban water management system, including:
  - fit-for-purpose water use strategy – mechanisms (including those relating to development design and construction) to conserve potable water, minimise wastewater and re-use all forms of water, including stormwater. For further guidance refer to the Water Corporation’s *Waterwise Land Development Program* and *Developing Alternative Water Supplies in the Perth Metropolitan Area Series*, (Water Corporation, 2007);
  - quantification of land required for storage (detention) of stormwater for the critical 1 in 100 year ARI and 1 in 5/10 year ARI (as indicated by the appropriate local government);
  - identification of land required for retention of the 1 in 1 year, 1 hour ARI storm event and treatment of all run-off contained in the drainage infrastructure network;
  - calculation of the proportion of constructed impervious surface;
  - map of existing groundwater levels and any proposed controlled groundwater level (including use of subsoil drains and treatment prior to discharge) with justification for this control;
- demonstrated understanding of the concepts and key issues associated with choice of stormwater controls – identification of types of best management practices for management of water quality and quantity, and indicative drawings of possible treatment trains and design approaches;
- infrastructure and management requirements and proposed locations for proposed water, wastewater and stormwater systems, having consideration of infrastructure already existing and identifying any necessary approvals; and
- if wastewater re-use is to be undertaken, a wastewater re-use management plan is to be prepared as required by *Liveable Neighbourhoods* (2007);
- landscape concept for any public open spaces which identifies strategies to be used to minimise water and nutrient use. For further guidance refer to the Water Corporation’s *Waterwise Land Development Program*;
- where a constructed water body is proposed, this should be depicted on the structure plan, together with information in the local water management strategy outlining the purpose and design of the water body, and a proposed schedule for management and ongoing maintenance, including the recommended transfer process to local government and funding requirements and options;
- issues to be addressed at subdivision stage (included in an urban water management plan);
- recommended monitoring framework, pre- and post-development; and
- proposed implementation of strategy, including roles, responsibilities and funding for monitoring and maintenance.

Work required to support the recommendations in the local water management strategy (where relevant) includes:

<p>Water balance modelling</p>	<p>Identify pre- and post-development water balances to inform the assessment of options for reducing the need to import potable water through consideration of fit-for-purpose use (eg toilet flushing, laundry, hot water and ex-house). Consider approvals required to achieve desired options. For further guidance see <i>Developing Alternative Water Supplies in the Perth Metropolitan Area Series</i> (Water Corporation, 2007).</p>
<p>Water dependent ecosystems and ecological health</p>	<ul style="list-style-type: none"> <li>• Consider findings of district water management strategy (or DoW drainage and water management plan) and provide more detailed assessment where necessary.</li> <li>• Show buffers of wetlands and waterways to be protected.</li> <li>• Continue monitoring of ecological health and hydrological regime of water dependent environments to be protected. Demonstrate that the predevelopment scenario of these environments will be maintained post development. Where any changes to the hydrological regime are proposed, this should be demonstrated consistent with the <i>Guidelines for ecological water requirements for urban water management</i> currently being developed by DoW.</li> </ul>
<p>Desktop historical land use assessment</p>	<ul style="list-style-type: none"> <li>• Discussion of previous land use and likely impacts on the quality of surface run-off and shallow groundwater, and how this will be addressed by the proposed system, including further site ground truthing.</li> <li>• Determine the areas of high-risk acid sulfate soils and potential acid sulfate soils consistent with <i>Planning Bulletin 64</i> (WAPC, 2003). Where these areas exist, identify an appropriate management strategy to address them.</li> </ul>
<p>Groundwater monitoring and modelling (primarily for high watertable areas)</p>	<ul style="list-style-type: none"> <li>• Identify the current state of the resource at the local level, based on site investigations, including quality, direction of flow and levels.</li> <li>• Demonstrate that potential impacts to groundwater and water dependent environments to be protected are avoided or minimised. Demonstrate that any potential impacts will not have a significant environmental impact. Where any changes to the hydrological regime are proposed, this should be demonstrated consistent with the <i>Guidelines for ecological water requirements for urban water management</i> currently being developed by DoW.</li> <li>• Assess potential for short-term mobilisation of nutrients and contaminants resulting from development works as well as long-term impacts on groundwater quality from development. Where necessary, identify pollutant pathways.</li> <li>• Demonstrate need for controlled groundwater levels or subsoil drainage where proposed, identifying likely changes in groundwater levels.</li> <li>• Explore potential for use of shallow groundwater for a non-potable source.</li> </ul>
<p>Surface water modelling</p>	<ul style="list-style-type: none"> <li>• Floodplain and wetland modelling to determine minimum building levels, setbacks for development, and receiving water levels.</li> <li>• Flow monitoring of existing surface water streams to establish current requirement.</li> <li>• Identify how to manage post-development flows to meet catchment target flows.</li> <li>• Drainage modelling to determine the detailed land requirements and flood ways needed to cope with major and minor storms (1 in 1 year, 1 in 5/10 year and 1 in 100 year), based on the receiving environment's requirements and or design criteria provided in an endorsed water management strategy or plan.</li> <li>• Establish acceptability of location of surface water flow paths (streams) and floodwater storage areas (floodplains) in consultation with drainage service provider.</li> <li>• Identify and address potential impacts on surface water dependent ecosystems to be protected. Demonstrate that any potential impacts will not have a significant environmental impact. Where any changes to the hydrological regime are proposed, this should be demonstrated consistent with the <i>Guidelines for ecological water requirements for urban developments</i> currently being developed by DoW.</li> </ul>
<p>Monitoring of flows in existing streams or drainage systems</p>	<ul style="list-style-type: none"> <li>• Identify the current quality of any surface water flows.</li> <li>• Identify current quantity of flows which will be required to establish pre-development requirements, ie 1 in 1 year flows.</li> </ul>



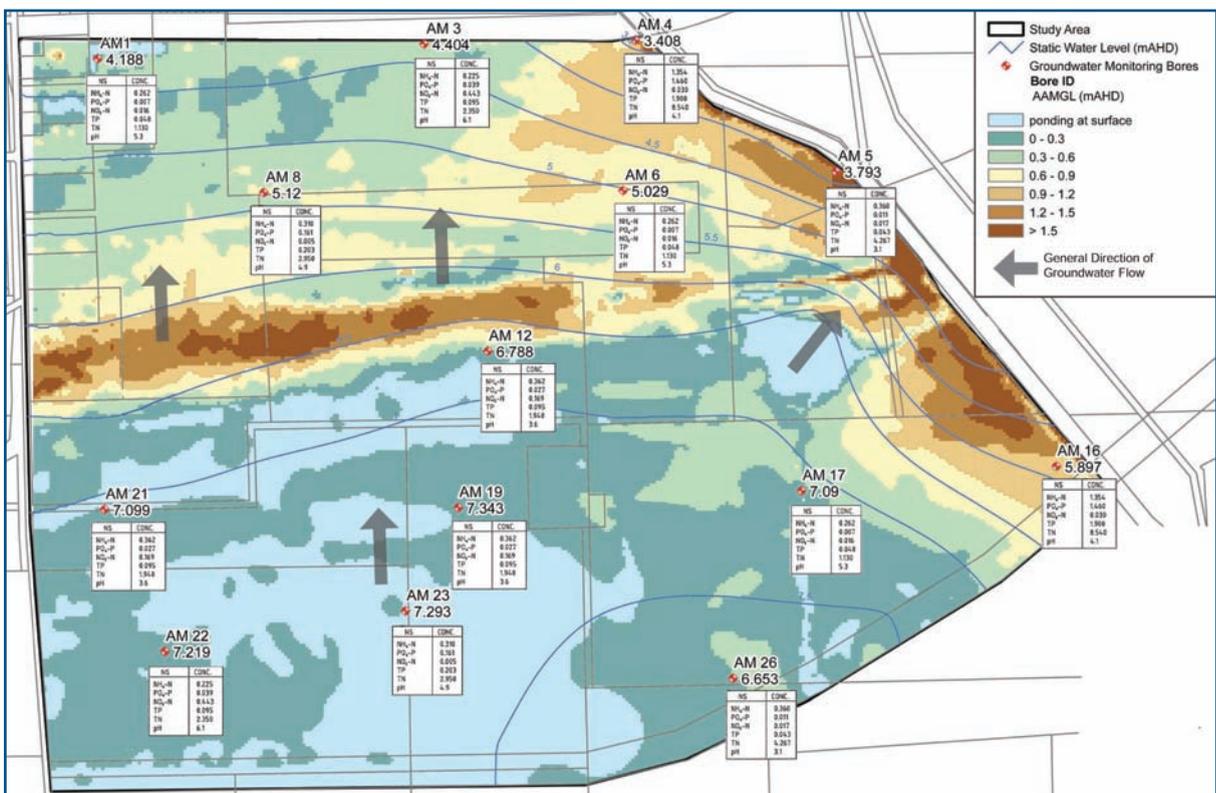


In greenfield areas and unmodified catchments including those with environmental assets, at least 12 months monitoring is suggested to establish accurate baselines and to support recommendations, particularly for groundwater levels, although 18 months, including two winters is preferred. This should be achievable in the usual planning timeframes where a monitoring program is established when commencing development of the plan. It should be noted that monitoring requirements are to be appropriate for the conditions of the catchment. Where catchments are highly modified and artificially controlled, an accurate description of those conditions is likely to be sufficient, on advice of DoW.

Where the local structure plan is not advertised in conjunction with the local planning scheme amendment, the provisions of the zone should require that the local structure plan and accompanying water management strategy is advertised prior to adoption. This ensures that appropriate feedback can be received from specialist agencies to ensure that the measures proposed in the local structure plan and water management strategy are adequate and consistent with their requirements.

Work required to identify local conditions should be undertaken by the landowner/developer (table 1). Where an area has fragmented ownership, it is likely that the most effective and efficient outcome would be achieved if this program was coordinated by the local government, with an agreed mechanism or arrangement between landowners for funding of the study. Where local government budgets permit, the work may be pre-funded by the local government, with costs recouped through development contributions schemes. A coordinated approach by several land owners to employ suitably qualified professionals to undertake the work would also be effective.

Further guidance on how to address urban water management at local structure plan stage is contained in DoW's guidelines for developing a local water management strategy (DoW, in preparation) *Liveable Neighbourhoods* (WAPC, 2007) and DoW's *Stormwater Management Manual for WA* (2004-2007), including the decision process which forms part of the manual. The local water management strategy checklist in appendix 1 may provide additional guidance on the contents of the document.



**Example groundwater plan** (courtesy of the Department of Water)

## 4.6 Stage 4a: Application for subdivision

Large subdivisions should be supported by an urban water management plan, as should small subdivisions in priority catchments or where there are significant risks to water resources. This plan should be undertaken instead of the conventional drainage and nutrient management plan.

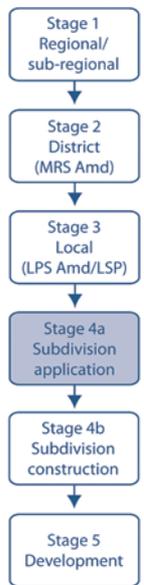
An urban water management plan is not generally required to support subdivision in infill/brownfield areas, unless the development is likely to impact on significant water resources. Subdivision or development in these circumstances should be consistent with the principles of *State Planning Policy 2.9 Water Resources* (WAPC, 2006) and the *Stormwater Management Manual for WA*, including the decision process which forms part of the manual (DoW, 2004-2007).

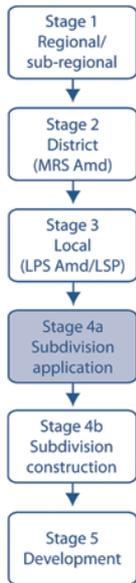
The urban water management plan is largely an extension of the local water management strategy, as it provides the detail to the design proposed in the local structure plan. The plan should address:

- compliance with the design objectives and other requirements as outlined in the local water management strategy. Demonstration of compliance with specified criteria and objectives should be achieved through appropriate assessment tools, calculations or assessments, to the satisfaction of DoW;
- site context – adjacent land use, soil profile, linkages between neighbouring lots, environmentally significant areas and buffers;
- agreed and approved measures to achieve water conservation and efficiencies of use, including non-potable supply. All approvals, designs, controls, management and operation of the proposed system must be outlined;
- management of groundwater levels and any proposed dewatering, including maintenance of ecosystem health. Proposals should demonstrate that the predevelopment hydrological regime of

water dependent ecosystems to be protected will be maintained. The following figures should be included:

- existing surface level, existing groundwater levels; and
- final surface level, final groundwater levels (amount of fill required);
- management of groundwater contamination “hot spots” and other specific site conditions, including acid sulfate soils and the potential for and management of increased export of contaminants;
- detailed stormwater management design, including the size, location and design of public open space areas; integrating major and minor flood management capability; and area of directly connected impervious surface. This will include maps of areas inundated in 1 year, 5 year and 100 year ARI events, information outlining required storages, invert levels, top water and peak flow levels, and information required to ensure integration with upstream and downstream systems. Where infrastructure provision is to be staged, this should be indicated;
- locations (mapped) and details of structural and non-structural best management practices to be implemented, including their maintenance requirements, expected performance and agreed ongoing management arrangements, including costs;
- management measures to be implemented to achieve protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages;
- strategies to minimise the use and application of nutrients in the subdivision on public and private open space. For further guidance refer to the Water Corporation’s Waterwise Land Development Program;
- detailed information supporting the purpose, design and management of any proposed constructed water body, including an assessment of lifecycle costs (including replacement);





- management of subdivisional works to prevent or ameliorate erosion (wind and water), sedimentation and turbidity (to ensure no impact on significant environments, maintenance of any installed best management practices and management of any dewatering at the construction stage of development);
- management of disease vector and nuisance insects such as mosquitoes and midges;
- monitoring program and/or contribution; and

Work required to support the urban water management plan includes:

Management of water dependent ecosystems	<ul style="list-style-type: none"> <li>• Show buffers for wetlands and waterways to be protected.</li> <li>• Continue monitoring of pre-development ecological health and hydrological regime of water dependent ecosystems to be protected so that accurate baselines can be determined.</li> <li>• Reference to a detailed survey of flora and fauna undertaken at an appropriate time to support management requirements proposed in the local structure plan.</li> </ul>
Site investigations	<ul style="list-style-type: none"> <li>• More detailed soil and site characteristics including infiltration capacity based on further site investigations, particularly in areas with significant water resources or issues.</li> <li>• Further field investigations for contamination or acid sulfate soils where required, consistent with DEC guidelines.</li> </ul>
Groundwater monitoring and modelling	<ul style="list-style-type: none"> <li>• Identify nutrient levels and pollutant pathways relating to background levels and contamination/nutrient hot spots.</li> <li>• Map groundwater level contours – existing and proposed.</li> <li>• Identify floor level heights and fill requirements.</li> <li>• If proposed, outline subsoil drainage strategy, including avoidance and management of impacts on water dependent ecosystems and treatment of subsoil drainage water, prior to discharge to the surface water system. The subsoil drainage strategy should also address areas with nutrient-rich groundwater.</li> <li>• Identify groundwater recharge rates.</li> </ul>
Surface water modelling	<ul style="list-style-type: none"> <li>• Demonstrate how post-development flows will meet catchment criteria.</li> <li>• Modelling of up to 1 in 1 year ARI event to determine capability for retention/detention and water quality treatment, where/if required.</li> <li>• Modelling of "minor" and "major" stormwater systems to identify and size flow paths (via pipes or overland flow) and required flood detention volumes.</li> <li>• Refinement of 1 in 100 year floodway if required.</li> </ul>
Conservation and efficient use of drinking water	<ul style="list-style-type: none"> <li>• Where non-potable water supply is proposed, detailed modelling of site water balance and demonstration of sustainable sources for non-potable, fit-for-purpose use (eg toilet flushing, laundry, hot water and ex-house). Any strategy should have the necessary approvals and agreements in place.</li> <li>• Strategy for irrigation and nutrient management of public open spaces to maximise water reuse and minimise potable water use and application of nutrients.</li> <li>• Alternative strategies to achieve water conservation objectives, including agreements and implementation mechanisms and expected performance.</li> </ul>

- implementation plan, including roles, responsibilities, funding and maintenance arrangements. Contingency plans should also be indicated where necessary. Clearly outline the actions to be undertaken by the developer to meet the requirements for improved urban water management outcomes.

Where an approved local water management strategy exists, the urban water management plan will be required to be lodged and approved prior to any site works as a condition of subdivision.

Recommended wording is as follows:

*“An urban water management plan to be prepared prior to commencement of ground disturbing activities, consistent with the [name] local water management strategy and the [name] [regional or district] water management strategy [delete if not appropriate], to the satisfaction of the WAPC on advice of DoW.”*

This ensures that if changes are required to the design to improve the performance of the urban water system, these can be done prior to commencing civil works. The timing of this approval has implications for construction schedules and landowners should allow at least four weeks for approval of urban water management plans.

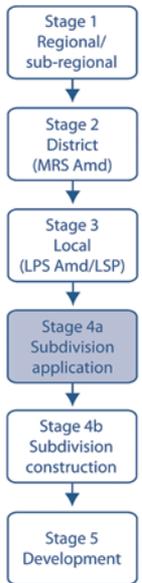
A condition to implement the urban water management plan will also be placed on the subdivision approval, such as:

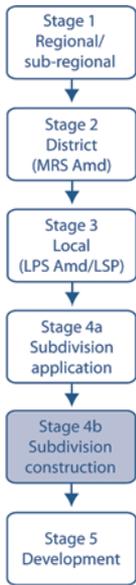
*“The approved urban water management plan shall be implemented by the landowner, including construction of the identified wastewater, stormwater and groundwater management systems, to the satisfaction of the WAPC on advice of local government.”*

Where no approved local water management strategy exists for a development area, an urban water management plan should be lodged with the application for subdivision, including for small subdivisions where water resource management is a priority. This will ensure that the detailed design is assessed at an appropriate stage in the process and enable appropriate changes to be made if required to incorporate water management measures.

The implementation condition will also be included as a condition of subdivision approval.

Further guidance on how to address urban water management at subdivision is contained in *Urban water management plans: guidelines for preparing plans and complying with subdivision conditions* (DoW, 2008), *Liveable Neighbourhoods* (WAPC, 2007), *Stormwater Management Manual for WA* (DoW, 2004-2007), the *Australian Run-off Quality Guidelines* (IEA, 2006) and *Australian Rainfall and Run-off* (IEA, 2001). Additional guidance on the contents of an urban water management plan is provided in the checklist in appendix 1.





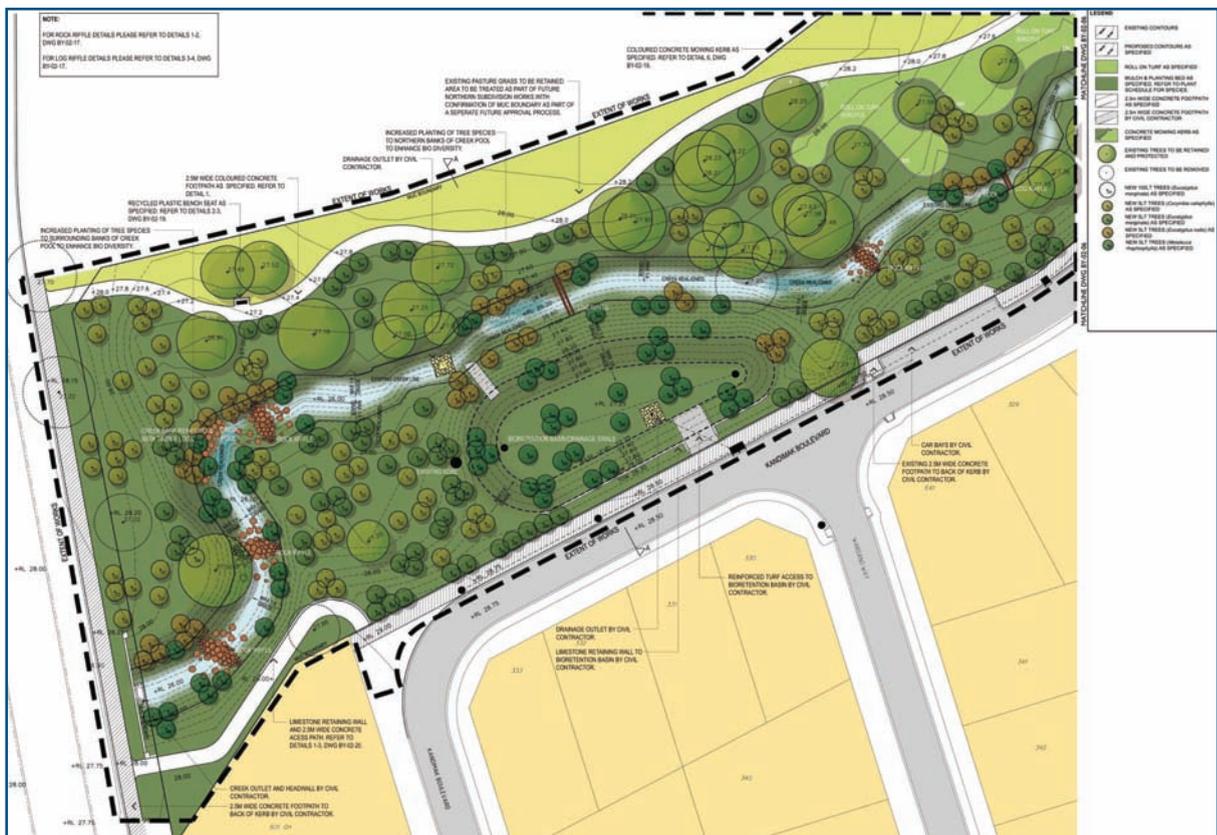
## 4.7 Stage 4b: Construction of subdivision

Actions at this stage of construction tend to be dictated by the need to clear the conditions of subdivision applied by the WAPC. Although it is a relatively short stage in the process, it can result in significant impacts on the water quality of receiving environments. These impacts result largely from dewatering, erosion and transfer of sediment.

There is a need to ensure that the subdivision is constructed in compliance with the approved urban water management plan, including water quality best management practices, stormwater management systems and measures to prevent erosion and control sediment transport. Sediment control is also particularly important during construction of housing. It is noted that many water quality treatment systems can be significantly impacted during this time if sediment and access to the treatment areas is not adequately controlled.

Monitoring of construction activities and approval of the final form of the subdivision is generally the delegated responsibility of the local government, through their role as clearing agency for the majority of the subdivision conditions. This includes approval of the engineering/construction drawings under section 170 of the *Planning and Development Act 2005*.

It should also be noted that where a subdivision application is not accompanied by the urban water management plan, appropriate advice from DoW will be required to clear the WAPC condition prior to commencement of siteworks. All efforts will be taken to ensure that any approval occurs in a reasonable period of time, although this will depend largely on the quality of information and level of justification of statements and actions in the urban water management plan. The department will also need to consult with local government as well as the service provider to ensure that the subdivision is designed and constructed to their requirements. The landowner should therefore allow time for approval of the plan in their subdivision construction schedule.



**Example landscape plan** (courtesy of the Department of Water)

## 4.8 Stage 5: Development



This stage relates to construction of the dwelling and/or building. It is recognised that certain elements of the local water management strategy and urban water management plan will be implemented during development. As the construction of a single house or conforming commercial structure does not usually require development approval, there is limited opportunity for statutory requirements at this stage and building approval is usually required. However conditions on development approvals should be explored in commercial and industrial areas to ensure implementation of strategies outlined in approved urban water management plans.

Where a development is in or adjacent to the Swan River Trust's development control area, it would need to be assessed by the Swan River Trust in accordance with the *Swan and Canning Rivers Management Act 2006* or the MRS. The urban water management plan may be used to substantiate the development application and accordingly, the Swan River Trust should be consulted early in the planning process regarding any proposal in their management area.

Significant advances in water conservation and water quality management, particularly where this relates to erosion, can be achieved at the design and construction stage of dwellings. This includes soil amendment underneath landscape and garden areas, xeriscaping and efficient

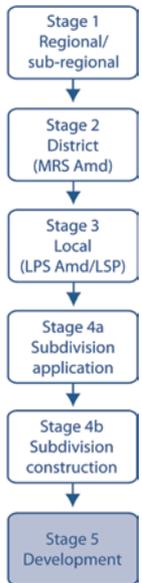
irrigation practices, lot-scale bioretention and wastewater reuse systems, rainwater tanks and water efficient fixtures and fittings. Management of sediment and erosion is also particularly important during the development phase so that water quality features and conveyance systems within the subdivision are not compromised by the influx of building sediment and litter. Access to treatment areas should also be controlled via sediment fences. Development must also connect to sewer where the connection to sewer exists.

Mechanisms to achieve improved outcomes at the development stage are largely through education and awareness programs or best practice land development guides such as the Water Corporation's Waterwise Land Development Program, or through requirements that are stipulated in the provisions of a zone in a town planning scheme.

Where no zone provisions have been created, a similar outcome may be achieved through using covenants imposed by developers. Covenants that require installation of water conservation and management devices, such as water efficient fittings and appliances, rainwater tanks, porous paving, xeriscaping and appropriate reticulation systems, are generally supported by state and local government.

Action is currently being taken to improve the resources of the Water Corporation's Waterwise Land Development Program and associated programs. This includes the development of practice notes that can be downloaded from the website and provided to interested parties at display homes and other appropriate venues. Other information is available at [www.yourdevelopment.org](http://www.yourdevelopment.org). This will improve the level of water conservation in new developments, although further action is likely to be required.

It is recommended that improvements are made to the Building Code of Australia to incorporate more stringent requirements for water efficiency and water reuse measures.





**The use of a purple-pipe system to supply an alternative fit-for-purpose water source for irrigation** (courtesy of the Satterley Property Group)

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# Appendix 1: Checklists to aid the preparation of water management strategy documents

## Checklist for integrated water cycle management assessment of regional/sub-regional strategy, region scheme or regional/sub-regional structure plan

1. Tick the status column for items for which information is provided.
2. Enter N/A in the status column if the item is not appropriate and enter the reason in the comments column.
3. Provide brief comments on any relevant issues.
4. Provide brief description of any proposed best management practices, eg. multi-use corridors, community based-social marketing, water re-use proposals.

Regional water management strategy item	Status	Comments/proposal
<b>Introduction and background</b>		
Understanding of integrated water cycle management		
Vision, principles and objectives		
Policy background		
<b>The regional plan area</b>		
Pre-development environment (described and mapped) – location and topography, climate, soils, environmental assets and receiving environments, existing surface water and groundwater characteristics, catchment boundaries, existing land uses, areas requiring special attention		
Previous studies/existing information, including any DoW water plans		
Information gaps		
<b>Design and performance criteria</b>		
Whole of catchment targets – potable water use, stormwater quality and quantity (including flood management), groundwater quality and quantity and wastewater and water re-use		
Sub-catchment targets as above		
<b>Analysis of development impacts and options</b>		
Regional water balance and sources of water for various uses (fit for purpose). Consider infrastructure needs and options		
Historical land use assessment – contamination, acid sulfate soils, nutrients		
Scenarios assessed by SQUARE and advice provided by DoW		
Response to findings of assessment		
Proposed land use scenario		
<b>Water management strategy</b>		
Post-development regional water balance and considerations		
Fit-for-purpose water use and allocation strategy		
Environmental asset (wetlands, waterways, remnant vegetation etc) management – identify and protect		
Water conservation and water use efficiency strategy		
Wastewater management and infrastructure planning needs		
Surface water management strategy – flood plain management, strategic drainage plan, regional structural requirements		
Groundwater management strategy		
Nutrient management strategy		
<b>Implementation</b>		
Monitoring, auditing and reporting		
Structure planning		
Subdivision		
Development		
Community consultation		
Assessment and review		
Resourcing requirements and commitments		
Information collation and transfer		

## Checklist for integrated water cycle management assessment of local planning strategy district structure plan or region scheme amendment

1. Tick the status column for items for which information is provided.
2. Enter N/A in the status column if the item is not appropriate and enter the reason in the comments column.
3. Provide brief comments on any relevant issues.
4. Provide brief description of any proposed best management practices, eg. multi-use corridors, community based-social marketing, water re-use proposals.

District water management strategy item	Status	Comments/proposal
<b>Introduction</b>		
Principles and objectives		
Previous studies and recommendations		
<b>Design and management objectives</b>		
Design objectives for potable water use, stormwater quality and quantity (including flood management), groundwater quality and quantity, wastewater and water re-use		
<b>Pre-development environment</b>		
Site characteristics – opportunities, constraints, areas requiring specialised investigation and management – discussed and mapped		
Hydrologic information – previous work, recent investigations, groundwater levels, flow and availability, groundwater and surface water quality identified and mapped, environmental water requirements identified, including waterway/wetland buffers		
<b>Analysis of development impacts and options</b>		
Assessment of proposed land use scenario by DoW (SQUARE)		
Response to assessment		
Strategies and recommendations for planning precincts to guide and control land uses and development where necessary.		
<b>Fit-for-purpose water source planning</b>		
Site water balance		
Allocation of water for all types of uses, including discussion of options		
Infrastructure (potable, non-potable, wastewater) – existing and required		
<b>Water management strategy</b>		
Drinking water conservation and efficiency of water use		
Surface water management strategy – flood management (flow paths, flow rates and levels at control points), conceptual stormwater management system, best planning practices, appropriate best management practices		
Groundwater management strategy – groundwater contours, levels and quality, allocation availability		
Wastewater management strategy		
<b>Implementation framework</b>		
Considerations and requirements for local planning		
Monitoring – pre-development, post-development, data analysis, presentation and reporting mechanisms		
Technical review		
Funding and ongoing maintenance responsibilities		

## Checklist for integrated water cycle management assessment of local structure plan or local planning scheme amendment

1. Tick the status column for items for which information is provided.
2. Enter N/A in the status column if the item is not appropriate and enter the reason in the comments column.
3. Provide brief comments on any relevant issues.
4. Provide brief description of any proposed best management practices, eg. multi-use corridors, community based-social marketing, water re-use proposals.

Local water management strategy item	Deliverable	<input checked="" type="checkbox"/>	Comments
<b>Executive summary</b>			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: Design elements and requirements for BMPs and critical control points	<input type="checkbox"/>	
<b>Introduction</b>			
Total water cycle management – principles & objectives Planning background Previous studies		<input type="checkbox"/>	
<b>Proposed development</b>			
Structure plan, zoning and land use. Key landscape features Previous land use	Site context plan Structure plan	<input type="checkbox"/> <input type="checkbox"/>	
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape Plan	<input type="checkbox"/>	
<b>Design criteria</b>			
Agreed design objectives and source of objective		<input type="checkbox"/>	
<b>Pre-development environment</b>			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		<input type="checkbox"/>	
Site Conditions - existing topography/ contours, aerial photo underlay, major physical features	Site condition plan	<input type="checkbox"/>	
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	<input type="checkbox"/>	
Environmental - areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental Plan plus supporting data where appropriate	<input type="checkbox"/>	
Surface Water – topography, 100 year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface Water Plan	<input type="checkbox"/>	
Groundwater – topography, pre development groundwater levels and water quality, test bore locations	Groundwater Plan plus details of groundwater monitoring and testing	<input type="checkbox"/>	
<b>Water use sustainability initiatives</b>			
Water efficiency measures – private and public open spaces including method of enforcement		<input type="checkbox"/>	
Water supply (fit-for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		<input type="checkbox"/>	
Wastewater management		<input type="checkbox"/>	
<b>Stormwater management strategy</b>			
Flood protection - peak flow rates, volumes and top water levels at control points, 100 year flow paths and 100 year detentions storage areas	100yr event Plan Long section of critical points	<input type="checkbox"/> <input type="checkbox"/>	
Manage serviceability - storage and retention required for the critical 5 year ARI storm events Minor roads should be passable in the 5 year ARI event	5yr event Plan	<input type="checkbox"/>	

Local water management strategy item	Deliverable	<input checked="" type="checkbox"/>	Comments
Protect ecology – detention areas for the 1 yr 1 hr ARI event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	1yr event plan Typical cross sections	<input type="checkbox"/> <input type="checkbox"/>	
<b>Groundwater management strategy</b>			
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoils areas/exclusion zones	Groundwater/subsoil Plan	<input type="checkbox"/>	
Actions to address acid sulfate soils or contamination		<input type="checkbox"/>	
<b>The next stage – subdivision and urban water management plans</b>			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design.		<input type="checkbox"/>	
<b>Monitoring</b>			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		<input type="checkbox"/>	
<b>Implementation</b>			
Developer commitments		<input type="checkbox"/>	
Roles, responsibilities, funding for implementation		<input type="checkbox"/>	
Review		<input type="checkbox"/>	

## Checklist for integrated water cycle management assessment of application for subdivision or urban water management plan

1. Tick the status column for items for which information is provided.
2. Enter N/A in the status column if the item is not appropriate and enter the reason in the comments column.
3. Provide brief comments on any relevant issues.
4. Provide brief description of any proposed best management practices, eg. multi-use corridors, community based-social marketing, water re-use proposals.

UWMP Item	Deliverable	<input checked="" type="checkbox"/>	Comments
<b>Executive summary</b>			
Development design elements and compliance with design objectives	Table 1: Design elements and compliance	<input type="checkbox"/>	
Key design requirements for detailed design – critical control points and elements	Table 2: Design requirements for critical control points		
<b>Introduction and planning approval</b>			
Location plan, adjoining lots, key landscape features and roads. Local Water Management Strategy. Structure plan, zoning and land use. Subdivision plan and/or approval	Location plan Site context plan Subdivision layout plan Or combination of above	<input type="checkbox"/>	
<b>Design objectives</b>			
Agreed design objectives and demonstration of compliance		<input type="checkbox"/>	
<b>Site characteristics</b>			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		<input type="checkbox"/>	
Site Conditions - existing topography/contours, aerial photo underlay, major physical features	Site condition plan	<input type="checkbox"/>	
Geotechnical - topography, test pit locations, soil zones and descriptions, site classification zones, proposed earthworks and approximate finished contour levels	Geotechnical plan	<input type="checkbox"/>	
Environmental - sensitive or significant vegetation areas, wetlands and buffers, waterways and buffers, contaminated sites	Environmental Plan plus supporting data where appropriate	<input type="checkbox"/>	
Surface Water – topography, 100 year floodways and flood fringe areas, 100 year proposed flow paths, water quality of flows entering and leaving (if applicable)	Surface Water Plan	<input type="checkbox"/>	
Groundwater – topography, test bore locations, groundwater pre development, groundwater post development, water quality details, groundwater variation hydrograph	Groundwater Plan plus details of groundwater monitoring and testing	<input type="checkbox"/>	
Landscape - proposed public open space areas, water source, bore(s), lake details (if applicable), approx watering requirements and water balance, indicative irrigation schedule. Demonstrate compliance with DoW Constructed Lakes Position Statement if applicable	Landscape Plan	<input type="checkbox"/>	
<b>Water use sustainability initiatives</b>			
Water supply and efficiency measures		<input type="checkbox"/>	
Fit-for-purpose strategy and agreed actions. If non-potable supply, support with water balance	Alternative Supply Schematic and Plan	<input type="checkbox"/>	
Wastewater management		<input type="checkbox"/>	

UWMP Item	Deliverable	<input checked="" type="checkbox"/>	Comments
<b>Stormwater and groundwater management design</b>			
Flood protection - peak flow rates, top water levels at control points, 100 year flow paths - floodways and flood fringe zones and/or along roads and reserves, 100 year inundation areas and volumes	100yr event plan Long section of critical points	<input type="checkbox"/> <input type="checkbox"/>	
Stormwater management system - storage areas, flows and hydraulic grade lines for both major and minor events including controlling inverts (critical control points). Locations and arrangements for agreed structural and non-structural best management practices and treatment trains supported by sizing criteria, areas of inundation, flow paths and cross sections. Show integration with landscaping	1yr event Plan 5yr event Plan Typical cross sections	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
Post development groundwater levels and fill requirements (including existing and final surface levels), outlet controls, and any subsoils (showing drawdown/impacts near sensitive environments). Describe modelling assumptions.	Groundwater/subsoil Plan Typical cross section (max and minimum)	<input type="checkbox"/> <input type="checkbox"/>	
Actions to address acid sulfate soils or contamination		<input type="checkbox"/>	
Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages		<input type="checkbox"/>	
Management of disease vector and nuisance insects		<input type="checkbox"/>	
<b>Management of subdivisional works</b>			
Management of construction activities including dewatering, acid sulfate soils, constructed best management practices, and dust, sediment and erosion control – timing and possible staging		<input type="checkbox"/>	
<b>Monitoring program</b>			
Sampling and assessment plan including duration and arrangements for ongoing actions		<input type="checkbox"/>	
<b>Implementation plan</b>			
Roles, responsibilities, funding for implementation		<input type="checkbox"/>	
Maintenance arrangements as agreed		<input type="checkbox"/>	
Assessment and review		<input type="checkbox"/>	