26 SHEPHERD STREET,
LIVERPOOL, NSW 2170
CIVIL ENGINEERING WORKS

LOCATION PLAN
SCALE 1:100

Sheet List Table	
Sheet Number	Sheet Title
C-001	COVER SHEET, DRAWING INDEX AND LOCALITY PLAN
C-005	GENERAL NOTES
C-010	CIVIL DESIGN PLAN - GROUND FLOOR
C-011	CIVIL DESIGN PLAN - BASEMENT LEVEL 1
C-012	CIVIL DESIGN PLAN - BASEMENT LEVEL 2
C-015	CIVIL DETAILS
C-020	SEDIMENT AND EROSION CONTROL PLAN
C-021	SEDIMENT AND EROSION CONTROL DETAILS

REV.	DESCRIPTION	DRAWN	APP'D	DATE
A	ISSUED FOR DA APPROVAL	CPO	HHC	20.12.16

ARCHITECT:

WOODS BAGOT

CLIENT:

CORONATION

WOOD & GRIEVE ENGINEERS

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MELBOURNE
SYDNEY
BRISBANE
GOLD COAST
ALBANY
BUSSELTON
SHENZHEN
DARWIN

26 SHEPHERD STREET,
LIVERPOOL
NSW 2170

TITLE:
COVER SHEET, DRAWING INDEX AND LOCALITY PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

DESIGNED : HHC	VERIFIED : / /
DRAWN : CPO	APPROVED FOR TENDER : / /
SCALE : AS SHOWN	APPROVED FOR CONSTRUCTION : / /

CAD FILE: 29650-SYD-C-001.dwg

PLOT/DATE/TIME: 20/12/2016 3:03:39 PM

PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-001	A

A1 DRAWING - BUILDING SERVICES GROUP

GENERAL NOTES

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS, SCHEDULE OF QUANTITIES, JOB SPECIFICATIONS AND ANY OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE WORK. ALL DISCREPANCIES SHALL BE REFERRED TO THE SUPERINTENDENT FOR DISCUSSION BEFORE PROCEEDING WITH THE WORK.
2. THE CONTRACTOR SHALL NOT ENTER NEIGHBOURING PROPERTIES WITHOUT PRIOR WRITTEN APPROVAL, FROM THE RELEVANT PROPERTY OWNER.
3. THE CONTRACTOR IS TO ENSURE SAFE PASSAGE OF TRAFFIC AND PEDESTRIANS IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL AUTHORITY.
4. THE CONTRACTOR SHALL BE REQUIRED, AT ALL TIMES, DURING THE PERIOD OF CONSTRUCTION, TO CLEAN THOSE PARTS OF THE ACCESS ROUTE TO THE SITE THAT MAY BE AFFECTED BY ANY MATERIAL DROPPED, DEPOSITED OR SPILLED ON THE ROADS AS A RESULT OF THE CONSTRUCTION PROCESSES ASSOCIATED WITH THE SITE.
5. SURVEY SETOUT INFORMATION IS TO BE ESTABLISHED ON SITE BY THE PRINCIPAL'S SURVEYOR TO ENABLE THE CONTRACTOR TO ACCURATELY SETOUT THE WORKS TO THE CO-ORDINATES SHOWN. SETOUT INFORMATION SHALL NOT BE OBTAINED BY SCALING FROM THESE DRAWINGS.
6. PRIOR TO COMMENCEMENT OF NEW WORK THE CONTRACTOR SHALL CONFIRM LOCATIONS, LEVELS AND DETAILS OF EXISTING CONNECTION POINTS AND SERVICE CROSSINGS BY POT HOLING. IF A VARIATION OCCURS CONTACT THE ENGINEER PRIOR TO CONSTRUCTION.
7. DESIGN FINISHED SURFACE LEVELS OF STRUCTURES ARE FOR THE CONTRACTOR'S GUIDANCE ONLY. ACTUAL FINISHED LEVELS SHALL BE SET OUT AS DIRECTED ON-SITE IN KEEPING WITH THE REQUIREMENTS AND SPECIFICATIONS OF THE LOCAL AUTHORITY AND ACTUAL FINISHED GROUND LEVELS.
8. THE CONTRACTOR SHALL CONTACT THE RELEVANT AUTHORITIES AND ARRANGE FOR RELOCATION AND / OR PROTECTION OF EXISTING SERVICES AS REQUIRED TO SUIT SURROUNDING NEW WORK, CONSTRUCTION LOADINGS AND TO SUIT FINAL FINISHED SURFACE LEVELS.

GENERAL STORMWATER NOTES

1. MANHOLES ARE TO BE CONSTRUCTED ON THE APPROPRIATE ALIGNMENTS IN ACCORDANCE WITH THE LOCAL AUTHORITY STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE SHOWN OR DIRECTED ON SITE. THE ALIGNMENT OF MAINS AND MANHOLES ARE TO BE SET-OUT FROM ACTUAL ALLOTMENT BOUNDARIES STAKED BY THE PROJECT SURVEYOR FROM THE FINAL LOT CALCULATIONS.
2. THE CONTRACTOR IS TO EXERCISE DUE CARE AND ATTENTION DURING PIPE INSTALLATION ENSURING PIPES ARE NOT DAMAGED DURING CONSTRUCTION AND CONSTRUCTION TRAFFIC DOES NOT EXCEED THE LOAD SPECIFIED FOR THE PIPE PROPOSED. IF THE PROPOSED PIPE CLASS WILL NOT WITHSTAND CONSTRUCTION LOAD, CONTRACTOR IS TO UPGRADE PIPE CLASSES TO SUIT AT NO COST TO THE PRINCIPAL.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE RELEVANT AUTHORITIES FOR ANY ADDITIONAL INSTALLATIONS NOT SHOWN ON THE DRAWINGS AND TO ENSURE THAT THE EXISTING SERVICES ARE NOT DAMAGED OR DISTURBED IN ANY WAY DURING CONSTRUCTION.
4. ALL CONNECTIONS TO EXISTING DRAINAGE PITS SHALL BE MADE IN A TRADESMAN-LIKE MANNER AND THE INTERNAL WALL OF THE PIT AT THE POINT OF ENTRY SHALL BE CEMENT RENDERED TO ENSURE A SMOOTH FINISH.
5. ALL REINFORCED CONCRETE PIPES ARE TO BE INSTALLED USING TYPE 'HS2' SUPPORT AS DEFINED IN AS 3725 - LOADS ON BURIED CONCRETE PIPES. IF ALTERNATIVE BEDDING METHODS ARE TO BE USED THE PIPE CLASS MUST BE REVIEWED.
6. CONTRACTOR IS TO ENSURE ALL STORMWATER DRAINAGE STRUCTURES ARE ADEQUATELY REINFORCED AND SHALL PROVIDE DESIGN CERTIFICATION FOR ALL REINFORCED CONCRETE LIDS.
7. WHERE KERB ADAPTORS ARE TO BE CONSTRUCTED IN CONJUNCTION WITH A CONCRETE FOOTPATH IN THE VERGE, A PIPE CONNECTION SHALL BE SHALL EXTEND TO THE PROPERTY BOUNDARY.
8. ALL STORMWATER DRAINAGE PIPES TO BE UPVC, UNLESS OTHERWISE SPECIFIED. ALL UPVC PIPES SHALL BE EITHER RUBBER RING OR SOLVENT WELD JOINTED.
9. MINIMUM DISTANCE BETWEEN ROOFWATER HOUSE CONNECTIONS AND SEWERAGE HOUSE CONNECTIONS IS 3.0m.
10. ALL UPVC ROOFWATER DRAINAGE PIPES TO BE MINIMUM CLASS SN6.
11. DIA. REFERS TO NOMINAL INTERNAL PIPE DIAMETER.
12. ALL STORMWATER MATERIAL AND WORKMANSHIP IS TO BE SUPPLIED AND UNDERTAKEN IN ACCORDANCE WITH THE LOCAL AUTHORITY AND AUSTRALIAN STANDARD AS3500.3 AS APPLICABLE.
13. ALL GRATES SHALL BE HINGED CLASS 'C' GALVANISED MILD STEEL WITH FRAME AND 'J' BOLT LOCK DOWN DEVICES.
14. ALL GRATES TO HAVE 150mm MINIMUM OF CONCRETE SURROUND.
15. MINIMUM SIZE FOR AN IN-GROUND PIPE RECEIVING A DOWNPIPE SHALL BE 150mm.

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NSW 2170

TITLE:

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PLOT/DATE/TIME: 20/12/2016 3:03:44 PM

PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-005	A

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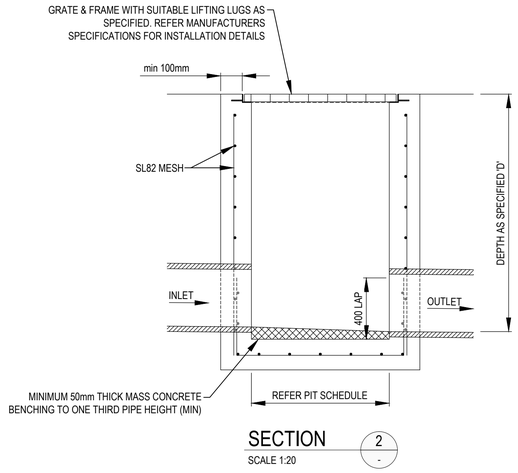

SECTION 2

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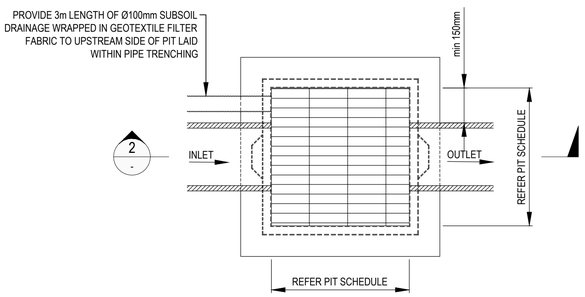
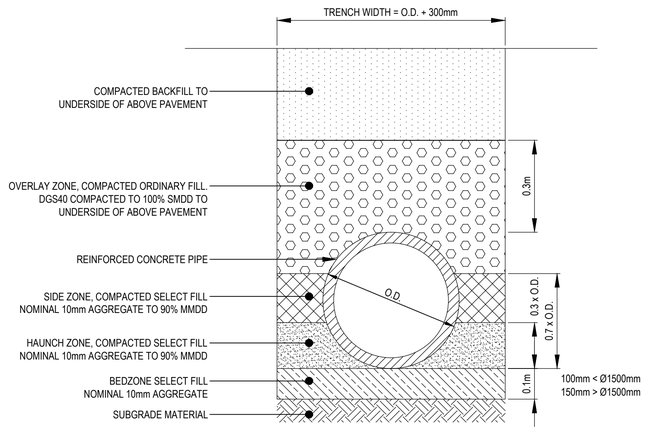


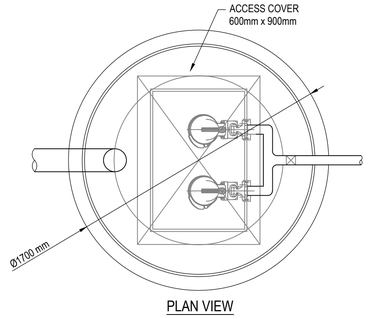
GRATED PIT PLAN

SCALE 1:20

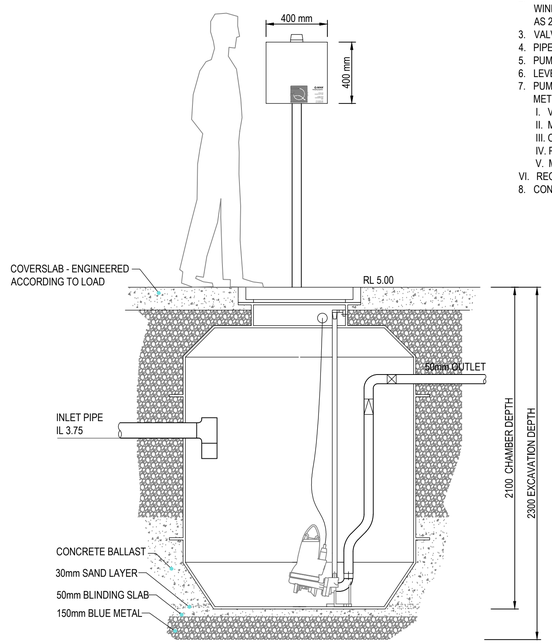


TYPICAL PIPE TRENCH DETAIL

SCALE 1:10



PLAN VIEW



ELEVATION

Q-MAX EMPS 1520 - 3m3 STORMWATER PUMP STATION

N.T.S

INSTALLATION PROCEDURE FOR Q-MAX FIBREGLASS PUMP WELLS

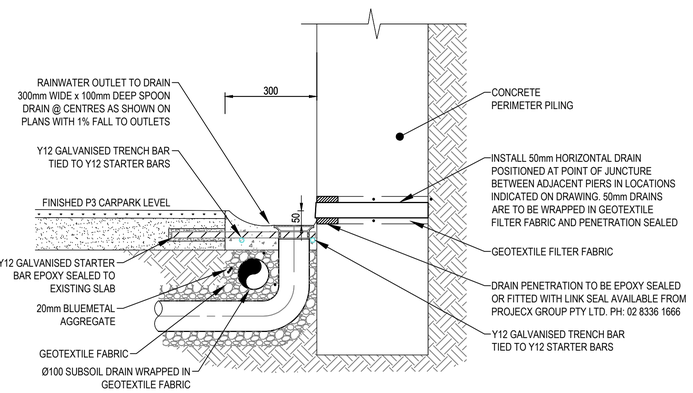
1. EXCAVATION FOR TANK SHOULD BE NO GREATER THAN 300MM OVERSIZE IF POSSIBLE.
2. LEVEL THE BASE WITH COMPACTED ROAD BASE AND POUR 50MM CONCRETE BLINDING SLAB WITH 30MM COVER OF CLEAN WASHED SAND.
3. LOWER WELL INTO EXCAVATION MAKING SURE NO SHARP OBJECTS CAN CAUSE DAMAGE.
4. AFTER LEVELLING WELL, HALF FILL IT WITH WATER.
5. CHECK ALL PLUMBING CONNECTIONS FOR LEAKS.
6. POUR CALCULATED VOLUME OF CONCRETE BALLAST AROUND BASE OF UNIT. AS A MINIMUM THE FIRST REINFORCMENT RING SHOULD BE COVERED (SEE DRAWING).
7. COMPLETE BACKFILL WITH 12-15MM GRAVEL OR CLEAN WASHED SAND.
8. CONCRETE COVERSLAB CAN THEN BE POURED AROUND THE WELL TO ENGINEERS REQUIREMENTS, DEPENDING ON TRAFFIC LOAD ETC.
9. BALLAST CAN BE CALCULATED AS FOLLOWS:
   VOLUME OF WELL IN CUBIC METRES / 2.2 = CUBIC METRES OF CONCRETE BALLAST (INCLUDING COVERSLAB).
10. ON COMPLETION, THE INSTALLATION IS TO BE INSPECTED AND CERTIFIED BY WWC AND Q-MAX OR APPROVED CONTRACTOR NEEDS TO COMMISSION THE INSTALLATION.

CERTIFICATION

1. ON COMPLETION THE INSTALLATION IS TO BE INSPECTED & CERTIFIED BY WGE & THE PUMP SUPPLIER ARE TO COMMISSION THE INSTALLATION.

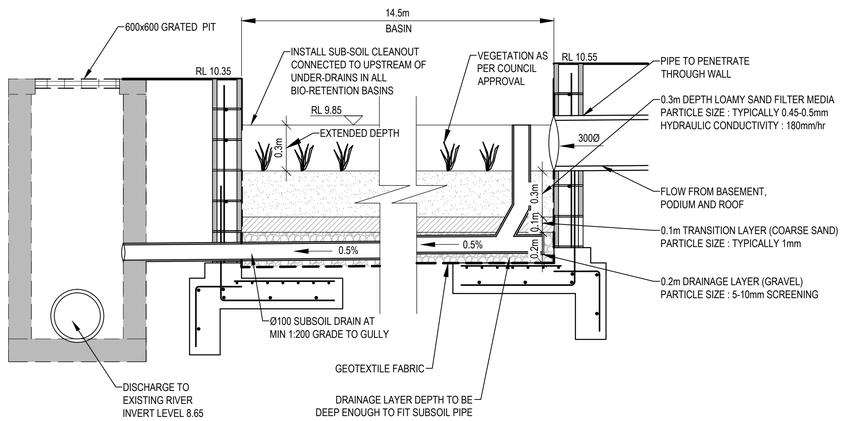
EMPS 1520 SPECIFICATIONS

1. INTERNAL DIAMETER - 1500mm NOMINAL.
2. METHOD OF MANUFACTURE - FILAMENT WOUND FIBREGLASS USING PATENTED CHOP HOOP FILAMENT WINDING PROCESS FOR MAXIMUM CIRCUMFERENTIAL & LONGITUDINAL STRENGTH - DESIGN CONFORMS TO AS 2634 - 1987.
3. VALVES - 50mm BSP, BRASS.
4. PIPEWORK - 50mm PN12 UPVC
5. PUMPS 2 x GRUNDFOS OR EQUIVALENT.
6. LEVEL CONTROLS - FLOAT SWITCHES
7. PUMP CONTROLLER - Q-MAX LOGIKOS M7, DUAL ALTERNATING CONTROLLER, WALL MOUNTED WITHIN 5 METRES OF PUMPWELL, WITH:
   I. VISUAL & AUDIBLE ALARMS.
   II. MOTOR PROTECTION.
   III. OPTIONAL BMS OUTPUTS.
   IV. PUMP COMPLIANCE PLATE FIXED TO INNER DOOR.
   V. MINIMUM CONDUIT SIZE 50mm.
   VI. REQUIRES SITE WIRING
8. CONCRETE BALLAST - MINIMUM 1.6 CUBIC METRES.



BUILDING PERIMETER SPOON DRAIN

N.T.S



SECTION 1

010

BIO-RETENTION BASIN CROSS SECTION

N.T.S

1:200 2 0 2 4 6 8 10 A1
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1:10 0.1 0 0.1 0.2 0.3 0.4 0.5 A1
1:20 A3

REV.	DESCRIPTION	DRAWN	APP'D	DATE
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ARCHITECT:

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TITLE:

CIVIL DETAILS

PRELIMINARY

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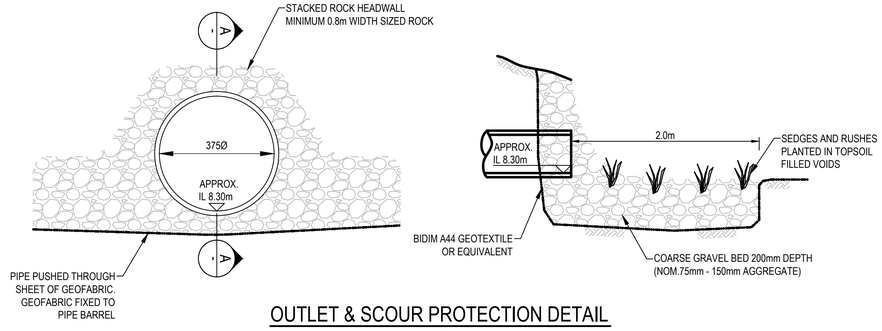
CAD FILE: 29650-SYD-C-015.dwg

PLOT/DATE/TIME: 20/12/2016 3:04:05 PM

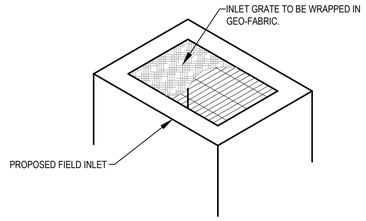
PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-015	A

A1 DRAWING - BUILDING SERVICES GROUP



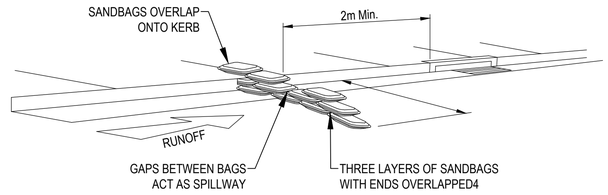
OUTLET & SCOUR PROTECTION DETAIL

N.T.S.



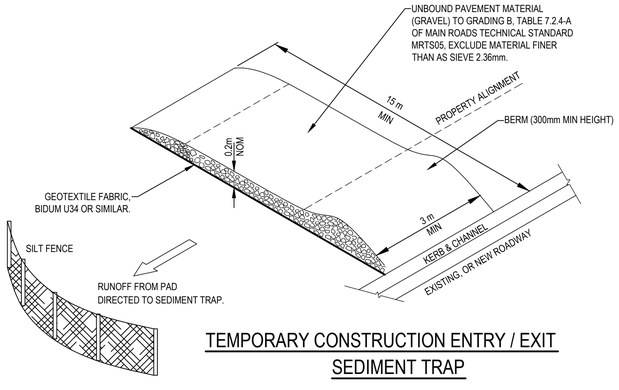
FIELD INLET SEDIMENT CONTROL

NTS

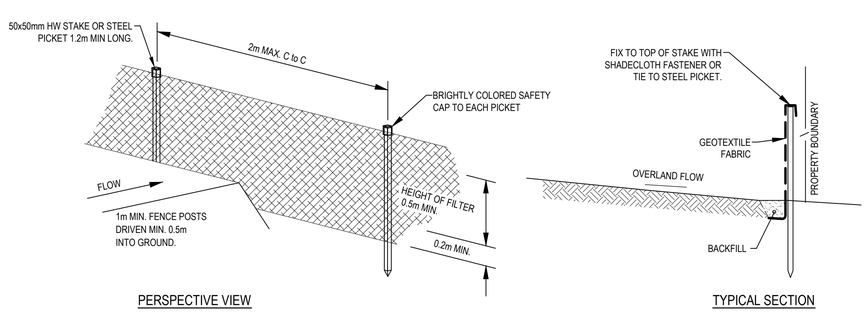


SANDBAG KERB INLET SEDIMENT TRAP

N.T.S.



TEMPORARY CONSTRUCTION ENTRY / EXIT SEDIMENT TRAP



PERSPECTIVE VIEW

SEDIMENT FENCE DETAIL

N.T.S.

TYPICAL SECTION

REV.	DESCRIPTION	DRAWN	APP'D	DATE
A	ISSUED FOR DA APPROVAL	CPO	HHC	20.12.16

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TITLE:

SEDIMENT AND EROSION CONTROL DETAILS

PRELIMINARY

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DESIGNED : HHC	VERIFIED : / /
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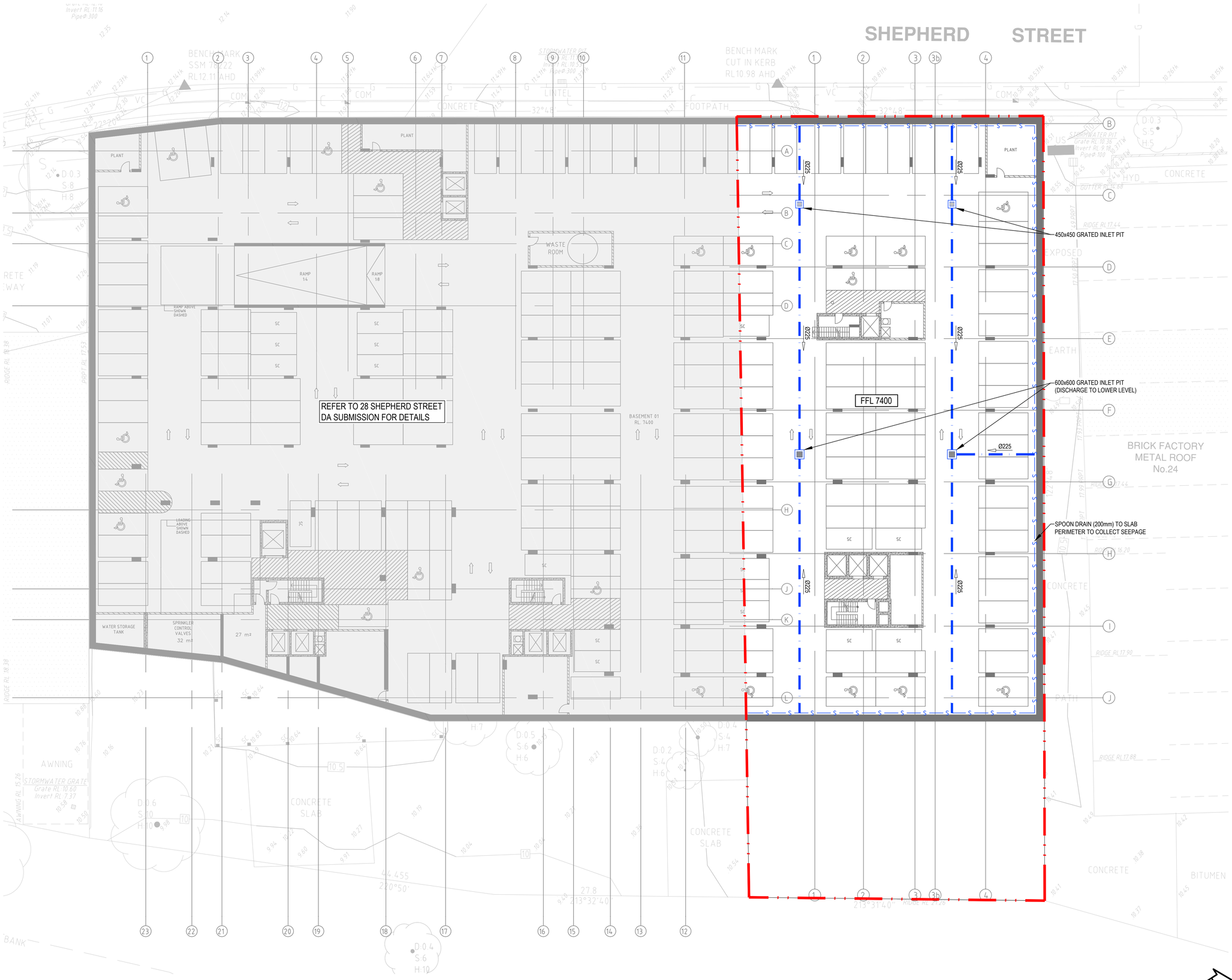
CAD FILE: 29650-SYD-C-021.dwg

PLOT/DATE/TIME: 20/12/2016 3:04:14 PM

PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-021	A

A1 DRAWING - BUILDING SERVICES GROUP



LEGEND

- PROPOSED SITE BOUNDARY
- PROPOSED BUILDING
- 28 SHEPHERD STREET
- PROPOSED STORMWATER PIPE
- PROPOSED SPOON DRAIN
- PROPOSED GRATED PIT
- BIO-RETENTION BASIN
- ROCK HEADWALL
- PROPOSED GRATED DRAIN
- PUMP PIT

REV.	DESCRIPTION	DRAWN	APP'D	DATE
B	ISSUED FOR DA APPROVAL	CPO	HHC	21.12.16
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ARCHITECT: WOODS BAGOT

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TITLE:
CIVIL DESIGN PLAN - BASEMENT LEVEL 1

PRELIMINARY
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DESIGNED : HHC	VERIFIED : / /
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SCALE : AS SHOWN	APPROVED FOR CONSTRUCTION : / /

CAD FILE: 29650-SYD-C-011.dwg

PLOT/DATE/TIME: 21/12/2016 4:25:09 PM

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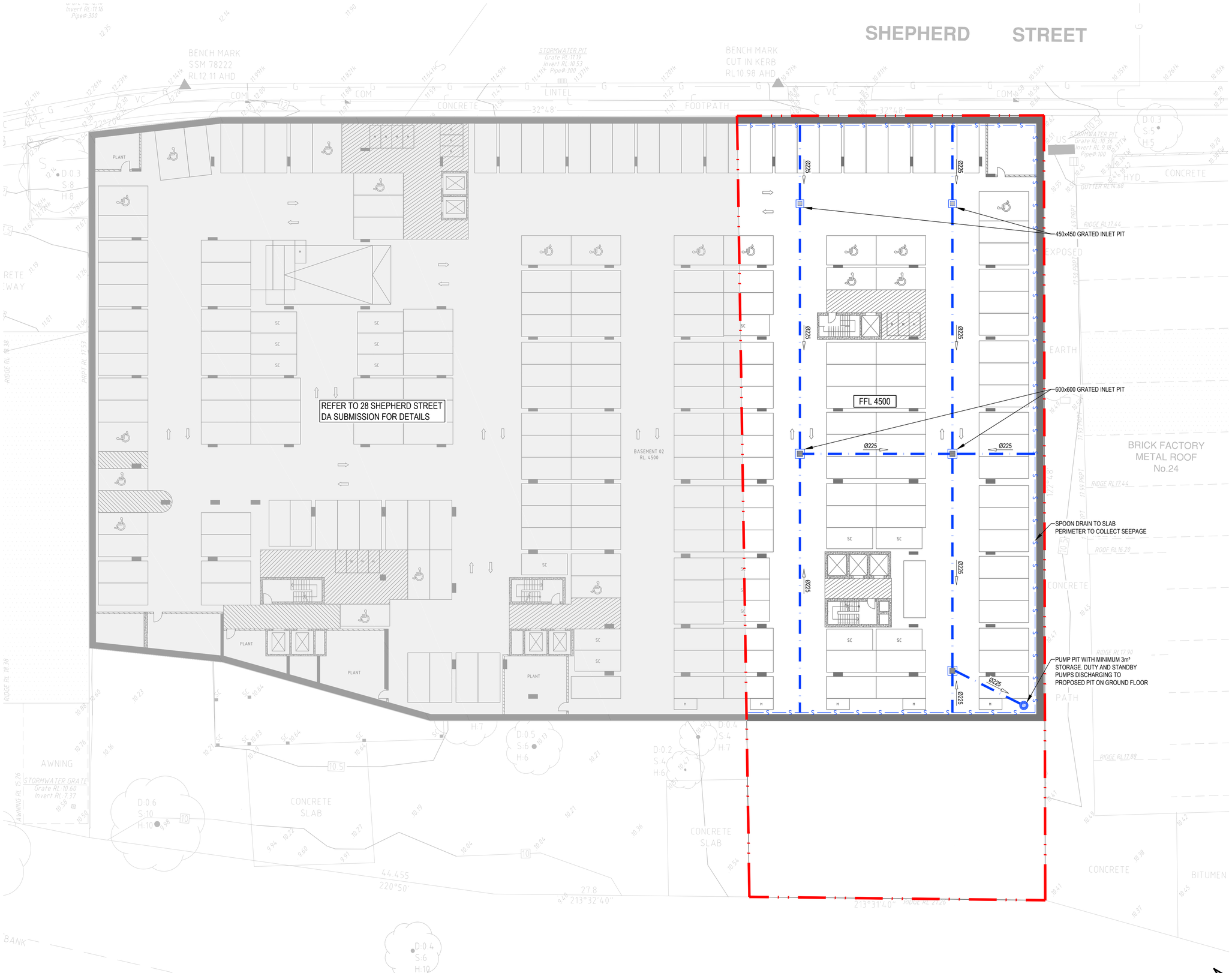
PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-011	B

A1 DRAWING - BUILDING SERVICES GROUP



LEGEND

- PROPOSED SITE BOUNDARY
- PROPOSED BUILDING
- 28 SHEPHERD STREET
- PROPOSED STORMWATER PIPE
- PROPOSED SPOON DRAIN
- PROPOSED GRATED PIT
- BIO-RETENTION BASIN
- ROCK HEADWALL
- PROPOSED GRATED DRAIN
- PUMP PIT

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TITLE:

CIVIL DESIGN PLAN - BASEMENT LEVEL 2

PRELIMINARY

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CAD FILE: 29650-SYD-C-012.dwg

PLOT/DATE/TIME: 21/12/2016 4:25:14 PM

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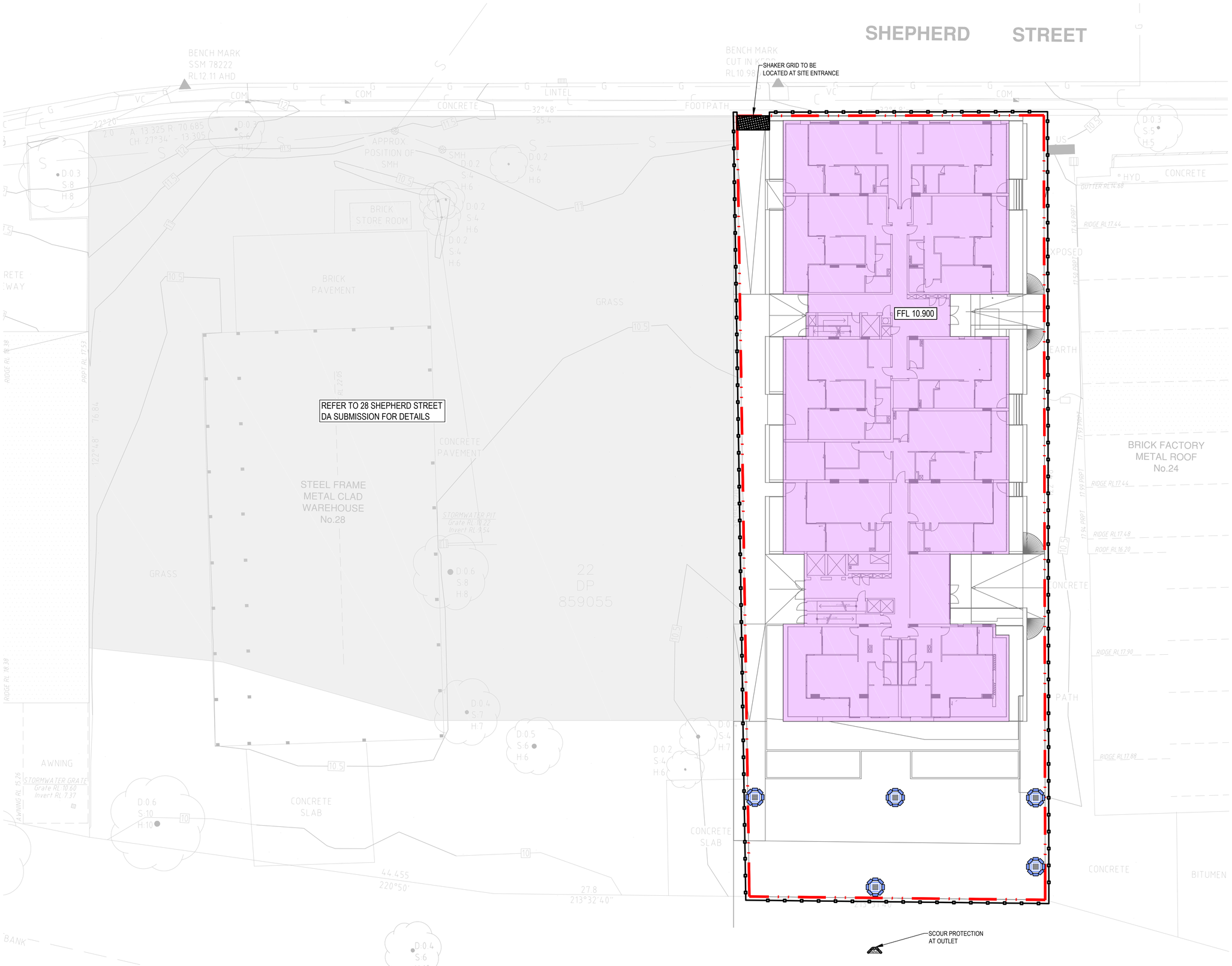
PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-012	B

A1 DRAWING - BUILDING SERVICES GROUP



1:200 1:400 — 2 0 2 4 6 8 10 A1 A3

LEGEND

- PROPOSED SITE BOUNDARY
- PROPOSED BUILDING
- 28 SHEPHERD STREET
- VEHICLE SHAKEDOWN DEVICE
- PROPOSED SILT FENCE
- SANDBAG PIT PROTECTION

NOTE:
REFER DRAWING C-021 FOR SEDIMENT AND EROSION CONTROL DETAILS

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SEDIMENT AND EROSION CONTROL PLAN

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PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-020	B

A1 DRAWING - BUILDING SERVICES GROUP

SHEPHERD STREET

BENCH MARK
SSM 78222
RL12.11 AHD

BENCH MARK
CUT IN KERB
RL10.98 AHD

FFL 10.900

REFER TO 28 SHEPHERD STREET
DA SUBMISSION FOR DETAILS

STEEL FRAME
METAL CLAD
WAREHOUSE
No.28

BRICK FACTORY
METAL ROOF
No.24

22
DP
859055

FLOW FROM BASEMENT
PUMP OUT PIT AND ROOF

14.5 x 3.5m BIO
RETENTION BASIN

DISCHARGE TO RIVER

1
015

LEGEND

- PROPOSED SITE BOUNDARY
- PROPOSED BUILDING
- 28 SHEPHERD STREET
- PROPOSED STORMWATER PIPE
- PROPOSED SPOON DRAIN
- PROPOSED GRATED PIT
- BIO-RETENTION BASIN
- ROCK HEADWALL
- PROPOSED GRATED DRAIN
- PUMP PIT

REV.	DESCRIPTION	DRAWN	APP'D	DATE
B	ISSUED FOR DA APPROVAL	CPO	HHC	21.12.16
A	ISSUED FOR DA APPROVAL	CPO	HHC	20.12.16

1:200 1:400 — 2 0 2 4 6 8 10 — A1 A3

ARCHITECT:
WOODS BAGOT

CLIENT:
CORONATION

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26 SHEPHERD STREET,
LIVERPOOL
NSW 2170

TITLE:
CIVIL DESIGN PLAN -
GROUND FLOOR

PRELIMINARY
NOT FOR CONSTRUCTION

DESIGNED : HHC	VERIFIED : / /
DRAWN : CPO	APPROVED FOR TENDER : / /
SCALE : AS SHOWN	APPROVED FOR CONSTRUCTION : / /

CAD FILE: 29650-SYD-C-010.dwg

PLOT/DATE/TIME: 21/12/2016 4:25:04 PM

PROJECT No.	DRAWING No.	REVISION
29650-SYD-	C-010	B

A1 DRAWING - BUILDING SERVICES GROUP

WOOD & GRIEVE ENGINEERS

Proposed Residential Development, 26 Shepherd Street, Liverpool

Stormwater Management Plan

Prepared for:

Coronation (26 Shepherd Street)
Pty Ltd C/- Coronation Property
Co. Pty Ltd

Date:
16 December 2016

Prepared by:

Hock Chua
Project No. 29650-SYD-C
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Revision

REVISION	DATE	COMMENT	APPROVED BY
0	20/12/2016	ISSUED FOR DA SUBMISSION	**HC**

Site Based Stormwater Management Plan

Site Address:	26 Shepherd St, Liverpool
Real Property Description:	Lot 23 on RP 859055
Proposed Development:	Residential Development
Client:	
Local Authority	Liverpool City Council
Authority Reference #:	N/A
Wood & Grieve Reference:	29650-SYD-C

_____

Hock Chua
For and on behalf of
Wood & Grieve Engineers

Contents

1. Introduction

Wood & Grieve Engineers have been commissioned by Coronation Property Co. Pty Ltd to prepare this Site Based Stormwater Management Plan (SBSMP) for the proposed development at 26 Shepherd St, Liverpool. The site's property description is Lot 23 on DP859055.

This SBSMP outlines the conceptual DA level stormwater design for the proposed development of medium rise, multi-unit residential apartments. This SBSMP has been prepared to accompany a development application for the site being lodged with the Liverpool City Council (LCC).

This stormwater management plan demonstrates that the proposed development complies with the Liverpool City Council published documents 'General Controls LDCP2008 (Amendment 14).

2. Purpose & Constraints

2.1 Purpose

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

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

- Flooding;
- Stormwater runoff volumes and detention (Stormwater Quantity); and
- WSUD.

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

- Appropriate standards to be maintained on all aspects of stormwater within the site,
- Examination of the surrounding area and properties to ensure they will not be adversely affected nor unduly disrupted by stormwater, and
- Establishment of a unified, clear and concise stormwater management strategy.

2.2 Constraints

Key statutory requirements for the proposed development in relation to stormwater include the following:

- Whenever land is developed a duty of care is owed to any property owners who receive stormwater flows which may be altered by the development, to ensure that such properties are not adversely affected by hydraulic or water quality impacts during the construction, maintenance and operational phase of the development,
- Stormwater discharging from the site is to be at an acceptable discharge standard with respect to water quality,
- Reasonable and practical measures must be implemented to avoid inappropriate use of any floodway or waterway,
- All reasonable and practical measures must be taken to minimise or prevent environmental harm,
- All proposed stormwater infrastructure design must have due regard for public safety.

3. Existing Site Characteristics

3.1 Property Detail

Address:	26 Shepherd Street, Liverpool
Real Property Description:	Lot 23 on DP859055
Total Site Area:	2,794 m^2

The existing site can be seen in Figure 1 below. The site is bounded to the north west by Shepherd Street and by the Georges River to the east. Existing industrial properties are located to either sides of the property. There is a separate development application for the site to the south, namely Lot 22 DP859055, No 28 Shepherd Street, Liverpool.

Figure 1: Site Location Plan (Source: NearMap)

Existing Site Characteristics

3.2 Existing Site Conditions & Improvements

The site comprises of one small outbuildings and a steel framed shed, but the majority of the site is undeveloped and remains as pervious grass areas. In order to facilitate the proposed development, it is proposed to demolish the existing structures on the site.

3.3 Topography, Catchments and Site Drainage

3.3.1 Topography

The site is generally flat with a gentle slope from Shepherd Street towards the rear, with levels ranging from around RL 11.0mAHD to RL 10.4mAHD at the rear.

3.3.2 Stormwater Catchments

The surrounding area has been investigated to determine the likely impact of existing external stormwater catchments on the proposed site. It has been determined that there is no external catchment affecting the site.

3.4 Soils & Erosion

3.4.1 Erosion and Sediment

A conceptual Erosion and Sediment Control plan has been prepared for each separate stage of the development. These plans are included in the Appendix to this report. The plans are required to manage the erosion risks associated with the development. The plans have been prepared with reference to the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control.

3.4.2 Acid Sulphate Soils

Acid Sulphate Soils are usually encountered in Holocene sediments and below RL 5.0m AHD. The lowest portion of the site is at an approximate RL 10 m, and the site is not subject to the Council's Acid Sulphate Soils overlay mapping. As such, acid sulphate soils are not expected to be a development issue.

3.5 Vegetation

The existing site is currently generally covered with areas of grass. There are a few trees on the site, many of which will need to be removed as part of the development.

Vegetation management for the proposed site has not been addressed within this SBSMP. A separate vegetation investigation and management plan has been undertaken by a suitably qualified consultant to accompany the development works.

4. Flooding

4.1 Existing Flood Conditions

Reference to LCC Flood mapping indicates that part of the site is impacted by Flooding during a 100 ARI storm event.

A flood impact statement has been obtained from Council and this is included in the Appendix. This shows that the 1% AEP flood level for the site is RL9.9. LCC controls require a free board of at least 500mm to proposed finished floor levels and to basement entries.

Submitted architectural plans for the development demonstrate compliance with the controls.

5. Stormwater Quantity

It is proposed that stormwater run-off from the site will be discharged directly to the Georges River adjoining the site to the rear. As such there is no requirement to provide attenuation of discharge.

6. Stormwater Quality

An assessment of water quality has been carried out using a MUSIC model for the development. The roof of the proposed buildings is to be landscaped hence no allowance for rainwater capture or re-use has been included.

The model includes run-off collected from the roof of the building, footpath and landscape area.
Council's DCP documents require the following minimum treatment targets be met for this site:

- Gross Pollutants 90% Reduction
- Total Suspended Solids 80% Reduction
- Total Phosphorous 45 % Reduction
- Total Nitrogen 45% Reduction

Output from the MUSIC model is included below, demonstrating that the proposal complies with Council's requirements in the DCP documents. An electronic copy of the model is also available for detailed assessment by Council as required.

The treatment targets achieved following modelling are as follows:

- Gross Pollutants 100% Reduction
- Total Suspended Solids 85.8% Reduction
- Total Phosphorous 47.5% Reduction
- Total Nitrogen 54.4% Reduction

The bio-retention basin is designed to be approximately 50m2 in surface area.

The Water Quality Treatment Analysis Results from MUSIC is summarized below.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.78	3.66	3
Total Suspended Solids (kg/yr)	377	53.4	85.8
Total Phosphorus (kg/yr)	0.585	0.307	47.5
Total Nitrogen (kg/yr)	8.16	3.72	54.4
Gross Pollutants (kg/yr)	91.4	0	100

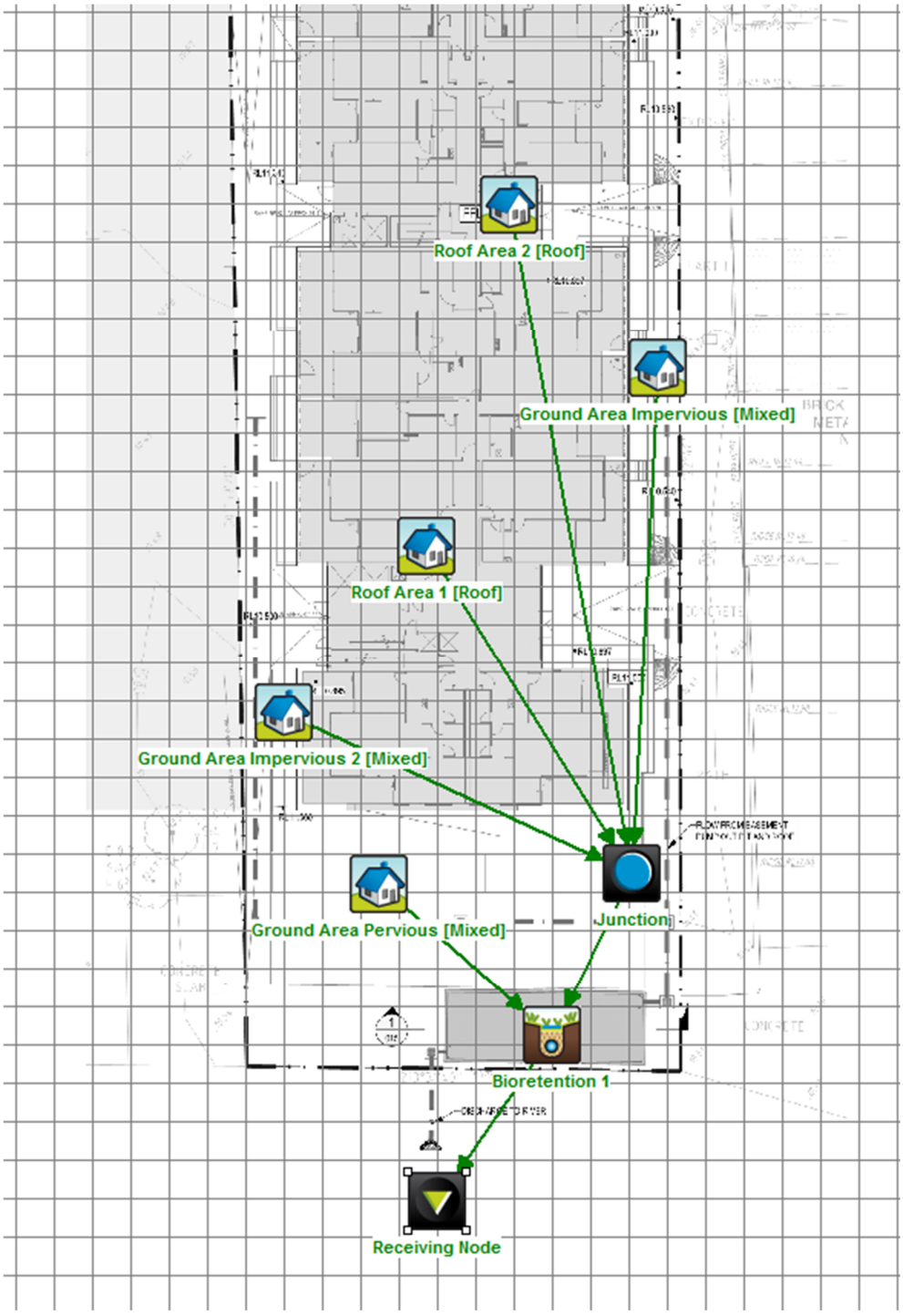

Figure 2: Water Quality Treatment Analysis Results (Source: MUSIC model)

7. Conclusion

This Site Based Stormwater Management Plan has been prepared for the proposed residential development at 26 Shepherd Street, Liverpool. The proposed development comprises a multiple occupancy apartment building, with below ground car parking, and limited external areas.

The development has been designed to be unaffected by the impact of potential flooding from storm events up to and including the 1% AEP storm.

In order to comply with LCC Development requirements, treatment of the run-off is proposed to improve the quality of stormwater discharged from the site. The proposed treatment in the form of rainwater re-use and a bio-retention basin will achieve the treatments targets specified in Council's DCP documents.

As such from a stormwater management perspective, we believe the development can be undertaken in accordance with the LCC guidelines and requirements and should be endorsed for approval.

Appendix A – MUSIC detailed data

MUSIC DETAILED DATA

Source nodes
Location,Ground Area Impervious 2,Ground Area Impervious,Roof Area 1,Roof Area 2,Ground Area Pervious
ID,2,3,5,7,8
Node Type,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode
Zoning Surface Type,Mixed,Mixed,Roof,Roof,Mixed
Total Area (ha),0.03,0.028,0.06,0.117,0.045
Area Impervious (ha),0.03,0.028,0.06,0.117,0.045
Area Pervious (ha),0,0,0,0,0
Field Capacity (mm),200,200,80,80,200
Pervious Area Infiltration Capacity coefficient - a,211,211,200,200,211
Pervious Area Infiltration Capacity exponent - b,5,5,1,1,5
Impervious Area Rainfall Threshold (mm/day),1,1,1,1,1
Pervious Area Soil Storage Capacity (mm),500,500,120,120,500
Pervious Area Soil Initial Storage (% of Capacity),10,10,25,25,10
Groundwater Initial Depth (mm),50,50,10,10,50
Groundwater Daily Recharge Rate (%),28,28,25,25,28
Groundwater Daily Baseflow Rate (%),27,27,5,5,27
Groundwater Daily Deep Seepage Rate (%),0,0,0,0,0
Stormflow Total Suspended Solids Mean (log mg/L),2.18,2.18,1.3,1.3,2.18
Stormflow Total Suspended Solids Standard Deviation (log mg/L),0.39,0.39,0.32,0.32,0.39
Stormflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Suspended Solids Serial Correlation,0,0,0,0,0
Stormflow Total Phosphorus Mean (log mg/L),-0.89,-0.89,-0.89,-0.89,-0.89
Stormflow Total Phosphorus Standard Deviation (log mg/L),0.31,0.31,0.25,0.25,0.31
Stormflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Phosphorus Serial Correlation,0,0,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),0.26,0.26,0.3,0.3,0.26
Stormflow Total Nitrogen Standard Deviation (log mg/L),0.23,0.23,0.19,0.19,0.23
Stormflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Nitrogen Serial Correlation,0,0,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),1,1,1.1,1.1,1
Baseflow Total Suspended Solids Standard Deviation (log mg/L),0.34,0.34,0.17,0.17,0.34
Baseflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Suspended Solids Serial Correlation,0,0,0,0,0
Baseflow Total Phosphorus Mean (log mg/L),-0.97,-0.97,-0.82,-0.82,-0.97
Baseflow Total Phosphorus Standard Deviation (log mg/L),0.31,0.31,0,0,0.31
Baseflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Phosphorus Serial Correlation,0,0,0,0,0
Baseflow Total Nitrogen Mean (log mg/L),0.2,0.2,0.32,0.32,0.2
Baseflow Total Nitrogen Standard Deviation (log mg/L),0.2,0.2,0.12,0.12,0.2
Baseflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Nitrogen Serial Correlation,0,0,0,0,0
Flow based constituent generation - enabled,Off,Off,Off,Off,Off
Flow based constituent generation - flow file, , , , ,

Appendix A – MUSIC detailed data

Flow based constituent generation - base flow column, , , , ,
Flow based constituent generation - pervious flow column, , , , ,
Flow based constituent generation - impervious flow column, , , , ,
Flow based constituent generation - unit, , , , ,
OUT - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
Rain In (ML/yr),0,0,0,0,0
ET Loss (ML/yr),0,0,0,0,0
Deep Seepage Loss (ML/yr),0,0,0,0,0
Baseflow Out (ML/yr),0,0,0,0,0
Imp. Stormflow Out (ML/yr),0,0,0,0,0
Perv. Stormflow Out (ML/yr),0,0,0,0,0
Total Stormflow Out (ML/yr),0,0,0,0,0
Total Outflow (ML/yr),0,0,0,0,0
Change in Soil Storage (ML/yr),0,0,0,0,0
TSS Baseflow Out (kg/yr),0,0,0,0,0
TSS Total Stormflow Out (kg/yr),0,0,0,0,0
TSS Total Outflow (kg/yr),0,0,0,0,0
TP Baseflow Out (kg/yr),0,0,0,0,0
TP Total Stormflow Out (kg/yr),0,0,0,0,0
TP Total Outflow (kg/yr),0,0,0,0,0
TN Baseflow Out (kg/yr),0,0,0,0,0
TN Total Stormflow Out (kg/yr),0,0,0,0,0
TN Total Outflow (kg/yr),0,0,0,0,0
GP Total Outflow (kg/yr),0,0,0,0,0

No Imported Data Source nodes

USTM treatment nodes
Location,Bioretention 1
ID,6
Node Type,BioRetentionNodeV4
Lo-flow bypass rate (cum/sec),0
Hi-flow bypass rate (cum/sec),100
Inlet pond volume,
Area (sqm),50
Initial Volume (m^3),
Extended detention depth (m),0.3
Number of Rainwater tanks,
Permanent Pool Volume (cubic metres),
Proportion vegetated,
Equivalent Pipe Diameter (mm),
Overflow weir width (m),2
Notional Detention Time (hrs),
Orifice Discharge Coefficient,
Weir Coefficient,1.7

Appendix A – MUSIC detailed data

Number of CSTR Cells,3
Total Suspended Solids - k (m/yr),8000
Total Suspended Solids - C* (mg/L),20
Total Suspended Solids - C** (mg/L),
Total Phosphorus - k (m/yr),6000
Total Phosphorus - C* (mg/L),0.13
Total Phosphorus - C** (mg/L),
Total Nitrogen - k (m/yr),500
Total Nitrogen - C* (mg/L),1.4
Total Nitrogen - C** (mg/L),
Threshold Hydraulic Loading for C** (m/yr),
Horizontal Flow Coefficient,3
Reuse Enabled,Off
Max drawdown height (m),
Annual Demand Enabled,Off
Annual Demand Value (ML/year),
Annual Demand Distribution,
Annual Demand Monthly Distribution: Jan,
Annual Demand Monthly Distribution: Feb,
Annual Demand Monthly Distribution: Mar,
Annual Demand Monthly Distribution: Apr,
Annual Demand Monthly Distribution: May,
Annual Demand Monthly Distribution: Jun,
Annual Demand Monthly Distribution: Jul,
Annual Demand Monthly Distribution: Aug,
Annual Demand Monthly Distribution: Sep,
Annual Demand Monthly Distribution: Oct,
Annual Demand Monthly Distribution: Nov,
Annual Demand Monthly Distribution: Dec,
Daily Demand Enabled,Off
Daily Demand Value (ML/day),
Custom Demand Enabled,Off
Custom Demand Time Series File,
Custom Demand Time Series Units,
Filter area (sqm),50
Filter perimeter (m),0.1
Filter depth (m),0.3
Filter Median Particle Diameter (mm),
Saturated Hydraulic Conductivity (mm/hr),100
Infiltration Media Porosity,0.35
Length (m),
Bed slope,
Base Width (m),
Top width (m),
Vegetation height (m),
Vegetation Type,Vegetated with Effective Nutrient Removal Plants
Total Nitrogen Content in Filter (mg/kg),500
Orthophosphate Content in Filter (mg/kg),40
Is Base Lined?,No

Appendix A – MUSIC detailed data

Is Underdrain Present?,Yes
Is Submerged Zone Present?,No
Submerged Zone Depth (m),
B for Media Soil Texture,13
Proportion of upstream impervious area treated,
Exfiltration Rate (mm/hr),0
Evaporative Loss as % of PET,100
Depth in metres below the drain pipe,
TSS A Coefficient,
TSS B Coefficient,
TP A Coefficient,
TP B Coefficient,
TN A Coefficient,
TN B Coefficient,
Sfc,0.61
S*,0.37
Sw,0.11
Sh,0.05
Emax (m/day),0.008
Ew (m/day),0.001
IN - Mean Annual Flow (ML/yr),0.00
IN - TSS Mean Annual Load (kg/yr),0.00
IN - TP Mean Annual Load (kg/yr),0.00
IN - TN Mean Annual Load (kg/yr),0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00
OUT - Mean Annual Flow (ML/yr),0.00
OUT - TSS Mean Annual Load (kg/yr),0.00
OUT - TP Mean Annual Load (kg/yr),0.00
OUT - TN Mean Annual Load (kg/yr),0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00
Flow In (ML/yr),0
ET Loss (ML/yr),0
Infiltration Loss (ML/yr),0
Low Flow Bypass Out (ML/yr),0
High Flow Bypass Out (ML/yr),0
Orifice / Filter Out (ML/yr),0
Weir Out (ML/yr),0
Transfer Function Out (ML/yr),0
Reuse Supplied (ML/yr),0
Reuse Requested (ML/yr),0
% Reuse Demand Met,0
% Load Reduction,0
TSS Flow In (kg/yr),0
TSS ET Loss (kg/yr),0
TSS Infiltration Loss (kg/yr),0
TSS Low Flow Bypass Out (kg/yr),0
TSS High Flow Bypass Out (kg/yr),0
TSS Orifice / Filter Out (kg/yr),0
TSS Weir Out (kg/yr),0

Appendix A – MUSIC detailed data

TSS Transfer Function Out (kg/yr),0
TSS Reuse Supplied (kg/yr),0
TSS Reuse Requested (kg/yr),0
TSS % Reuse Demand Met,0
TSS % Load Reduction,0
TP Flow In (kg/yr),0
TP ET Loss (kg/yr),0
TP Infiltration Loss (kg/yr),0
TP Low Flow Bypass Out (kg/yr),0
TP High Flow Bypass Out (kg/yr),0
TP Orifice / Filter Out (kg/yr),0
TP Weir Out (kg/yr),0
TP Transfer Function Out (kg/yr),0
TP Reuse Supplied (kg/yr),0
TP Reuse Requested (kg/yr),0
TP % Reuse Demand Met,0
TP % Load Reduction,0
TN Flow In (kg/yr),0
TN ET Loss (kg/yr),0
TN Infiltration Loss (kg/yr),0
TN Low Flow Bypass Out (kg/yr),0
TN High Flow Bypass Out (kg/yr),0
TN Orifice / Filter Out (kg/yr),0
TN Weir Out (kg/yr),0
TN Transfer Function Out (kg/yr),0
TN Reuse Supplied (kg/yr),0
TN Reuse Requested (kg/yr),0
TN % Reuse Demand Met,0
TN % Load Reduction,0
GP Flow In (kg/yr),0
GP ET Loss (kg/yr),0
GP Infiltration Loss (kg/yr),0
GP Low Flow Bypass Out (kg/yr),0
GP High Flow Bypass Out (kg/yr),0
GP Orifice / Filter Out (kg/yr),0
GP Weir Out (kg/yr),0
GP Transfer Function Out (kg/yr),0
GP Reuse Supplied (kg/yr),0
GP Reuse Requested (kg/yr),0
GP % Reuse Demand Met,0
GP % Load Reduction,100
PET Scaling Factor,2.1

No Generic treatment nodes

Other nodes
Location,Receiving Node,Junction
ID,1,4
Node Type,ReceivingNode,JunctionNode

Appendix A – MUSIC detailed data

IN - Mean Annual Flow (ML/yr),0.00,0.00
IN - TSS Mean Annual Load (kg/yr),0.00,0.00
IN - TP Mean Annual Load (kg/yr),0.00,0.00
IN - TN Mean Annual Load (kg/yr),0.00,0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00
OUT - Mean Annual Flow (ML/yr),0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00
% Load Reduction,0.00,0.00
TSS % Load Reduction,0.00,0.00
TN % Load Reduction,0.00,0.00
TP % Load Reduction,0.00,0.00
GP % Load Reduction,0.00,0.00

Links
Location,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link
Source node ID,2,3,4,6,5,7,8
Target node ID,4,4,6,1,4,4,6
Muskingum-Cunge Routing,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed
Muskingum K, , , , , , ,
Muskingum theta, , , , , , ,
IN - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00

Catchment Details
Catchment Name,26 Shepherd Street
Timestep,6 Minutes
Start Date,1/01/1959
End Date,31/12/1959 11:54:00 PM
Rainfall Station, 66062 SYDNEY
ET Station,Monthly User Defined
Mean Annual Rainfall (mm), 1490
Mean Annual ET (mm), 1260