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Bungarribee Industrial - TOLL/IPEC site

AECOM has assessed the proposal for the TOLL/IPEC site to ascertain the implications in relation to Water Sensitive Urban Design. We have confirmed that the stormwater quality targets can be met and the proposal is consistent with the objectives and intent of the original WSUD Strategy for the site.

The proposed layout for the TOLL/IPEC site requires the following modifications to the design:

- the central road within the estate (Huntingwood Drive) to be shortened,
- the removal of two small raingardens,
- the realignment of stormwater pipes that were previously laid along Huntingwood Drive, and
- an overland flow path will be integrated with the surface levels proposed for the site to safely convey flood flows through the site.

The key elements (and inputs to the water quality modelling) that have been reviewed include:

- Catchment areas directed to the main wetland and bioretention treatment elements
- Impervious proportion of the proposed TOLL/IPEC site
- Configuration of Gross Pollutant Traps (GPT's) that Blacktown City Council (BCC) has previously requested be implemented at the lot scale to assist in the control of gross pollutants generated on lots)
- Expected pollutant reduction as simulated in MUSIC modelling

Catchments and impervious areas

The proposed catchments are shown in Figure 1.

The total catchment area has been recalculated from the latest CAD files for the estate (October 2012). The total catchment area has increased slightly (from 75.92ha to 77.64 ha) as a result of minor differences in the mapped catchment boundaries (at the interface with surrounding roads). The table below shows that there has been a small increase in the catchment directed to the central sedimentation basin, and a small decrease in the catchment area directed to the northern bioretention system.

Table 1 – Catchment areas in the current water quality modelling and original work for the CC approval

Catchment	Area and % impervious (2012)	Area and % impervious (original)	Difference
External	19.92ha, 80% impervious	19.92 ha, 80% impervious	None
Northern	17.42 ha, 89% impervious	18.5 ha, 90% impervious	- 1.08 ha
Central	24.25 ha, 90% impervious	21.3 ha, 90% impervious	+ 2.95 ha
Southern	16.06 ha, 91% impervious	16.2 ha, 90% impervious	- 0.14 ha
TOTAL	**77.64 ha, 88% impervious**	**75.92 ha, 87% impervious**	+ 1.72 ha

The impervious areas represented in the current plans are not significantly different from the initial assumptions (refer to Table 1). The impervious area for the TOLL/IPEC site was measured from the proposed layout (October 2012). The site is 90% impervious. The pervious areas are landscape buffers at the edge of the site and small landscaped areas within the site.

Figure 1 – Stormwater Catchments (southern, central, northern and external) and WSUD treatment areas. The TOLL IPEC site lies on the western side of the estate, adjoining the existing Metcash site.

Gross Pollutant Traps (GPT's)

GPT's have been included in the MUSIC modelling as BCC has previously requested they be implemented at the lot scale to assist in the control of gross pollutants generated on lots.

In the water quality modelling, a single GPT is represented for each catchment, with a high flow bypass (based on typical supplier recommendations for the relevant catchment size). Note GPT's are installed at the discharge points on each lot, but will have similar treatment performance to that represented by the single node in the modelling.

Stormwater Quality - MUSIC Modelling

The MUSIC model has been updated as the design has evolved to accurately reflect the site conditions. It includes the site catchments as detailed above in **Figure 1**.

The water management principles stipulated in the WSUD concept strategy (2006) and approved for the development by the then Department of Planning (now Department of Planning and Infrastructure) were derived from the following state and local government planning policies:

- Sydney Regional Environmental Plan (SREP) 31 – Regional Parklands
- Development Control Plan No.1 – Interim Regional Parklands Management
- Landcom Water Sensitive Urban Design Policy
- Blacktown City Council Stormwater Management Policy (2000)

For the purposes of this consent, the treatment targets set for the site for the purposes of MUSIC modelling were agreed to be (% Pollutant load reduction)

- Total Suspended Solids – 80%,
- Total Phosphorus – 45%
- Total Nitrogen – 45%

The following inputs and assumptions were used in the MUSIC modelling:

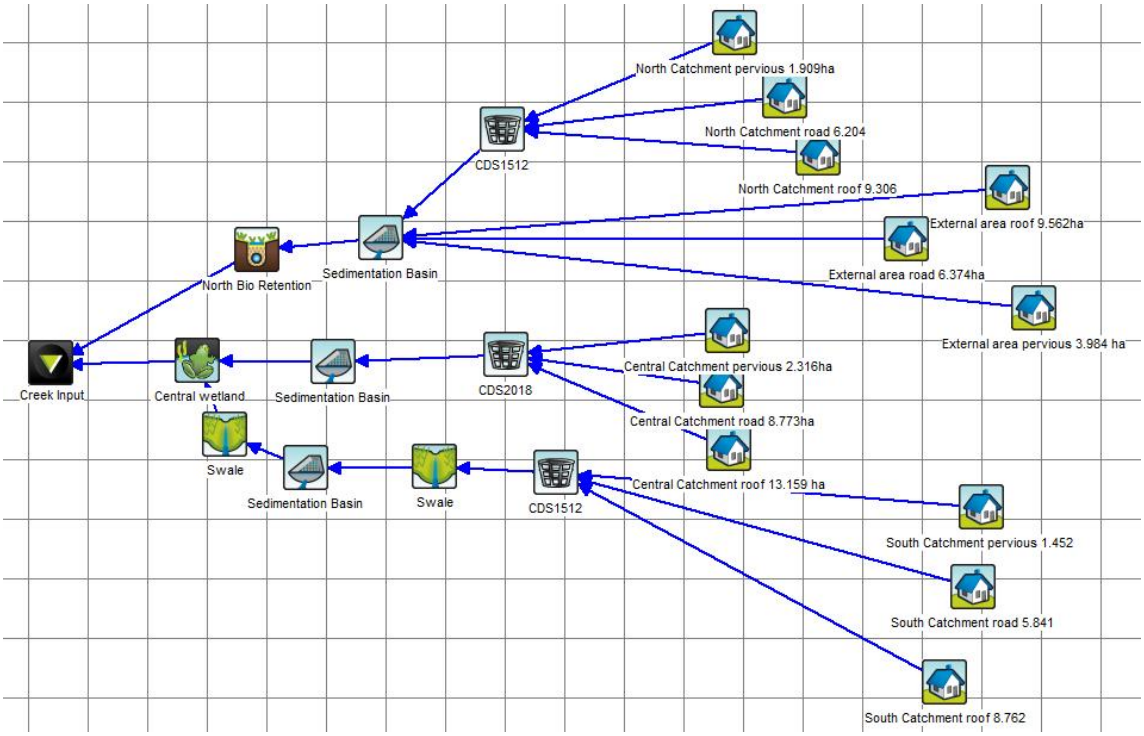
- Parameters for the generation of pollutants from the site were based on the BCC MUSIC modelling guidelines. MUSIC version 5 (5.1.16) was used for the simulation.
- The MUSIC model was run with rainfall data from a 10 year time period (01/01/1967 – 01/01/1977) with 6-minute precipitation data from the Liverpool (Whitlam Centre) rainfall gauge (067035). This meteorology station has a mean annual rainfall of 857 mm/yr and mean annual potential evapo-transpiration of 1262 mm/yr. This station has rainfall comparable with the daily data available from the Prospect Dam Bureau of Meteorology station which has a mean annual rainfall of 866 mm/yr (120 year record from 1887, no 6 minute data was available from this station).
- Catchment parameters are consistent with Council guidelines. All contributing catchments have been modelled based on estimated land use densities. We have assumed impervious fractions as detailed above (Table 1) based on current site plans, with default assumptions of 90% imperviousness for the parcels within the industrial estate.
- Sensitivity analysis to the inclusion of GPTs in the model has been done. GPT's are to be implemented at the lot scale by the lot owners, and will assist in the control of gross pollutants generated on lots.

The treatment nodes of the MUSIC model comprise all elements of the treatment train including swales, sediment basins, constructed wetlands and bioretention systems. These treatment devices were designed with design parameters within the recommended values of WSUD Technical Design Guidelines such as:

- Water Sensitive Urban Design - Technical Design Guidelines for South East Queensland. Version 1 June 2006. Water by Design. Moreton Bay Waterways and Catchments Partnership.
- WSUD Engineering Procedures: Stormwater. Produced by Melbourne Water.

The figure below provides a screen shot of the MUSIC model for the WSUD strategy.

Figure 2 – MUSIC model layout



The major design parameters used in the treatment nodes were as follows:

Swales	
Length (varies between swales) (m)	225, 243
Base width (m)	1.0
Top width (m)	5.0
Vegetation height (m)	0.25
Exfiltration rate (mm/hr)	0.36

Sedimentation Basins	
Surface Area (North, Central, South, m^2)	600, 600, 570
Extended detention depth (m),	0.5
Permanent pool volume (North, Central, South, (m^3)	560, 560, 530
Average depth of permanent pool (m)	1.0
Seepage Loss (mm/hr),	0.04
Evaporative Loss as % of PET	75
Notional Detention Time (hours)	1

Central Wetland parameters	
Surface Area (m^2)	16,608
Extended detention depth (m),	0.35
Permanent pool volume (m^3)	5986
Average depth of permanent pool (m)	0.35
Seepage Loss (mm/hr),	0.04
Evaporative Loss as % of PET	125
Notional Detention Time (hours)	72

Bioretention System (Saturated Zone) Parameters	
Surface Area (m^2)	4,250
Filter Area (m^2)	4,000
Extended Detention Depth (m),	0.3
Filter Depth (m)	0.6
Saturated Hydraulic Conductivity (mm/hr)	180
Saturated Zone Depth (m)	0.5
Exfiltration loss (mm/hr)	0.00 (lined)

Gross Pollutant Traps

High Flow Bypass

Northern Catchment:	1.1 m^3/s
Central Catchment:	2.6 m^3/s
Southern Catchment	1.1 m^3/s

Pollutant removal rates for GPTs

TSS: 0% removal for concentrations up to 75 mg/L
Up to 70% removal for 75mg/L – 1,000mg/L
TP: 30% removal
TN: 0% removal

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Results - Stormwater Quality - MUSIC Modelling

The MUSIC results in the form of pollutant loads reductions are presented in **Table 2**. The criteria are met for all pollutants of concern, both with GPT's included in the model (**Table 2**) and when GPT's are excluded (**Table 3**). The removal of the two small raingardens in Huntingwood Drive as a result of the modification proposed for the TOLL/IPEC site does not impact on the site meeting the water quality targets.

Table 2 – MUSIC results and treatment targets – with GPT's included in the model

Pollutant	Source	Residual	% Reduction	Target %
Total Suspended Solids (kg/yr)	78,500	9,560	88	80
Total Phosphorus (kg/yr)	168	69	69	45
Total Nitrogen (kg/yr)	1,170	607	48	45

Table 3 – MUSIC results and treatment targets – without GPT's

Pollutant	Source	Residual	% Reduction	Target %
Total Suspended Solids (kg/yr)	78,100	12,100	85	80
Total Phosphorus (kg/yr)	167	74	56	45
Total Nitrogen (kg/yr)	1,160	604	48	45

Stretch Targets

BCC's current water quality targets are now more stringent than the targets that were in place when the initial WSUD strategy was developed. The current BCC targets are considered stretch targets for the site. The stretch targets are 85:65:45 (compared with 80:45:45) for percentage reduction in mean annual loads of Total Suspended Solids, Total Phosphorus and Total Nitrogen respectively.

The stretch targets for TSS and TN are met for both models. The stretch targets for TP are achieved with GPTs represented in the model (**Table 2**).

There are a range of other additional elements that further improve stormwater quality (but that have not been included in the MUSIC modelling). These elements include:

- Rainwater harvesting and water reuse for non-potable demands (air conditioning, irrigation, toilet flushing and potentially truck cleaning).
- Street bioretention systems along Huntingwood Drive (treating road runoff)

The inclusion of GPT's on each lot, water reuse, road side bioretention raingardens and the centralised stormwater management infrastructure (swales, sedimentation basins, wetland and large bioretention system) will provide a very high level of stormwater treatment for the Bungarribee Industrial Estate which will exceed the stretch targets (as demonstrated in **Table 2**).

Conclusion

In summary, the latest MUSIC modelling reflects the current design of the proposed development and demonstrates that relevant water quality targets can be achieved. The modelling accurately reflects the proposed site conditions based on the current design and this design achieves the water quality targets.

Yours sincerely

AECOM Australia Pty Limited

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