



STRATHFIELD MUNICIPAL COUNCIL

PART N
of STRATHFIELD
CONSOLIDATED DEVELOPMENT
CONTROL PLAN 2005

Water Sensitive Urban Design (WSUD)

Adopted by Council August 2011
Amended February 2023

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1. INTRODUCTION

Refer to “**General Introduction**” at page 5 of this Consolidated Plan.

1.1 Purpose of Part N

The purpose of this Part is to provide direction and advice to landowners and developers including design principles to incorporate Water Sensitive Urban Design (WSUD) within development in the Strathfield Local Government Area.

WSUD seeks to ensure that urban development and urban landscapes are designed, constructed and maintained in a manner that minimises the impacts on the urban water cycle – drinking water, wastewater, stormwater, and groundwater.

Strathfield Council encourages developers to use vegetative methods of Water Sensitive Urban Design where applicable to maintain the aesthetic and biodiversity value of the Local Government Area, in particular along the Cooks River Corridor.

1.2 Objectives Of Part N

The specific objectives of Part N are:

- a. Protect and enhance natural water systems (creeks and rivers etc.).
- b. Treat urban stormwater to meet water quality objectives for reuse and/or discharge to receiving waters.
- c. Match the natural water runoff regime as closely as possible (where appropriate).
- d. Reduce potable water demand through water efficient fittings and appliances, rainwater harvesting and wastewater reuse.
- e. Minimise wastewater generation and treatment of wastewater to a standard suitable for effluent reuse opportunities.
- f. Integrate stormwater management into the landscape so as to maximise the visual and recreational amenity of urban development, through prioritization of retaining and/or enhancing vegetation and greenspace where possible
- g. Provide objectives and controls for specific WSUD elements including water conservation, stormwater quality and waterway stability management.

2. APPLICATION REQUIREMENTS

2.1 When Do These Controls Apply?

The incorporation of appropriate water sensitive urban design measures is required for the following types of development:

- Residential land subdivisions involving 10 or more proposed allotments;
- Medium density housing involving 10 or more dwellings;
- Residential apartment buildings involving 10 or more residential apartments;
- Mixed use developments involving 10 or more residential apartments or a gross floor area of 2,000 square metres or more (whichever the lesser);
- Serviced apartment or hotel developments;
- Industrial developments (including major alterations and additions to existing industrial buildings) involving a site area of 2,000 square metres or more;

- Industrial subdivisions involving 5 or more proposed allotments or a site area of 2,000 square metres or more (whichever is the lesser);
- Business parks; and
- Commercial office developments involving a gross floor area of 2,000 square metres or more.
- Any development which involves the construction or designation of 10 or more additional car parking spaces, whether the spaces be covered or uncovered.

2.2 Pre-Application Consultation

Discussions with Council are encouraged at an early stage in the development application process to agree on a general design approach before a detailed WSUD Strategy is prepared. The aim of the consultation process is to provide advice and guidance to the applicant on Council's requirements.

2.3 Required Information

Development applications that are required to meet the water conservation and stormwater quality targets are to submit a **Water Sensitive Urban Design Strategy**. A **Water Sensitive Urban Design Strategy** is a written report detailing potable water saving and stormwater quality control measures that are to be implemented on the site. The strategy is to include the following detail:

- **Proposed development** – Describe the proposed development at the site, including site boundaries, proposed land uses.
- **WSUD objectives** – Identify the WSUD objectives that apply to the proposed development.
- **Water conservation** – This section should demonstrate how the potable water conservation targets will be met. For residential developments this maybe in the form of a BASIX Certificate.
- **Stormwater quality** – This section should demonstrate how the stormwater quality targets will be met. It should include stormwater quality modelling results and identify the location, size and configuration of stormwater treatment measures proposed for the development. Stormwater quality elements are to be sized using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). Modelling parameters for the determination of the size and configuration of WSUD elements must be undertaken in MUSIC.
- **Integration with the urban design** – The WSUD Strategy should outline how WSUD elements will integrate with the development layout and proposed landscaping. If there are roads on site this should consider the placement and incorporation of WSUD elements within and around roads, verges and footpaths.
- **Costs** – Prepare capital and operation and maintenance cost estimates of proposed water cycle management measures. Both typical annual maintenance costs and corrective maintenance or renewal/adaptation costs should be included.
- **Checklist** – outlining the details of the WSUD strategy and reference of the location of the information.

2.4 Specialist Advice

Applicants and developers are required to employ the services of appropriately qualified and experienced practitioners for the development of appropriate WSUD plans and strategies. The benefit of using consultants with demonstrated capacity to fulfil the requirements of this Part will generally reflect a smoother and more straightforward approval and construction process.

3. TYPES OF WATER SENSITIVE URBAN DESIGN (WSUD) TREATMENT MEASURES

3.1 General

The main WSUD treatment measures include:

- Rainwater tanks;
- Gross Pollutant Traps / Litter Traps;
- Grassed and Vegetated Swales;
- Bio-Retention Systems;
- Bioretention Basins;
- Sedimentation Basins;
- Constructed Wetlands;
- Infiltration Measures;
- Aquifer Storage and Recovery; and
- Porous Pavements.

The role and function level of the various WSUD treatment measures is summarised in the following Table 1:

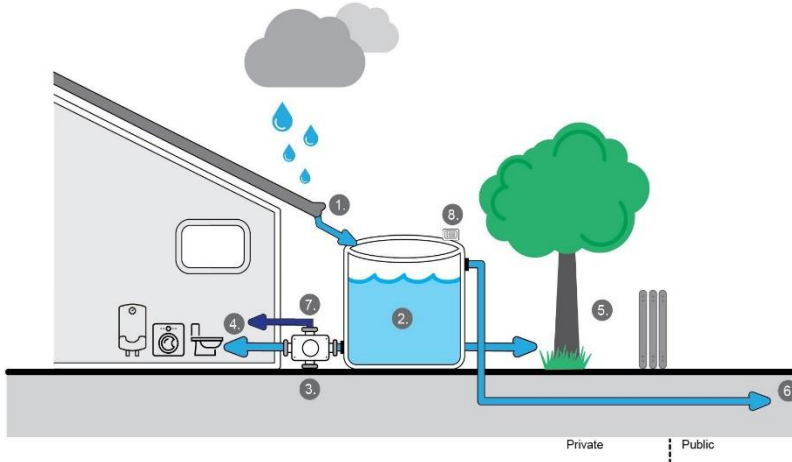
Table 1: Primary Role and Function of WSUD Treatment Measures

WSUD Treatment Measure	Water Quality Function	Water Quantity Function
Rainwater Tanks	Low	High
Gross Pollutant Traps (GPTs)	High	Low
Grassed and Vegetated Swales	High	Low
Bio-retention Systems	High	Medium
Bio-retention Basins	High	Medium
Sedimentation Basins	High	Medium
Constructed Wetlands	High	Low
Infiltration Measures	High	Medium
Aquifer Storage and Recovery	Medium	Low
Porous Pavements	Medium	Medium

In landscaping of the development, certain species of flora can also be planted to aid in WSUD. Please see Part 3.3 of this document and Appendix 1. where a list is provided of example species beneficial to WSUD in WSUD strategies as well as in surrounding landscaping.

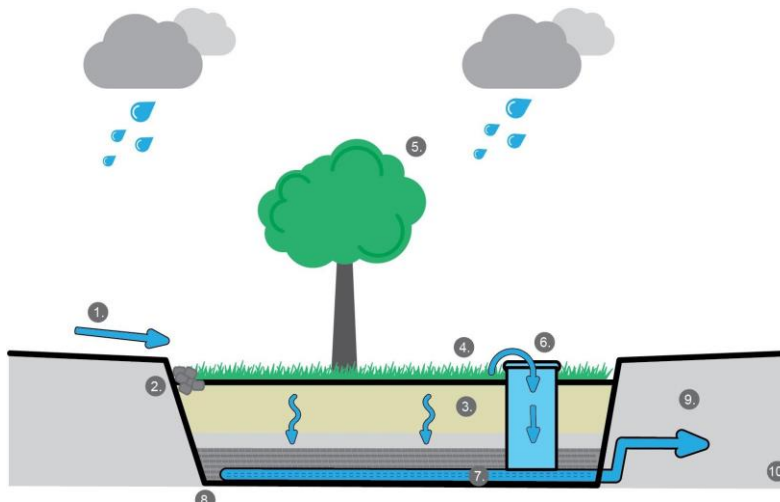
3.2 Examples of WSUD treatment strategies

Figure 1 Schematic of preferred design of rainwater harvesting system (Source: Wollondilly Shire Council)



1. Gutter guards and first flush systems are important in preventing leaves and sticks and other pollutants entering rainwater tank
2. Smart tank technology is encouraged
3. Pumps and filters, with potable back up
4. Internal uses of rainwater should include toilet flushing, laundry and hot water
5. All outdoor watering should use rainwater as its primary source. This includes a 'slow leak' that slowly and consistently releases water to a defined area of the garden planted with vegetation that thrives in damp soils.
6. Overflow systems to central median swales should be plumbed as per NCC Volume 3 Plumbing Code. Overflows can also drain to a tree pit in the road reserve, pending agreement with Council.

Figure 2 Typical cross section of a raingarden/bioretention asset. (Source: Wollondilly Shire Council)



1. Runoff and associated pollutant concentrations into raingardens assumed to be from 'mixed urban area'
2. Inlets to raingardens must have flow interceptor to reduce velocities and capture sediment. 450 x 450 mm sediment trap is ideal (with permeable base to reduce standing water)
3. Filter media must have between 180 mm / hour and 300 mm / hour infiltration capacity
4. Using appropriate vegetation density

5. Trees and shrubs in garden bed
6. Overflow to allow bypass of events greater than 3 months average recurrence interval (ARI). Extended detention of minimum 200 mm. Levels to be checked to ensure all batters are above overflow level
7. Underdrain present
8. No liner recommended
9. Submerged zone acts to allow for some retention and water availability for vegetation over dry periods
10. Outflow to waterways or other WSUD asset



Figure 3. Example of Grassed swale (Source: Water Sensitive Urban Design of the Sydney Region)



Figure 4. Example of Vegetated swale (Source: Water Sensitive Urban Design of the Sydney Region)



Figure 5. Examples of Bio-Retention Basins (Source: Water Sensitive Urban Design of the Sydney Region)



Figure 6. Example of Porous Pavement (Source: Water Sensitive Urban Design of the Sydney Region)



Figure 7. Example of Porous Pavement surrounding carparks (Source: Water Sensitive Urban Design of the Sydney Region)

3.3 Vegetation preference for planting

To improve quality of stormwater and also reduce quantity, certain species of flora are preferential in planting for more effective WSUD. Planting should incorporate several growth forms – shrubs, tufted plants and groundcover species, to ensure that the plant roots occupy all parts of the media. The list of species available in Appendix 1. is indicative only, the advice of a WSUD professional should be sought to guide the exact location, species mixes and planting densities to ensure optimal treatment performance based on the detailed specifications of each treatment measure.

Please see list in Appendix 1. for species that are preferred options in WSUD strategies and in general landscaping.

4. WSUD DEVELOPMENT CONTROLS

4.1 WATER CONSERVATION

Potable mains water conservation seeks to reduce the demand for potable water, with the added benefit of reducing wastewater volumes. Reduced potable mains water demand is a key commitment of the NSW Government as outlined in the Metropolitan Water Plan (see <http://www.waterforlife.nsw.gov.au/>). The NSW Government's BASIX Scheme requires all new residential development to incorporate water savings measures (<http://www.basix.nsw.gov.au>). There are, however, no such requirements for other development types (e.g. commercial, industrial etc.), which are addressed in these controls.

Objectives

- To reduce consumption of potable water for all development types within Strathfield Council.
- To use harvested rainwater, treated urban stormwater or treated wastewater for non-potable substitution where appropriate.

Requirements

For all development types identified in Section 2.1, water conservation requirements are:

- All residential buildings are to demonstrate compliance with State Environmental Planning Policy - Building Sustainability Index (BASIX), as required

- All buildings *not* covered by the State Environmental Planning Policy -BASIX:
 - that are installing any water use fittings must demonstrate minimum standards defined by the Water Efficiency Labelling and Standards (WELS) Scheme. Minimum WELS ratings are 4 star dual-flush toilets, 3 star showerheads, 4 star taps (for all taps other than bath outlets and garden taps) and 3 star urinals. Water efficient washing machines and dishwashers are to be used wherever possible.
 - are to install rainwater tanks to meet non-potable demand including outdoor use, toilets, and laundry.
 - are to install dual reticulation for toilet flushing, laundry, irrigation and potentially cooling towers in large redevelopment areas
 - are to incorporate passive cooling methods that rely on improved natural ventilation to supplement or preclude mechanical cooling,
 - where cooling towers are used they are:
 - to be connected to a conductivity meter to ensure optimum circulation before discharge.
 - to include a water meter connected to a building energy and water metering system to monitor water usage.
 - to employ alternative water sources for cooling towers where practical
- Industrial and business developments must supply 80% of their non-potable demand using non-potable sources. Rainwater shall be the primary source and only supplemented by recycled water when rainwater cannot meet 80% of the demand. When the 80% demand threshold cannot be met, the use of non-potable sources shall be maximized and be considered on a merits basis by Council.

4.2 Stormwater Quality

Urban development increases the pollution load entering receiving environment. Stormwater quality controls have been derived through the modelling of numerous combinations of urban development types and stormwater management / WSUD strategies at various locations. They reflect a cost- effective level of stormwater treatment, that is considered to be technically feasible in terms of the land-take (or footprint) of stormwater/WSUD measures likely to be required for compliance. Stormwater quality controls are to be modelled in MUSIC (the Model for Urban Stormwater Improvement Conceptualisation), utilising Strathfield data. These modellings are to be presented in the Water Sensitive Urban Design Strategy produced to Council at the time the Development Application is also presented.

Objectives

- To safeguard the environment by improving the quality of stormwater run-off entering receiving waters.
- To improve stormwater run-off quality by maintain high levels of greenspace and promoting tree retention/planting as a strategy best fit for Strathfield Council WSUD.
- Achieve a 'no net' increase in pollutants into waterways as a result of a development

Requirements

For all development types identified in Section 2.1, stormwater quality requirements are:

Table 2. Required pollutant reduction targets

<i>Pollutant</i>	% post development average annual load reduction
<i>Gross pollutants (greater than 5mm)</i>	90
<i>Total suspended solids (TSS)</i>	85
<i>Total Phosphorus (TP)</i>	65
<i>Total Nitrogen (TN)</i>	45
<i>Total Hydrocarbons</i>	90

Modelling for the determination of the mean annual loads of landuses must be undertaken in MUSIC. The MUSIC model must be presented to council along with the WSUD Strategy.

5. WSUD STRATEGY

5.1 Pre-lodgment consultation of proposed WSUD strategy

Pre-lodgment discussions with Council are highly recommended at an early stage in the application process to discuss and agree on the overall design approach before a detailed WSUD Strategy is completed and submitted with the Development Application.

The aim of the consultation process is to provide direction and guidelines to the applicant and to provide advice on Council's requirements. The level of consultation required will largely depend on the size and the complexity of the development.

Where WSUD assets are proposed to be ultimately handed over to Council following the completion of the subdivision or development, a formal pre-lodgment meeting with Council staff is required to consider the draft WSUD strategy.

5.2 Preparation of WSUD strategy

The preparation of the WSUD strategy must be undertaken by a suitably qualified and experienced consultant and must take into account any Council requirements discussed at a formal pre-lodgment meeting with Council.

The preparation of the WSUD strategy will require baseline and construction phase water quality monitoring and / or suitable computer simulation modelling of stormwater quality and peak stormwater flow discharges upfront.

The WSUD strategy should define the specific stormwater treatment and management measures for both the construction and operational phases of the development.

The strategy should also provide comprehensive details of proposed WSUD measures to be incorporated into the proposed development.

The WSUD strategy should outline where vegetation has been preserved and where it has been enhanced.

The stormwater quality objectives for each development must provide specific information on both the temporary and permanent measures to be used in order to ensure the quantity of pollutants and the peak discharge flow rates from the site will meet the 'no net' increase objective, where applicable. The objectives should also include details on the stormwater control measures proposed for both the construction and operational phases of the development.

All WSUD elements should not contribute to any increased flooding risk and must be designed to take into account the requirements of the Landscaping and Flood Management sections of this DCP.

The final WSUD strategy is to be submitted with the Development Application.

REFERENCES

Blacktown City Council, 2015. Part J Water Sensitive Urban Design and Integrated Water Cycle Management
<https://www.blacktown.nsw.gov.au/Plan-build/Stage-2-plans-and-guidelines/Blacktown-planning-controls/Blacktown-Development-Control-Plan-2015>

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<https://www.melbournewater.com.au/building-and-works/stormwater-management/introduction-wsud>

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https://wollongong.nsw.gov.au/development/development-policies-guidelines/development-control-plans?result_33507_result_page=2

APPENDIX 1

Recommended vegetation for WSUD

Bioretention basins, raingardens and swales

Successful bioretention basins and swales depends on the ability for the vegetation to slow down flow of water and uptake nutrients from the soil and the water during run off.

Basin

Botanical name	Common name	Plants per square metre
<i>Austrostipa stipoides</i>	N/A	8-10
<i>Bolboschoenus caldwellii</i>	N/A	8-10
<i>Bolboschoenus fluviatilus</i>	Marsh club rush	8-10
<i>Baloskion / Restio pallens</i>	N/A	8-10
<i>Carex appressa</i>	Tall sedge	8-10
<i>Carex fascicularis</i>	Tassel sedge	8-10
<i>Cyperus polystachyos</i>	N/A	8-10
<i>Dianella revoluta</i>	Blue flax lily	8-10
<i>Ficina nodosa</i>	Knobby club rush	8-10
<i>Gahnia filum</i>	Chaffy saw-sedge	8-10
<i>Juncus kraussii</i>	Sea rush	8-10
<i>Juncus pallidus</i>	Pale rush	8-10
<i>Juncus usitatus</i>	Common rush	8-10
<i>Lachnagrostis billardierei</i>	N/A	8-10
<i>Lachnagrostis filiformis</i>	N/A	8-10
<i>Pennisetum alopecuroides</i>	Swamp foxtail grass	8-10
<i>Poa labillardieri</i>	Eskdale, tussock grass	8-10
<i>Rytidosperma tenuior,</i> <i>Austrodanthonia tenuior, Danthonia</i> <i>tenuior</i>	Wallaby grass	8-10
<i>Schoenoplectus mucronatus</i>	N/A	8-10
<i>Themeda trianda, Themeda australis</i>	Kangaroo grass	8-10

Basin and Batters

Botanical name	Common name	Plants per square metre
<i>Daviesia ulicifolia</i>	Gorse bitter pea shrub	1
<i>Melaleuca erubescens</i>	Pink honey myrtle shrub	1
<i>Isolepis cernua</i>	Nodding club rush	8-10
<i>Isolepis inundata</i>	Swamp club sedge	8-10
<i>Ficinia nodosa</i>	Knobby club rush	8-10
<i>Juncus usitatus</i>	Common rush	8-10
<i>Pennisetum alopecuroides</i>	Swamp foxtail grass	8-10

Batters and Landscape

Botanical name	Common name	Plants per square metre
<i>Aristida ramosa</i>	Purple wiregrass	8-10
<i>Bothriochloa macra</i>	Red grass	8-10
<i>Dianella longifolia</i>	Blueberry lily	8-10
<i>Lomandra filiformis</i>	Wattle mat-rush	8-10
<i>Lomandra longifolia</i>	Tanika, spiny mat-rush	8-10
<i>Microlaena stipoides</i>	Weeping grass	8-10

Riparian Corridors

The macrophyte zone, refers to the area of near constant inundation, the littoral zone is the near-shore environment that can be inundated. Beyond the reach of inundation, extending out from the top of banks should be planted a mix of canopy (trees), shrubs and grasses.

Macrophyte Zone

Botanical name	Common name	Plants per square metre
<i>Aristida vagans</i>	Three-awned spear grass	10
<i>Bolboschechnus caldwellii</i>	Salt club sedge	12
<i>Carex appressa</i>	Tall sedge	12
<i>Cyperus caudata</i>	Sedge	12
<i>Cyperus trinervis</i>	Australian flat sedge	12
<i>Ficinia nodosa</i>	Knobby club rush	10
<i>Juncus bufonius</i>	Toad rush	10-12
<i>Juncus usitatus</i>	Common rush	12
<i>Lepyrodia scariosa</i>	Scale rush	10-12
<i>Schoenoplectus validus</i>	River club rush	12

Littoral Zone

Botanical name	Common name	Plants per square metre
<i>Aristida vagans</i>	Three-awned spear grass	8
<i>Carex appressa</i>	Tall sedge	8
<i>Carex fascicularis</i>	Tassel sedge	8
<i>Cymbopogon refractus</i>	Barbed wire grass	12
<i>Daniella longifolia</i>	Flax lily	16
<i>Ficinia nodosa</i>	Knobby club rush	8
<i>Juncus usitatus</i>	Common rush	12
<i>Lomandra longifolia</i>	Mat rush	8
<i>Triglochin striatum</i>	Streaked arrowgrass	8

Canopy Layer

Botanical name	Common name	Plants per square metre
<i>Angophora floribunda</i>	Rough-barked apple	0.25
<i>Casuarina glauca</i>	Swamp oak	0.5
<i>Eucalyptus amplifolia</i>	Cabbage gum	0.2
<i>Eucalyptus crebra</i>	Narrow-leaved iron bark	0.2
<i>Eucalyptus moluccana</i>	Grey box	0.2
<i>Eucalyptus tereticornis</i>	Forest red gum	0.2
<i>Melaleuca decora</i>	White feathered honey myrtle	0.25
<i>Melaleuca linarifolia</i>	Snow in summer	0.25

Shrub Layer

Botanical name	Common name	Plants per square metre
<i>Acacia falcata</i>	Hickory wattle	0.5
<i>Acacia parramattensis</i>	<i>Parramatta green wattle</i>	0.5
<i>Banksia marginata</i>	<i>Silver banksia</i>	1
<i>Boronia rigens</i>	<i>Stiff boronia</i>	1
<i>Bursaria spinulosa</i>	<i>Blackthorn</i>	1
<i>Dodonea purpurea</i>	<i>Purpurea</i>	1
<i>Dodonea triquetra</i>	Common hop-bush	2
<i>Grevillea junipera subsp. Junipera</i>	Juniper-leaved grevillea	1
<i>Hardebergia violacea</i>	Native sarsaparilla	2

<i>Indigofera australia</i>	Australian indigo	1
<i>Kunzea ambigua</i>	Tick bush	1
<i>Melaleuca thymifolia</i>	Thyme honey myrtle	0.5
<i>Leptospermum petersonii</i>	Lemon scented tea tree	0.5
<i>Westringia fruticosa</i>	Coastal rosemary	2

Native Grass Layer

Botanical name	Common name	Plants per square metre
<i>Danthonia semiannularis</i>	Wallaby Grass	6
<i>Daniella longifolia</i>	Flax lily	8
<i>Dianella revoluta</i>	Blue flax lily	8
<i>Deyeuxia quadriseta</i>	Reed Bent grass	6
<i>Dichelachne micrantha</i>	Plume grass	6
<i>Lomandra longifolia</i>	Matrush	4
<i>Poa labillardieri</i>	Tussock grass	4
<i>Themeda australis</i>	Kangaroo grass	4

Wetland

Plant species used in wetlands play specific roles depending on their location. The species included in this list have been specifically chosen for their suitability to specific water depths, their growth form, hardiness and proven performance in treatment wetlands. It is also encouraged to use the species recommended for wetlands to also be suitable for planting around the edges of ponds or sediment basins. Water depth should be used as a guide to suitable plants for these situations

Deep Marsh

Botanical name	Common name	Inundation Depth	Plants per square metre
<i>Baumea articulata</i>	Jointed rush	0-800mm	4-8
<i>Eleocharis sphacelata</i>	Tall spike-rush	200-1500mm	4-8
<i>Marsilea drummondii, hituda</i>	Nardoo	<1m	4-8
<i>Ottellia ovalifolia/potamageton</i>	Swamp lily	100-400mm	4-8
<i>Schoenoplectus mucronatus/ validus</i>	Bog bulrush	0-400mm	4-8

Shallow Marsh

Botanical name	Common name	Inundation Depth	Plants per square metre
<i>Alisma plantago-aquatica</i>	Water-plantain	0-300mm	8-10
<i>Baumea articulata</i>	Jointed rush	0-800mm	8-10
<i>Bolboschoenus caldwellii</i>	Marsh club rush	0-300mm	8-10
<i>Bolboschoenus fluviatilis</i>	River bulrush	0-300mm	8-10
<i>Eleocharis acuta</i>	Spikerush	0-200mm	8-10
<i>Philydrum lanuginosum</i>	Woolly waterlilies	0-300mm	8-10
<i>Vallisneria gigantea</i>	Eelgrass	0-2000mm	8-10

Edge (Wet)

Botanical name	Common name	Inundation Depth	Plants per square metre
<i>Carex appressa</i>	Tall sedge	N/A	8-10
<i>Cyperus exaltatus</i>	Cyperus	N/A	8-10
<i>Fimbristylis dichotoma</i>	Forked fimbry	N/A	8-10
<i>Juncus usitatus</i>	Juncus	N/A	8-10
<i>Philydrum lanuginosum</i>	Woolly waterlilies	N/A	8-10

Edge (Dry)

Botanical name	Common name	Inundation Depth	Plants per square metre
<i>Isolepis nodosa</i>	Knobby club rush	N/A	8-10
<i>Lomandra Longifolia</i>	Spiny-head mat-rush	N/A	8-10
<i>Poa labillardieri</i>	Tussock grass	N/A	8-10

(Source: City of Ryde, 2009. Water Sensitive Urban Design Vegetation Selection Guide)