



Government of **Western Australia**
Department of **Water**

Guidelines for district water management strategies

Guidelines for preparing a district water management strategy to support a region scheme amendment or district structure plan

December 2013

Looking after all our water needs

Guidelines for district water management strategies

Guidelines for preparing a district water
management strategy to support a region scheme
amendment or district structure plan

Looking after all our water needs

Department of Water
December 2013

Department of Water
168 St Georges Terrace
Perth Western Australia 6000
Telephone +61 8 6364 7600
Facsimile +61 8 6364 7601
National Relay Service 13 36 77
www.water.wa.gov.au

© Government of Western Australia

December 2013

This work is copyright. You may download, display, print and reproduce this material in unaltered form only (retaining this notice) for your personal, non-commercial use or use within your organisation. Apart from any use as permitted under the *Copyright Act 1968*, all other rights are reserved. Requests and inquiries concerning reproduction and rights should be addressed to the Department of Water.

ISBN 978-1-922124-05-0 (online)

The recommended reference

Department of Water 2013, *Guidelines for district water management strategies: Guidelines for preparing a district water management strategy to support a region scheme amendment or district structure plan*, Department of Water, Perth.

Acknowledgements

This document was prepared by the Department of Water's Peel Region on behalf of the Urban Water Management Branch. We thank staff across the department, including the regions, for their contribution to this publication.

For more information about this report, contact:

Jane Sturgess
Urban Water Management Branch
Email: jane.sturgess@water.wa.gov.au
Telephone +61 8 9550 4228
Facsimile +61 8 9581 4560

Disclaimer

This document has been published by the Department of Water. Any representation, statement, opinion or advice expressed or implied in this publication is made in good faith and on the basis that the Department of Water and its employees are not liable for any damage or loss whatsoever which may occur as a result of action taken or not taken, as the case may be in respect of any representation, statement, opinion or advice referred to herein. Professional advice should be obtained before applying the information contained in this document to particular circumstances.

This publication is available at our website <www.water.wa.gov.au> or for those with special needs it can be made available in alternative formats such as audio, large print, or Braille.

Contents

Preface	v
1 Introduction	1
1.1 Purpose of a district water management strategy	1
1.2 Aim of this document	1
1.3 Application of this document.....	1
2 Urban water management planning	3
3 Developing a district water management strategy	7
3.1 When to prepare a district water management strategy.....	7
3.2 What should be addressed in a district water management strategy	7
4 Issues that may require special consideration	20
4.1 Crossing local government boundaries	20
4.2 Fragmentation of land ownership	20
4.3 Non-drinking water proposals.....	20
4.4 New/private water services providers.....	21
Appendices	22
Appendix 1 – District water management strategy guide.....	22
Appendix 2 – Example figures	26
Shortened forms	37
Glossary.....	38
References	41

Figures

Figure 1 Integrating water planning with land planning processes	3
Figure 2 Example location plan.....	27
Figure 3 Example aerial photo of the site.....	28
Figure 4 Example district structure plan – proposed land use	29
Figure 5 Example geotechnical plan	30
Figure 6 Example acid sulfate soils risk map	31
Figure 7 Example environmental and social considerations	32
Figure 8 Example groundwater and topographic contours (depth to groundwater), wetlands, public drinking water source areas	33
Figure 9 Example surface water hydrology.....	34
Figure 10 Example arterial drainage plan	35

Tables

Table 1	Principles and objectives for water sensitive urban design	9
Table 2	What to include in a district water management strategy	13

Preface

Water management reports need to be prepared to implement *Better urban water management* (Western Australian Planning Commission 2008). These reports 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.

These water management reports include:

- regional water management strategies (RWMS)
- drainage and water management plans (DWMP)
- district water management strategies (DWMS) – the subject of this document
- local water management strategies (LWMS)
- urban water management plans (UWMP).

The water management reports assist with the implementation of:

- *State planning policy 2.9 Water resources* (Western Australian Planning Commission 2006)
- *Liveable neighbourhoods: a Western Australian government sustainable cities initiative* (Western Australian Planning Commission 2007)
- *Better urban water management* (Western Australian Planning Commission 2008)

Figure 1 shows the integration of water planning with land planning processes.

1 Introduction

1.1 Purpose of a district water management strategy

A District Water Management Strategy (DWMS) is a high level water management report which is a requirement of *Better urban water management* (BUWM) (Western Australian Planning Commission 2008). The report accompanies a district structure plan or region planning scheme amendment and is prepared by the initiator of the planning proposal.

The purpose of a district water management strategy (DWMS), as outlined in *Better urban water management*, is to demonstrate that the land is capable of supporting the change in land use and is able to achieve appropriate urban water management outcomes. The DWMS informs the decision making process associated with the proposed land use change. This involves demonstrating that the development:

- will not detrimentally impact water resources and associated environmental values
- can manage surface water and groundwater
- can be serviced with water and wastewater.

1.2 Aim of this document

This document aims to guide proponents¹ and their representatives, decision-making authorities, advisory agencies and local government on the preparation of a DWMS as required under *Better urban water management* (Western Australian Planning Commission 2008).

This guideline describes:

- when a DWMS is required
- how a DWMS should be prepared and presented
- what information a DWMS should contain.

1.3 Application of this document

The Department of Water applies these guidelines when assessing and determining a DWMS. Guidance on the purpose and content of other water management documents in *Better urban water management* (Western Australian Planning Commission 2008) is available in:

¹ For the purpose of this guideline, the proponent is the person or organisation that is the initiator of a planning proposal.

Guidance note 2: Water management reports in the land planning process
(Department of Water 2013a)

Guidance note 3: Preparation and assessment of water management reports
(Department of Water 2013b)

Interim: Developing a local water management (DoW 2008)

Urban water management plans: Guidelines for preparing plans and complying with subdivision conditions (DoW 2008)

This document also helps implementation of *State policy 2.9: Water resources* (WAPC 2006) and *Liveable neighbourhoods: a Western Australian government sustainable cities initiative* (WAPC 2007).

2 Urban water management planning

Better urban water management (WAPC 2008b) describes a process for ensuring that water management issues are considered at all stages of the land planning process. It includes water sensitive urban design. It guides the development industry when providing the water management information required to support a land-use planning proposal at each stage of development from a regional scale (i.e. regional structure plan) down to subdivisions or development applications (see Figure 1 for the relationship between the different levels of planning). The level of detail in the required water management report should be sufficient to support the decisions of the planning system by providing urban water management information at each level of the planning process. The required water management report should demonstrate compliance with the policies and principles of *State planning policy 2.9: Water resources* (WAPC 2006).

Figure 1 shows the relation between the land planning and water planning processes and the water management reports required at each planning level.

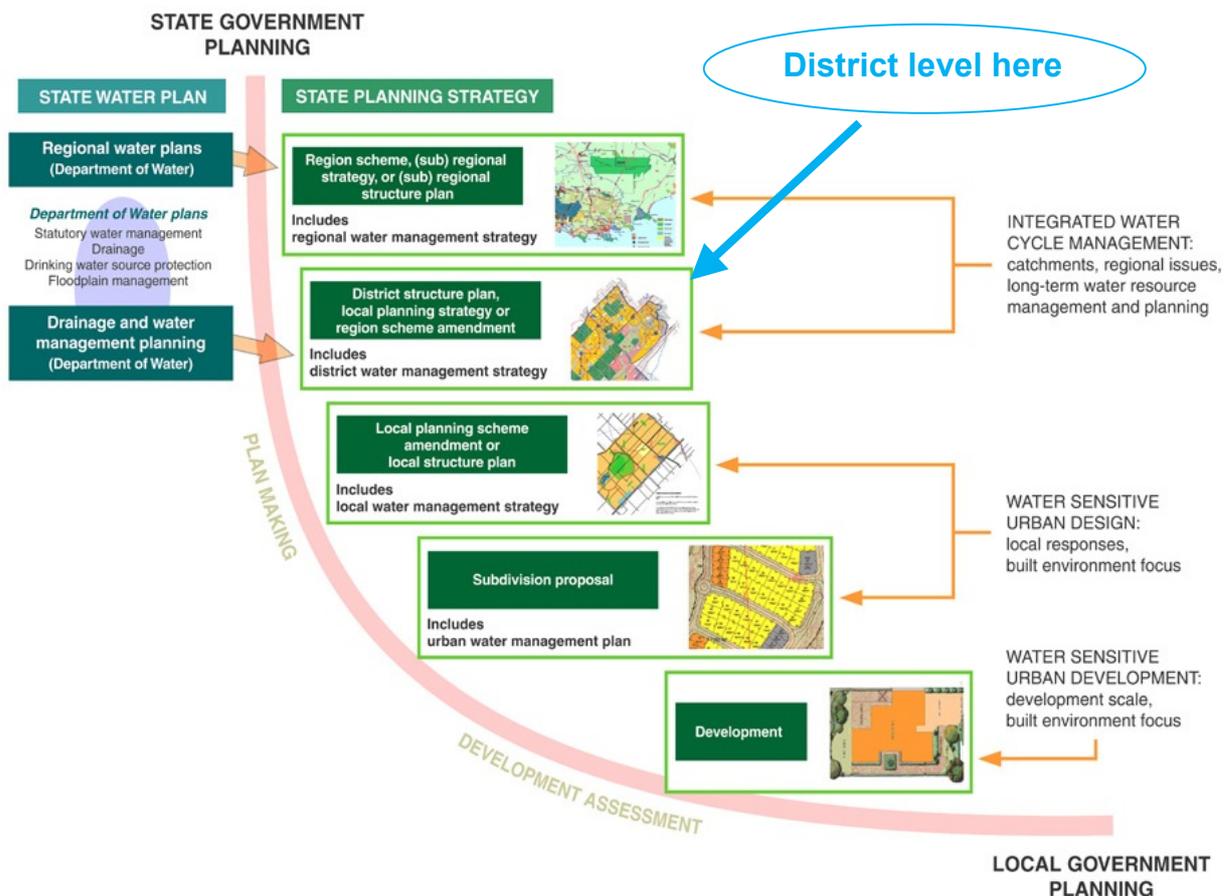


Figure 1 Integrating water planning with land planning processes

Water management plans and strategies

As described in Figure 1, a water plan or strategy needs to be prepared to ensure the protection of water resources, land-use proposals (such as scheme amendments, structure plans and other planning proposals) for each level of planning (regional, district, local and subdivision).

These water management reports include:

- regional water management strategies (RWMS)
- drainage and water management plans (DWMP)
- district water management strategies (DWMS) – the subject of this document
- local water management strategies (LWMS)
- urban water management plans (UWMP).

The brief discussion of the plans and strategies below provides the context for the detailed description of preparing a DWMS.

Regional level planning and water management report

Regional water management strategy

A regional water management strategy (RWMS) is prepared by the initiator (such as the Department of Planning) of the regional level planning proposal. It identifies areas for future land-use change and potential effects on water resources. The RWMS accompanies a regional or sub-regional strategy, region scheme or a regional or sub-regional structure plan. At this regional level, broad-scale water planning for future growth areas includes:

- identifying and mapping regionally significant water resources (at the catchment level)
- identifying areas to be set aside to protect and manage these water resources
- identifying viable water sources to support the future land use.

The planning efforts at this stage must consider total water cycle management (including a regional or catchment water balance) and incorporate regional water planning. Total water cycle management considers the integration and management of all forms of water present within the subject area or catchment including surface water and groundwater as well as water conservation strategies for supply and use.

Drainage and water management plans

At the regional level, the Department of Water prepares drainage and water management plans (DWMP) to help address water management in areas with development pressures and significant water issues. These contain more detailed information than the RWMS. A DWMP provides sub-regional level information about pre-development conditions and defines design objectives for the area. The development of the DWMS should be supported by available DWMPs, and should

identify the objectives, outcomes and design criteria for water management in the district or catchment. The DWMS needs to ensure that the design objectives, site conditions and approaches described are consistent with any relevant DWMP.

In areas with no prior drainage and water management planning the DWMS will need to provide the information that would normally be provided in a DWMP.

District level planning and water management report

The initiator of the district structure plan or region scheme amendment, or the local planning strategy where no region scheme exists, prepares the DWMS.

Other examples of when a DWMS is required are outlined in *Better urban water management guidance note 2: Water management reports in the planning process* (DoW 2013a).

Better urban water management (WAPC 2008b) identifies some district level planning processes required to be supported by a DWMS. These include the preparation of a district structure plan or region scheme amendment. As identified in *Liveable neighbourhoods* (WAPC 2007), district structure planning may apply to either one or more local government areas. Normally the state government endorses planning at this level through a district structure plan, with local planning strategies and local planning schemes being the responsibility of each local government (WAPC 2007).

The district structure plan or region scheme amendment should include a summary of the DWMS within a chapter of the proposal and the complete DWMS should be included as an appendix of the planning document.

The information gathered for a district structure plan or region scheme amendment will inform the DWMS and are prepared in conjunction to inform each other as well as highlighting areas requiring further investigations or special attention as part of future land use planning and/or development.

Local level planning and water management report

Local water management strategies (LWMS) are prepared by the initiator (such as the landowner or developer) of the local planning scheme amendment or local structure plan and should draw on any existing DWMS. The strategy will demonstrate how the proposed urban form (including residential, rural–residential, commercial or industrial) will address water use and management to guide all stages of the subdivision and will include all elements of the total water cycle relevant to the development area and associated catchment. Please refer to *Interim: Developing a local water management strategy* (DoW 2008a) for further information regarding LWMS.

Subdivision planning and water management plan

An urban water management plan (UWMP) is prepared by the initiator of the subdivision application and shall be informed by the LWMS, if available. The UWMP

demonstrates the critical parameters for drainage infrastructure design at the subdivision stage including detailed design plans regarding water use and management. Please refer to *Urban water management plans – Guidelines for preparing plans and for complying with subdivision conditions* (DoW 2008b) for further information regarding UWMP.

3 Developing a district water management strategy

3.1 When to prepare a district water management strategy

A district water management strategy (DWMS) provides the information required for a decision to be made regarding the following district level planning activities and processes:

- Rezoning to urban, urban deferred, industrial, commercial, rural or rural-residential in a region scheme.
- Preparation of a district structure plan.
- Lifting of urban deferment where the original rezoning was not supported by a DWMS.
- Rezoning a local scheme where no region scheme exists.

Prior to rezoning land and a subsequent change in land use through a region scheme amendment, such as rural zoning to urban, an assessment to evaluate whether the change in land use is appropriate and compatible with regard to the management of the district's water resources² is needed. To demonstrate that the proposed development site is suitable for the change in land use either a completed DWMS is required to support a region scheme amendment or a local planning strategy where there is no region scheme.

A DWMS is also required with the submission of a district structure plan or when an urban zoning deferment is lifted. Refer to *Better urban water management guidance note 2: Water management reports in the planning process* (DoW 2013a) for further guidance on when a DWMS is required.

3.2 What should be addressed in a district water management strategy

The development proponent must demonstrate that the area will be capable of supporting the change of land use based on the risks the development poses to water resources identified in the proposal area and/or the risks water resources will pose to the development and the technical feasibility of providing water and wastewater services. The level of risk to water resources proposed, service arrangements and whether connection to existing and/or new service

² Water resources are defined as water in the landscape (above and below ground) with current or potential value to the community and the environment and include the following natural or modified features: wetlands, waterways, estuaries, groundwater, surface water, irrigation dam, floodplain, foreshore, stormwater, existing and future surface and groundwater drinking water catchments and sources for public and private supplies, and wastewater (WAPC 2009).

infrastructure/water sources is proposed will determine the level of detail of investigations required. The level of risk and complexity of water service provision may require a more thorough investigation to demonstrate that services can and will be provided. In some cases where there is an identified risk, site-specific monitoring may be required. Refer to *Better urban water management guidance note 3: Preparation and assessment of water management reports* (DoW 2013b) for guidance on the level of detail required.

Examples of water assets, constraints, features or risks that should be considered include:

- water availability for potable and non-potable water needs
- wastewater servicing capacity
- floodplains
- shallow groundwater
- inundation
- public drinking water source protection areas
- wetlands and their buffer areas
- waterways and their foreshore areas
- other water-dependent ecosystems (WDEs³; e.g. karst)
- acid sulfate soils
- contaminated sites.

The DWMS will need to show how the risks to and from water resources as a result of the proposed development will be managed and/or mitigated. Proponents should ensure that the proposed methods of managing these risks are feasible. Proponents should also identify the potential impacts the development may have to sensitive receiving environments adjacent to or near the development site. Any changes to these methods at later stages of the planning process may have implications for planning approvals, development designs and construction.

The document should identify any existing environmental, social, cultural and economic values associated with water within the study area and adjacent area that may be affected.

The DWMS is not intended to be an extensive document, as proponents will need to undertake further more detailed investigations and designs at the local level to inform the future local water management strategy (LWMS).

³ WDEs refer to surface water and groundwater dependent environments and ecosystems throughout the document.

Principles and objectives to follow in DWMS development

Proponents should follow the principles and objectives listed below in Table 1. These have been adapted from the water sensitive urban design brochure series *Water sensitive urban design in WA: An introduction* (DoW 2011) when developing water management strategies for the proposed change of land use.

Table 1 Principles and objectives for water sensitive urban design

Principle 1: Manage catchments to maintain or improve water resources

Objective	Explanation
1. Manage runoff from all rainfall events as high in the catchment as possible.	The hydrology of the area should be maintained relative to pre-development conditions to avoid adverse situations like flooding (including impacts to downstream properties), inundation, downstream water loss or other changes in water balance that may impact on the ecological values of receiving environments and aquatic ecosystems.
2. Manage post development hydrology to maintain and/or improve hydrological, hydrogeological and ecological functions.	
3. Maintain or improve water quality of surface water and groundwater.	The health of aquatic ecosystems and receiving environments of significance must be maintained or restored. This includes ecological, hydrological, hydrogeological and sediment transport regimes. The social, cultural, heritage and economic values should be recognised and maintained.
4. Manage, protect and restore waterways and wetlands.	
5. Minimise pollutant inputs through implementation of appropriate structural and non-structural controls.	
6. Retain native vegetation and natural landform.	
7. Protect public drinking water source areas.	
8. Safeguard the quality and availability of water resources for the future.	

Principle 2: Manage flooding and inundation risks to human life and property

Objective	Explanation
1. Provide adequate clearance from the 100-year average recurrence interval flood level and surface water or groundwater inundation	Flood events to be managed without compromising critical urban infrastructure, building integrity and community safety. Appropriate levels of service for drainage infrastructure should be established without compromising the social and economic value of water resources.
	Major storm events need to be planned for and managed in areas

and waterlogging.	where storm surge is likely to occur, especially in areas close to the coast. Planning should include the possibility of future sea level rise and storm surges.
2. Prevent increased flooding or inundation of upstream, downstream or adjacent developed areas.	The management of shallow groundwater should not impact upon local and regional water resources or development infrastructure.
3. Manage surface water flows to prevent damage to downstream infrastructure and assets.	
4. Manage risk to public health from disease vector and nuisance insects.	

Principle 3: Ensure the efficient use and reuse of water resources

Objective	Explanation
1. Minimise water use within developments.	The development of fit-for-purpose sources should be investigated to meet non-drinking water demands.
2. Maximise water reuse, including using wastewater and harvested stormwater.	Water sensitive development should incorporate a diverse range of water sources and supplies which support the natural environment. Where an alternative scheme is proposed for the delivery of water, wastewater or non-drinking water, the concept for delivery should be described.
3. Achieve highest value use of fit-for-purpose water, considering all available sources of water for their potential as a resource.	

Principle 4: Recognise and maintain economic, social and cultural values associated with water

Objective	Explanation
1. Improve social amenity by having multiple use corridors and by integrating water management measures into the street and lot landscape to increase visual, recreational, cultural, public health and ecological values.	Water sensitive urban design (WSUD) takes a holistic approach of integrating total water cycle management. Implementation of WSUD incorporates water supply, wastewater, stormwater and groundwater management, urban design and environmental protection, and assists in maintaining and protecting social economic and cultural values.
2. Implement water management systems that are economically viable in the long term.	
3. Ensure the delivery of best practice urban water management through	

planning and design of quality urban areas in accordance with sustainability and precautionary principles.

Level of information needed

Where applicable, the preparation of a DWMS should be based on available regional level information. This may include reviewing regional groundwater and surface water (quantity and quality) data if available as well as any information documented within regional water management strategies and/or drainage and water management plans (DWMP) (see the Department of Water's website at <www.water.wa.gov.au>. Go to Managing water > Urban water > Strategies and management plans.)

The level of detail to be contained in the strategy will depend on:

- the location of the proposal and its surrounding catchment
- the type of land use or urban form proposed
- the type, extent and significance of the site's and adjacent site's water resources
- the assets and/or constraints that the site's or adjacent site's water resources may present to the proposed land-use change
- how water resources are to be managed as part of the proposed development.

Please refer to *Better urban water management guidance note 3: Preparation and assessment of water management reports* (DoW 2013b) regarding the level of detail required in a DWMS.

Water resource factors considered in a DWMS include:

- the presence of wetlands
- shallow groundwater
- seasonal waterlogging
- provision of water services and water availability for drinking and non-drinking water use.

Identifying factors early in the planning process is necessary so that the potential implications of the proposed development are understood. For example, if an urban proposal is within a groundwater area that is fully allocated⁴, investigation of an alternative viable source of water should be mentioned in the DWMS. It may be possible to defer the securing of non-drinking ('fit-for-purpose') water for uses such as irrigating Public Open Space areas, to the LWMS stage. Please contact the Department for further advice.

⁴ Full allocation is where the annual volume of groundwater for consumptive use has reached the allocation limit in that groundwater area

The strategy should refer to regional level strategies or plans, where available, for background on the water resource issues which need addressing in the DWMS. Information may include existing regional drainage networks and natural drainage pathways and systems to define land needed for drainage and flood management.

Table 2 provides further guidance on what should be included in a DWMS. The information must be concise and supported by relevant tables and figures such as existing longitudinal sections.

Appendix 2 is a guide of what to include and can be completed and attached in an appendix to the completed DWMS. Please note, depending on the site, additional information may be required.

Once a DWMS is completed and submitted with the district level planning proposal, the Department of Water in conjunction with other agencies will assess the strategy in accordance with *Better urban water management*, (WAPC 2008b) and provide feedback and advice to the proponent (or the proponent's consultant) with a copy going to the planning approval authority. Revisions to the DWMS need to satisfy the requirements of *Better urban water management* (WAPC 2008b) before final approval is granted by the Department of Water to facilitate progress of the proposal through the planning system.

If there are changes to the district structure plan, scheme amendment or local planning strategy, a review of the DWMS may be required.

Information from other agencies

Proponents should consult with other regulatory agencies to find out if additional investigations are required at this level of the planning and development process.

The agencies could include:

- Department of Environment Regulation
- Department of Parks and Wildlife
- Department of Planning
- Department of Health
- relevant local government
- water service provider (e.g. Water Corporation)
- Swan River Trust, where relevant.

Table 2 What to include in a district water management strategy

Requirement	Comments
1. Executive summary	
Provide a summary of the proposed water management objectives and how these water management objectives will be met.	
2. Planning background and previous studies	
<p>Describe the location of the site.</p> <p>Identify which planning document the DWMS is supporting (e.g. district structure plan, region scheme amendment, lifting of urban deferment or local planning strategy) and provide a summary of the planning background.</p> <p>Provide references to key state and/or local policies, guidelines and requirements, including guiding documents, strategies (RWMS), plans (e.g. DWMP) and technical studies, and briefly outline relevance to current development.</p>	<p>Include figures illustrating location, subject area, zoning and other features relevant to the proposal.</p> <p>References to appropriate literature should demonstrate that the consultant is aware of key state and/or local policies, guidelines and requirements. Accurate referencing is important.</p>
3. Design criteria	
<p>Recognise water management principles, objectives and design criteria for water sensitive urban design and total water cycle management for the study area.</p> <p>State any catchment design objectives previously identified in water strategies and/or plans that are to be applied. Modelling may be used to support catchment water management objectives for the proposed change in land use. State also the requirements for any environmental protection policies (e.g. <i>Environmental Protection Peel Inlet – Harvey Estuary Policy 1992</i>), water quality improvement plans (e.g. Peel–Harvey, Swan–Canning and Vasse–Geographe) and state planning policies (e.g. Peel–Harvey Coastal Plain Catchment Policy, Swan–Canning River System and Gnamara Groundwater Protection Policy).</p>	<p>Guidance for design objectives and principles for water sensitive urban design can also be found in <i>Better urban water management</i> (WAPC 2008b), <i>State planning policy 2.9: Water resources</i> (Government of Western Australia 2006), <i>Liveable neighbourhoods</i> (WAPC 2007), <i>Stormwater management manual for WA</i> (DoW 2004–2007) and the <i>Decision process for stormwater management in WA</i> (DoW 2009a).</p> <p>These objectives may be refined if there is a RWMS or DWMP. Further guidance on water management principles, objectives and design criteria, can be found at www.water.wa.gov.au. Go to Managing water > Urban water > Strategies and management plans.</p>
4. Pre-development environment (identification of assets, risks and constraints)	
<p><i>Site characteristics</i></p> <p>Provide preliminary desktop assessment to describe the characteristics of the study area. Where regionally significant assets are identified, field investigations and referral to the</p>	<p>Long-term groundwater monitoring data from departmental regional bores is available upon request, and online data is available from the Department of Water’s website at www.water.wa.gov.au. Go to Tools & data.</p>

Requirement	Comments
<p>Environmental Protection Agency may be required. Investigations should consider previous studies and their recommendations which will help identify the risks and opportunities within and around the study area. If the area is highly constrained or of high ecological value, more comprehensive investigations will be necessary.</p> <p>General investigations and supporting figures on the following should be provided to broadly describe the characteristics of the study area regarding:</p> <ul style="list-style-type: none"> • climate – historical, current and future trends • topography, landform and geotechnical conditions: e.g. flat, hilly or sloping land, plains, foothills, dunes, acid sulfate soils – see <i>Planning bulletin 64: Acid sulfate soils</i> (WAPC 2009) and <i>Acid sulfate soils planning guidelines</i> (WAPC 2008a), phosphorus retention index, geology mapping and contaminated sites • existing land use • significant environmental features/assets. Identify assets including wetland types, their classification and buffers, waterways and their estuaries, public drinking water source areas, <i>Bush Forever</i> sites (WAPC 2000), locally and regionally significant flora and fauna, and water-dependent threatened ecological communities. • social, cultural and heritage considerations • hydrology of the area (see below) • existing infrastructure and other features likely to influence the proposed development (e.g. drainage, roads, bridges, community buildings). 	<p>Identify and map all water resources for the study area. The plans should include:</p> <ul style="list-style-type: none"> • regional drainage network which indicates surface flow paths and comprises all existing arterial drainage and natural drainage paths (including any longitudinal sections) • public drinking water source protection areas • other major infrastructure features • wetlands and waterways of significance. As a minimum this should include conservation category wetlands, resource enhancement wetlands, <i>'Environmental Protection (Swan Coastal Plain Lakes) Policy'</i> 1992 wetlands, Ramsar wetlands, those listed in the <i>Directory of important wetlands in Australia</i> (Environment Australia 2001) and those that support significant flora and fauna and threatened ecological communities. • acid sulfate soil risk mapping • existing 100-year ARI flood mapping.
<p><i>Hydrology and hydrogeology of the area</i></p> <p>Define the broad-scale water management issues that will affect the proposed change in land use (e.g. flood risk, waterlogging). This involves an assessment of the study area's pre-development condition (at a district scale).</p> <p>Review and describe pre-development surface water and groundwater monitoring data (quantity and quality) and outcomes of broad-scale</p>	<p>Identify the current hydrology and hydrogeology of the catchment as a whole including connectivity with upstream catchments and potential restrictions or limitations in downstream flow capacity. This should be presented as an indicative water balance and may be presented in a diagram with explanatory notes. The pre- and post-development water balances can be presented together (see 'Post-development</p>

Requirement	Comments
<p>investigations. This may include information from a RWMS, DWMP or the Department of Water's long-term monitoring data.</p> <p>Where a DWMP or broad monitoring information is not available, please contact the Department of Water as proponents may need to undertake on-site monitoring.</p>	<p>water management' below). Further guidance on a development's drinking and non-drinking water demand can be found from Water Corporation's H₂Options water balance tool found at www.watercorporation.com.au</p> <p>Information needs to demonstrate an understanding of how both surface water and groundwater move through the site (from upstream catchments and to downstream catchments or receiving water bodies).</p> <p>Monitoring may be required to provide an indication of groundwater and surface water conditions (levels, flows and quality) where no information is available. Refer to <i>Water monitoring guidelines for better urban water management strategies and plans</i> (DoW 2012b).</p>
<p>Surface water</p>	<p>Include waterways and wetlands and an indication of ecological values and conditions.</p>
<ul style="list-style-type: none"> • Identify pre-development surface water flow direction, water quality, catchment areas, drainage lines and associated features (e.g. controlling culverts, bridges) within the study area as well as upstream and downstream of it. • Describe floodplain studies that include modelling of flood events, identification of the flood fringe and floodways, and water levels. • Identify indicative or final waterways foreshore areas as per <i>Operational policy: Identifying and establishing waterways foreshore areas</i> (DoW 2012a). • Identify wetlands and their buffer areas. 	
<p>Groundwater</p>	<p>Include hydrogeological parameters of the study area and relevant catchments including groundwater level fluctuations over time and regional groundwater flow directions</p> <p>Include an assessment of regional groundwater conditions including resident catchment and aquifer levels, flows and quality.</p>
<ul style="list-style-type: none"> • State pre-development groundwater levels, water quality and direction of flow in the study area. • Understand seasonal and long-term variations. • Identify groundwater-dependent ecosystems and other environmental assets that are located within or surrounding the proposed development. • Describe known interactions between surface water and groundwater. 	

Requirement	Comments
<ul style="list-style-type: none"> Consider the pre-development total water cycle environment and the connectivity between the different water resources. 	
<p>Water-dependent ecosystems</p>	
<p>Identify and map all surface water and groundwater water-dependent ecosystems within the study area.</p>	<p>Water-dependent ecosystems are those parts of the environment in which the species composition and natural ecological processes are determined by the permanent or temporary presence of water resources, including flowing or standing surface water or groundwater. Refer to <i>Better urban water management guidance note 7: Managing the hydrology and hydrogeology of water-dependent ecosystems in urban development</i> (DoW 2013c).</p>
<p>Describe aspects of water-dependent ecosystems (such as waterways and their floodplains, estuaries and foreshore areas, wetlands and their buffers, public drinking water source protection areas, coastal dune areas and karst) including flora, fauna, any existing ecological water requirement studies and the level of connectivity between surface and groundwater.</p>	
<p>Identify the risks of the proposed land use on the water-dependent ecosystems.</p>	
<p>Water resource issues</p>	
<p>Identify the water resource issues that will need to be addressed as part of future planning and development focusing on those with the potential to influence the urban form and/or that will require specific management. Issues may include a lack of available groundwater, shallow groundwater, significant environmental assets, existing contamination, steep slopes or clay soils. The water resource issues will need to be addressed as part of the proposed water management strategy.</p>	
<p>5. Post-development water management</p>	
<p>Describe the proposed broad-scale management strategies that will address the water resource issues and meet the objectives and design criteria. These should address, as a minimum, surface water, groundwater, environmental assets, and water use and potential reuse of water resources.</p>	<p>Seek advice from the Department of Water for establishing minimum buffer distance(s) between water bodies and environmental assets and the proposed development (groundwater drainage systems or bores) to avoid detriment to the water balance and hydrology of these water bodies and environmental assets. Associated investigations that may be required to support this decision include identifying management strategies for maintaining the pre-development hydrology and/or the ecological water requirements.</p>
<p>Develop an indicative post-development water balance that incorporates groundwater, surface water, stormwater, potable and non-potable water and wastewater.</p>	
<p>Evaluate whether the proposed development may have an adverse effect upon the quality, water balance or hydrology of water bodies.</p>	<p>Seek advice from the Department of Parks and Wildlife for establishing buffers for</p>

Requirement	Comments
Describe broad-scale water management issues that will affect the proposed change in land use (e.g. flood risk, waterlogging).	wetlands. Infrastructure, including drainage, is not permitted within the buffers of wetlands. Surface water flows into wetlands may be permitted via vegetated overland flow paths in accordance with the Department of Water's <i>Decision process for stormwater management in WA</i> (DoW 2009a). Proposals should be consistent with wetland or waterways management plans where these are developed.
Surface water	
Estimate or determine land requirements for water management (including waterway foreshore areas ⁵ and wetland buffers, and allocation of land for water sensitive urban design of road reserves and public open spaces).	Seek advice from the Swan River Trust where the development is likely to affect waters in the Trust's Development Control Area.
Identify water quality issues and scope preliminary strategies for improvement.	
Describe the proposed strategy for managing small (less than and equal to one year ARI events), minor (greater than 1 year and less than or equal to 5 year for residential) and major (greater than 5 year and up to 100 year ARI events) surface water flows (for further refinement at the next level of the planning process).	Ensure adequate land areas are available to incorporate water sensitive urban design features, flood management, and surface water and groundwater-dependent ecosystem buffers. Retain existing channel form and alignment of waterways. Maximise the retention of remnant native vegetation, including mature trees, in road reserves and public open spaces to mimic pre-development water balance scenarios.
Groundwater	
Describe the proposed groundwater management strategy including, but not limited to:	Where a district structure plan that covers an area with many landowners likely to develop at different times has been prepared and/or the arterial drainage system traverses more than one local government area, arterial drainage planning is required to ensure integrated drainage infrastructure requirements across the catchment.
<ul style="list-style-type: none"> • any management (modification) of groundwater levels • use of groundwater resources • management and maintenance of groundwater quality • the potential for fit-for-purpose water use. 	Where changes to groundwater levels are proposed and/or where the use of groundwater has the potential to adversely affect the water resource and/or any environmental asset, further investigation and justification of the strategy is likely to be required. Refer to <i>Water resource considerations when controlling groundwater levels in urban development</i> (DoW 2013d) for further advice.
Water-dependent ecosystems	
Identify principles and approaches for managing, retaining and restoring groundwater-dependent ecosystems (e.g. karst or wetlands and their buffers) and surface water-dependent ecosystems (e.g. waterways and their foreshore areas).	
Contamination and acid sulfate soils	Seek advice from the Department of Water on the status of groundwater quality and quantity for any proposed potable or non-potable use.
Additional action may be required in areas of	

⁵ As per *Operational policy: Identifying and establishing waterways foreshore areas*, a final foreshore area may be required if the risks are high, there are significant site constraints or detailed district structure planning is being undertaken.

Requirement	Comments
identified high risk acid sulfate soils, contaminated sites or areas with historically high nutrient and/or non-nutrient contaminants.	Early consideration of this resource will enable identification of potential alternative sources, inclusive of the technical investigations necessary to demonstrate proof of concept.

6. Water services and efficiency initiatives

Potable water supply

Outline essential servicing options for potable water supply including details of the technical, environmental and regulatory feasibility in determining the best service option. Highlight the preferred option and describe the location of abstraction/access, water treatment required, public drinking water source protection areas and infrastructure required.

Identify any regulatory approvals and required technical investigations and provide written evidence of any approvals obtained.

Provide recommendations for water efficiency and conservation measures.

Seek advice from the Department of Water on the availability and suitability of groundwater for potable use and licensing of groundwater abstraction, including any requirements for establishing public drinking water source protection areas where the development of a new potable water source is required. Further information on the preparation of Drinking Water Source Protection Plans and the proclamation of public drinking water sources areas is provided in *Water Quality Protection Note: Identification, assessment and protection of public drinking water source areas* (DoW 2007b).

Wastewater servicing

Outline options for sewerage services including treatment options, the preferred option, details of the treatment plant location, treatment process/technology, level of treatment (i.e. final water quality), solid and liquid waste disposal, buffers (i.e. for odour, noise), and infrastructure.

Identify any regulatory approvals and technical investigations required and provide written evidence of any approvals obtained.

Provide recommendations regarding water efficiency and conservation measures.

Seek advice from either an existing licensed or a proposed water and wastewater service provider regarding available or proposed servicing.

Seek advice from the Economic Regulatory Authority on the requirements and level of information needed to support an application for a Water Services Operating Licence. See Section '4.4 New/private water services providers' below for further information.

Non-potable (fit-for-purpose) water supply

Outline the non-potable water source options, highlighting the preferred option.

Proponents should consider the broad pre- and post-development water balance to assess the potential options for non-drinking water sources including evaluation of options and feasibility.

Identify any regulatory approvals and technical investigations required and provide written evidence of any approvals obtained.

Provide recommendations for water efficiency

Seek advice from the Department of Environment Regulation in regard to the environmental regulation of prescribed premises (i.e. wastewater treatment plants/sewerage facility), including the requirement for works approvals, licences and/or registrations of such facilities.

Seek advice from the Department of Health in relation to their regulatory requirements in regard to the operation and provision of water services.

Post-development water supply and services proposals should identify total water cycle needs including water supply options, fit-for-purpose water sources, uses, efficiency strategies and wastewater treatment or reuse for the study area. Further guidance

Requirement	Comments
and conservation measures.	<p>regarding fit-for-purpose water source options can be found at <www.water.wa.gov.au>. Go to Managing water > Recycling > Waterwise community toolkit.</p> <p>Refer to the Department of Water's <i>Guideline for the approval of non-drinking water systems in Western Australia - urban developments</i> (DoW 2013e) available at <www.water.wa.gov.au> and Water Corporation's H₂Options at www.watercorporation.com.au for further guidance.</p> <p>The proponent should seek preliminary advice from other regulatory agencies.</p> <p>Proponents should consider who will be the asset manager and who will manage the water supply in the immediate and longer term, particularly where there is no existing water service provider.</p> <p>Proponents should consider the feasibility of the preferred option, including the likely investigations and approvals required for the proposed development. Investigation of surface water and groundwater availability can be assisted by allocation plans supplied by the Department of Water upon request.</p>

7. Implementation framework

This should contain commitments and obligations for further action and/or investigations to be undertaken at the next stage of the planning process by the proponent (e.g. LWMS), including:

- identification of issues requiring specialised investigations and management for the subsequent LWMS, including timing and responsibilities for investigations
- recommendations for implementing the DWMS including monitoring, maintenance responsibilities, technical reviews and requirements for the preparation of the subsequent LWMS.

Monitoring or modelling may include surface water and groundwater quantity and quality, and water-dependent ecosystems (including ecological water requirements). The *Water monitoring guidelines for better urban water management strategies and plans* (DoW 2012b) provides useful information.

4 Issues that may require special consideration

Depending on the proposed development and the site's features, the following issues may require further consideration.

4.1 Crossing local government boundaries

A coordinated approach between local governments, proponents and consultants to avoid unforeseen difficulties with regard to management responsibility for water planning is recommended. For example, when the district area covers more than one local government area, there will need to be a flexible approach to implementing the district water management strategy (DWMS) where there are differing bylaws, policies, planning priorities, land-use zonings and permitted land uses between councils.

Responsibilities for implementing the DWMS must be clearly defined in the strategy, including timeframes and responsible authorities for each commitment and obligation.

4.2 Fragmentation of land ownership

Land ownership in an area of district size is likely to be fragmented. Decisions will need to be made about who bears the costs and who coordinates studies.

Some ways of dealing with these circumstances include:

- a coordinated approach by several landowners or proponents
- coordination by local governments, with an agreed mechanism or arrangement between landowners for funding the study, such as through a development contribution scheme.

A coordinated approach between proponents in managing drainage is required so that proponents share responsibility in developing the overall district drainage plan.

4.3 Non-drinking water proposals

Where a non-drinking water proposal is to be implemented through the land planning process, the requirements outlined in the *Guideline for the approval of non-drinking water systems in Western Australia – urban developments* (DoW 2013e) should also be submitted as an appendix to the DWMS. The guideline is intended for use by proponents such as developers and local governments interested in implementing a development scale non-drinking water system.

Proponents of a non-drinking water scheme should take into account any existing and planned water infrastructure and ensure their project is compatible with it. Non-drinking water source options include treated wastewater, stormwater, greywater, groundwater and rainwater. Please refer to *Guideline for the approval of non-drinking*

water systems in Western Australia – urban developments (DoW 2013e) for further explanation and guidance on what is required at the district level.

4.4 New/private water services providers

Efficient and timely provision of appropriate infrastructure and utility services in areas suitable and intended to be subdivided and developed is a fundamental objective of the Western Australian Planning Commission's planning strategies and policies.

Where essential water services are intended to be provided by an existing service provider and/or water source/treatment facility, the details of the infrastructure requirements and an agreement in writing for the provision of those services from an existing licensed water service provider are sufficient to demonstrate serviceability at the district planning stage.

However, where essential water services are proposed to be provided by a new and/or private water service provider, information is required to demonstrate the technical, environmental and regulatory feasibility of proposed water services. The following are critical information requirements to demonstrate proof of concept of proposed services at the district planning stage:

- Demonstrate secured water source for potable use (i.e. demonstrated access to an existing supply, a hydrogeological report demonstrating availability and suitability of any new proposed potable groundwater source, preparation of a Drinking Water Source Protection Plan and establishment of a Public Drinking Water Source Protection Area if required).
- Identify land areas, buffers and potential impacts on surrounding properties associated with the treatment of potable water supply and wastewater, water source protection and odours.
- Demonstrate acceptable disposal of solid waste and excess treated wastewater in accordance with relevant environmental and health requirements.

A copy of written advice from the Economic Regulatory Authority should be included to demonstrate the proposed service provider has the credentials to be issued with an operating licence.

Appendices

Appendix 1 - District water management strategy guide

Use the guide below to assist with the completion of the DWMS. Tick the box where items have been met. If the item is not applicable to the DWMS, include N/A with explanation in the notes column. Provide any other relevant comments briefly in the notes column.

District water management strategy item	<input checked="" type="checkbox"/>	Notes
Executive summary		
Describe proposed water management objectives and how the objectives will be met.	<input type="checkbox"/>	
Planning background and previous studies		
Map the location of the site.	<input type="checkbox"/>	Location or site context plan
State which planning document the strategy is supporting.	<input type="checkbox"/>	District structure plan if available
Provide references to the key state and/or local policies, guidelines, strategies and their relevance.	<input type="checkbox"/>	
Design criteria		
Recognise water management principles, objectives and design criteria.	<input type="checkbox"/>	
Design objectives from previous water strategies and/or plans.	<input type="checkbox"/>	
Pre-development environment (identification of assets, risks and constraints)		
Describe site characteristics: provide preliminary desktop assessments and/or field investigations (if required)	<input type="checkbox"/>	Include existing data
Describe climate.	<input type="checkbox"/>	Description
Describe and map topography, landform and geotechnical conditions.	<input type="checkbox"/>	Aerial photo Geotechnical plan Acid sulfate soil risk mapping

District water management strategy item	<input checked="" type="checkbox"/>	Notes
Describe the existing land use.	<input type="checkbox"/>	Description
Identify environmental assets and their significance.	<input type="checkbox"/>	Environmental plan plus supporting data where available
Detail the social, cultural and heritage considerations.	<input type="checkbox"/>	
Describe the hydrology and hydrogeology of the area: <ul style="list-style-type: none"> • surface water • groundwater • water-dependent ecosystems • water resource issues. 	<input type="checkbox"/>	Surface water hydrology plan Groundwater and topographic contours plan (or depth to groundwater) Waterways and wetlands plan Indicative water balance (pre- and post-development water balances can be presented together – see below)
Describe existing drainage infrastructure and other infrastructure likely to affect management of water resources.	<input type="checkbox"/>	Arterial drainage plan (if available) including local drainage
Post-development water management		
Identify the proposed broad scale management strategies that will address water resource issues and meet the objectives and design criteria.	<input type="checkbox"/>	
Calculate an indicative water balance.		Indicative water balance. May be presented as a diagram including pre- and post-development volumes with explanatory notes
Describe the impacts to water resources and/or impacts to proposed change in land use from water issues.		
Surface water <ul style="list-style-type: none"> – Estimate land requirements for water management. – Identify water quality issues and scope for improvement. – Describe proposed strategy for management of small, minor and major surface flows. 	<input type="checkbox"/>	Include any existing data
Describe groundwater levels, use, management and maintenance.	<input type="checkbox"/>	Include data if available

District water management strategy item	<input checked="" type="checkbox"/>	Notes
Identify water-dependent ecosystems	<input type="checkbox"/>	
Identify contamination issues – high risk acid sulfate soils, contaminated sites or areas with historical high nutrient and/or non-nutrient contaminants.	<input type="checkbox"/>	Include data or plans if available
Water services and efficiency initiatives		
Describe potable water supply <ul style="list-style-type: none"> – options including details of technical, environmental and regulatory feasibility – regulatory approvals, technical investigations and any obtained written approvals – recommendations for water efficiency and conservation 	<input type="checkbox"/>	Written evidence if obtained
Identify wastewater servicing <ul style="list-style-type: none"> – options including preferred option, location, treatment process, level of treatment, disposal, buffers and infrastructure – approvals and investigations required and any obtained written approvals – recommendations for water efficiency and conservation 	<input type="checkbox"/>	Written evidence if obtained
Identify non-potable (fit-for-purpose) water supply <ul style="list-style-type: none"> – non-potable water source options. Highlight preferred option with consideration of pre and post development water balance – approvals and investigations required and any obtained written approvals – recommendations for water efficiency and conservation 	<input type="checkbox"/>	Written evidence if obtained

District water management strategy item	<input checked="" type="checkbox"/>	Notes
Implementation framework		
<p>Describe commitments and obligations for the next stage of the planning process (e.g. LWMS).</p> <p>Identify issues that need specialised investigation and management for the subsequent LWMS.</p> <p>Make recommendations for implementing the DWMS.</p>	<input type="checkbox"/>	<p>Commitments and obligations may be displayed in table format</p>

Appendix 2 - Example figures

The figures shown in this appendix intend to give an example of the figures required within a district water management strategy.

These are:

- Location or site plan
- Aerial photography
- District structure plan
- Geotechnical plan
- Acid sulfate soil risk map
- Environmental and social considerations
- Groundwater and topographic contours (depth to groundwater), wetlands and public drinking water source areas
- Surface water hydrology
- Arterial drainage plan (if available).

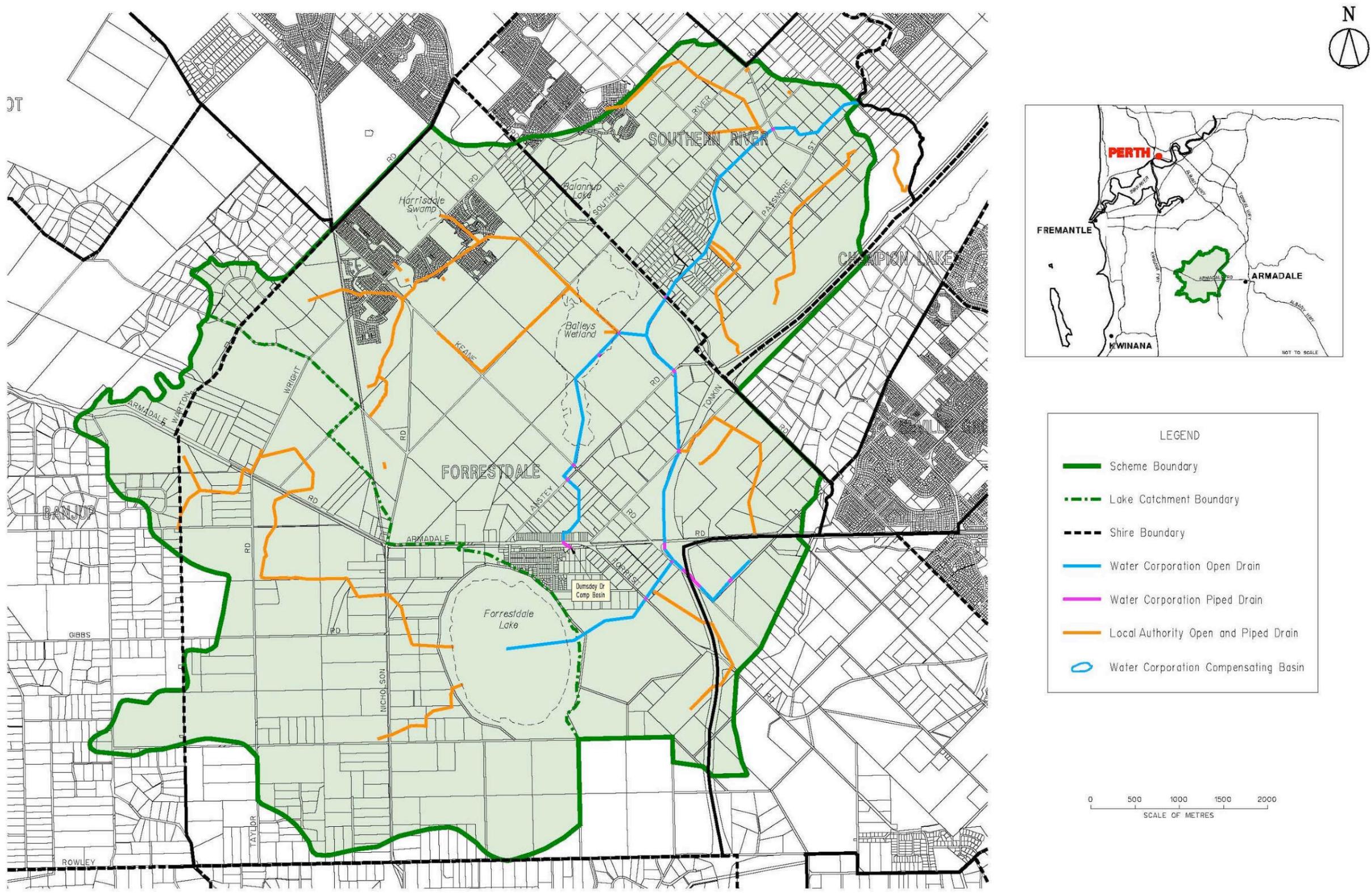


Figure 2 Example location plan (figure from Forrestdale main drain arterial drainage strategy, DoW 2009b)

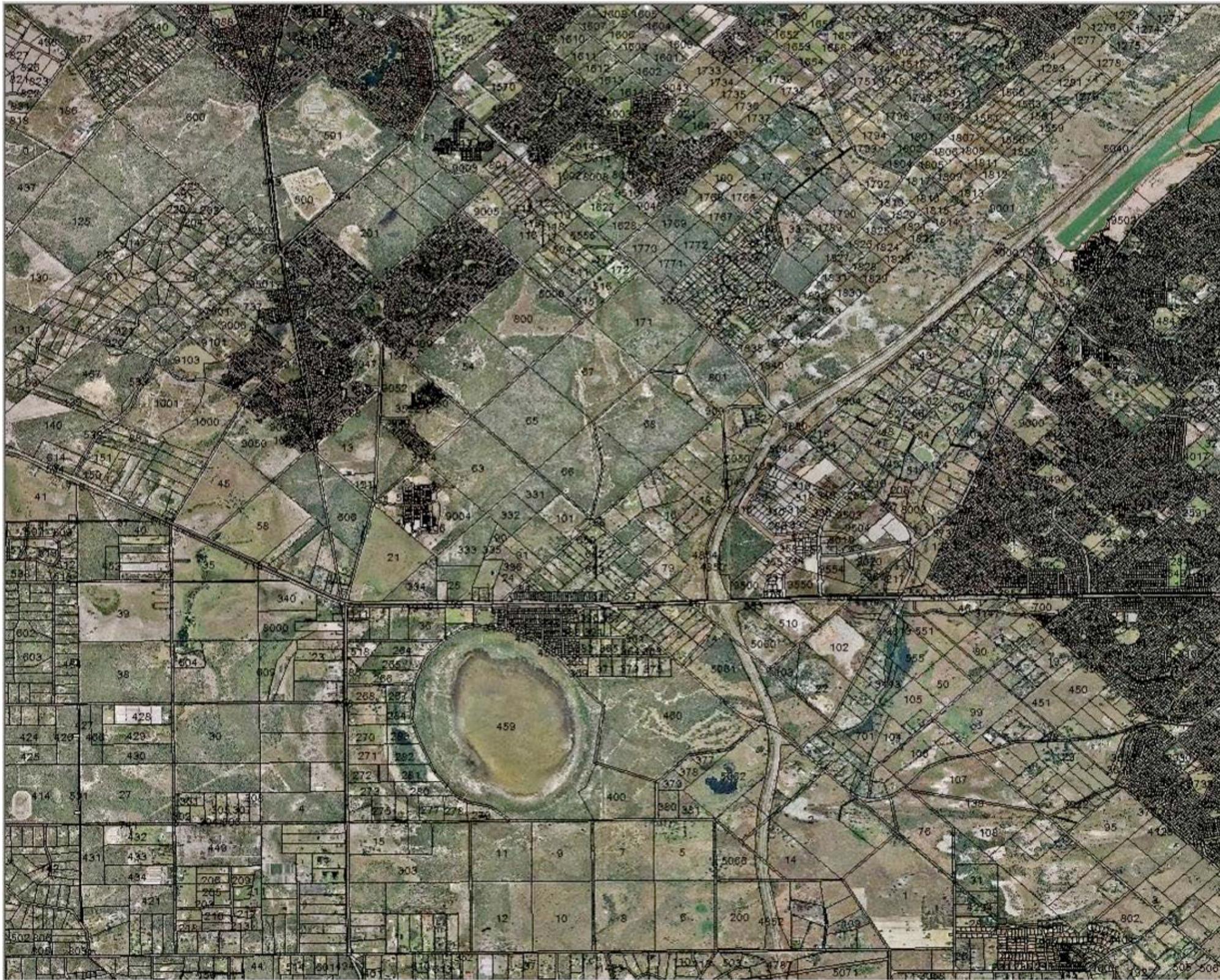


Figure 3 Example aerial photo of the site

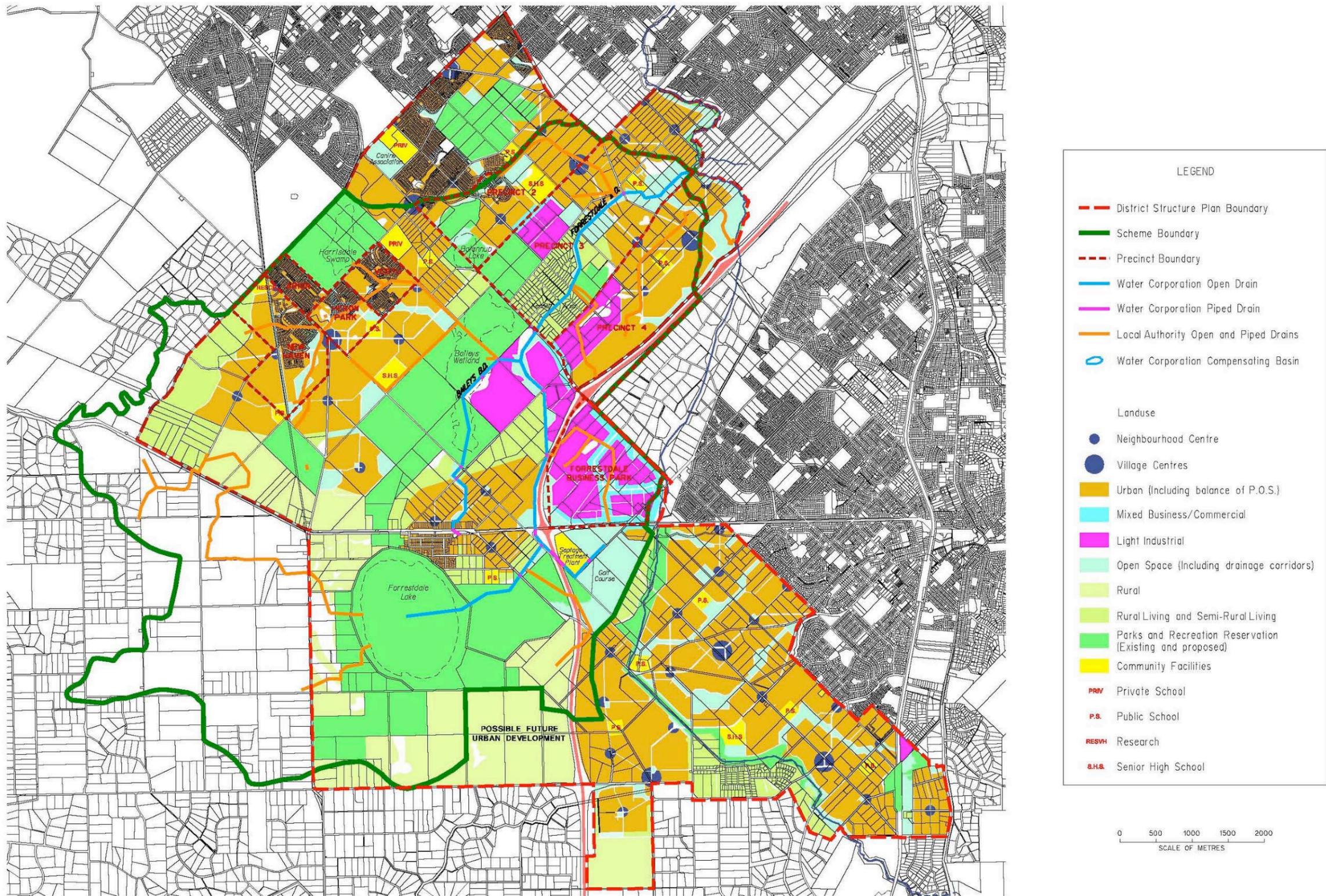


Figure 4 Example district structure plan – proposed land use (figure from Forrestdale main drain arterial drainage strategy, DoW 2009b)

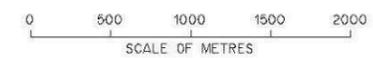
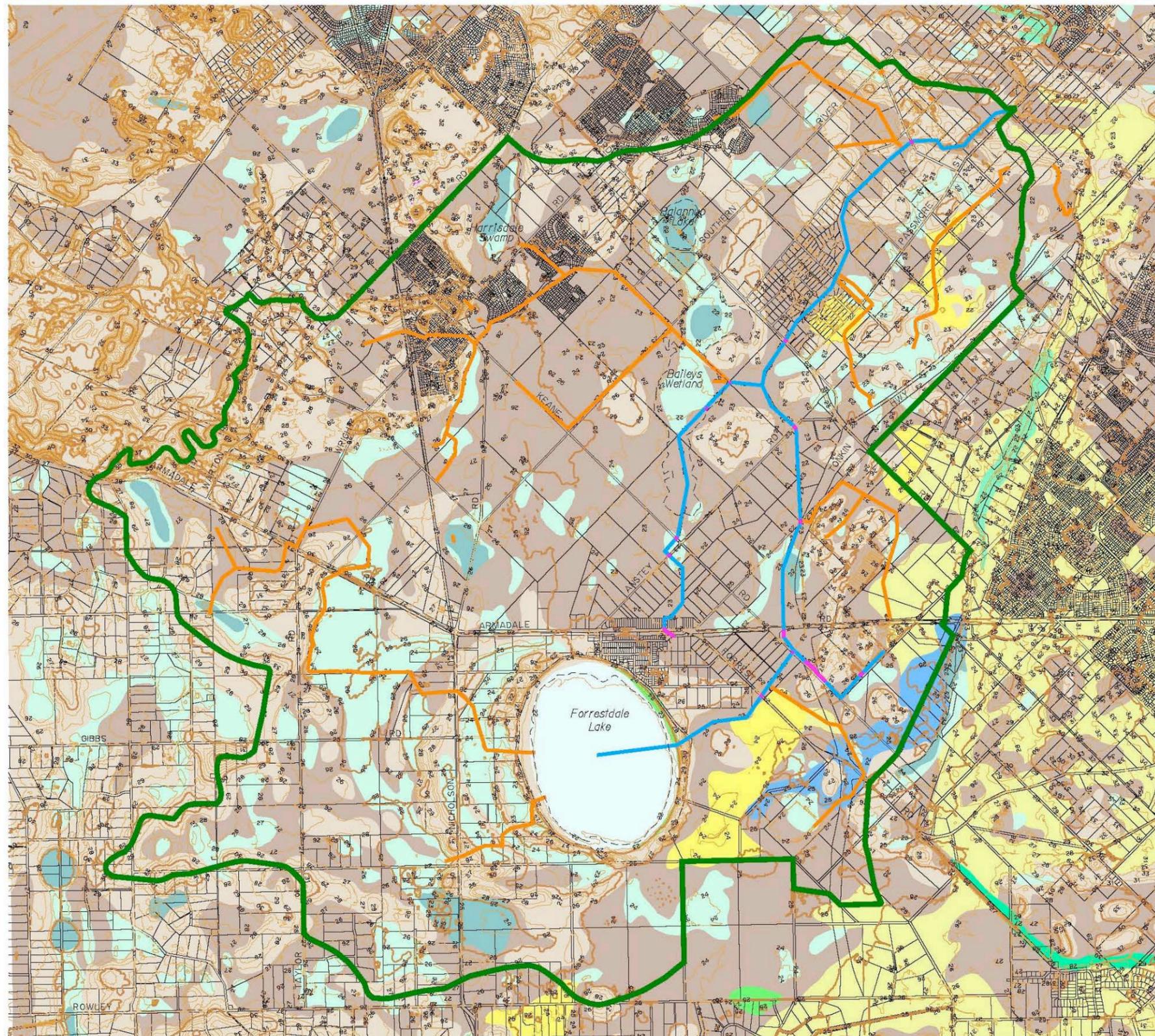


Figure 5 Example geotechnical plan (figure from Forrestdale main drain arterial drainage strategy, DWR 2009b)

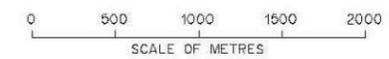
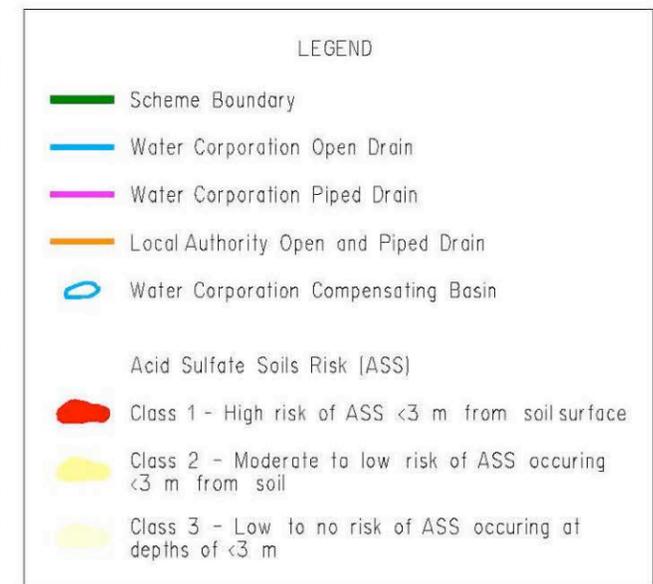
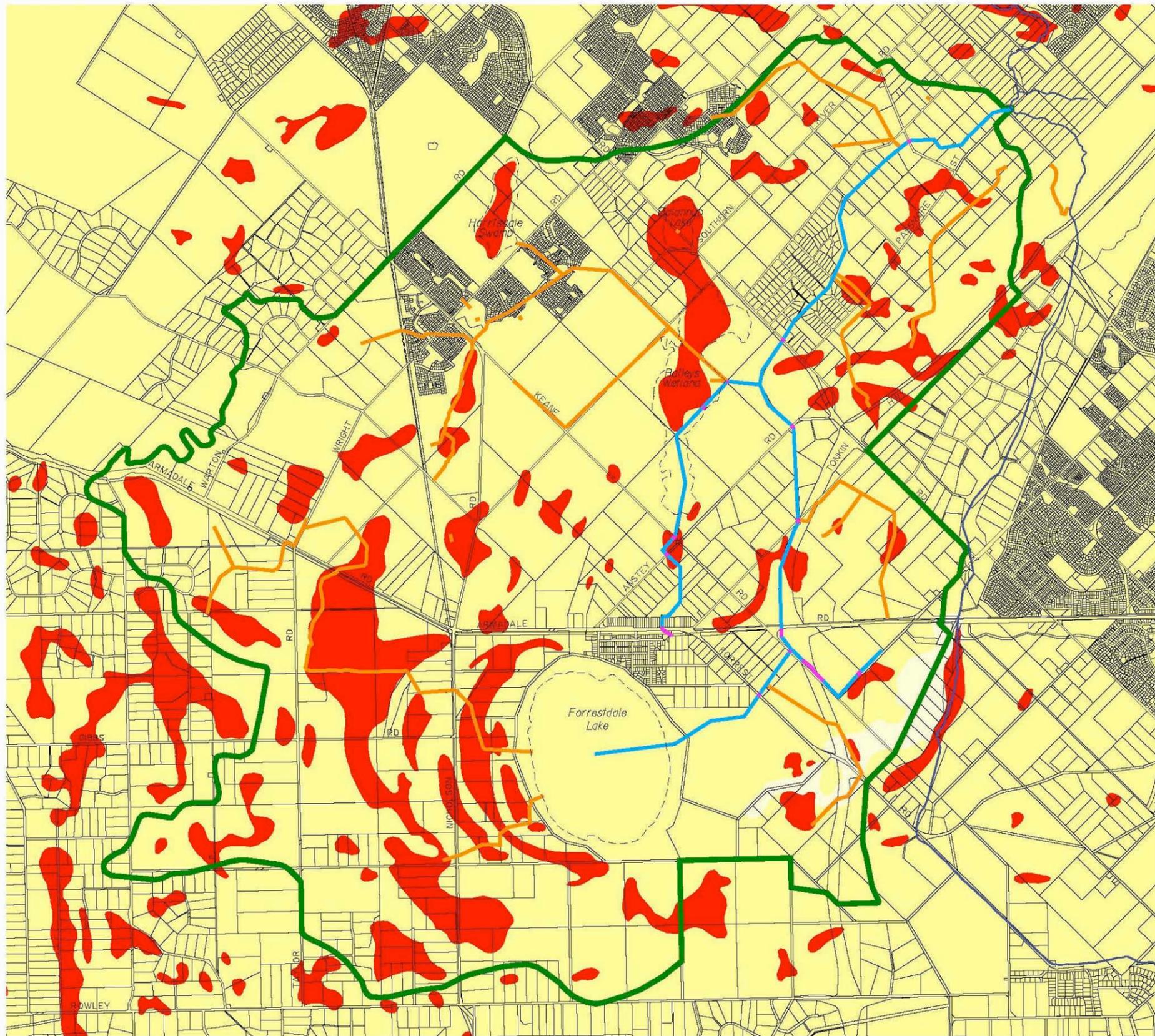


Figure 6 Example acid sulfate soils risk map (figure from Forrestdale main drain arterial drainage strategy, DoW 2009b)

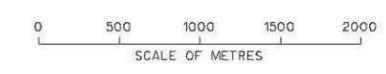
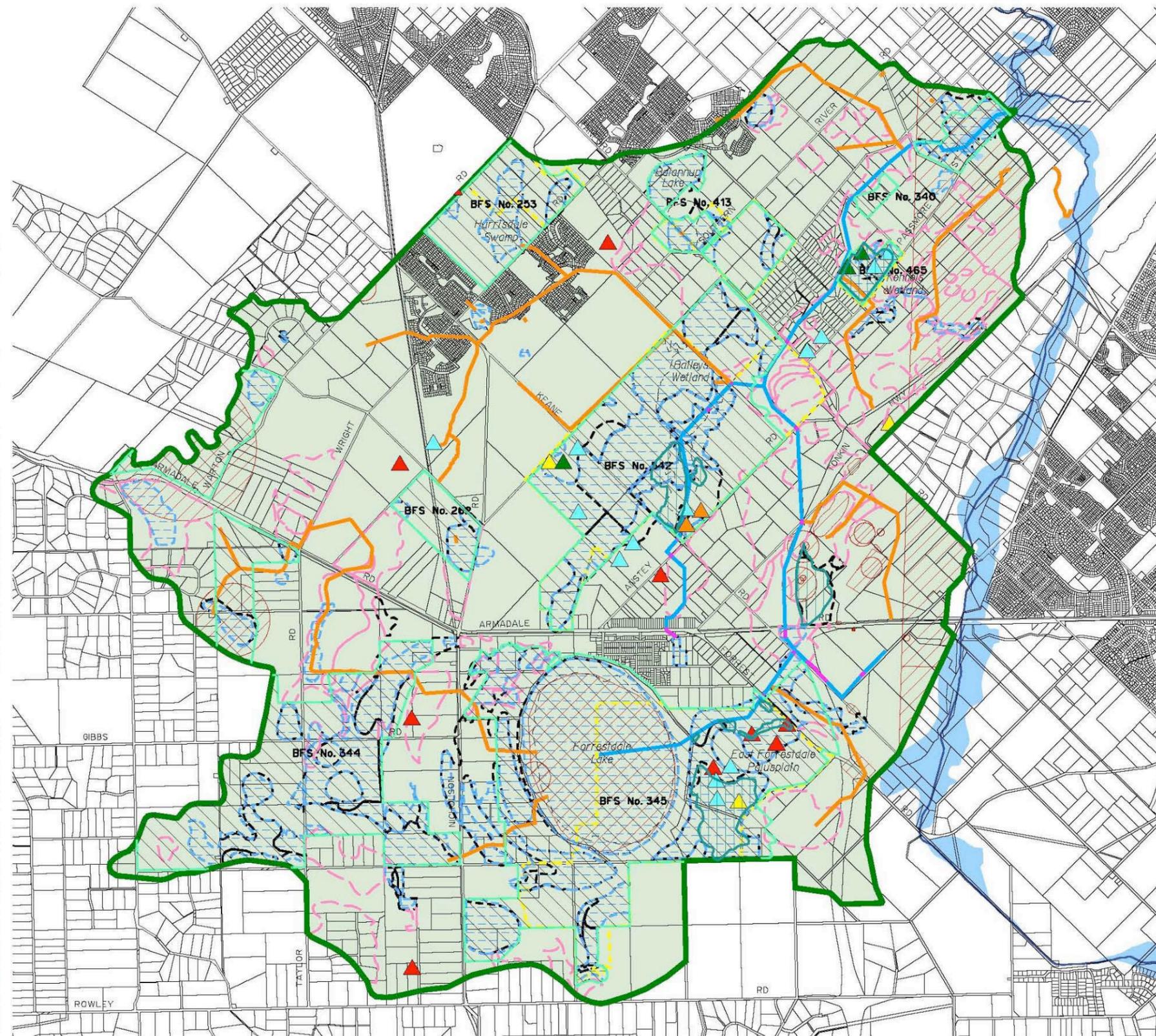


Figure 7 Example environmental and social considerations (figure from Forrestdale main drain arterial drainage strategy, DoW 2009b)

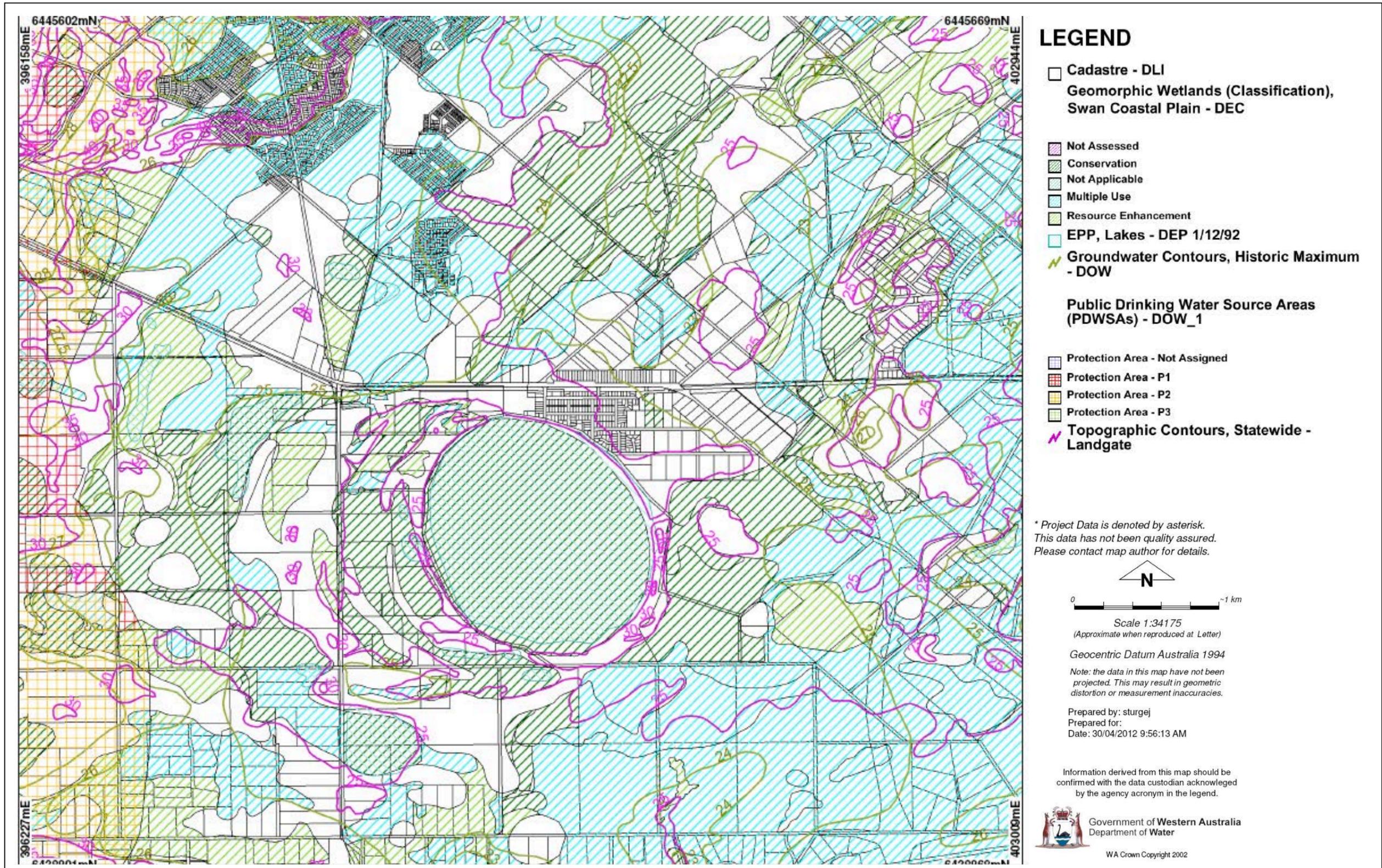


Figure 8 Example groundwater and topographic contours (depth to groundwater), wetlands, public drinking water source areas

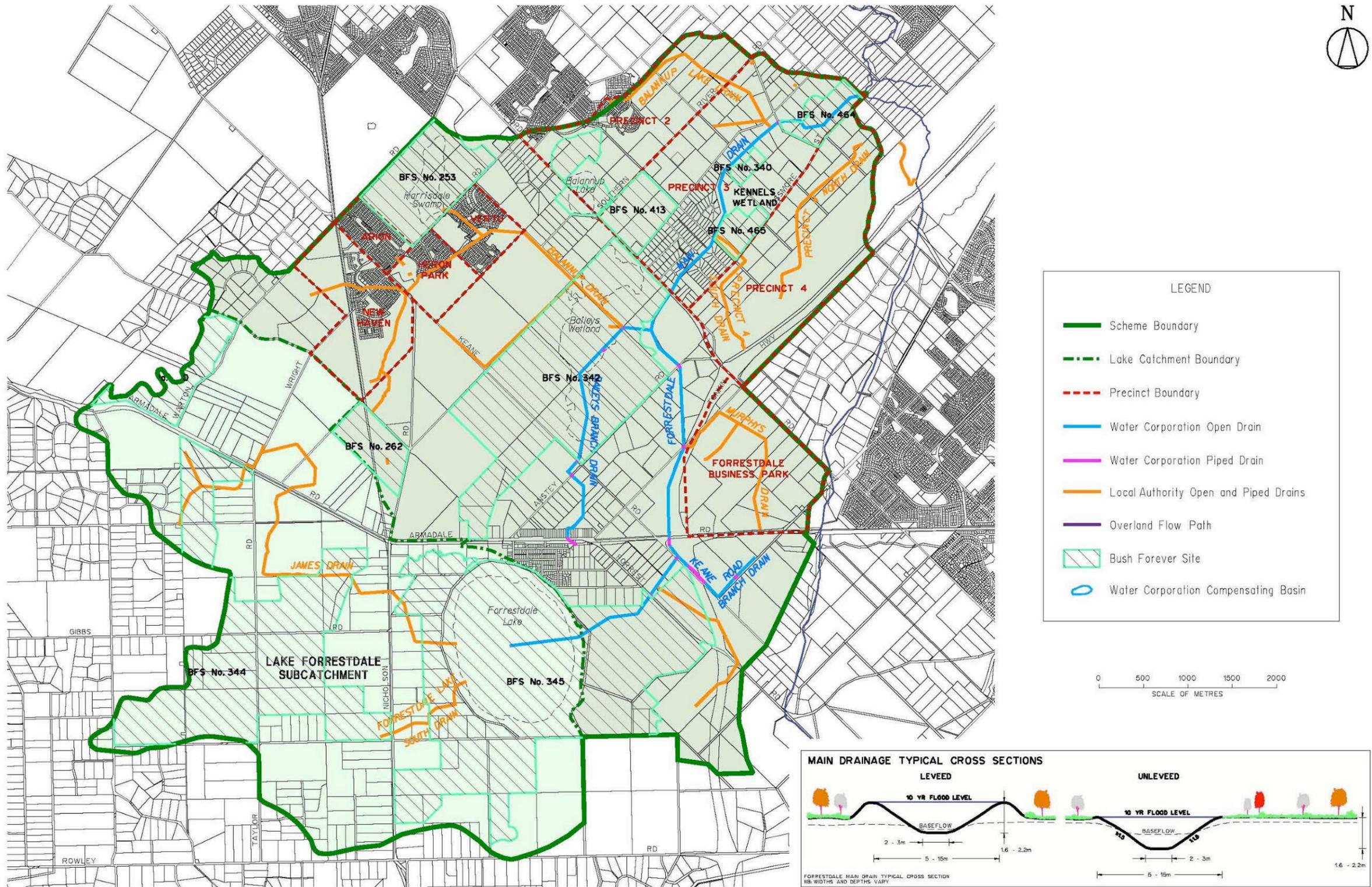


Figure 9 Example surface water hydrology (figure from Forrestdale main drain arterial drainage strategy, DoW 2009b)

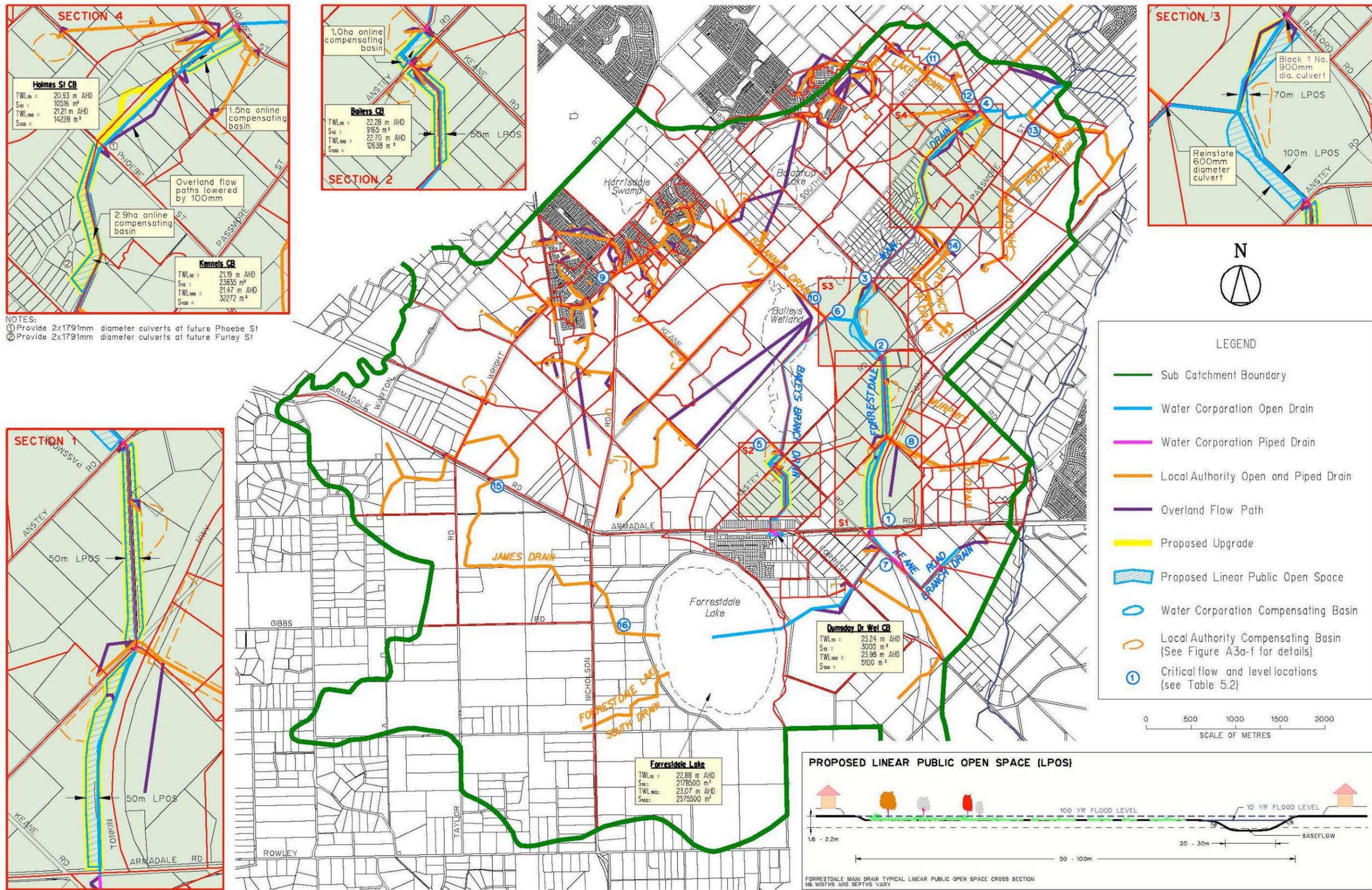


Figure 10 Example arterial drainage plan (figure from Forrestdale main drain arterial drainage strategy, DoW 2009b)

Shortened forms

ARI	Average recurrence interval
BUWM	Better urban water management
DoW	Department of Water
DWMP	Drainage and water management plan
EWR	Environmental water requirement
DWMS	District water management strategy
IPWEA	Institute of Public Works Engineering Australia
LWMS	Local water management strategy
RWMS	Regional water management strategy
UWMP	Urban water management plan
WAPC	Western Australian Planning Commission
WDE	Water-dependent ecosystem
WSUD	Water sensitive urban design

Glossary

ARI	Average recurrence interval
Controlled groundwater levels	The controlled (i.e. modified) groundwater level (measured in metres Australian Height Datum) at which drainage inverts are set. This level must maintain the hydrologic regimes of water-dependent ecosystems, such as wetlands, that are to be protected.
Drinking water	Drinking water, or potable water, is water suitable for drinking, cooking and other uses, requiring high quality water. The standards that define drinking water are described in the Australian drinking water guidelines (ANZECC & ARMCANZ 2000).
Ecological water requirements (EWRs)	The water regimes needed to maintain ecological values of water-dependent ecosystems at a low level of risk.
Fit-for-purpose	Water that is treated to a quality appropriate for its intended end uses, as described in the <i>Australian guidelines for water recycling: managing health and environmental risks, phase 1</i> (Australian Government 2006).
Flood fringe	The areas of the floodplain, outside the floodway, that are affected by flooding. These areas are generally covered by still or very slow moving waters during a 100-year average recurrence interval flood.
Floodplain	The portion of a waterway valley that is covered with water when it overflows its banks during major flows.
Floodway	The river channel and the portion of the floodplain that forms the main flow path of flood waters once the main channel has overflowed.
Hydrological regimes	Patterns of water presence and absence, encompassing variations in the timing, frequency, duration, extent, depth, variation, direction and rate of flow.
Non-drinking water	Is not of drinking water quality but, depending

	<p>on its quality, may still be used for many other purposes.</p>
Public drinking water source areas	<p>The collective description for water reserves, catchment areas and underground water pollution control areas declared under the provisions of the <i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i> or <i>Country Areas Water Supply Act 1947</i>.</p>
Receiving water bodies	<p>Waterways, wetlands, coastal marine areas and shallow groundwater aquifers.</p>
Total water cycle	<p>Recognising the interconnectedness of water supply, groundwater, stormwater, wastewater, flooding, water quality, wetlands, watercourses, estuaries and coastal waters.</p>
Water balance	<p>A model showing the volume of water flowing into an area, flowing out of it, and the change in storage within it.</p>
Water-dependent ecosystem (WDE)	<p>Those parts of the environment, the species composition and natural ecological processes that are determined by the permanent or temporary presence of water resources, including flowing or standing water and groundwater.</p>
Water sensitive urban design (WSUD)	<p>A design philosophy that provides a framework for managing water-related issues in urban areas. It incorporates the sustainable management and integration of stormwater, wastewater and water supply into urban design. A basic WSUD principle is to include water resource management issues early in the land-use planning process. WSUD can be applied at the lot, street, neighbourhood, catchment and regional scale.</p>
Waterway	<p>Any river, creek, stream or brook, including its floodplain and estuary. This includes systems that flow permanently, for part of the year or occasionally, and parts of the waterway that have been artificially modified.</p>

Waterway foreshore area

The land that adjoins or directly influences a waterway. It is the transition area between the edge of the waterway and the furthest extent of riparian vegetation, the floodplain and riverine landforms. It may also be a negotiated area endorsed by the Department of Water.

Wetland

Area of seasonally, intermittently or permanently waterlogged or inundated land, whether natural or otherwise, such as lakes, swamps, marshes, springs, and damplands. Excluded from this definition are waterways (rivers, creeks, streams or brooks) and their floodplains and estuaries.

Wetland buffer

An interface adjoining a wetland that is designated to help protect the wetland's natural values from the threats posed by the surrounding land uses.

References

- ANZECC & ARMCANZ 2000, *Australian and New Zealand guidelines for fresh and marine water quality*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, <www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html>
- Australian Government 2006, *Australian guidelines for water recycling* (Phase 1 and Phase 2 modules), Environment Protection and Heritage Council, <www.ephc.gov.au/taxonomy/term/39>.
- Department of Water 2004–2007, *Stormwater management manual for Western Australia*, Department of Water, Perth.
- 2007, *Water Quality Protection Note: Identification, assessment and protection of public drinking water source areas*, WQPN 87, Department of Water, Perth.
- 2008a, *Interim: Developing a local water management strategy*, Department of Water, Perth.
- 2008b, *Urban water management plans – Guidelines for preparing plans and for complying with subdivision conditions*, Department of Water, Perth.
- 2009a, *Decision process for stormwater management in WA*, Department of Water, Perth.
- 2009b, *Forrestdale main drain arterial drainage strategy*, Department of Water, Perth.
- 2011, *Water sensitive urban design in WA: An introduction*, Department of Water, Perth.
- 2012a, *Operational policy: Identifying and establishing waterways foreshore areas*, Department of Water, Perth.
- 2012b, *Water monitoring guidelines for better urban water management strategies and plans*, Department of Water, Perth.
- 2013a, *Better urban water management guidance note 2: Water management reports in the planning process*, Department of Water, Perth.
- 2013b, *Better urban water management guidance note 3: Preparation and assessment of water management reports*, Department of Water, Perth.
- 2013c, *Better urban water management guidance note 7: Managing the hydrology and hydrogeology of water dependent ecosystems in urban development*, Department of Water, Perth.
- 2013d, *Water resource considerations when controlling groundwater levels in urban development*, Department of Water, Perth.

- 2013e, *Guideline for the approval of non-drinking water systems in Western Australia – urban developments*, Department of Water, Perth.
- Environment Australia 2001, *A directory of important wetlands in Australia, Third Edition*, Environment Australia, Canberra.
- Institute of Public Works Engineering Australia (WA Division Inc.) 2011, *Local government guidelines for subdivisional development edition 2.1*, Institute of Public Works Engineering Australia, Perth.
- Water Corporation, *H2Options*, Water Corporation Perth,
<http://www.watercorporation.com.au/H/h2options.cfm?uid=9142-8327-1452-2349>.
- Western Australian Planning Commission 2000, *Bush Forever*, Western Australian Planning Commission, Perth.
- 2006, *State planning policy 2.9: Water Resources*, Western Australian Planning Commission, Perth.
- 2007, *Liveable neighbourhoods: a Western Australian Government sustainable cities initiative*, Western Australian Planning Commission, Perth.
- 2008a, *Acid sulfate soils planning guidelines*, Western Australian Planning Commission, Perth.
- 2008b, *Better urban water management*, Western Australian Planning Commission, Perth.
- 2009, *Planning bulletin 64/2009: Acid sulfate soils*, Western Australian Planning Commission, Perth.

Department of **Water**

168 St Georges Terrace, Perth, Western Australia
PO Box K822 Perth Western Australia 6842

Phone: 08 6364 7600

Fax: 08 6364 7601

www.water.wa.gov.au

10307-02 0 1213