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Water Quality Control Report for No. 15 Bellfrog Street, Greenacre

1 Introduction

The total site area is some 6480 m2. The site falls towards the back and a drainage easement is available to drain all the runoff by gravity.

It is proposed to construct a warehouse, a workshop, storage sheds and driveways/car parking on this site. Council's OSD policy applies to this land. An above ground OSD is proposed with a storage of 346 m3. The description of proposed area types is given in the table below:

Description	Area (m2)
Site Area	6480
Roof Warehouse	960
Roof awnings	576
Roof workshop	142
Soil & material handling area	444
Driveways/car parking	3450
Driveway by passing OSD	44
Landscaped area by passing OSD	863

2 General

The water quality modelling software program MUSIC has been used to establish the effectiveness of the water quality treatment proposal. MUSIC has been developed by the Cooperative Research Centre for Catchment Hydrology, and is designed as a planning tool for water quality treatment trains for catchment runoff. The model provided for submission and approval is:

- *Bellfrog_grassed_swale3.sqz*

The program MUSIC is able to model pollutant loads present in stormwater runoff from a catchment and assess the effectiveness of different treatment devices in terms of pollutant load reduction.

3 Pollutant Loading

Strathfield City Council (SCC) has provided pollutant concentration levels for Total Suspended Solids (TSS), Total Phosphorous (TP), and Total Nitrogen (TN) from testing by others of pollutant levels of various land types including industrial hardstand, roofs, and roads. These levels will produce a good representation of the above expressed catchments.

The post developed condition of the lots will be medium density residential. MUSIC nodes for Roof, Driveway and landscaped areas as required by the Council were used in this study.

	Roof Areas	Road Areas	General Urban	Forest/Natural
Impervious Area Properties				
Rainfall Threshold (mm)	1.4	1.4	1.4	1.4
Pervious Area Properties				
Soil Storage Capacity (mm)	170	170	170	170
Initial Storage (% of Capacity)	30	30	30	30
Field Capacity (mm)	70	70	70	70
Infiltration Capacity Coefficient a	210	210	210	210
Infiltration Capacity Coefficient b	4.7	4.7	4.7	4.7
Groundwater properties				
Initial Depth (mm)	10	10	10	10
Daily Recharge Rate (%)	50	50	50	50
Daily Baseflow Rate (%)	4	4	4	4
Daily Seepage Rate (%)	0	0	0	0
Total Suspended Solids Baseflow Concentrations				
Mean (log mg/L)	-	-	1.2	0.78
Std Dev (log mg/L)	-	-	0.17	0.17
Serial Correlation (R squared)	-	-	0	0
Stormflow Concentration Parameters				
Mean (log mg/L)	1.3	2.43	2.15	1.6
Std Dev (log mg/L)	0.32	0.32	0.32	0.32
Serial Correlation (R squared)	0	0	0	0
Total Phosphorus Baseflow Concentrations				
Mean (log mg/L)	-	-	-0.85	-1.52

Std Dev (log mg/L)	0.25	0.25	0.19	0.19
Serial Correlation (R squared)	0	0	0	0
Stormflow Concentration Parameters				
Mean (log mg/L)	-0.89	-0.30	-0.60	-1.10
Std Dev (log mg/L)	0.25	0.25	0.25	0.25
Serial Correlation (R squared)	0	0	0	0
Total Nitrogen Baseflow Concentrations				
Mean (log mg/L)	-	-	0.11	-0.52
Std Dev (log mg/L)	-	-	0.12	0.12
Serial Correlation (R squared)	0	0	0	0
Stormflow Concentration Parameters				
Mean (log mg/L)	0.30	0.34	0.3	-0.05
Std Dev (log mg/L)	0.19	0.19	0.19	0.19
Serial Correlation (R squared)	0	0	0	0

4 Water Quality Treatment Proposal

Stormwater carries pollutants that it has picked up from the surfaces it has come into contact with. This creates a risk of contamination to downstream habitats. A treatment train can be implemented to protect against this risk of contamination. A treatment train consists of more than one mechanism that removes pollution; in our case a series of treatment devices are used. The treatment train is effective because the different treatment devices in series overlap in the pollutants they remove thus providing a more thorough treatment with redundancies along the treatment train.

The water quality treatment train has been designed to ensure that pollutant removal rates satisfy the requirements in the Strathfield City Council Stormwater Quality Control Policy.

Pollution Retention Criteria	
Pollutant	**Retention Criteria for Development Sites**
Total Suspended Solids	85% reduction in post development mean annual load
Gross Pollutants	90% reduction in post development mean annual load
Total Phosphorus	60% reduction in post development mean annual load
Total Nitrogen	45% reduction in post development mean annual load

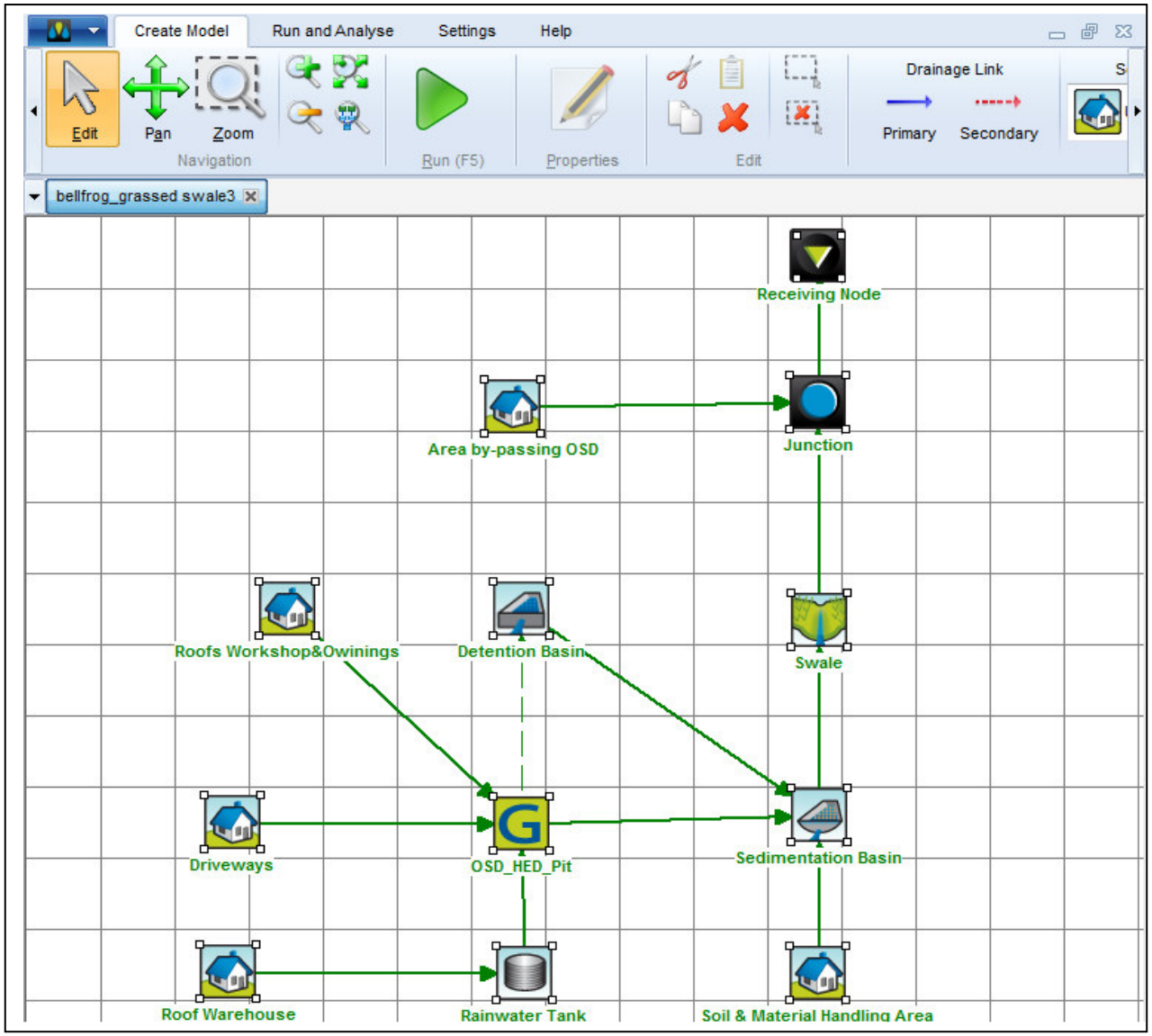
The following treatment train is proposed:

Use a 10 KL rainwater tank to collect and store warehouse roof runoff and re-use it for toilet flushing. It was assumed that 15 people would be using the toilets with a total of 300 l/day.

Incorporate the OSD into the treatment train with the 23 l/s as a low flow by-pass. Only the excess volume of water would be directed to the OSD storage.

Use a sedimentation basin to remove sediments and also to provide water for irrigation of the landscaped areas with an average of 300 KL/a. The overflow from the sediment basin is directed to a grassed swale. The grassed swale is 20 m long, 5 m wide with a 1% fall.

The schematic model layout is shown below:



5 Modelling Results

The modelling has been completed with the intention to model the post developed water quality runoff condition and ensure that pollutant removal rates satisfy the requirements in the Strathfield City Council Stormwater Quality Control Policy.

The results for the treatment train effectiveness can be seen below.:

Flow (ML/yr)	4.28	1.94	54.7
Peak Flow (m3/s)	0.139	5.58E-02	59.9
Total Suspended Solids (kg/yr)	1.05E+03	56.7	94.6
Total Phosphorus (kg/yr)	1.91	0.293	84.6
Total Nitrogen (kg/yr)	9.96	3.57	64.2
Gross Pollutants (kg/yr)	107	0.946	99.1

As can be seen from the above table the treatment train has been successful in achieving the Council pollution retention criteria.

6 Conclusion

The modelling results above have been determined using pollutant loads obtained from Strathfield City Council (SCC) in the MUSIC program. A treatment train consisting of numerous pollution removal devices has been implemented to provide pollution removal for the developed site.

The treatment train operates as a complete system removing the target pollutants to the required level.

The results of modelling have confirmed the effectiveness of the proposed treatment train which satisfies the BCC Stormwater Quality Control Policy.

7 Operation and Maintenance

The two main parts of the treatment train are rainwater tank, the OSD, the sedimentation basin and the grassed swale.

The operation and maintenance of the rainwater tank can be organised by the management or by an independent contractor. It is preferable that a contractor is engaged who would inspect the rainwater tank systems once a year and undertake repairs and or cleaning as necessary. The maintenance of the sedimentation tank will have to be done by the same contractor as required or a minimum once a year. The contractor will have to check if the pumps/diverters and automatic irrigation systems are operational and the sediment level in the tanks and the PH of the rainwater. RWTs would have to be cleaned once the water becomes acidic.

The maintenance of the OSD system is described in a separate document.

The maintenance of the grassed swale would consist of regular moving, leaving at least 50 mm of grass. Once a year the maintenance contractor would have to check that the swale surface is uniform, fill in with a top soil any holes or depressions, ensuring that the overflow from the sedimentation tank is spread equally across the entire width of the swale.

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