Water Sensitive Urban Design Strategy

Brookvale Oval Redevelopment

Centre of Excellence and Grandstand
Brookvale NSW

Revision 07

For Manly Warringah Sea Eagles

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Revision Information

Project	Brookvale Oval Redevelopment Centre of Excellence and Grandstand
Title	Water Sensitive Urban Design Strategy
Client	Manly Warringah Sea Eagles (MWSE)
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Revision Schedule

Revision	Date	Issue Name	Author	Authorised
01	26 Sep-2019	Client Review	MB	KM
02	1 Oct-2019	Final Draft DA	MB	KM
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05	10 Oct-2019	For DA	MB	KM
06	11 Oct-2019	For DA	MB	KM
07	21 Oct-2019	For DA	MB	KM

Contents

1. Introduction

This report has been prepared on behalf of APP corporation to provide assessment of water sensitive urban design strategy development consent for a Centre of Excellence, a state-of-the-art facility to be used by professional sportsmen and women in conjunction with the community, and 3,000 covered seats to deliver an improved experience for spectators attending the site. The proposal will support the operations of the Manly Warringah Sea Eagles (MWSE) and ensure its viability into the future. The following strategies are described in this report:

- Stormwater Quality Management
- Water Conservation
- Ground water Quality Management

2. Stormwater Quality Management

This design of the OSD Tank will be provided with filtration to remove pollutants before it discharges into the Authority Stormwater main.

The development targets to remove pollutants are as follows:

- 90 percent reduction in the post development average annual load of Gross Pollutants (greater than 5mm)
- 85 percent reduction in the post development average annual load of Total Suspended Solids;
- 65 percent reduction in the post development average annual load of Total Phosphorus; and

The stormwater quality treatment train is designed based on the impervious area provided by the architect and modelled in MUSIC software to show compliance with council targets.

The northern side of the site is designed in MUSIC to treat pollutants from the roof and driveway. The western side of the site is not treated as it is a porous granite gravel surface.

The WSUD treatment terrain includes: 50KL Rainwater tank (RWT) re-use for irrigation and toilet purposes, one (1) 'ocean guard' for the driveway area and a 'filterra bioretention' minimum surface area of 30m2 by Ocean Protect or equivalent.

According to the MUSIC modelling results, the proposed strategy achieves the reduction targets specified by Council listed above.

2.1. MUSIC Modelling

The effectiveness of the combination of treatment train measures has been assessed using numerical modelling within MUSIC (Model for Urban Stormwater Improvement Conceptualisation version 6). The results of the modelling were compared against the Council's pollutant reduction targets to determine the effectiveness of the proposed measures.

MUSIC simulates the performance of a group of stormwater management measures, configured in series or in parallel to form a "treatment train" against historic rainfall event data sets. It is the industry standard water quality modelling software developed by the MUSIC Development Team of the Cooperative Research Centre for Catchment Hydrology (CRCCH).

The MUSIC User Manual suggests that the time-step should not exceed the time of concentration of the smallest sub-catchment however due consideration must also be made regarding the shortest detention time of nodes within the treatment train.

2.2. MUSIC Catchment Breakdown

The Table below provides a breakdown of the catchment areas used in the MUSIC model:

	Catchment Area (ha)	% Imperviousness
Roof	0.465	100%
Driveway	0.028	100%

Table 1 – MUSIC Catchment Breakdown

2.3. Event Mean Concentration

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ). The EMC values used in the MUSIC models for this project were based on the Sydney Catchment Management Authority (CMA) Source Node(s) utilising modified % impervious area, rainfall threshold, soil properties & pollutant concentrations. The table below summarises the parameters used for the development site;

NODE TYPE	MEAN BASE FLOW CONCENTRATIONS Log_{10} (mg/L)			MEAN STORM FLOW CONCENTRATIONS Log_{10} (mg/L)		
	TSS	TP	TN	TSS	TP	TN
Roof	Not Applicable*Note			1.300	-0.890	0.300
Impervious	Not Applicable*Note			2.150	-0.600	0.300
Pervious	1.200	-0.850	0.110	2.150	-0.600	0.300

Table 2 - EMC Inputs for MUSIC

**Note – Impervious areas do not have base flows.*

2.4. Results

The results of the modelling are summarised below with the pollutant loads expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the pollution from the post developed site to that of the existing developed state of the site to determine whether the reduction targets have been achieved.

Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.69	2.42	34.6
Total Suspended Solids (kg/yr)	164	23.1	85.9
Total Phosphorus (kg/yr)	0.648	0.141	78.2
Total Nitrogen (kg/yr)	8.1	2.13	73.7
Gross Pollutants (kg/yr)	107	0	100

Table 3 –MUSIC Results

GP = Gross Pollutants TSS = Total Suspended Solids
TP = Total Phosphorus TN = Total Nitrogen

The MUSIC model layout is shown in the figure below.

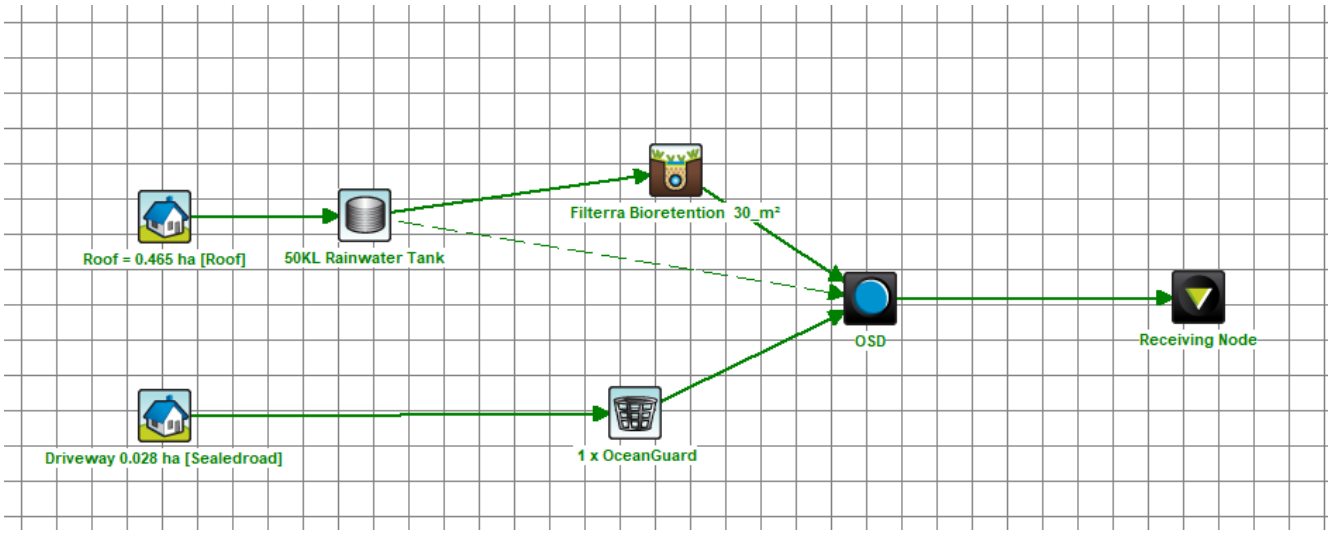

Figure 1 - MUSIC model Layout

The results tables show that the proposed treatment train will achieve the reduction targets for the full range of pollutants. Through the implementation of the proposed water quality measures stormwater discharge from the site can be effectively managed to ensure that there is no detrimental effect to the water quality downstream of the subject site.

3. Water Conservation

3.1. Sanitary Fixtures

The installation of water efficient tapware in accordance with Clause 3.5.8 of the Northern Beaches Council Development Control Plan will be specified below as a minimum requirement:

- 3 Star Showerheads

- 3 Star Urinals
- 4 Star Dual-Flush Toilets
- 4 Star Tapware
- Washing Machines
- Dishwashers

3.2. Rainwater Reuse Tank

The design intent is to collect rainwater from the roof which will then reticulated to the rainwater harvesting tank (Rainwater Tank sized at 50KL). The rainwater harvesting tank overflow provision will overflow into the On-Site Detention (OSD) tank and then into the Authority Stormwater main. During periods where there is no rainfall, the rainwater harvesting tank will be topped up by the potable cold water supply. We will seek if feasible to use the existing Bore Water connection for the propose development.

The rainwater harvesting tank design parameters are the following:

- Rainwater reuse for the sanitary fixtures (water closets and urinals)– Average Monthly Usage is **25.5KL**.
- Rainwater reuse for irrigation of approx. 3 000 m2 (2L per m2) – Average Monthly Usage is **68KL**

Referring the design parameters highlighted in clause 3.2, the following graph (Figure 1) was generated via the Sydney Water Rainwater Tank Calculator. The graph compares the daily rainwater provided by a 50kL tank against the average water needed on a monthly basis.

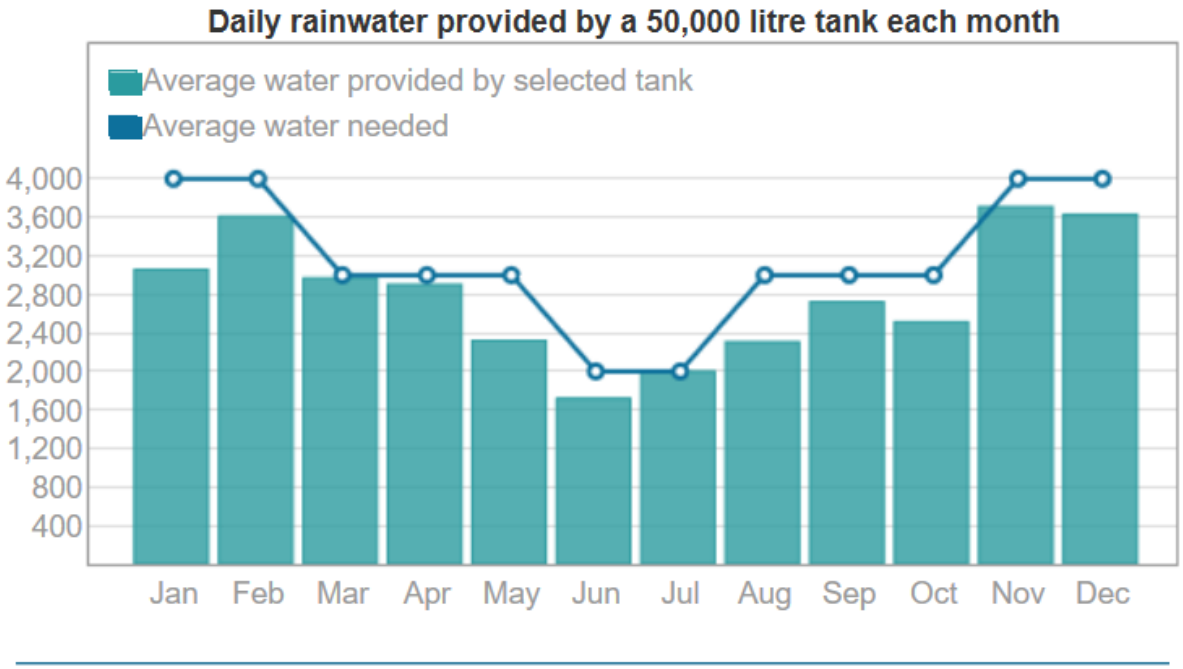

Figure 2 - 50kL Tank Size coverage Vs Demand

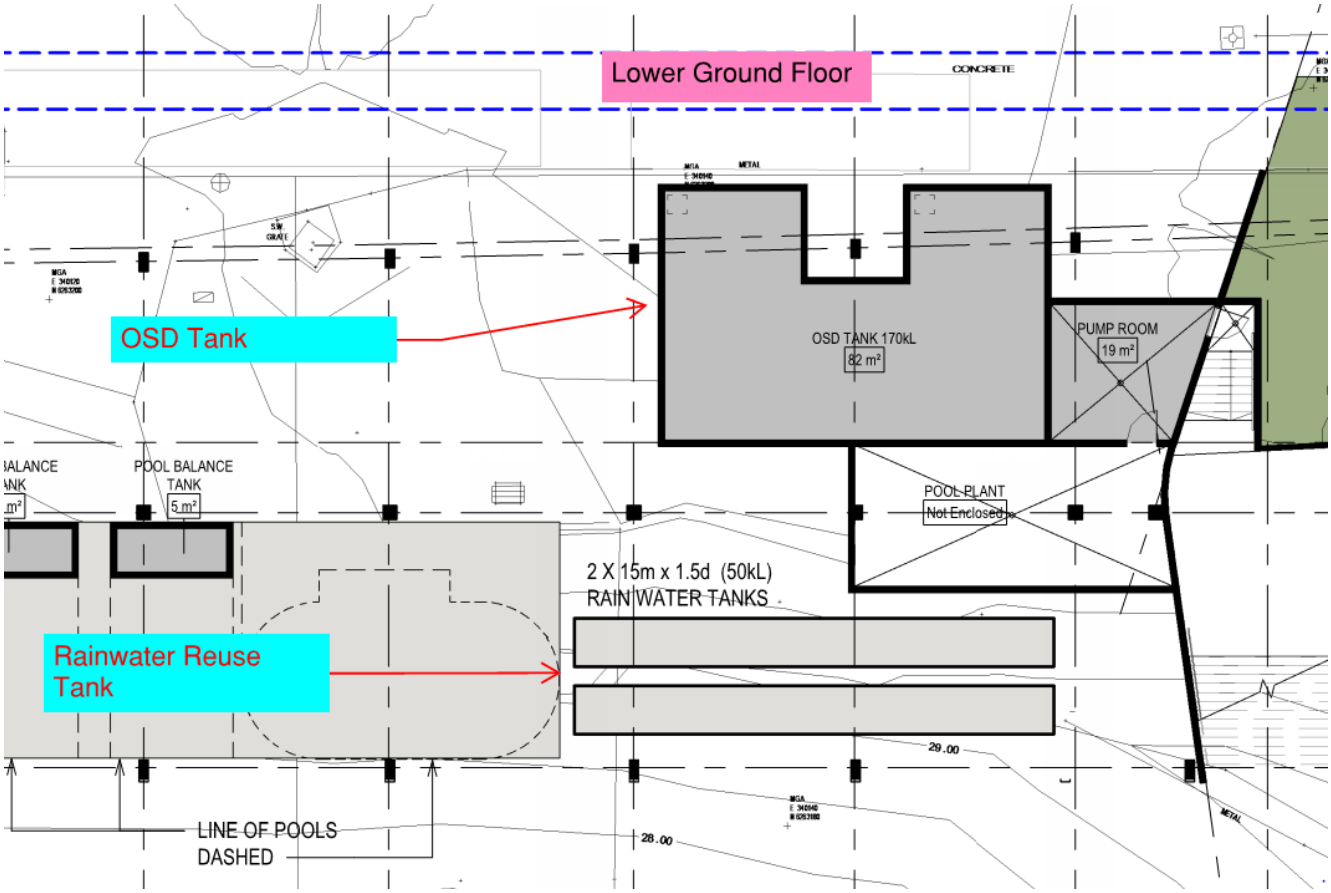

Figure 4 – Rainwater Reuse Tank (50kL) & OSD Tank Location

Tank size (kL)	% rainwater provided	Drinking water saved each day (litres)
50	88	2,782
100	98	3,107
150	100	3,143
190	100	3,143
240	100	3,143
290	100	3,143

Figure 53 - Tank Size vs. % Rainwater Provided

Based on these parameters, a **50 000 L** tank could provide up to 88% of the rainwater needed each day during the year.

4. Ground Water Quality Management

The existing site for the propose development located at the northern end of Brookvale Oval is served by rainwater tanks from Bore Water connection from the Ground Water.

The proposed development will incorporate a rainwater tank to serve sanitary fixtures and irrigation. During periods there is no rainfall the rainwater harvesting tank will be topped up by the potable cold water supply. We will seek if feasible to use the existing Bore Water connection for the propose development.

Ground Water Quality Management plan for the propose development refer to the following documents submission as part of the development application:

- Erosion and Sediment Control Plan / Soil and Water Management Plan
- Stormwater Management Plan / Stormwater Plans and On-site Stormwater Detention (OSD)
- Geotechnical Report
- Acid Sulfate Soil Report
- Water Table Report
- Statement of Environmental Effects