Assyrian Schools Limited
c/o-PMDL

Stormwater Management Report:

Lots 2320 and 2321 DP 1223137, 17 and 19 Kosovich Place, Cecil Park, NSW

P1705798JR08V02
September 2018

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT


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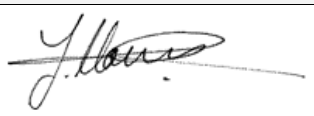
Erica Zhu	Darren Galia	Terry Harvey	

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Introduction

1.1 Overview

This stormwater management report has been prepared by Martens & Associates Pty Ltd (MA) to support a state significant development application (SSDA) for a proposed primary school at 17-19 Kosovich Place, Cecil Park, NSW (the 'site').

The school is proposed to be developed in two stages. The stormwater management report is designed to be compatible with this staged approach and should be read in conjunction with MA planset P1705798-PS04(Stage 1) and P1705798-PS03 (Stage 2).

1.2 Project Scope and Aims

This report provides the following:

- Evidence of compliance with Secretary's Environmental Assessment Requirements (SEARs) No. 9210 as they relate to stormwater management;
- Water quality assessment modelling and results using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) in accordance with NSW OEH (2013), as required by SEARs.
- Drainage system concept design to cater for the minor system by way of pit and pipe and major system by way of pit and pipe and overflow paths.
- Documentation of water quantity requirements for the development in accordance with SEARs.

1.3 Relevant Planning Controls and Design Principles

The following planning and engineering controls and design principles have been considered:

- Fairfield City Council (FCC) (2013) – *Local Environmental Plan.*
- Fairfield City Council (FCC) (2017) – *Stormwater Management Policy*.

- NSW Office of Environment & Heritage (NSW OEH) (2013) – *Guidelines for Developments Adjoining Land Managed by the Office of Environment and Heritage*.

- Greater Sydney Local Land Services (GSLLS) (2015)– *NSW MUSIC Modelling Guidelines*.

2 Site Description

2.1 Location and existing land use

The site is approximately 3 ha and located at Lots 2320 DP 1223137and Lot 2321 DP 1223137, 17-19 Kosovich Place, Cecil Park, NSW within the FCC Local Government Area (LGA). The site is currently used for rural purposes, and is predominantly open grasslands. The site is zoned RU4 – Primary Production Small Lots. The north west corner of the site is zoned as E2-Environmental Conservation.

The surrounding land uses are primarily rural and rural residential all around the site, locally, except to the south which is land owned by the Western Sydney Parklands Trust. There is also a church located to the north and the Westlink M7 motorway located approximately 350 m to the east.

2.2 Topography and Hydrology

Site elevation is approximately 89 m AHD to the site's north western boundary, sloping up to 102 m AHD near the eastern boundary. The site is characterised by steep slopes in the east and gentle slopes in the west. Site drainage generally occurs via overland flow to an unnamed tributary of Ropes Creek near the western boundary.

3 Stormwater Quality Assessment

3.1 Water Quality Objective

Water quality objectives are to comply with NSW OEH *Guidelines for Developments* (2013) which requires stormwater management measures to ensure stormwater quality is not different from natural levels before discharge to OEH land (i.e. a Neutral or Beneficial approach). In lieu of modelling guidelines, MA has deferred modelling to comply with FCC Stormwater Management Policy (2017).

3.2 Modelling Methodology

3.2.1 Overview

Model for Urban Stormwater Improvement Conceptualisation (*MUSIC*, Version 6.2) was used to evaluate pre-development and post-development mean annual loads. The following modelling scenarios were considered:

1. Pre-Development – the existing site was modelled to determine baseline (pre-development) pollutant generation rates for TSS, TP and TN.

2. Post-Development – the developed site was modelled including the water quality structures proposed to achieve water quality objectives.

3.2.2 Approach

An iterative approach was used to determine appropriate types, sizes and locations of stormwater treatment devices required to satisfy the adopted water quality objectives.

3.2.3 Climate Data (Treatment)

Pluviograph data was sourced from ewater using the Liverpool (Whitlam Centre) pluviograph. The data was run on a 6-minute time step from 01/01/1967-31/12/1976.

3.2.4 Input Parameters

Input parameters for source and treatment nodes are consistent with FCC Stormwater Management Policy (2017) and are provided in MUSIC models P1705798MUS01V02 (Stage 1) and P1705798MUS02V02 (Stage 2).

3.2.5 Catchment Areas

Pre-development catchment areas were subdivided into existing land use being agricultural, roof, road and landscaped areas with impervious areas measured from SIX Maps (2018).

Post-development catchments with impervious percentage areas were based on measured values from the proposed landscaped plan. Footpaths in the Stage 2 (lower landscaped areas) are considered effective impervious areas (i.e 100% pervious).

3.3 Treatment Train Philosophy

The stormwater treatment strategy for the site utilises roof water capture and reuse in combination with at source controls to ensure treatment objectives are satisfied. Individual stormwater quality improvement devices (SQIDs) are outlined in the following sections.

3.3.1 *Stage 1*

3.3.1.1 Rainwater Tank

Runoff from designated roof areas will be connected to a rainwater tank for reuse. The collected water will be reused for landscape irrigation. The following was included in modelling:

- 139 kL (2 m x 5 m x 14 m) rainwater tank; to be located under the Civic Heart paved area.
- An annual external reuse rate of 550 kL/year (0.4 kL/m^2/year) was applied and scaled by potential evapotranspiration variations.

3.3.1.2 Bioretention Basins

Stormwater runoff from the site shall be conveyed by way of pit and pipe to biofiltration basins. Stormwater exceeding the biofiltration basin treatment capacity shall overtop the proposed extended detention depth and bypass untreated stormwater to the proposed pit and pipe network. The biofiltration systems were modelled in accordance with the

proposed parameters nominated below and are subject to detailed design:

- Extended detention depth: 0.3 m
- Filter area: 20 m^2 for the total site, basin shown in planset P1705798PS04-E100.
- Filter depth: 0.40 m.
- Saturated Hydraulic Conductivity: 125 mm/hr.
- Total Nitrogen Content: 800mg/kg
- Total Orthophosphate Content: 40 mg/kg

3.3.2 *Stage 2*

3.3.2.1 Rainwater Tank

Runoff from designated roof areas will be connected to the existing 139 kL rainwater tank installed in stage 1 for reuse. The collected water will be reused for landscape irrigation. The following was included in modelling:

- 139 kL (2 m x 5 m x 14 m) rainwater rainwater tank to be located under the Civic Heart paved area;
- An annual external reuse rate of 1150 kL/year (0.4 kL/m^2/year) was applied and scaled by potential evapotranspiration variations.

3.4 MUSIC Results

MUSIC modelling results for Stage 1 (P175798MUS01V02) and Stage 2 (P175798MUS02V02) are provided in Table 1 and Table 2.

Table 1: *MUSIC results: Pre-development and Post-development for Stage 1.*

Parameter	Pre-development	Post-development	% Change
TSS (kg/year)	948.00	818.00	-13.71%
TP (kg/year)	3.95	3.45	-12.66%
TN (kg/year)	21.1	20.7	-1.90%
Gross Pollutants (kg/year)	137	96.0	-29.93

Table 2: *MUSIC results: Pre-development and Post-development for Stage 2.*

Parameter	Pre-development	Post-development	% Change
TSS (kg/year)	965.00	622.00	-35.54%
TP (kg/year)	4.04	1.77	-56.19%
TN (kg/year)	20.90	16.00	-23.44%
Gross Pollutants (kg/year)	137	13.1	-90.44%

3.5 Conclusion

The modelling results indicate that the water quality objectives will be met by the proposed water quality treatment systems. The proposed management system is consistent with the principles of Water Sensitive Urban Design (WSUD) as the proposed treatment strategy utilises 'at source' controls rather than relying solely on end-of-line structures. This approach is considered the most appropriate for the site and will provide an appropriate outcome for receiving environments.

4 Stormwater Quantity Assessment

4.1 Objectives

Water quantity objectives are to comply with FCC Stormwater Management Policy (2017). Site stormwater management has been designed to comply with the objectives of FCC Stormwater Management Policy (2017) as follows:

- Drainage system to carry all flows during minor storm events, up to the 5 year ARI event, by way of pit and pipe.
- Drainage system to carry all flows during major storm events, up to the 100 year ARI event, by way of pit and pipe and overland flow.
- On-site Detention (OSD) to ensure maximum permissible site discharge of 78 L/s/ha for the 5 min, 15 min, 30 min, 60 min, 180 min, 360 min and 540 min durations for the 5 and 100 year ARI for the developed site.
- Providing stormwater quantity devices outlets outside of preliminary 1% AEP flood extent so as to not be drowned outlets.

4.2 Overview

The DRAINS software package (version 2018.06 – 28 June 2018) was used with the ILSAX hydrological engine to satisfy the OSD criteria nominated in Section 4.1. A conceptual pit and pipe system is provided in MA planset P1705798PS04-E100 (Stage 1) and P1705798PS03-E100 (Stage 2) with hydraulic analysis to be completed at detailed design stage.

4.3 Modelling Methodology

Parameters used in the model are consistent with *Australian Rainfall and Runoff (AR&R)* 1987 procedure. Modelling assumptions are derived from the following sources:

- Intensity Frequency Duration (IFD) coefficients were based on the Institution of Engineers *AR&R* (1987).
- ILSAX parameters for the post-development catchments were based on suggested values in FCC Stormwater Management Policy (2017) and are provided in Table 3 and Table 4.

- Catchment delineation was developed using site survey data, LIDAR data and the proposed drainage system. A layout and table of the post-development catchment assessment has been provided in Plans P1705798PS04-E100 (Stage 1) and P1705798PS03-E100 (Stage 2).

- Post-development catchment impervious areas were determined based on development layout design.

Table 3: Rainfall and ILSAX details used in DRAINS modelling.

Parameter	Element	Value
IFD data [1]	2year 1hour Rainfall Intensity (mm/h)	30.6
	2year 12hour Rainfall Intensity (mm/h)	6.48
	2year 72hour Rainfall Intensity (mm/h)	1.92
	50year 1hour Rainfall Intensity (mm/h)	59.3
	50year 12hour Rainfall Intensity (mm/h)	12.8
	50year 72hour Rainfall Intensity (mm/h)	4.26
	G	0.01
	F2	4.30
	F50	15.87
	Antecedent moisture condition	4.00

Notes

1. Obtained from FCC *Stormwater Management Policy* (2017).

Table 4: ILSAX hydrology details used in DRAINS modelling.

Parameter	Element	Value
ILSAX parameters [1]	Impervious area depression storage (mm)	1.0
	Supplementary area depression storage (mm)	1.0
	Grassed area depression storage (mm)	5.0
	Soil type	4

Notes

1. Obtained from FCC *Stormwater Management Policy* (2017).

4.4 Site Drainage

The proposed concept pit and pipe network is provided in MA planset P1705798-PS04-E100 (Stage 1) and P105798-PS03-R03-E100 (Stage 2) and utilises the following system to manage runoff:

- Development run-off shall be captured by the proposed pit and pipe network and conveyed to a water quality treatment or OSD system prior to discharging offsite.

- Hydraulic modelling shall be completed at detailed design stage to comply with FCC Stormwater Management Policy (2017) and AS 3500.3.

4.5 OSD Tank

OSD tanks have been designed for the proposed development to satisfy the objectives in Section 4.1. Further details for OSD basins are provided in MA planset P1705798PS04-E600 (Stage 1) and P1705798PS03-E600 (Stage 2) with a summary of key components provided in Table 5 and Table 6.

Table 5: Summary of OSD tanks for Stage 1.

OSD Number	Volume (m^3)	Primary orifice (mm)	Primary Orifice Centre Elevation (mAHD)	Primary Weir (mAHD)	Primary Weir Crest Length (m)
1	156	98	92.83	94.63	4.1
2	52	48	94.30	95.34	1.7

Table 6: Summary of OSD tank for Stage 2.

OSD Number	Volume (m^3)	Primary orifice (mm)	Primary Orifice Centre Elevation (mAHD)	Primary Weir (mAHD)	Primary Weir Crest Length (m)
3	25	48	93.40	94.50	0.9

4.6 DRAINS Results

A summary of the critical storm runoff results from DRAINS model P1705798DRN02V03 (Stage 1) and P1705798DRN03V04 (Stage 2) for the 5 and 100 year ARI storm events is provided in Table 7 and Table 8 with full results provided in MA planset P1705798PS04-E600 (Stage 1) and P1705798PS03-E600 (Stage 2).

Table 7: Summary of OSD results for Stage 1.

Storm Event	Critical Duration	Peak flow (L/s)	Permissible Site Discharge (L/s)	Post < PSD
5	1 hr	62	63.02	Yes
100	1 hr	63	63.02	Yes

Table 8: Summary of OSD results for Stage 2.

Storm Event	Critical Duration	Peak flow (L/s)	Permissible Site Discharge (L/s)	Post < PSD
5	1 hr	72	73.09	Yes
100	1 hr	73	73.09	Yes

4.7 Conclusion

The proposed drainage system has been designed to capture and convey site stormwater. Hydraulic modelling shall be completed at detailed design stage to comply with FCC Stormwater Management Policy (2017) and AS 3500.3. The OSD and water quality (WSUD) elements have been designed to comply with the SEAR's requirements, with further details provided at the detailed design stage.

5 References

Blacktown City Council (2013) – *Developer Handbook for Water Sensitive Urban Design*.

DRAINS (2017), *DRAINS content menu.*

Fairfield City Council (FCC) (2013) – *Local Environmental Plan.*

Fairfield City Council (FCC) (2017) – *Stormwater Management Policy.*

Institution of Engineers, Australia (2006) – *Australian Rainfall and Runoff.*

Land and Property Information NSW (2016) – *SIX Maps Viewer.*

Nearmaps Site Aerial (2017) – *Nearmaps.*

NSW Office of Environment & Heritage (NSW OEH) (2013) – *Guidelines for Developments Adjoining Land Managed by the Office of Environment and Heritage*.

Greater Sydney Local Land Services (GSLLS) (2015) – *NSW MUSIC Modelling Guidelines*.