Crowle Gardens Development
Integrated Water Cycle Plan

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Introduction

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Objectives

The following objectives have been adopted

1. Stormwater treatment is designed to meet (consistent with Ryde Council's Draft DCP requirements) the following targets for water quality:
    1. 85% reduction in the total suspended solids loads from the development
    2. 60% reduction in the total phosphorous loads from the development
    3. 45% reduction in the total nitrogen loads from the development
2. Water conservation target
    1. 40% reduction in water use consistent with State Environmental Planning Policy—Building Sustainability Index (BASIX) 2004
    2. 50% stretch target
3. Reduction of wastewater discharge by 20%
4. Integration of stormwater treatment into the landscape

Methodology

To assess the following initiatives the following tools were used:

- BASIX Online Tool was used to determine the water conservation savings for various water efficient fixtures and appliances
- The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) v5 was used to assess the performance of treatment systems and rainwater tanks using standard parameters recommended in the Ryde Council Draft MUSIC Modelling Guidelines

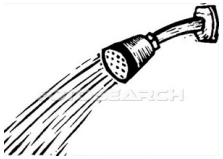
Site Constraints

There are a number of key constraints and opportunities at the site which impact on the strategy:

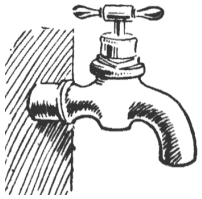
- Heritage gardens – the heritage gardens control the locations and areas that vegetated and other stormwater treatment systems can be located
- Existing trees on the site, and adjacent to the site, limit the locations that treatment of runoff can occur (particularly along Belmore and Junction St)
- Options for rainwater harvesting are limited. The amount of roof runoff is significantly less than total water demands at the site.
- The subcatchments on the site require a distributed stormwater treatment strategy rather than one centralised treatment system

Initiative 1: Water efficiency

Water saving 32 ML/year (47% of baseline)

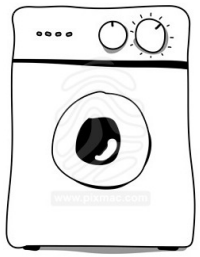


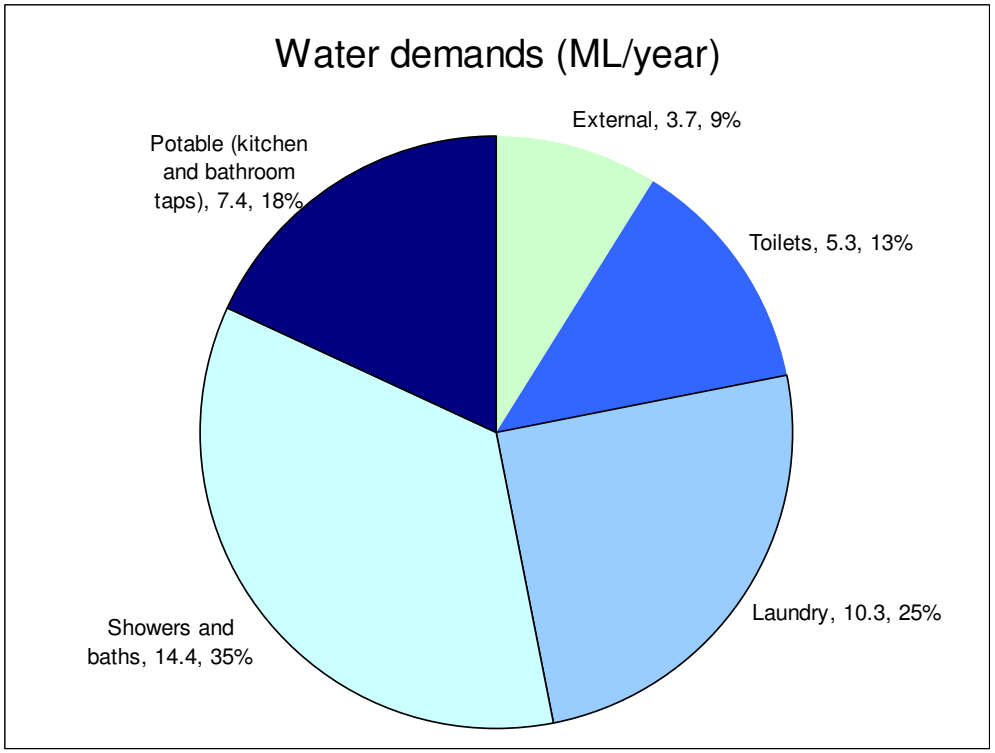
- Baseline water demands: 256 L/p/day = **69ML/year**
- BASIX requires 40% reduction: to 41 ML/year
- Use of the BASIX Tool showed that a 40% mandatory reduction can be met using efficient fixtures as listed below in dwelling and communal facilities. A break down of the water demand (ML/y) after the adoption of efficient fittings is shown in the chart below
- Efficient appliances and fixtures to be adopted:



Dwellings:
5 star taps
4 star toilet
4 star dishwasher
4 star washing machine
3 star showerheads

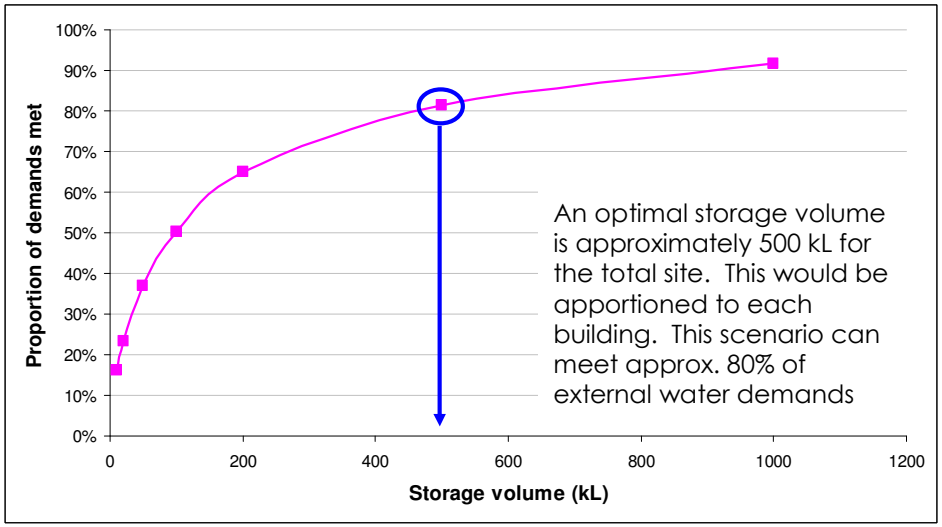
Communal Areas:
5 star taps
3 star shower heads
4 star toilets

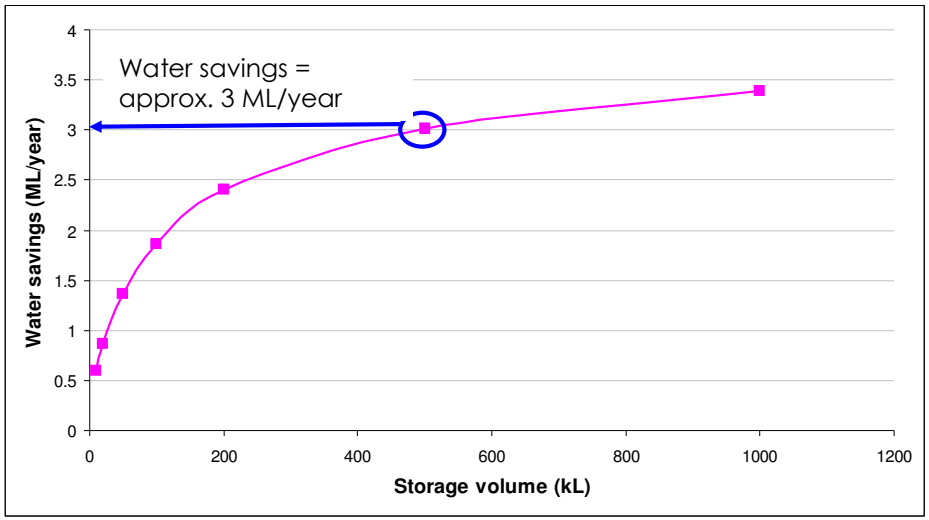




Initiative 2: rainwater tanks to supply irrigation and Block F

Water saving 3.0 ML/year (4% of baseline and 80% of irrigation demand)





- The curves show that an optimal storage volume is **500 kL**
- This would be equivalent to 100kL per residential building or approximately 1 kL per dwelling.
- It is cost effective to use rainwater for irrigation as the tank does not have to be plumbed into the residential buildings.
- The rainwater tank will also be plumbed into non-potable uses within Block F.
- Irrigation includes the heritage gardens, memorial garden and village green and lawn strips lining pavements and adjacent to buildings.
- The catchment area has been assumed to be 6,600m^2 (approx. 80% of all hard roofs)
- This can supply approx. **3 ML/year** or **80%** of the irrigation demand for the site.

Initiative 3: Stormwater treatment

Bioretention systems

Stormwater treatment wetland (surface water)

Street Tree Bioretention systems (surface water)

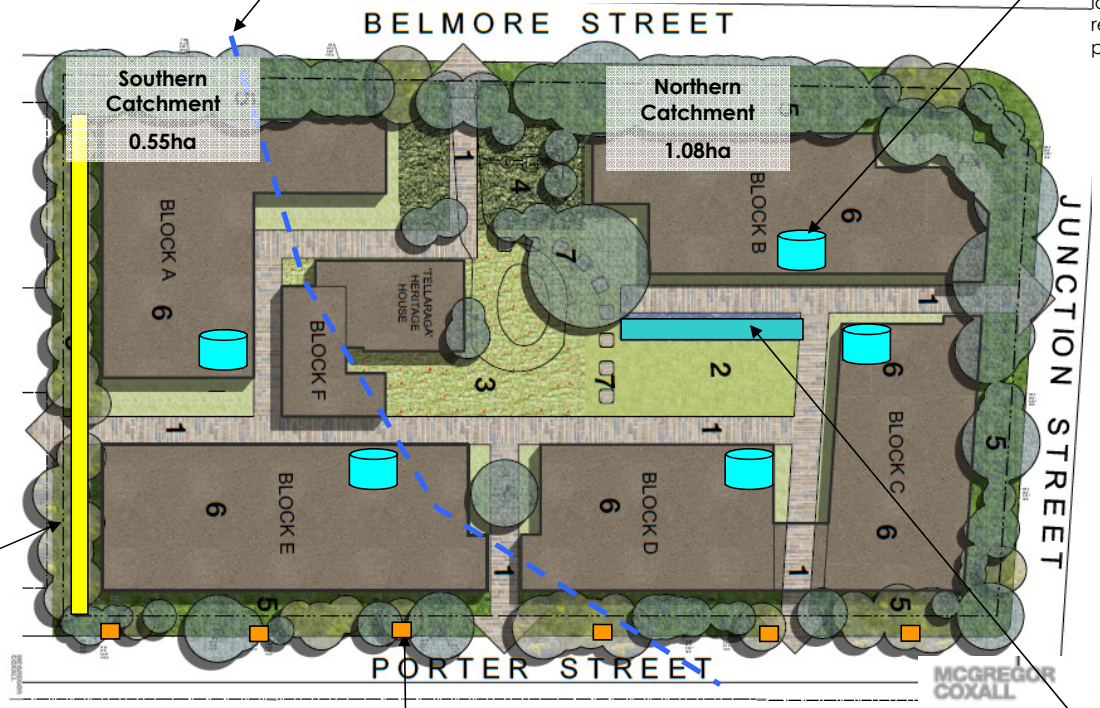
Rainwater tanks for external water use

A linear bioretention system with a 320m² footprint will treat runoff from southern catchment.

A total roof area of 1000m² from block A and E will be directed to the bioretention system for treatment as well as all surface runoff in this catchment. The remaining roof areas drain to rainwater tanks.

Approx. catchment boundary

Rainwater tanks for irrigation and re use in the community building (Block F). The rainwater tank will have a total storage of 500 kL for the entire site or 100 kL per residential building. The exact tank location and configuration will be resolved in subsequent design phases.



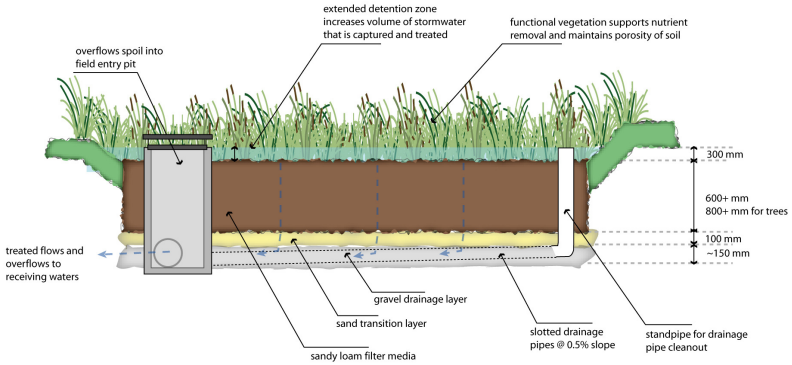
Stormwater treatment wetland and water body with a 150m² footprint. The system treats all the surface runoff from the northern catchment including approx 5% of the roof area from blocks B, C and D. The remaining roof area drains to rainwater tanks and/or OSD.

Street tree bioretention systems to treat runoff from Porter Street equating to approx. 30m² of bioretention area to be provided. The final number of trees will be dependant on available space and position of existing trees.

Initiative 3: Stormwater treatment

- Treatment objectives are based on mean annual pollutant loads consistent with Ryde Council's Draft DCP:
  - 85% removal of total suspended solids (TSS)
  - 65% removal of total phosphorus (TP)
  - 45% removal of total nitrogen (TN)
- Three stormwater treatment systems are proposed:
  1. A 320m^2 bioretention system to treat the southern catchment, including Blocks A, E and F
  2. A 150m^2 wetland to treat a portion of the northern catchment, including Blocks B, C and D
  3. A series of street tree bioretention systems along Porter Street, to treat runoff from the street.
- Additional pollutants will be removed by the rainwater reuse as outlined in Initiative 2.
- The treatment systems and rainwater tank have been estimated to remove the following pollutant loads (using MUSIC):

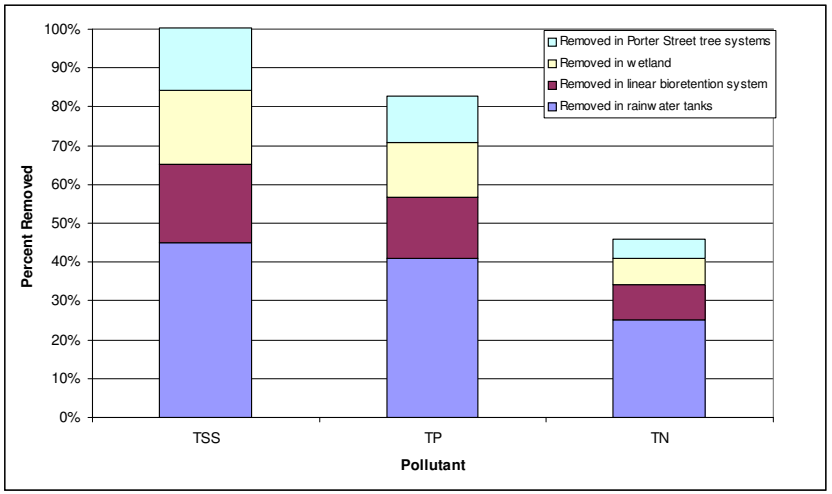
Typical cross-section of a bioretention system



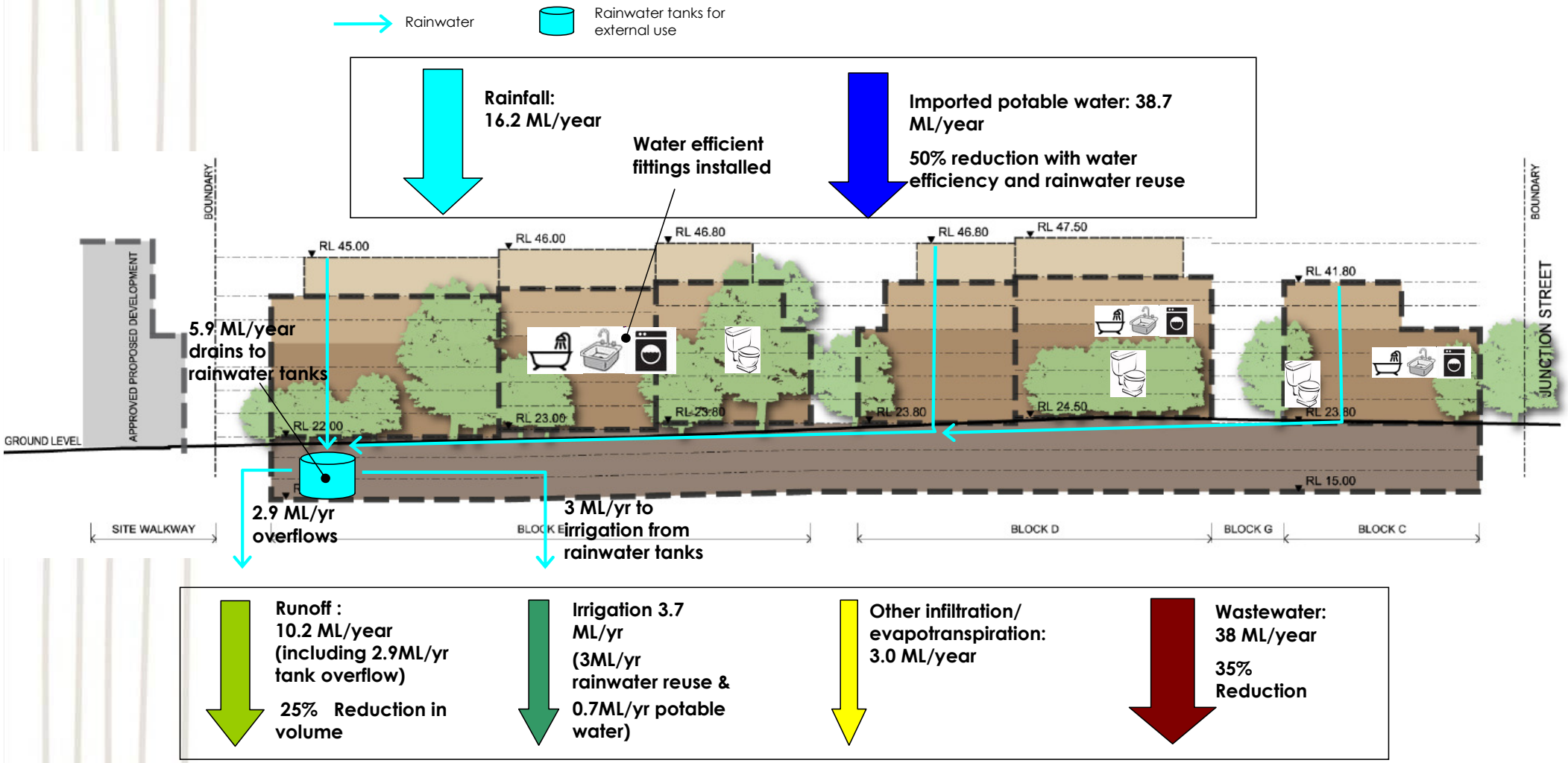
Pollutant	Percent Load Reduction from Development Site				
	Rainwater tanks	Wetland	Linear Bioretention	Street Trees	**Total**
Total suspended solids (kg/yr)	44%	20%	19%	16%	102%**
Total phosphorus (kg/yr)	41%	16%	14%	12%	83%
Total nitrogen (kg/yr)	25%	9%	7%	5%	46%
Runoff volume (ML/yr)	23%	2%	0%	0%	25%

Ryde Council Draft DCP stormwater quality targets are met

** Note that >100% TSS removal is achieved due to the treatment of external Porter Road catchment. By treating this catchment more pollutants are removed than are actually generated from the development site, providing an overall *improvement* in sediment removal.



Water Balance Summary



Integrated Water Cycle Management Plan Summary

Ryde Council's Draft DCP targets for stormwater quality and the SEPP Building Sustainability Index for water conservation will be met with the initiatives proposed in this report. A summary of the targets and outcomes are shown in the table on the right.

Objective	Target	Outcome	Method
Stormwater Water Quality (TSS/TP/TN)	85/60/45%	102/83/46%	Stormwater wetland, raingarden street trees and rainwater harvesting
Runoff Volume Reduction	N/A	25%	Rainwater harvesting and evapotranspiration
Water Conservation	40%	47%	Water efficient fixtures and fitting
Stretch Water Conservation	50%	51%	500 kL tank for rainwater harvesting for irrigation and Block F
Wastewater Reduction	20%	35%	Water efficient fixtures and fitting