WOOD & GRIEVE ENGINEERS

Compass Centre, Bankstown

Stormwater Management Report

Prepared for:

Client name
Fioson Pty Ltd

Date:
10 February 2016

Prepared by:

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Project No. 28397-SYD-C
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Revision

Site Address:	83-99 North Terrace and 62 The Mall Bankstown
Real Property Description:	Lot 9 on DP777510, Lot 1 on DP207810, Lot 15, 16, 17, 19, 20, 21, 22, 23, 24 and 27 on DP5541, Lot 1 on DP507818, Lot 18B on DP412699.
Proposed Development:	Mixed Use Development
Client:	Fioson Pty Ltd
Local Authority	Bankstown City Council
Authority Reference #:	N/A
Wood & Grieve Reference:	28397-SYD-C-R-SMP

Ian Harris BEng (Hons)
For and on behalf of
Wood & Grieve Engineers

REVISION	DATE	COMMENT	APPROVED BY
01	07.12.2015	Draft DA Issue	**IH**
02	10.02.2016	DA Issue	**IH**
03	08.09.2016	DA Issue	**IH**

Contents

1. Introduction

Wood & Grieve Engineers have been commissioned by Fioson Pty Ltd to prepare this Stormwater Management Plan (SMP) in support of the Development Application for the proposed development at 83-99 North Terrace and 62 The Mall Bankstown. The sites real addresses are Lot 9 on DP777510, Lot 1 on DP207810, Lot 15, 16, 17, 19, 20, 21, 22, 23, 24 and 27 on DP5541, Lot 1 on DP507818, Lot 18B on DP412699.

This SMP outlines the conceptual DA level stormwater design for the proposed development of a multistorey mixed use development on the site.

This SMP demonstrates the application of Water Sensitive Urban Design (WSUD) principles and illustrates that the proposed development complies with the Bankstown City Council Standards and Guidelines for stormwater, Australian Rainfall and Runoff, Australian Standards and best engineering practise.

The purpose of this SMP is to evaluate the quantity and quality of stormwater associated with the proposed development plan so as to demonstrate to Council that an appropriate stormwater management strategy has been adopted.

The SMP specifically addresses the following items for both the construction and operational phases of the development:

- Stormwater runoff volumes and detention (Stormwater Quantity);
- Stormwater quality treatment measures (Stormwater Quality);
- Erosion and Sedimentation Control.

The following will be achieved with the correct application of this SMP report:

- Appropriate standards to be maintained on all aspects of stormwater within the site,
- Pollution control to be maintained,
- Establishment of a unified, clear and concise stormwater management strategy.

2. Existing Site Characteristics

2.1 Property Detail

Address:	83-99 North Terrace and 62 The Mall Bankstown
Real Property Description:	Lot 9 on DP777510, Lot 1 on DP207810, Lot 15, 16, 17, 19, 20, 21, 22, 23, 24 and 27 on DP5541, Lot 1 on DP507818, Lot 18B on DP412699
Total Site Area:	10,122m² (1.012Ha)

The proposed development can be seen on the concept design drawings in Appendix A of this report.

The proposed development will consist of a multistorey mixed used development with four levels of basement carparking.

As can be seen in the site location aerial photo below, the site is bounded by The Mall to the north, The Appian Way to the east, North Terrace to the south and Fetherstone Street to the west.

The site is currently fully developed with a public library, retail and commercial buildings and on grade car parking.

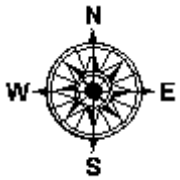

Figure 1: Site Location Plan (Source: Nearmaps 2015)

Existing Site Characteristics

2.2 Topography

The site currently falls from south to north and from west to east. The high point on the site is located on the south western boundary with an RL25.97m AHD, the low point being at the south eastern corner of the site with an RL21.60m AHD.

2.3 Stormwater Catchments

Analysis of the surrounding topography suggests that flows from a large upstream catchment (Approximately 110Ha) pass along The Mall to the north of the site and The Appian Way along the east of the site. The stormwater is generally conveyed from the north along Appian Way north of The Mall with only minor flows being conveyed west to east along The Mall (refer to Figure 2 below).

Stormwater conveyance modelling undertaken by BMT WBM indicates that in the existing scenario overland flow passes through the existing on grade car park at the north east corners of the site adjacent to the Mall and Appian Way intersection.

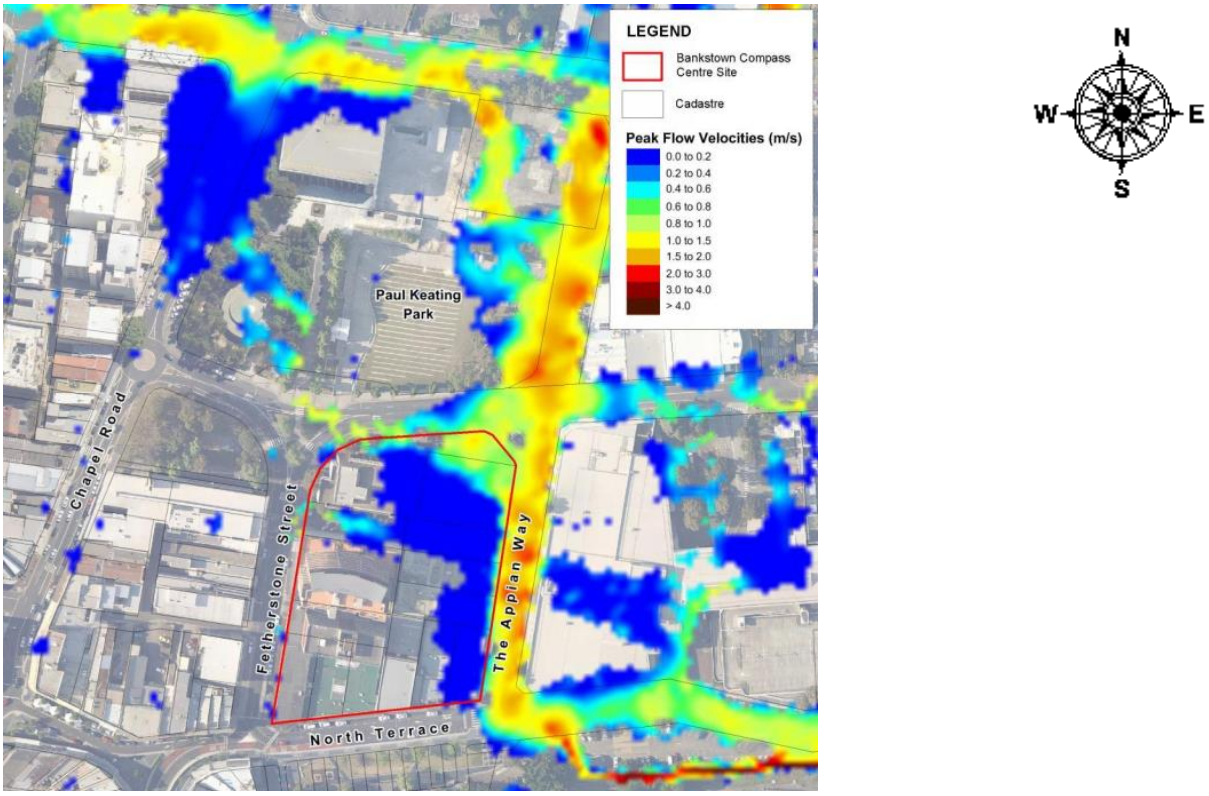

Figure 2: 100 Year Storm Event Overland Flow Velocities (Source: BMT WBM Report 2015)

2.4 Existing Stormwater Discharge

In the current condition there is very limited in ground stormwater drainage through the site. There are a number of local stormwater drainage inlets located within the on grade car park at the north east corner of the site and these connect to the existing Sydney Water drainage system located under Appian Way.

The existing buildings connect through a series of kerb connectors to the external street kerb and gutter. Any flows in excess of the capacity of the discharge outlets currently surcharge at roof level onto the existing footpath and are then conveyed to the street kerb and gutter.

Figure 3: Typical Existing Kerb Connection on Appian Way

There is currently no on site detention on the site to attenuate discharge flows from the site nor is there any water quality treatment.

3. Local Authority Requirements

Bankstown City Council set the design requirements for any new stormwater management system associated with new development in their Development Engineering Standards. A summary of the key requirements for the development of the Stormwater management system for this development are summarized below.

3.1 Stormwater Conveyance Requirements

Council's Development Engineering Standards states that the following design storm Average Recurrence Intervals ARI's should be allowed for when designing the Stormwater runoff conveyance systems for the development.

Stormwater Design Element	Design Storm ARI (Years)
Site Piped Drainage (Residential)	10
Eaves Gutters and Downpipes (Residential)	10
Site Piped Drainage (Commercial & Industrial)	20
Eaves Gutter and Downpipes (Commercial & Industrial)	20
Box Gutters and Downpipes	100

Table 1: Stormwater Drainage Serviceability

3.2 On Site Detention Requirements

Council's Development Engineering Standards states:

"OSD must be designed and constructed to control stormwater runoff from development sites such that, for 5 to 100 year ARI events, peak stormwater discharges from the site do not exceed pre-development stormwater discharges."

3.3 Stormwater Quality and Pollution Control

Council's Development Engineering Standards identifies that:

"A developer should refer to the following publications to determine the appropriate stormwater pollution control system for the proposed development:

- The EPA's manual on Managing Urban Stormwater (Treatment Techniques)
- Stormwater Treatment Devices User Guide (NSW Supply) - Government Contract No.019, July 1999, Department of Public Works and Services
- The relevant Australian Standards for pollution control devices"

4. Stormwater Conveyance

This section of the report discusses the systems proposed to allow for stormwater to be conveyed across the site to the legal point of discharge.

As discussed in section 3.1 of this report council have set minimum design parameters for the flows they require to be conveyed through the in ground drainage system and what they will allow to be conveyed in a controlled manner overland across the site.

4.1 Roof Drainage

All roof areas will be drained through a conventional gutter and downpipe system. The drainage system will be designed in accordance with AS3500.3:2003 to convey the minor design storm runoff from the roof to the in ground drainage system. Flows in excess of the design flows will surcharge the roof drainage system and discharge onto the surrounding ground where it will then be conveyed overland to the surrounding ground floor drainage network within. The drainage system will run vertically to the underside of the ground floor slab and then horizontally to the legal point of discharge for the site.

4.2 Surface Drainage

The surface areas will be drained through a variety of methods, discussed below, in accordance with AS3500.3:2003 and council's stormwater drainage guidelines.

4.2.1 Podium Drainage

The podium drainage has been designed to meet the following criteria:

- For all drainage events up to and including the 100 year design storms the runoff from the development will be conveyed through the building drainage to the point of discharge without surcharging.

Surface runoff from the podium and landscapes areas will be directed to stormwater inlet structures using the design topography of these elements. The inlet structures have been designed to adequately convey the surface runoff into the building drainage network.

As the site is flood affected there is no requirement to attenuate the flows from the drainage system so the system will be connected directly to the council stormwater system.

4.3 Basement Drainage

A basement drainage system has been provided on the lowest basement level. This system has been designed to cater for wind driven rain on the access ramps and runoff from wet cars. The basement slab will be graded to local low points where the runoff will be collected by rainwater outlets and conveyed to a pump out pit. From the pump out pit a dual pump set will pump the runoff to the OSD tank where it will drain via gravity to the street drainage.

4.4 Legal Point of Discharge

The legal point of discharge for the development will be into the existing council drainage pit at the corner of Appian Way and North Terrace.

The location of these connections can be seen on the concept design drawings included in Appendix A of this report.

5. Stormwater Attenuation

An increase in the density of development will increase the amount of impervious area, reduce the time of concentration, decrease infiltration and will thus increase the amount of stormwater runoff created by the site. In order to ensure that a non-worsening stormwater discharge from the post-development site can be achieved, attenuation is required to mitigate peak stormwater flows.

A hydraulic assessment has been undertaken to demonstrate that through the use of stormwater attenuation devices the proposed development does not increase the peak discharge to the council drainage system for all events up to and including the 100 year. This assessment was undertaken using DRAINS and the calculations associated with the design have been included in Appendix B of this report.

The outcome of the OSD analysis was that the provision of a 39.9m³ storage tank will be sufficient to attenuate the post development discharge flows back to the pre development flows.

Discharge from the OSD tank will pass through the sites water quality treatment device prior to discharging via gravity to council's drainage system at the legal point of discharge.

It is proposed that all site drainage systems will be directed to the OSD tank and there will be no bypass.

6. Stormwater Quality Treatment

As discussed in section 3.3 of this report Bankstown City Council has set targets for the reduction of water borne pollution being conveyed from the site through the stormwater drainage system.

This section of the report demonstrates the Stormwater Quality Improvement Devices (SQID's) to be implemented and the Pollutant Export Modelling undertaken to demonstrate the effectiveness of the treatment system in achieving the reduction targets set by council.

6.1 Potential Pollutants

There are a wide range of potential stormwater pollutant sources which occur from urbanised catchments, many which can be managed through appropriate stormwater quality treatment. Typical urban pollutants may include:

- Atmospheric deposition
- Erosion (including that from subdivision and building activities)
- Litter and debris
- Traffic emissions and vehicle wear
- Animal droppings
- Pesticides and fertilisers
- Application, storage and wash-off of car oil, detergents and other household and commercial solvents and chemicals
- Solids accumulation and growth in stormwater systems
- Weathering of buildings

These pollutants in urban stormwater can be placed into various categories as follows. The pollutants underlined below are able to be readily modelled:

- Suspended Solids
- Litter
- Nutrients such as Nitrogen and Phosphorous
- Biological oxygen demand (BOD) and chemical oxygen demand (COD) materials
- Micro-organisms
- Toxic organics
- Trace metals
- Oils and surfactants

While only the key pollutants underlined above will be examined within the modelling, the stormwater Quality Improvement Devices implemented are expected to assist in reducing a wide range of pollutants. For example, heavy metals are commonly associated with, and bound to fine sediments. Thus reducing the discharge of fine sediment during the construction and operational phases will also reduce the discharge of heavy metals to existing stormwater systems.

6.2 Pollutant Reduction System

In order to achieve the pollutant reduction targets specified in section 3.3 of this report a series of treatment devices are proposed which together form a treatment train. The diagram below shows the proposed treatment train for this development.

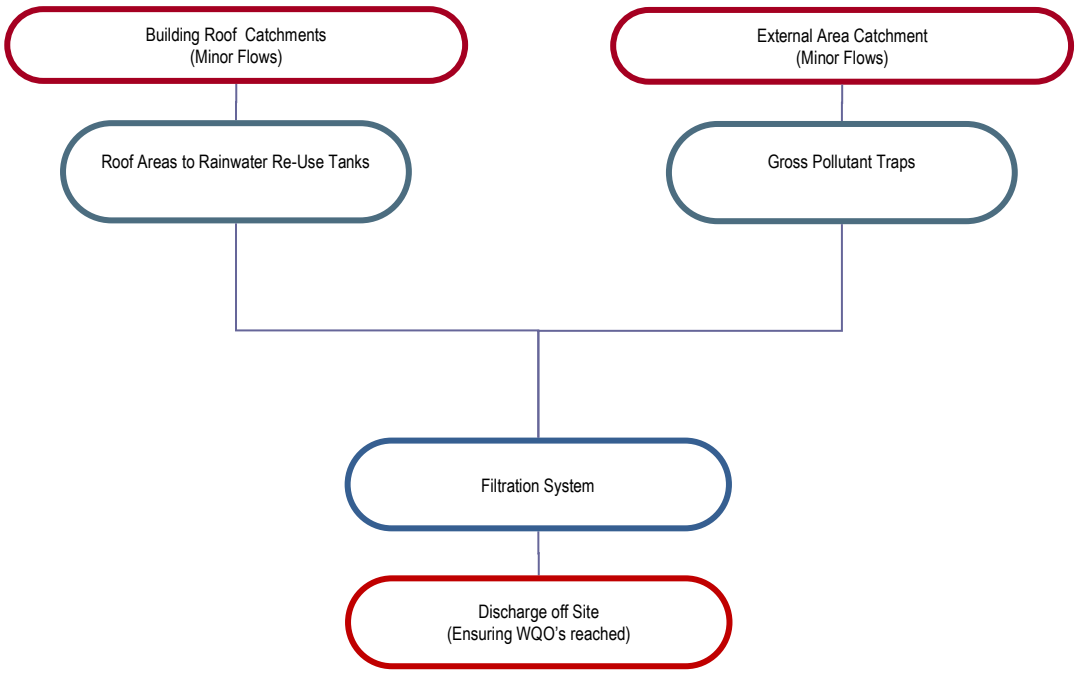

Figure 4: Proposed Water Quality Treatment Train

Further discussion on each element of this treatment train is provided below.

The following is a list of stormwater quality control requirements in addition to temporary sediment and erosion control design requirements for construction works:

- Silt arrestors and trash screens must be placed at the last storm water drainage pit before discharging into Council's drainage system. The silt arrestor and trash screen must be designed generally in accordance with Council's Standard Drawing S-106. Trash screens must be constructed of a suitable galvanized steel mesh. The size of the openings must be such that the screen will trap the design litter and in accordance with AS3500.

- Oil arrestors must be installed in the drainage system for industrial and large commercial developments where required by Council and the DA Consent.

The proposed treatment train system to satisfy the Bankstown City Council's Stormwater Quality and Pollution Control requirements consists of a rainwater tank and Humes Jellyfish.

6.2.1 Rainwater Tanks

As shown in the proposed treatment train, the roof water from the building will drain to rainwater tanks and will be used for irrigation. The use of rainwater tanks will allow for a reduction of TSS by the settling of particles over time and through the screening of water before it enters the tank.

6.2.2 Humes Jellyfish

The Humes Jellyfish filter unit used filtration cartridges to remove high levels of stormwater pollutants including:

- Total Suspended Solids (TSS), median removal efficiency of 89%, including particles down to two microns
- Total Nitrogen (TN), median removal efficiency of 55%
- Total Phosphorous (TP), median removal efficiency of 65%
- Total Copper (Cu), median removal efficiency of 61%
- Total Zinc (Zn), median removal efficiency of 91%.

Three Jellyfish JF-1800, 3 high flow cartridge, 1 drain down cartridge units have been proposed for the development.

The MUSIC modelling parameters for this device are set by the manufacturer, Humes.

Figure 5: Jellyfish infiltration Unit (Source: Humes)

7. Erosion & Sedimentation Control

Landcom have published a design guide entitled "Managing Urban Stormwater - Soils and Construction" which is regarded as the standard to which erosion and sedimentation control should be designed to within NSW. Bankstown City Council specifies compliance with the Landcom design guide in their Development Engineering Standards.

The control of erosion and sedimentation describes the measures incorporated during and following construction of a new development to prevent the pollution and degradation of the downstream watercourse.

A Soil and Water Management Plan has prepared as part of the development application documentation and is included in Appendix A of this report.

Common control measures adopted are:

- Sedimentation fences;
- Sedimentation basins;
- Stormwater drainage inlet protection;
- Overland flow diversion swales;
- Shaker Grids and wash downs for vehicles leaving the construction site;
- Dust control measures.

The maintenance of these control measures throughout their intended lifespan will ensure that the risk of erosion and sedimentation pollution of the downstream watercourse will be minimized.

Appendix A – Civil Drawings

Appendix B – OSD Calculations

Project Design Calculations

Project Name:	Bankstown Compass Centre
Project Number:	28397
Design Engineer:	I. Harris
Office:	Sydney
Date:	8/09/2016 2:28 PM
Design Section:	Civil - OSD

On Site Detention Design

Referring to Bankstown City Councils Development Engineering Standards:

On Site Detention (OSD) is required where an increase in stormwater runoff, from a new development site, has an adverse effect to the receiving stormwater system.

Provision of OSD is intended to reduce the potential for local flooding and damage to existing properties by limiting runoff from new developments, to pre-developed levels. A suitably qualified Civil Engineer shall be engaged to prepare calculations and designs in accordance with these requirements. Notwithstanding the following criteria, Council may consider the need for OSD on a case-by-case basis where justified by sound engineering principles.

Assessment of requirement for OSD

Existing Site Discharge Rates:

Site Catchment Information	Site Area	10,124m² (1.0124Ha)
	Site Imp Area	9,111m² (90%)
Peak Discharge Flows (DRAINS)	Q_5	0.392cumecs
	Q_{10}	0.441cumecs
	Q_{20}	0.512cumecs
	Q_{50}	0.548cumecs
	Q_{100}	0.608cumecs

Proposed Site Discharge Rates:

Site Catchment Information	Site Imp Area	10,124m² (100%)	
Peak Discharge Flows (DRAINS)	Q_5	0.400cumecs (+0.008cumecs, 8L/s)	2% increase
	Q_{10}	0.450cumecs (+0.009cumecs, 9L/s)	2% increase
	Q_{20}	0.521cumecs (+0.009cumecs, 9L/s)	1.7% increase
	Q_{50}	0.571cumecs (+0.023cumecs, 23L/s)	4.2% increase
	Q_{100}	0.636cumecs (+0.028cumecs, 28L/s)	4.6% increase

In accordance with the council guidelines:

OSD must be designed and constructed to control stormwater runoff from development sites such that, for 5 to 100 year ARI events, peak stormwater discharges from the site do not exceed pre-development stormwater discharges.

As there is an increase to the peak discharge flows from the site OSD will be required.

Project Name:	Bankstown Compass Centre
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OSD Design Calculations

From council's guidelines:

Acceptable methods for discharge control from OSD systems are the use of orifice plates installed over the outlet pipe, broad crested weir or choke pipe installed in the outlet pipe.

As it is normally impractical to use a single outlet of fixed diameter to restrict flows for the range of events from 5 years to 100 years ARI, the discharge control pit should be designed to have a two-stage outlet. The first stage outlet should limit discharge to predevelopment 5-year ARI flow (Qp5) and the second stage outlet should be designed to restrict flows for larger events up to and including Qp100.

This can be achieved using a dual chamber pit with the required diameter choke pipe or orifice plate between the two and the top of the dividing wall forming a weir. This design may also act as an emergency overflow in the event the first stage outlet becomes blocked by debris.

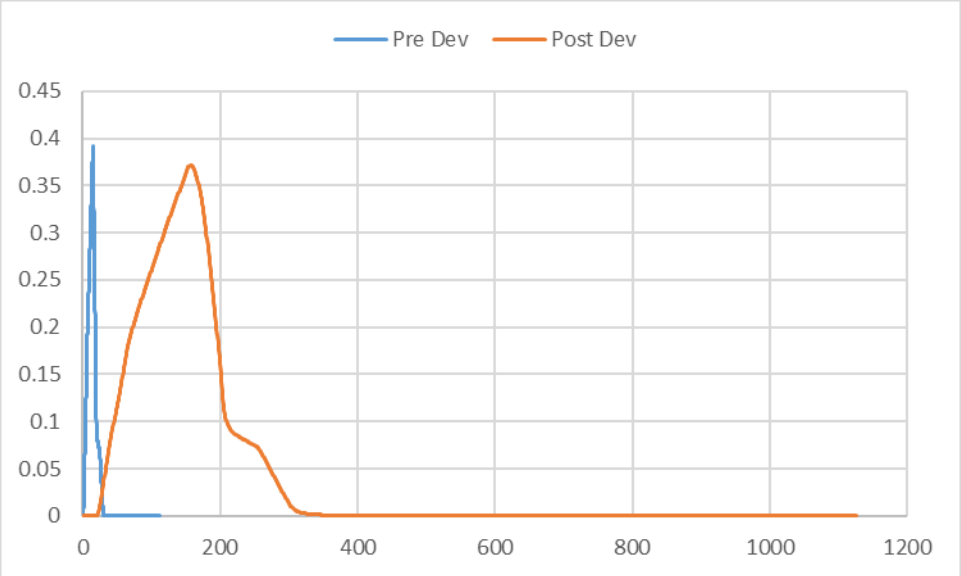
The design of the detention storage shall take into consideration of any backwater effects, drowned orifice and dead storage.

Analysing the peak discharge and impact of OSD storage on post development discharge with DRAINS:

OSD Storage Provided: 39.9m³

Post Development Peak Discharge Flows	Q_5	0.372cumecs (-0.02cumecs, 20L/s)	5% decrease
	Q_{100}	0.607cumecs (-0.001cumecs, 1L/s)	0.16% decrease

Minor Storm Discharge Hydrographs



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Major Storm Discharge Hydrographs