Department of Water
Government of Western Australia

Urban water management plans

Guidelines for preparing plans and for complying with subdivision conditions

Department of Water

August 2008

Department of Water
168 St Georges Terrace
Perth Western Australia 6000
Telephone +61 8 6364 7600
Facsimile +61 8 6364 7601
http://www.water.wa.gov.au

August 2008

ISBN 978-1-921508-17-2 (pbk)
ISBN 978-1-921508-18-9 (pdf)

Acknowledgements

This document was prepared for the Department of Water by Essential Environmental Services.

Figures were contributed by Thompson, McRobert and Edgeloe (TME), Emerson Stewart and McNally Newton Landscape Architects.

The Department of Water would like to thank the following for their contribution to this publication.

Grahame Heal, City of Mandurah; Scott Wills, JDA; Toby Vangelovski, Emerson Stewart; Martyn Glover; IPWEA and Wayne Edgeloe, TME.

For more information about this report, contact the drainage and waterways branch of the Department of Water.

Cover photos: Water-sensitive urban development in Mandurah, courtesy of Essential Environmental Services.

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1 Aim of this document

This document is intended to provide guidance regarding the urban water management issues that need to be addressed at the subdivision stage of development. It also explains what you should include when preparing an urban water management plan (UWMP).

It provides detailed guidance for compliance with the Western Australian Planning Commission's *Better urban water management* and *State planning policy 2.9 water resources*.

Where to get more information

Additional policies and design guidance on how to address urban water management during the subdivision stage is contained in the Western Australian Planning Commission's *Liveable neighbourhoods* (4th edn), the *Stormwater Management Manual for Western Australia*, *Australian runoff quality: A guide to water sensitive urban design* and *Australian rainfall and runoff: A guide to flood estimation*.

Catchment-specific policies and technical guidance may also be available; for example, in the Peel–Harvey catchment documents such as the *Peel–Harvey coastal catchment water sensitive urban design technical guidelines* and *Peel–Harvey WSUD local planning policy* provide such guidance. Check what documents are available in your area.

See the reference list at the end of this document for more information about these publications.

2 Planning for urban water management

State planning policy 2.9 water resources promotes managing 'the urban water cycle as a single system in which all urban water flows are recognised as a potential resource and where the interconnectedness of water supply, stormwater, wastewater, flooding, water quality, wetlands, waterways, estuaries and coastal waters is recognised'.

It also requires development to consider 'total water cycle management and water-sensitive urban design principles and ensure that development is consistent with current best management practices and best planning practices for the sustainable use of water resources'.

The principles of water-sensitive urban design are outlined in Schedule 4 of *State planning policy 2.9 water resources*. Water-sensitive urban design is, put simply, a way to achieve better urban water management through the land use planning and development approvals process.

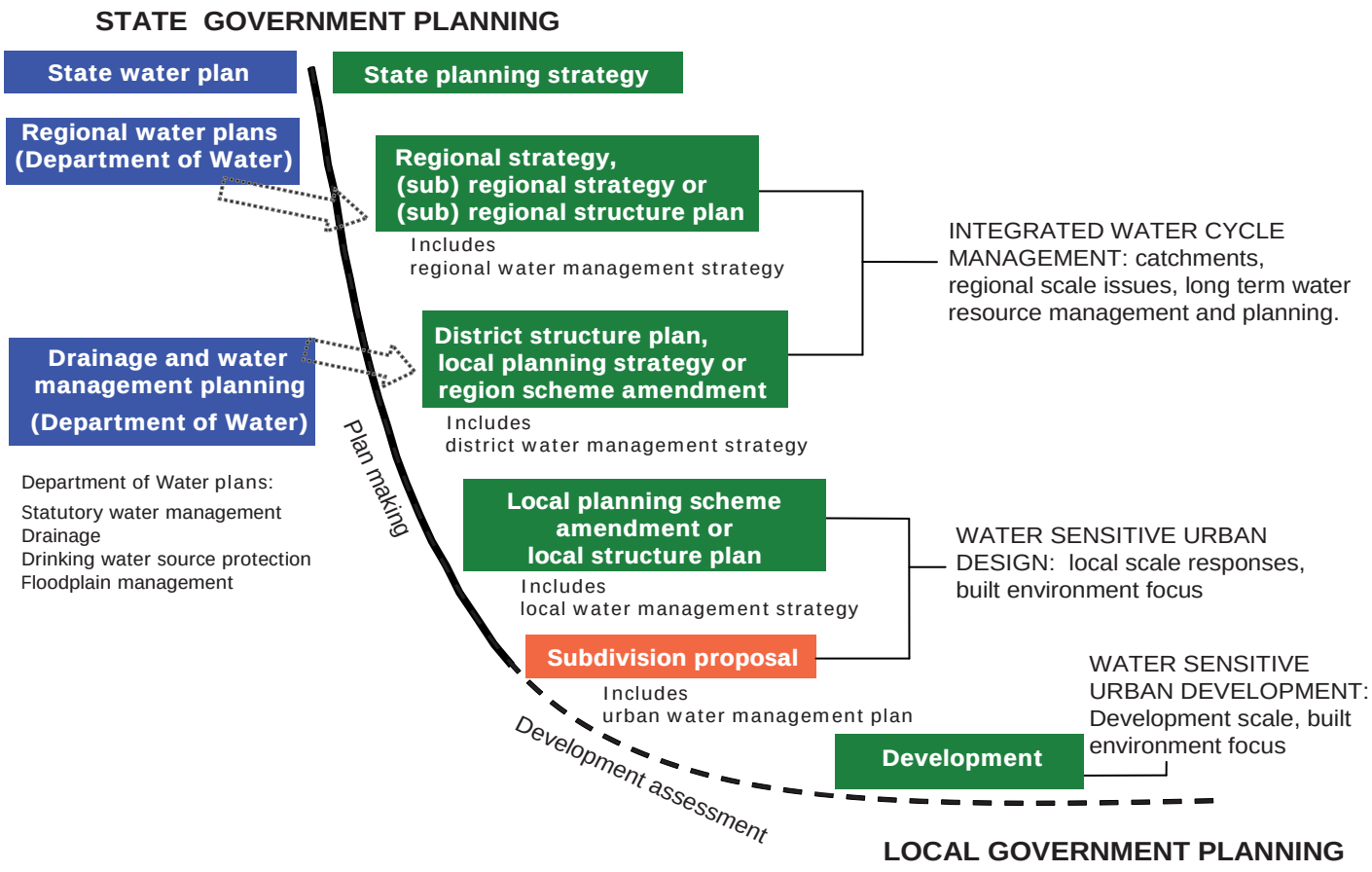
To assist the land development industry to demonstrate compliance with the policies and principles of *State planning policy 2.9 water resources*, the Western Australian Planning Commission has updated *Planning bulletin 61 urban stormwater management* and published *Better urban water management*.

Who needs an urban water management plan?

Better urban water management recommends that large greenfield subdivisions (generally for more than 25 lots) or small subdivisions within a priority catchment are supported by a UWMP to demonstrate how the proposed development complies with published policy.

This document provides guidance on how to develop and what to include in a UWMP, as well as information to aid compliance with urban water management conditions.

The actions required at the various stages of the planning process, as set out in *Better urban water management*, are shown in Figure 1.



Note: The above diagram depicts the optimal process. In situations where there is existing zoning and a lack of guiding information, a flexible approach to implementation may be required. This is at the discretion of the Western Australian Planning Commission on advice of the Department of Water.

Figure 1 Integrating water planning with the land planning processes

3 Developing an urban water management plan

Good water-sensitive urban design requires consideration of all forms of water, including drinking water, wastewater, stormwater, groundwater and water for the environment. To determine appropriate strategies to manage all forms of water, consideration must be given to the site's specific conditions. The design should be a response to the site's conditions, within the overall planning vision for the proposed development.

Determining the design at the subdivision stage is too late to achieve the best results. A strategy for managing all forms of water should be developed and approved at the local structure planning stage, via a local water management strategy. Where this has not been done, however, best efforts should be made to integrate water management into the subdivision design.

The achievement of a water-sensitive subdivision design should be demonstrated using a UWMP that addresses the principles and strategies of water-sensitive urban design. Generally, these principles require that four key elements are addressed (as outlined in Table 1).

The following should also be considered as part of determining the design:

- *Runoff*. To manage the runoff from the constructed impervious surfaces, thoroughly evaluate the water 'losses' (through evaporation, evapotranspiration, and infiltration and retention storage in soak wells, pipes, underground storage, rainwater tanks, bio-retention systems, swales, etc.) that occur during regular (or frequent, less than one-year intensity) ARI events.
- *Soil type and stormwater infiltration*. Assess the potential of the soil to absorb (through infiltration, in conjunction with evaporation and evapotranspiration) the water from a one-in-one-year ARI event. Consider the degree of infiltration when doing post-development water balance.
  Maximise stormwater infiltration on sandy soils. The water from everyday rainfall should be retained within the lots, the road reserve or the first park. These areas should be vegetated or contain underground storage that later discharges to the groundwater or surface water systems.
- *Water treatment*. Design water-treatment infrastructure in accordance with guidelines contained in Chapter 9 of the *Stormwater management manual for Western Australia*.
  - Stormwater should have some degree of treatment before it is allowed to infiltrate to the groundwater (e.g. a bio-retention swale and/or soil amendment).
  - Where the export of nutrient-rich groundwater is likely to occur or be increased (e.g. via the use of subsoil drainage), provision should be made to treat the exported groundwater.

- *Water-borne pollutants*. Identify pollutants and ensure appropriate management practices are implemented to combat them. Refer to Chapters 7 and 9 of the *Stormwater management manual for Western Australia*.
- *Climate change*. Consider the future effects of climate change.

Table 1 Key elements for water-sensitive urban design

Key element	Action
Water balance, conservation, use and efficiency	Demonstrate that you understand how water is used across the site. Predevelopment water balance should have been agreed during the structure planning or earlier. The development should achieve: 1 conservation of drinking water, through water-efficient fixtures and fittings and through xeriscaping (landscaping using plants that don't need irrigation) both private and public spaces 2 fit-for-purpose water use, including from rainwater tanks, greywater and/or reticulated non-potable supply 3 ecological protection, i.e. maintaining the daily, monthly and annual variation in groundwater and surface water (minimums and maximums, flow intensities, extremes).
Flood protection (managing extreme events, such as 100-year floods)	• Demonstrate that the development is not within a floodway. Development is not permitted within floodways; however, development may occur within a floodplain (flood fringe), but only if approved in the local structure plan. • Ensure that buildings' floors are 0.5 metres above the 100-year flood level. It is advisable to check with local government and consider climate change. • Accommodate major floods in road reserves and public parkland in accordance with *Liveable neighbourhoods* (Figure 60, Element 5) and the agreed landscape plan. • Identify the likely flood event flowpaths, flow rates and velocities, storage areas and hydraulic grade lines, including top water levels.
Frequent (up to 1 year ARI)events	• Ensure that runoff from constructed impervious surfaces from the one-in-one-year (one hour duration) ARI event can be retained, where possible, within the lot or road reserve. Where ground conditions do not support adequate infiltration rates, runoff may also be contained in underground storage systems or public open spaces, provided there is no reduction in the public open spaces' amenities and the design complies with the policies explained in *Liveable neighbourhoods*. • Design the development so that the amount of water flowing offsite remains unchanged before and after development. • Plant vegetation on all surfaces that are used to accommodate one-in-one-year (one hour duration) ARI event to avoid this area becoming water-logged and to manage water quality. • Size the water quality structural controls according to the design criteria contained in the local water management strategy and the guidelines in the *Stormwater management manual for Western Australia*.
Groundwater	• If it is part of the proposal, indicate the proposed controlled groundwater level; for example, through the installation of a subsoil drain. If a controlled groundwater level is proposed close to environmentally sensitive areas, it must be shown that the new regime will be similar to that currently existing. • Treat any additional outflow of groundwater (e.g. via subsoil drainage) through a structural control, ie bioretention system or riparian vegetation zone (see Chapter 9 of the *Stormwater management manual for Western Australia or the River Restoration Manual for WA*) before it reaches the receiving environment.

4 Tips for preparing an urban water management plan

Tip 1: Only address what is relevant

This document contains a detailed list of requirements for UWMPs; however, you only need to address those that are relevant to the development.

Explain the key issues that have guided the design. Do not spend time on insignificant or irrelevant issues, but briefly and clearly state why an issue is not relevant.

Tip 2: Keep it short

A UWMP does not need to be a lengthy document. It should only contain information that is relevant, that has been used to make a decision or that is needed to justify a design element. Information provided as figures and/or tables preferred to substantial text.

Tip 3: Use references wisely

Do not repeat information contained in the local water management strategy unless it is directly relevant. Do, however, provide detailed references and ensure that the documents you refer to are easily available if required.

Tip 4: Focus on the design and construction

The UWMP should focus on the design, construction and implementation. It must state what will be done, when and by whom.

Ensure that it only refers to what WILL be done. Do not refer to actions that are not yet agreed or approved.

5 What to include in an urban water management plan

The UWMP is largely an extension of the local water management strategy. The UWMP articulates the critical parameters for infrastructure design at the subdivision stage. The relationship is depicted in Figure 1.

This document assumes that a local water management strategy has been prepared to accompany the local structure plan and that the local water management strategy was supported by key stakeholders, such as the Department of Water, Water Corporation and the relevant local government. Where a local water management strategy has not been prepared and approved, a UWMP should also outline the proposed water management strategy as well as the detailed implementation.

Although this document aims to provide guidance regarding the preparation of UWMPs, it is difficult to be specific as each UWMP will be a direct response to the site and the planned development. There is no one-size-fits-all approach.

Remember that a UWMP should only contain information used to make a conclusion or decision regarding the management of water within the proposed development. It should not contain information just for information's sake.

When preparing a UWMP, it helps to break the information into sections. The likely major headings of a UWMP are listed below. The content of each of these sections is explained in more detail in Table 2.

- Summary
- Planning approval
- Design objectives
- Site characteristics
- Water sustainability initiatives
- Stormwater and groundwater management
- Other issues
- Managing subdivision works
- Monitoring program
- Implementation plan

A helpful checklist has been developed to aid preparation of UWMPs (Appendix 1). Some example figures are included in Appendix 2.

Table 2 What to include in an urban water management plan, by section

Requirements	Comments
Summary	
In the summary, state each key element of the water management strategy and briefly explain how the action/design response achieves the design objective. A second table (or list) that identifies the key elements of the drainage and subdivision design is recommended. This can be checked against the detailed design drawings. The key elements should include (but not be limited to): • the location and size of structural controls to address water quantity and quality objectives • the location and volume of storage for rainfall and floods (one-year, five-year and 100-year ARI events) • the anticipated peak flows of rainfall and floods (one-year, five-year and 100-year ARI events) • hydraulic grade lines and invert levels • subsoil criteria (grade, outfalls, spacing) • land scape elements.	It is most important to summarise how the design objectives have been met and the key design criteria. Provide the actual numbers that can be linked to the detailed design drawings. Providing information as a table is ideal.
Planning approval	
Identify the land to which the UWMP applies. Refer to the WAPC subdivision application or approval (including the WAPC reference number and condition number), as well as previous approvals (including date of zoning and structure plan approval, or lodgement). Details of catchment(s) and land use should be provided. Include the following maps and diagrams (e.g. appendix 2 figure 1): • *Location plan*. The plan needs at least a 1 kilometre radius including roads, surrounding lot numbers and key landscape/use elements. • *Proposed/approved structure plan and subdivision design (application or approved)*. These must include any proposed constructed water body.	There is no need to define water sensitive urban design; however, details of any relevant planning and/or environmental studies may be useful, particularly any applicable local water management strategy.
Design objectives	
Clearly state the relevant design objectives and acknowledge the origin of the design objective (i.e. approved local water management strategy). Later sections of the UWMP should demonstrate compliance with the objectives.	Provide a reference for the origin of each design objective and any assumptions.
Site characteristics	
List and describe the soil type, the soil's phosphorus retention index, profile and permeability of the soil, the current and past land use, any environmentally sensitive areas (both in and next to the site), the surface water characteristics (flow paths, flow rates, storage areas and quality), the groundwater characteristics (quality, levels and direction of flow) and areas of contamination or acid sulfate soils. Where an acid sulfate soil management plan has been prepared, indicate whether it has been approved and what the implications are for the subdivision construction and the management of water (including dewatering). In this section you should include figures or maps to demonstrate	Provide more detail than in the local water management strategy. The information here should be based on additional, more detailed site assessments. Focus on demonstrating how the site characteristics affect the design.

Requirements	Comments
the following (e.g. appendix 2 figure 2): • *Land use*. Include the topography and show links between environmentally sensitive areas and neighbouring lots. • *Constraints (or opportunities)*. Include wetland types and classification, Bush Forever protected areas, locally significant remnant vegetation, existing drains and waterways, where earlier land use might have caused contamination and acid sulfate soils (the red and orange areas shown in Figures 1–10 of *Planning bulletin 64 acid sulfate soils*). • *Surface water flow paths*. Include existing drains, waterways etc. to show how water flows across the site. Show where the water is coming from and where it goes. If water is flowing across the site, how much is it (both entering and exiting)? Show the floodplain of a 100-year flood (e.g. appendix 2 fig 3). • *Groundwater depth*. Show the depth to current groundwater using regional information confirmed by onsite testing (preferably quarterly over 2 years or sufficient data to demonstrate the required outcome). Also include topography, bore locations and hydrographs. Provide contours for the entire map, not just the lots being developed (e.g. appendix 2 fig 4). • *Groundwater quality*. Include a map with bore locations and test results. Identify past land use that might have potential for contamination. Also include acid sulfate soil mapping (the red and orange areas shown in Figures 1–10 of *Planning bulletin 64 acid sulfate soils*) and any further test results.	
Water sustainability initiatives	
Outline the agreed and approved measures to achieve water conservation and efficiency, including non-potable supply. Outline all approvals, designs, controls, management and operation of the proposed system. Where sustainability initiatives that affect the water management strategy are proposed, include a refined water balance for both pre- and post-development. Explain the potential to reduce the use of drinking water. Will the developer provide a non-potable water supply? Is there a contingency plan if you can't achieve the proposed sustainability initiatives? Explain how the developer will ensure reduced use of potable water (inside and outside homes and in public spaces) to improve water efficiency. How much water is required to water public open space? Provide a landscape schedule and ensure irrigation requirements are minimised.	The water conservation strategy should have been determined as part of the local structure plan as this is where the most efficient methods can be identified. Do not discuss options that are not going to be implemented. Further information on water efficiency and reuse options and the preparation of Water Conservation Plans can be found on the Department of Water's and Water Corporation's websites.
Stormwater and groundwater management	
Outline the detail of the drainage system, based on detailed surface water and groundwater modelling. Provide a detailed description of the stormwater management system and how it works. Include a description of the size, location and design of the system, including public open space, integrating major and minor flood management capability. Provide information about the required storage (for one-year, five-year and 100-year ARI events), invert levels, top water and peak flow levels, and how it will be integrated with upstream and downstream systems. Indicate the system control point(s) and show where the flows will	Modelling using the rational method alone is not acceptable. Where there is limited interaction between the groundwater and surface water, this section may be divided. The one-in-five-year ARI event is the Department of Water's suggested minor event for achieving the 'serviceability' criteria of *Australian rainfall and runoff: A guide to flood*

Requirements	Comments
go (for one-year, five-year and 100-year ARI events). Consider the following: • How will the drainage design address water quality? Which structural and non-structural best-management practices are to be implemented and where they are to be located? What is the likelihood of exporting nutrient-rich groundwater? What actions will be undertaken to manage this issue? • How will the best-management practices be maintained and managed? How much will the maintenance and management cost and how will these expenses be covered? (Note that this may vary with the agreement of the local government.) • How will groundwater levels be managed to maintain the ecosystem's health? Is any dewatering proposed? It should be possible to demonstrate that the development will have no impact on groundwater-dependent ecosystems. • Are there significant waterways, wetlands (and their buffers), remnant vegetation and ecological linkages? Explain how these will be protected. • Is there contamination and/or acid sulphate soils? What actions are planned to manage these appropriately? Figures that show the following should be included for the whole development and, where appropriate, for critical locations (e.g. appendix 2 figures 6 to 11): • pipe/swale network, including locations of best-management practices (swales, bio-retention areas, soak wells, side-entry pits, etc.); this figure should depict the area inundated by one-year and 100-year ARI events (ideally also five-year ARI events to allow *Liveable neighbourhoods* calculations) • cross-sections of swales, storage areas and multiple-use corridors, including indicative final landform/landscaping • long section(s) of system showing invert levels, groundwater levels, hydraulic grade lines for one-year, five-year and 100-year ARI events • existing surface levels and maximum and minimum groundwater levels; these should be generated from site tests and the Department of Water's regional data • final surface level, final groundwater levels, amount of fill required (include basin/swale invert level and calculation method for MGL • drawdown influence from any subsoils, especially close to wetlands.	*estimation*. *Liveable neighbourhoods* recognises that flows between the one and five-year events may be contained within restricted use public open space. Flows larger than the five-year ARI event may be contained within public open space. Check with the local government or Main Roads to determine the appropriate design for clearing stormwater from the road pavement. Refer to *Liveable neighbourhoods* (Element 5, Figure 1). Once the water is clear of the pavement, the flow-management criteria (for one-year, five-year and 100-year ARI events) shall apply. If subsoils are set at or above the MGL (maximum groundwater level), it is assumed that this will adequately manage any impact on groundwater-dependent ecosystems. The invert level of storage areas or swales should be set at least 0.3 metres above the MGL or approved controlled groundwater level.
Landscape concept	
Provide a separate section on managing public open spaces if a number of water efficiency (and other) strategies are to be implemented. Address plant species selection, nutrient application and irrigation management (e.g. appendix 2 figure 5). If a constructed water body is proposed and has been endorsed in the local water management plan, the UWMP shall address all of the requirements of the Department of Water's *Interim position statement: Constructed lakes* and any local government requirements or policies. Where significant environmental areas exist on or near the site, additional measures are likely to be needed to ensure their protection. Provide information about the areas' current hydrology	Look to retain vegetation and trees to aid in stormwater management.

Requirements	Comments
and demonstrate that it will not be dissimilar post-development.	
Managing subdivision works	
Outline any actions that will be taken to optimise the management of the subdivision works and to ensure no impact on regional conservation areas. Address (as a minimum): • dewaterin g • acid sulfate soils • dust and sediment control • maintenance of any installed best-management practices during housing construction.	Management of sediment during housing construction is a key factor in the success of installed best management practices. A non potable source of water should be used for dust control.
Monitoring program	
Outline the monitoring program proposed, including its methods, frequency and parameters. It should extend for at least 3 years after the last stage of construction of the subdivision, unless otherwise negotiated with the local government. Where housing construction delays are expected, this monitoring management period may be extended. Administration arrangements should be made with the local government authorities. A contingency plan should also be identified, together with appropriate trigger values, responsibilities and financial arrangements.	The monitoring program is important to gain information on the performance of the subdivision as well as individual best-management practices where possible. It should address both groundwater and surface water quantity and quality. Please contact the Department of Water to participate in the best-management practice research and development program.
Implementation plan	
Outline the roles, responsibilities, funding and maintenance arrangements for implementing the UWMP. Where actions are identified as the responsibility of an organisation other than the developer, negotiations should have been completed (or at least commenced) with the assigned agency.	

6 Conditions of subdivision

All subdivision proposals must address urban water management. 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.

Where an approved local water management strategy exists, a condition of subdivision will be imposed by the Western Australian Planning Commission. This is in accordance with *Better urban water management*, which requires further advice regarding how the subdivision will achieve urban water management.

Conditions of subdivision will be one of three types:

- *Type 1*. Drainage systems shall be designed and constructed consistent with the *Stormwater management manual for Western Australia*. (Local government)
- *Type 2*. A UWMP is to be prepared prior to commencement of ground-disturbing activities, consistent with the regional, district or local water management strategy to the satisfaction of the Western Australian Planning Commission on the advice of the Department of Water. (Department of Water)
- *Type 3*. A UWMP to be prepared prior to commencement of ground-disturbing activities, consistent with the *Stormwater management manual for Western Australia* to the satisfaction of the Western Australian Planning Commission on the advice of the Department of Water. (Department of Water)

The time requirement included in Type 2 and Type 3 is important. It ensures that if changes are required to the design to improve the performance of the urban water management system, these can be done before civil works begin. The timing of approval has implications for construction schedules and land owners should allow *at least* four weeks for approval of UWMPs. Where revisions are required to the UWMP, it is likely to take longer than four weeks.

An additional condition will be imposed to ensure that the UWMP is implemented as intended, such as: The approved UWMP shall be implemented by the land owner, to the satisfaction of the Western Australian Planning Commission on the advice of the local government. (Local government)

The following sections provide information to meet the requirements of each subdivision condition.

Type 1: Consistent with the *Stormwater management manual for Western Australia*

Type 1 conditions of subdivision are generally applied to small, infill subdivisions with fewer than 25 lots where the subsequent development poses a low risk to the environment, including water resources.

In these cases, there is often limited scope to achieve total water-cycle solutions due to the small proposal area and, in many instances, the need to connect with existing infrastructure. The focus of this condition is, therefore, drainage and improved stormwater management.

Compliance with the *Stormwater management manual for Western Australia* may be demonstrated by including both structural and non-structural elements in the development proposal. Structural examples include structural stormwater management treatments (such as retention/detention swales and bio-retention systems), flush road kerbing adjacent to public open spaces, swales within public open spaces and baseless manholes. Examples of non-structural practices are street sweeping and community-based social marketing campaigns. The proposed elements may be depicted on a plan displaying where the drainage infrastructure will be located and explained in a letter of commitment from the land owner.

Developers will not need to demonstrate compliance with the design criteria for urban water management at this stage. The Department of Water is developing design guidance for the sizing of structural controls for water quality management for publication later in 2008. Developers should, however, demonstrate that they have considered soil permeability, the effects on groundwater and measures to improve the efficiency of potable water use. The design should be supported by a landscape plan that clearly depicts the proposed landscape of private spaces and parkland amenities.

Type 2: Includes a UWMP that is consistent with the regional, district or local water management strategy

Where a regional water management strategy, district water management strategy, local water management strategy or a Department of Water drainage and water management plan has been prepared, it should be used to guide the detailed design of urban water management measures and infrastructure. This should be outlined in the UWMP.

Type 3: Includes a UWMP that is consistent with the *Stormwater management manual for Western Australia*

Where site-specific criteria have not been determined in a water management strategy or in a Department of Water drainage and water management plan, the UWMP should demonstrate compliance with the generic criteria outlined in *Better urban water management* and the *Decision process for stormwater management in WA*.

7 Summary

A UWMP implements the local water management strategy. It is the ‘what’, rather than the ‘how’, of the management of water in a new subdivision.

A UWMP should not be a lengthy document as it should not repeat information provided in other documents or outline actions or strategies that are not going to be implemented.

A UWMP should clearly and concisely outline the design response to managing water in the particular development. It should demonstrate how the design objectives will be met and provide the critical information for the next stage – the detailed design.

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Appendices

Appendix 1: UWMP checklist

UWMP item	Deliverable	☑
Summary		
Development of design elements and compliance with design objectives	Table 1: Design elements and compliance	☐
Key design requirements for detailed design – critical control points and elements	Table 2: Design requirements for critical control points	☐
Planning approval		
Location plan, adjoining lots, key landscape features and roads, local water management strategy	Location plan	☐
Structure plan, zoning and land use	Site context plan	☐
Subdivision plan and/or approval	Subdivision layout plan	☐
	OR a combination of the above	☐
Design objectives		
Agreed design objectives and demonstration of compliance		☐
Site characteristics		
Existing information and more detailed assessments (monitoring) of site; explanation of how the site characteristics affect the design		☐
Site conditions – existing topography/contours, aerial photo underlay, major physical features	Site condition plan	☐
Geotechnical – topography, test pit locations, soil zones and descriptions, site classification zones, Proposed earthworks and approximate finished contour levels	Geotechnical plan	☐
Environmental – sensitive or significant vegetation areas, wetlands and buffers, waterways and buffers, contaminated sites	Environmental plan, plus supporting data where appropriate	☐
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	☐
Groundwater – topography, test bore locations, groundwater pre- and post-development, water quality, groundwater variation hydrograph	Groundwater plan, plus details of groundwater monitoring and testing	☐
Landscape – proposed public open spaces, water source, bore(s), lake details (if applicable), approx. watering requirements and water balance, indicative irrigation schedule; demonstrate compliance with *Interim position statement: Constructed lakes* (if applicable)	Landscape plan	☐
Water sustainability initiatives		
Water supply and efficiency measures		
Fit-for-purpose strategy and agreed actions; if non-potable supply, support with water balance	Alternative supply scheme and plan	☐
Wastewater management		☐

UWMP item	Deliverable	☑
Stormwater and groundwater management		
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	100-year flood plan Long section of critical points	☐ ☐
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 management practices and treatment trains, supported by sizing criteria, areas of inundation, flow paths and cross sections; show integration with landscaping	1-year event plan 5-year event plan Typical cross sections	☐ ☐ ☐
Post-development groundwater levels and fill requirements (including existing and final surface levels), outlet controls, and any subsoils (showing drawdown/effects near sensitive environments; describe modelling assumptions	Groundwater/subsoil plan Typical cross section (max and minimum)	☐ ☐
Actions to address acid sulfate soils or contamination		☐
Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages		☐
Management of disease vectors and nuisance insects		☐
Other issues		
Any other issues as explained in Table 2		☐
Managing subdivision works		
Management of construction activities including dewatering, acid sulphate soils, constructed best-mangement practices, and dust, sediment and erosion control – timing and possible staging		☐
Monitoring program		
Sampling and assessment plan including duration and arrangements for ongoing actions		☐
Implementation plan		
Roles, responsibilities, funding for implementation		☐
Agreed maintenance arrangements		☐
Assessment and review		☐

Appendix 2: Example figures

Figure A1 Example location plan, site context plan and subdivision layout plan

Figure A2 Example environmental plan

Figure A3 Example surface water plan

Figure A4 Example groundwater plan

Figure A5 Example landscape plan

Figure A6 Example 100 year ARI event plan

Figure A7 Example long section

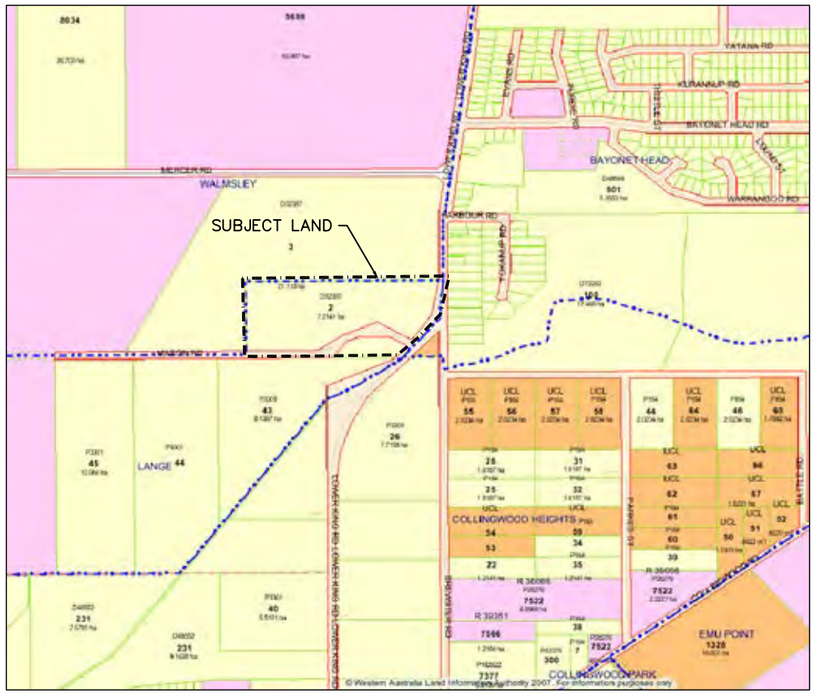
Figure A8 Example 5 year ARI event plan

Figure A9 Example 1 year ARI event plan

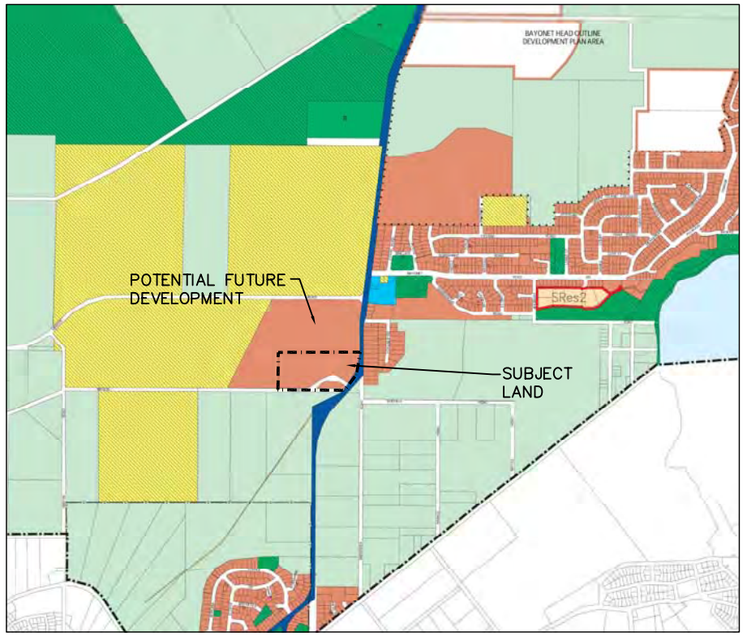
Figure A10 Example cross section

Figure A11 Example subsoil plan

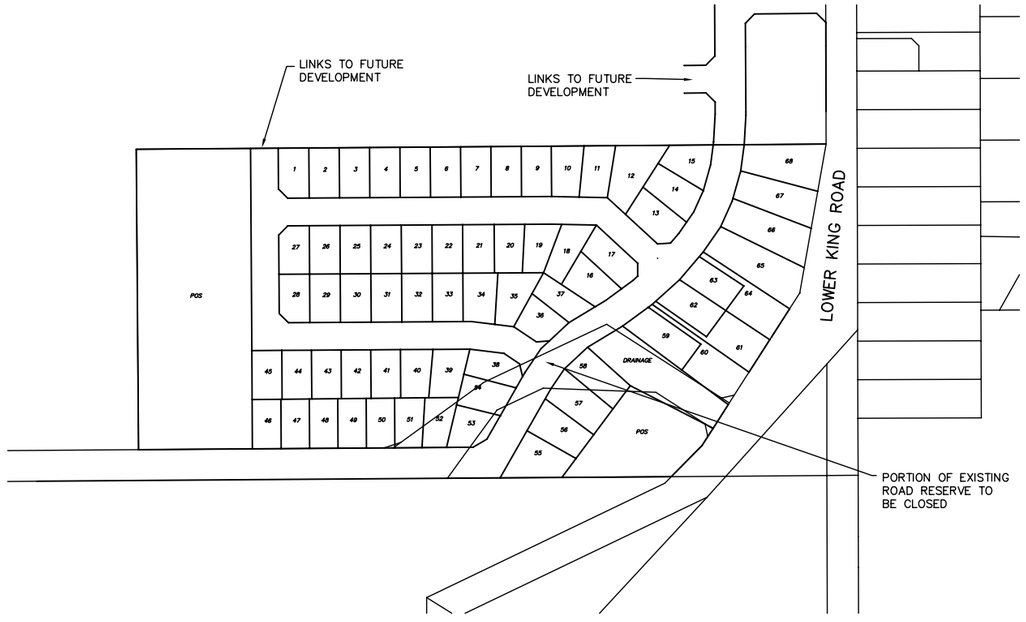
SITE PLAN
SCALE 1:2000



LOCALITY PLAN
NTS



SITE CONTEXT PLAN
NTS



SUBDIVISION LAYOUT PLAN
1:2000

Figure A1 Example location plan, site context plan and subdivision layout plan

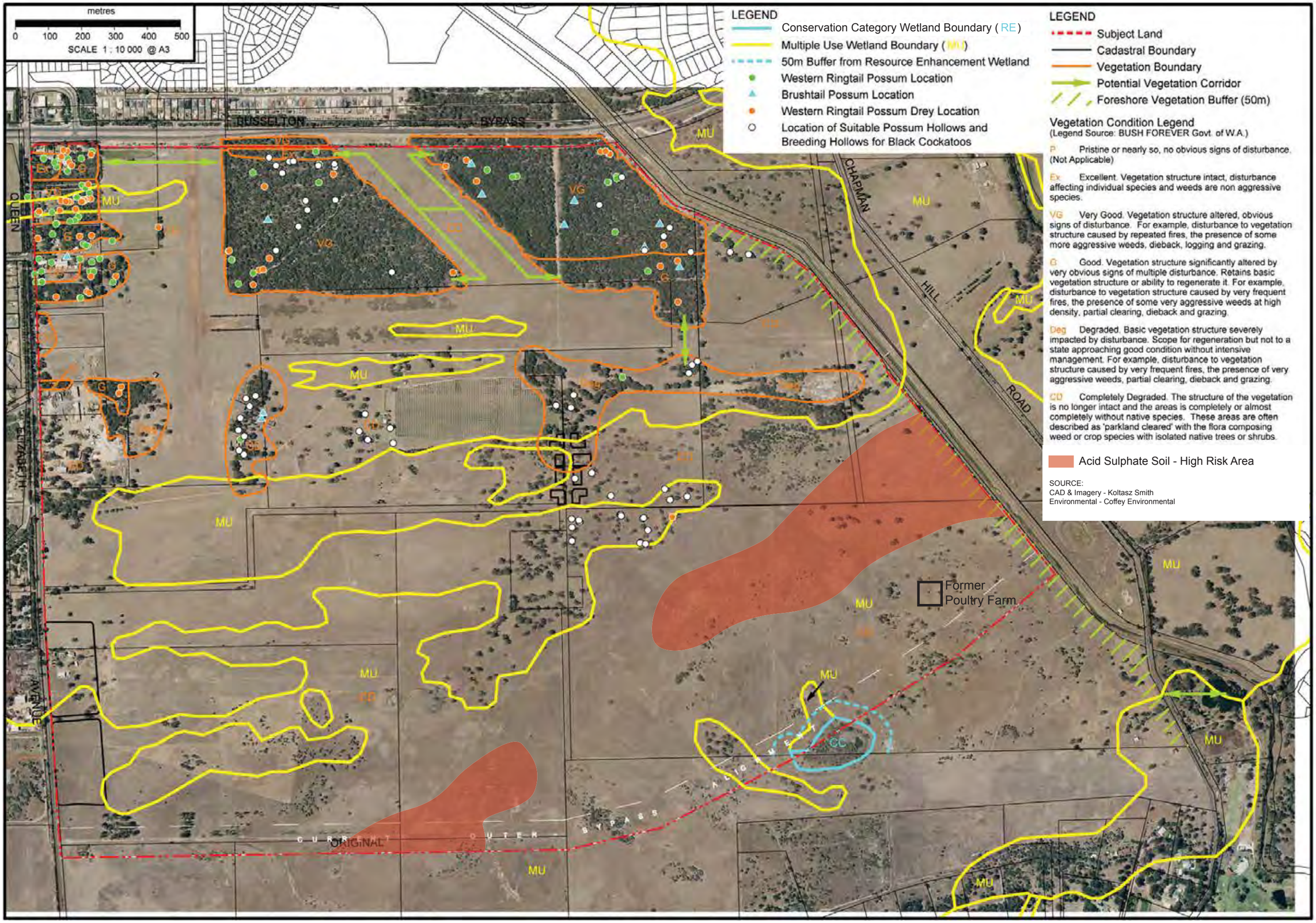


Figure A2 Example environmental plan

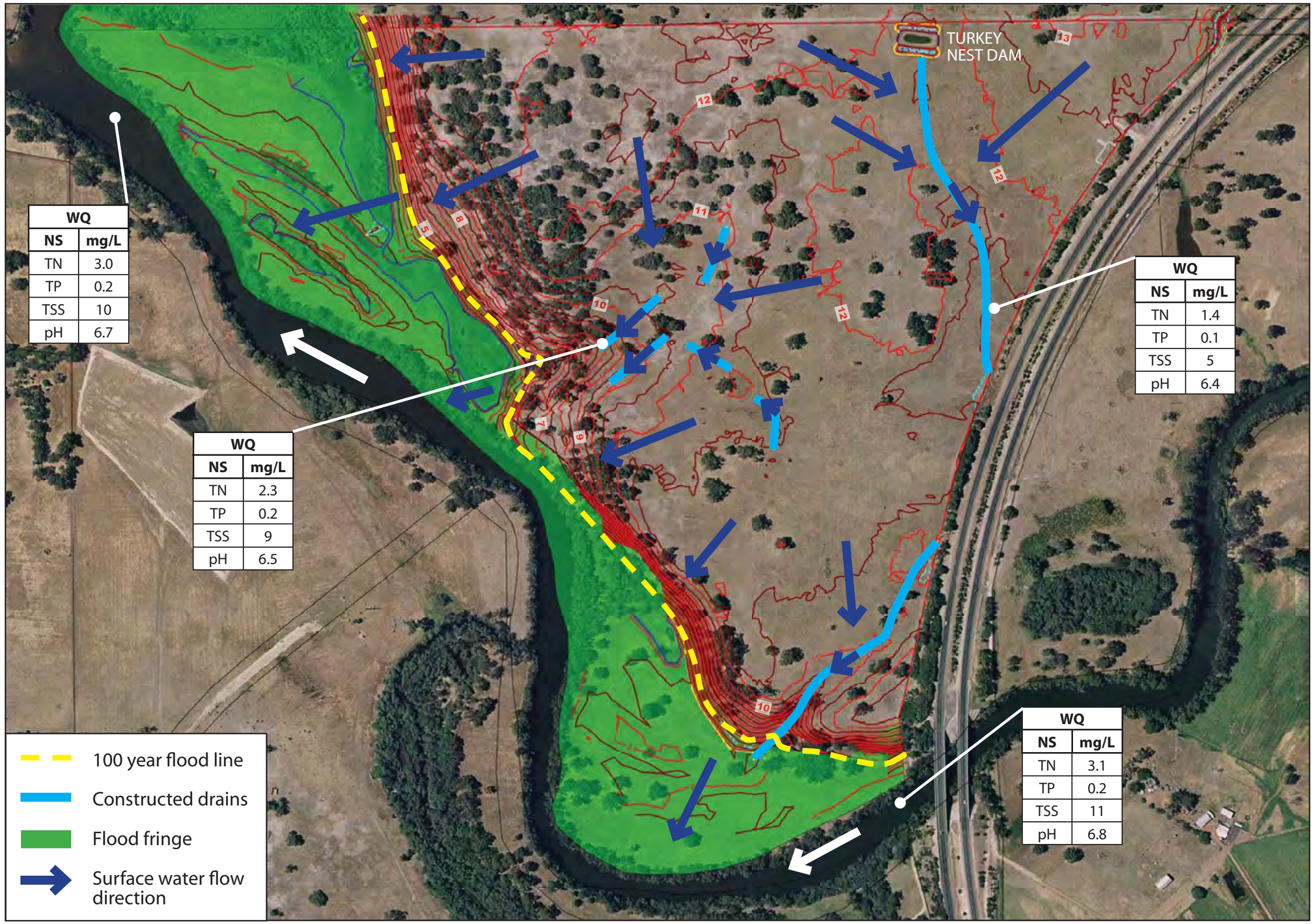


Figure A3 Example surface water plan

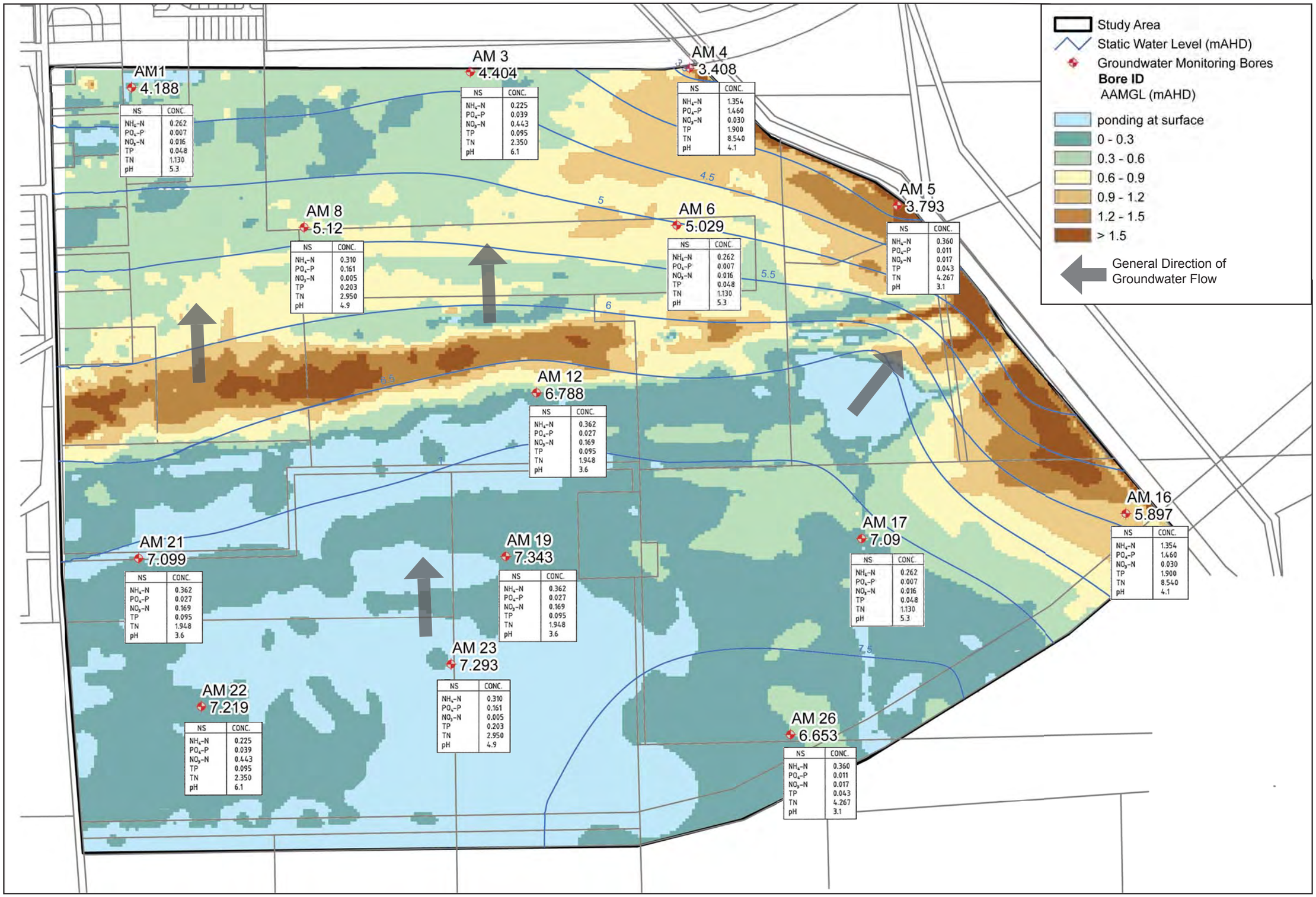


Figure A4 Example groundwater plan

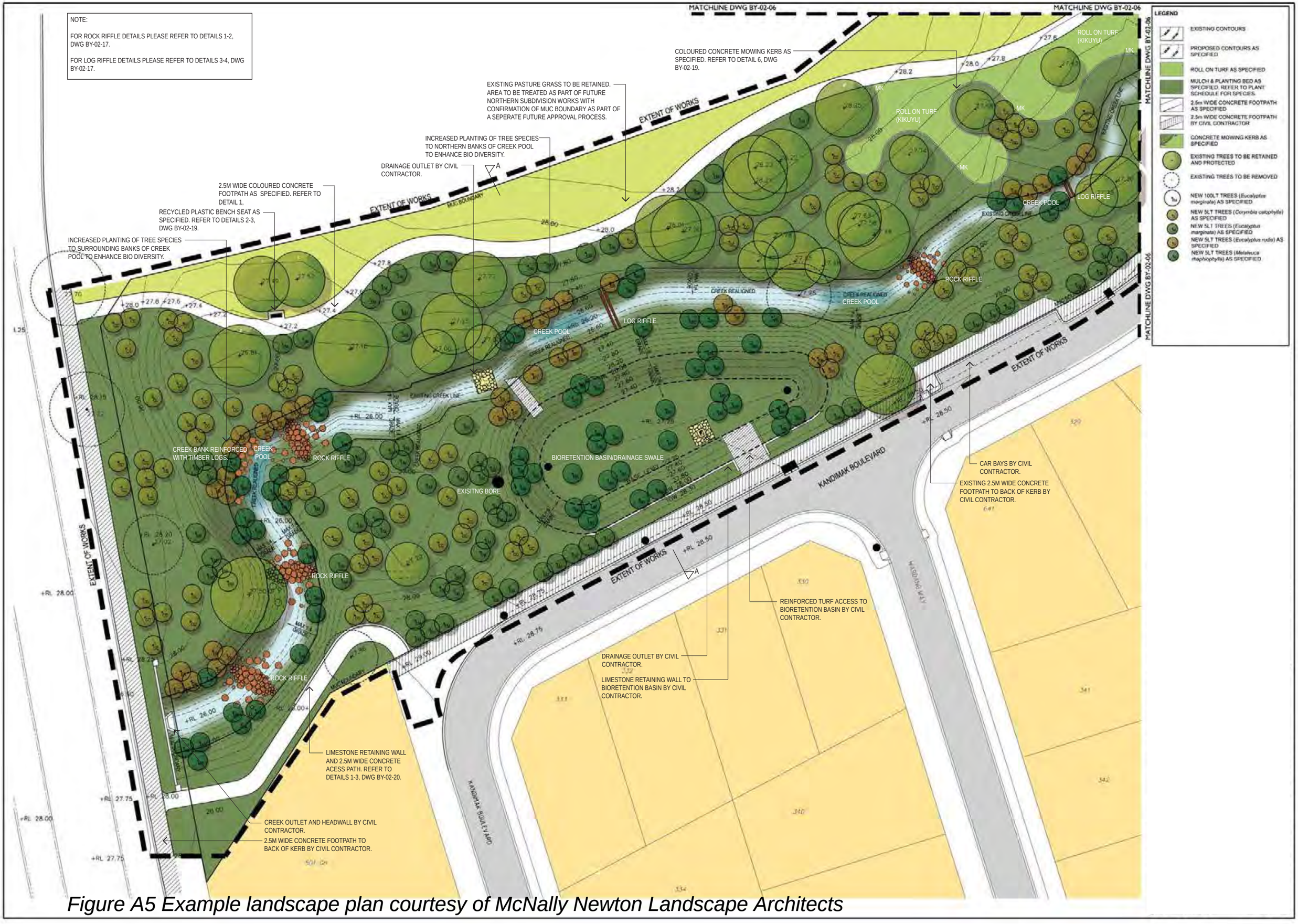


Figure A5 Example landscape plan courtesy of McNally Newton Landscape Architects

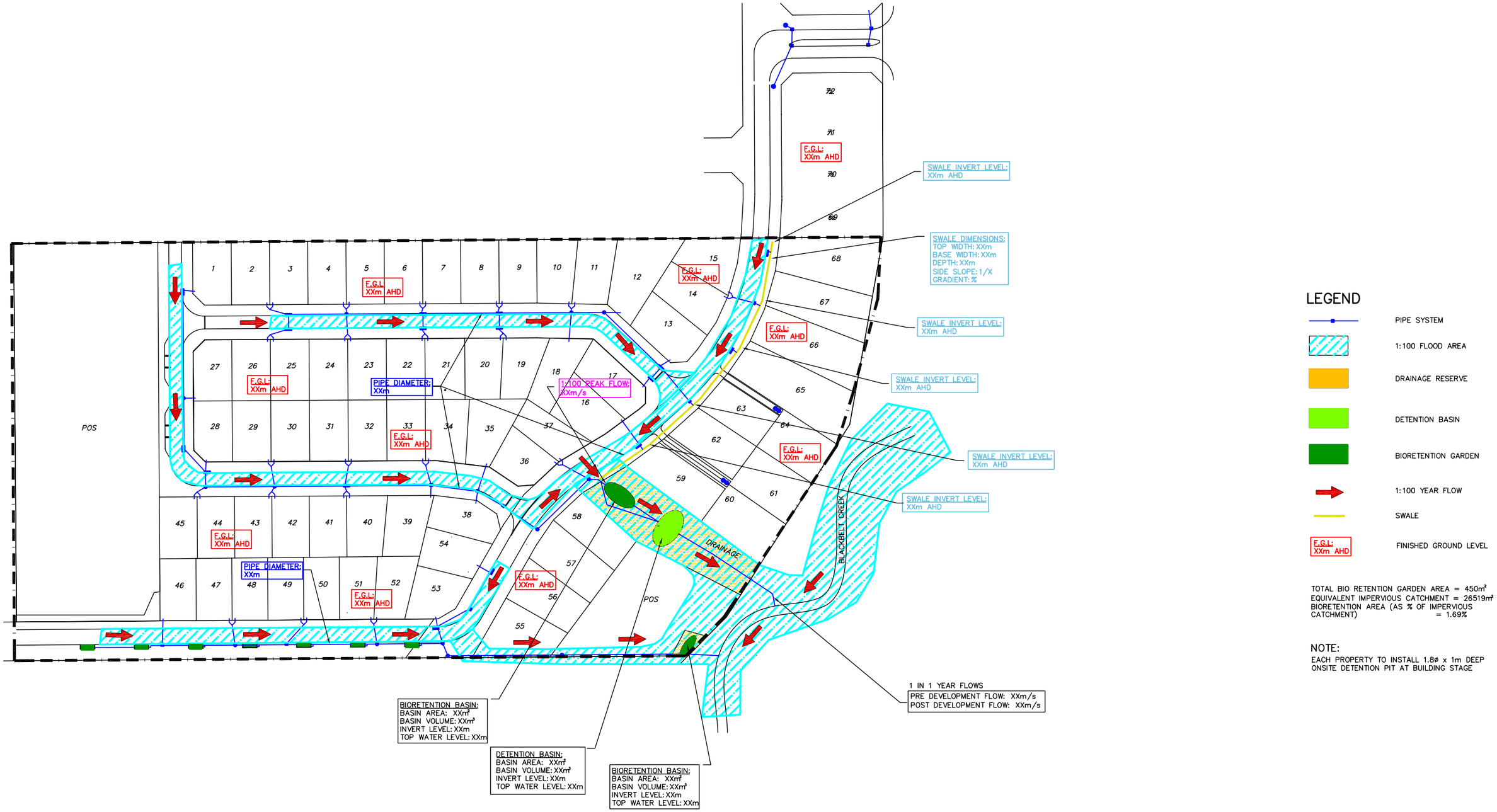
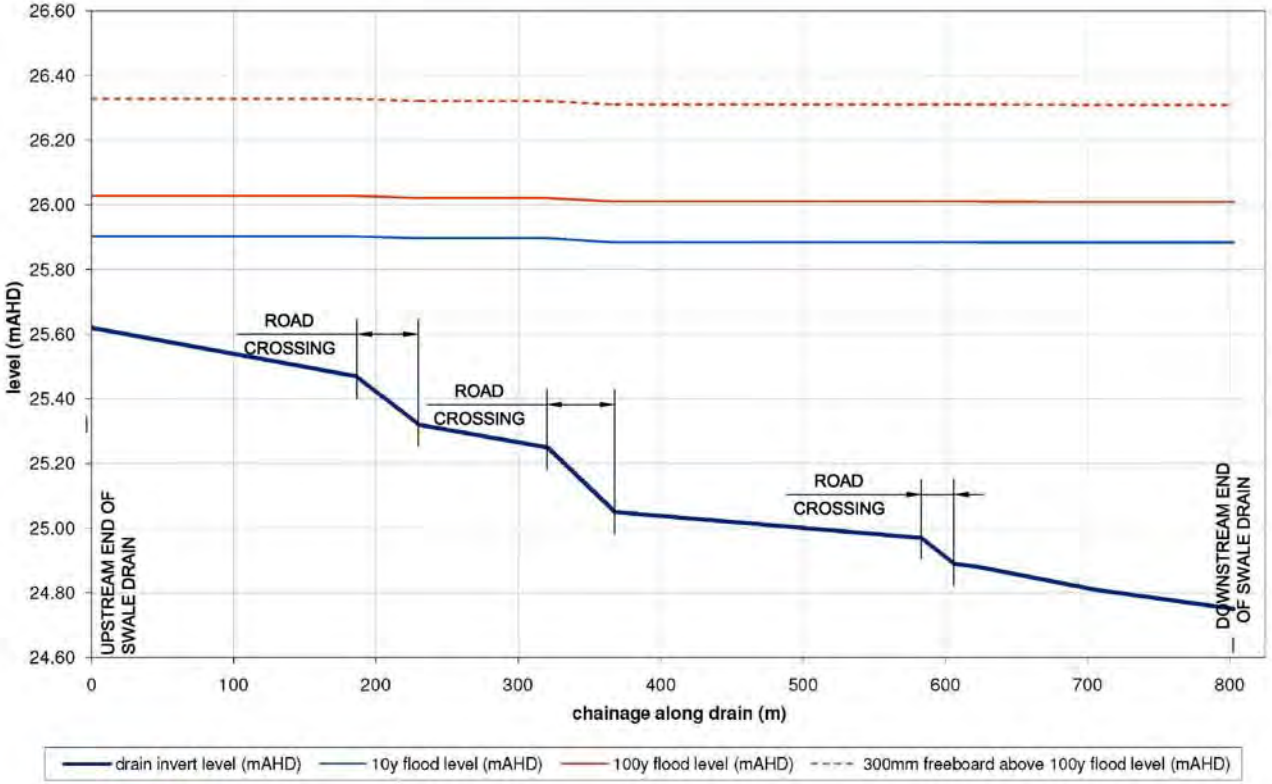
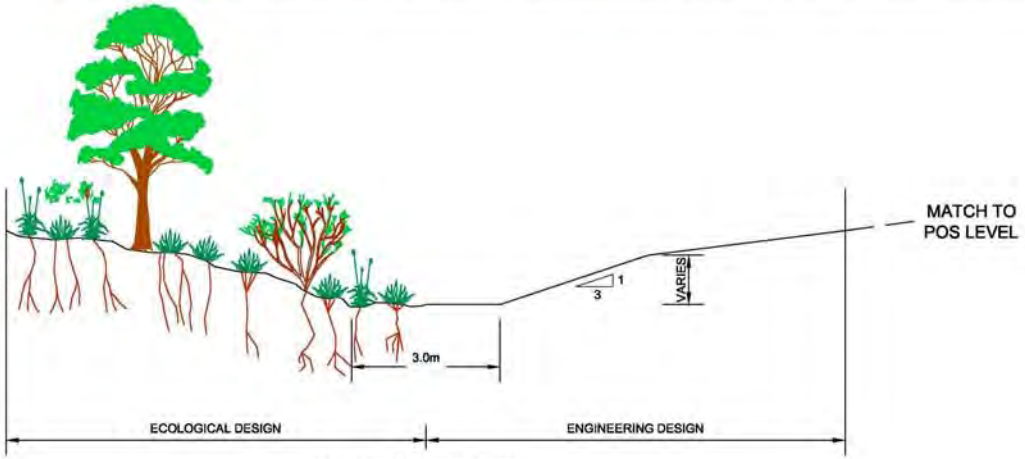


Figure A6 Example 100 year ARI event plan

LOCATION PLAN

SWALE DRAIN LONG SECTION





SWALE DRAIN CROSS SECTION

Figure A7 Example long section

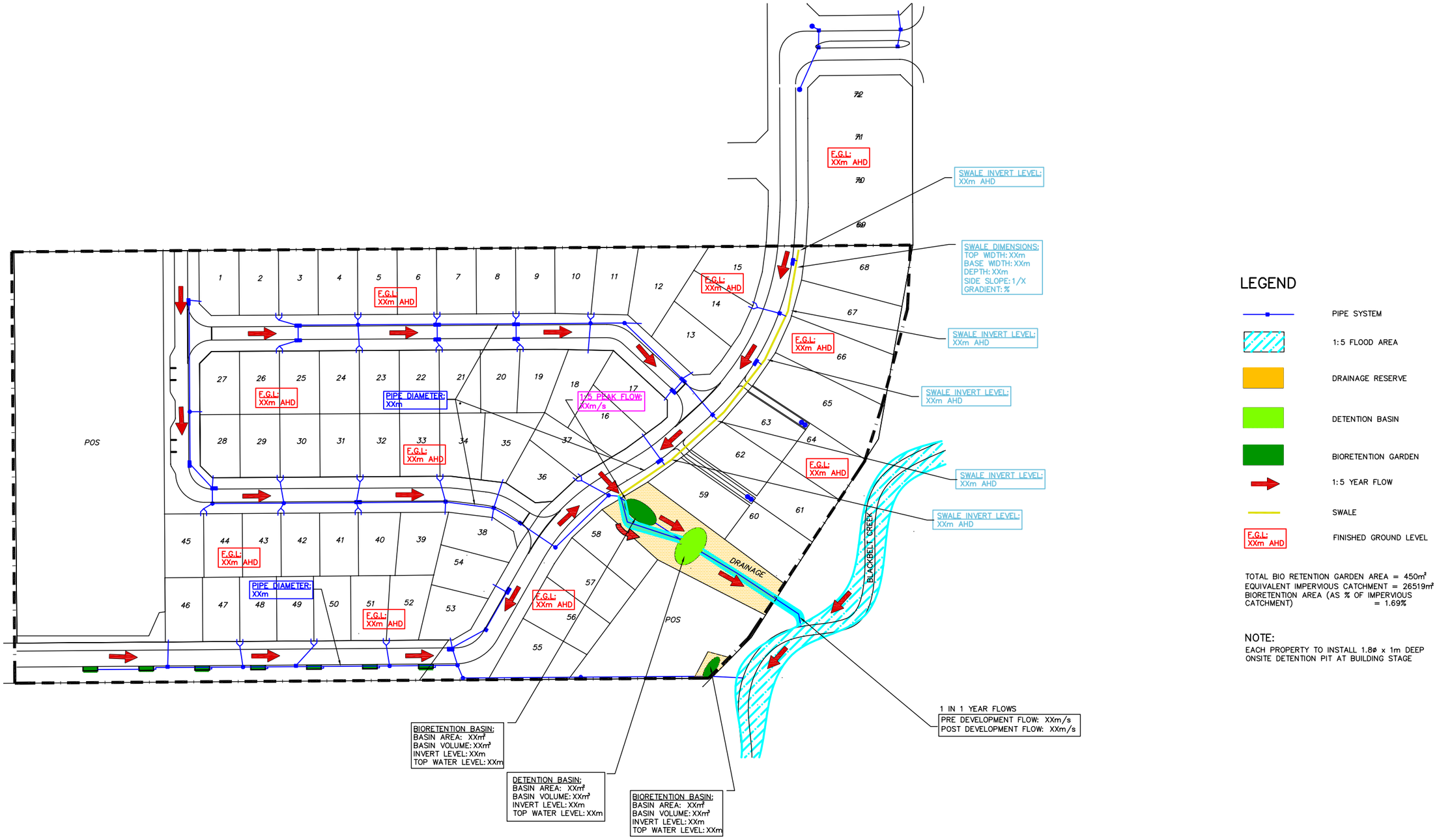


Figure A8 Example 5 year ARI event plan

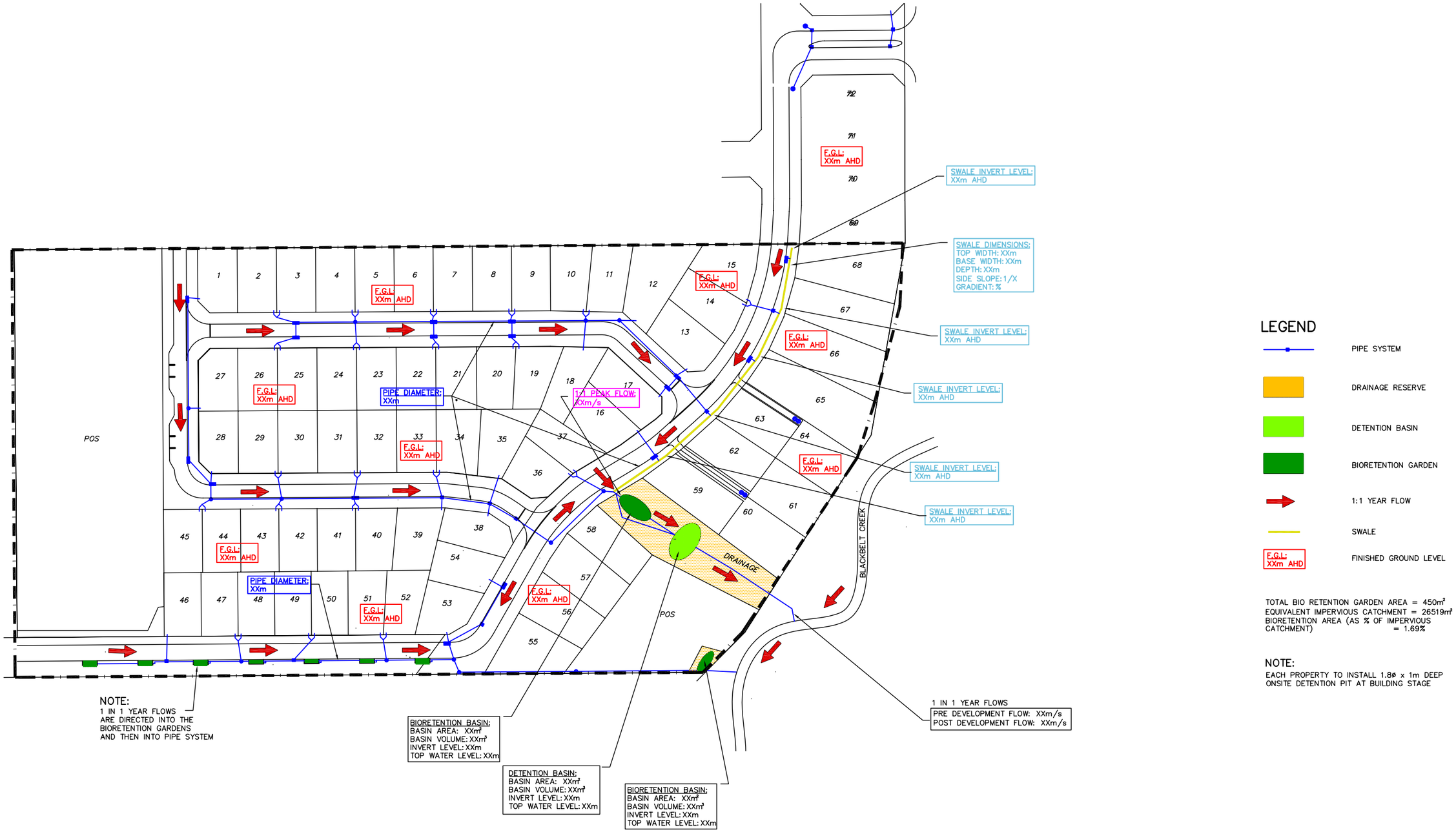


Figure A9 Example 1 year ARI event plan

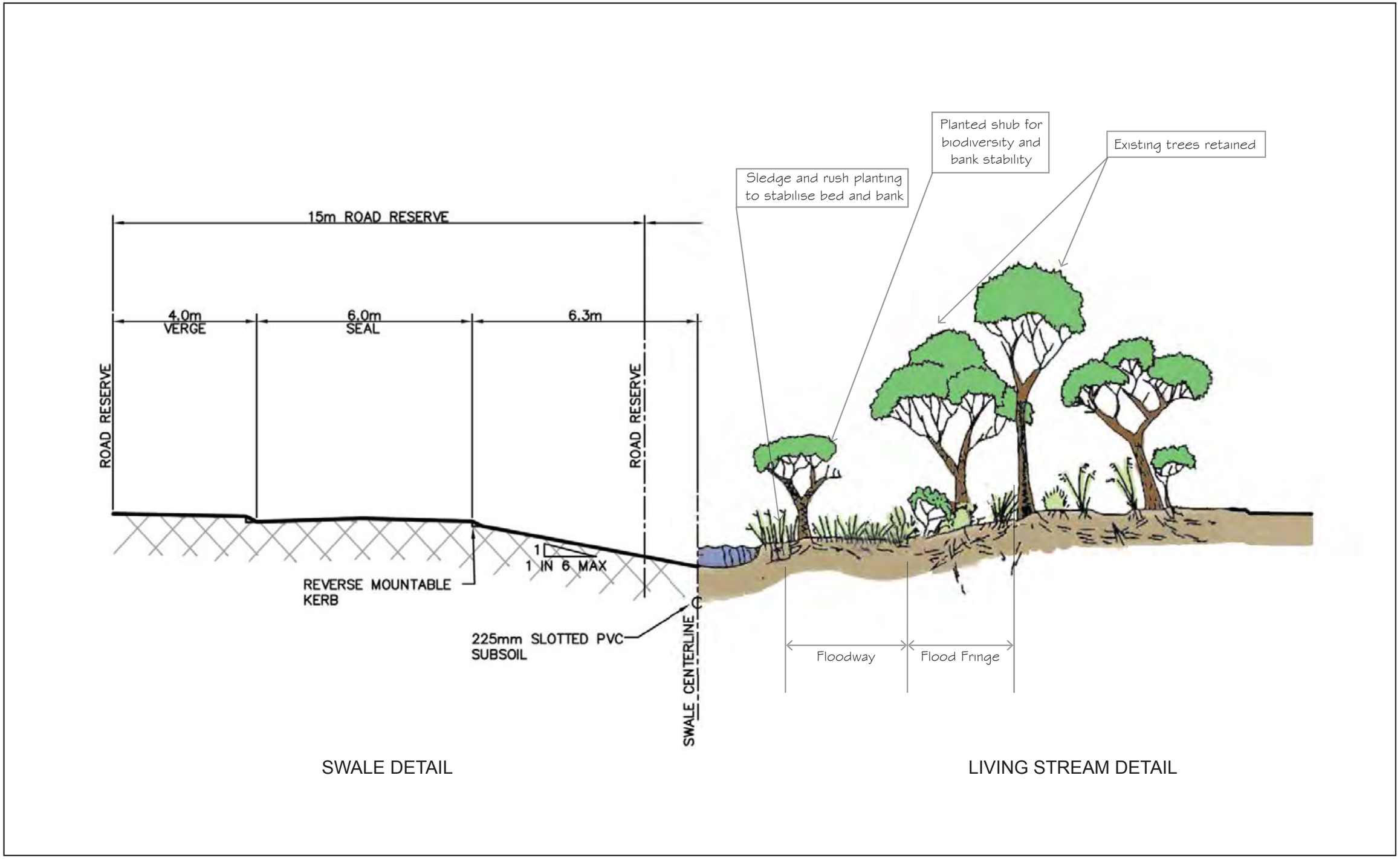


Figure A10 Example cross section

Figure A11 Example subsoils plan