NORTHROP

CIVIL ENGINEERING REPORT: STORMWATER MANAGEMENT REPORT

Powerhouse Museums Discovery Centre

2 Green Road, Castle Hill NSW 2154

PREPARED FOR
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Civil Engineering Report: Stormwater Management Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
14.07.2020	1	Draft Issue For Co-ordination	E. Flack	T. Howe
24.07.2020	2	Issue For SSDA Submission	E. Flack	T. Howe
04.08.2020	3	Re-Issue For SSDA Submission	E. Flack	T. Howe
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14.01.2021	6	Re-Issue For SSDA Submission	E. Flack	T. Howe

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1. General

1.1 Introduction

The report supports a State Significant Development (SSD) Application for the proposed construction and use of a new building to facilitate the expansion of the Museums Discovery Centre (MDC) site at 2 Green Road, Castle Hill.

The primary objective of the SSD Application is to provide expanded facilities to accommodate the Powerhouse collection including spaces for storage, conservation, research and display and spaces to facilitate increased public access to the collection through education, public programs, workshops, talks, exhibitions and events. The expansion of the existing MDC facility within the site at 2 Green Road Castle Hill will integrate with the existing MDC site located at 172 Showground Road, Castle Hill and its operations on a permanent basis.

The proposal is a type of "Information and Education Facility" with a Capital Investment Value (CIV) in excess of $30 million and is classified as SSD under Schedule 1 Clause 13 of the State Environmental Planning Policy (State and Regional Development) 2011 (State and Regional Development SEPP).

Create Infrastructure is the proponent of the SSD Application.

This report covers the works shown as the Northrop Drawing Package required for the development of the site including:

- Stormwater Drainage;
- Stormwater Detention;
- Stormwater Quality;
- Flooding.

1.2 Related Reports and Documents

This report is to be read in conjunction with the following reports and documents:

1. State Significant Development Application (SSDA) Civil Documentation prepared by Northrop; Job Number 181569, revision 4.
2. Architectural Drawings by Lahznimmo Architects, Project Number 18-14.
3. The Hills Shire Council Development Control Plan (DCP) 2012 Appendix B – Water Sensitive Urban Design.
4. The Hills Shire Council Design Guidelines for Subdivision/Developments, September 2011.
5. Australian and New Zealand Standard AS/NZS 3500.3:2018 Plumbing and Stormwater Drainage.
6. Upper Parramatta River Catchment Trust On-Site Stormwater Detention Handbook Fourth Edition, December 2005.
7. Greenstar Design & as-built submission guidelines v1.3
8. Site Survey prepared by YSCO Geomatics Land Resource Consultants, dated December 2018

1.3 Background

The MDC is owned and operated by the Museum of Applied Arts and Sciences (MAAS) and features exhibitions and displays in collaboration with Australian Museum and Sydney Living Museums, who also maintain collection storage and conservation facilities on the site. The MDC is located at 172 Showground Road, Castle Hill. There are six buildings primarily providing collection storage as well as

areas for displays and education and public programs, accessible to visitors (Building E). During 2017-2018 a total of 17,481 persons visited the MDC site.

The MDC Expansion is part of the renewal of the Museum of Applied Arts and Sciences, known as the Powerhouse Program, that includes:

- Powerhouse Parramatta: A new benchmark in cultural placemaking for Greater Sydney that will be a symbol of a new approach to creative activity and engagement.
- Powerhouse Ultimo: The NSW Government is committed to retaining a creative industries presence at Ultimo. A creative industries precinct is critical to cementing Sydney's reputation as Australia's cultural capital while investing in one of the fastest growing economic sectors of the state.
- Powerhouse Collection Relocation and Digitisation Project: The relocation of the Powerhouse collection and digitisation of around 338,000 objects, enhancing the collection's accessibility for local, national and international audiences.

The MDC expansion is an integral component of the Powerhouse Program and will provide the opportunity to increase visitation to the site, forming an important and significant cultural institution within The Hills Shire. In addition to the storage component of the proposal, the expansion will increase access to the Powerhouse collection through a range of spaces for visible storage, research and viewing of the collection, as well as flexible spaces for education and public programs, workshops, talks, exhibitions and events.

1.4 The Development

1.4.1 Site Description

The proposed Building J site is located within the property known as 2 Green Road, Castle Hill which comprises a single lot legally described as Lot 102 DP 1130271. The site is generally square in shape with a splay corner to the intersection of Green Road and Showground Road and a total area of approximately 3.8ha. The site has a primary frontage of approximately 183m to Green Road and a secondary frontage of approximately 186m to Showground Road. Refer to Figure 1. The location of the proposed new MDC building (to be known as "Building J") is located on the western end of the site and is marked on Figure 1 in a dashed yellow line (referred as the Building J Site). The overall site contains large institutional buildings set within a landscaped setting featuring a high tree canopy.

The overall site is a TAFE campus that caters for approximately 400 enrolled students, and provides courses on business and financial services, hospitality, general education, community services, health, nursing, carpentry, building and retail. The site currently includes TAFE buildings, car parking and vegetated open space areas. A dam is situated in the north eastern part of the site.

The MDC site is located immediately west of the existing TAFE site at 172 Showground Road, Castle Hill. A subdivision application (included within this SSD Application) will consolidate the site of the proposed Building J with the existing MDC site. The main public vehicle access to the MDC site is via Windsor Road. There is also a vehicular access point to the MDC on Showground Road. The MDC and TAFE have a longstanding arrangement, that permits vehicle access to the MDC site from Green Road, allowing vehicles to traverse across the TAFE site to access the MDC site.

Figure 1 - Existing Site Layout Plan & Proposed Development Site

Development surrounding the site to the east, and north consists of established residential neighbourhoods generally comprising two storey detached dwellings. Opposite the site to the south east and south west are a mix of warehouses, industrial units, and large format bulky goods retail premises. Views into the TAFE and MDC site from the surrounding roads is obscured by dense trees and vegetation along the perimeter of the sites.

A public park and children's playground is adjacent to the north of the site that is bound by Sunderland Avenue to the east and Castlegate Place to the west. The dwellings along Sunderland Avenue and the southern side of Pentonville Parade are the nearest residential properties to the proposed Building J site.

1.4.2 Proposed Development

The successful delivery of this SSD project supports a priority cultural infrastructure project and is a NSW Government 2019 election commitment (Powerhouse Precinct at Parramatta). This application will deliver a significant cultural institution for Castle Hill and The Hills Shire.

The proposed Building J will offer many opportunities for public engagement as part of a desire to increase public access to the Powerhouse collection. The renewal of the site offers a range of opportunities to increase public access including visible storage facilities, booked tours, Open Days, public and education programs, workshops, talks and other events. The facilities in Building J will serve the needs of a variety of user groups including staff, volunteers, education groups, researchers, artists, scientists, industry partners and the general public.

The SSD Application seeks consent for the delivery of the MDC expansion as a single stage, comprising:

- Site preparation works, including the termination/relocation and installation of site services and infrastructure, tree removal (337 trees in total), earthworks, and the erection of site protection hoardings and fencing.
- Demolition of existing car park and vehicle accessway along the eastern and north eastern parts of the site. A new at-grade car park is proposed to be constructed on the eastern side of the TAFE site and will accommodate 24 car parking spaces removed from the Building J site.
- Construction of the proposed new Building J. The proposed new Building J will cater for the following uses:
    - Storage for the Powerhouse collection and archives (both collected archives and institutional archives).
    - Flexibles spaces for education and public programs, workshops, talks, exhibitions and events.
    - Suites of conservation laboratories and collection work spaces.
    - Photography, digitisation and collection documentation facilities.
    - Work space for staff, researchers, industry partners and other collaborators. This will include amenities, meeting and storage rooms, collection research and study areas as well as other ancillary facilities.
    - Components of the image and research library.
    - Object and exhibition preparation, packing, quarantine and holding areas.
- Construction of new vehicle accessways to maintain connectivity to the MDC and TAFE sites.
- Subdivision of the proposed Building J site from the TAFE site including creation of right-of-carriageway easement to facilitate access over the new realigned accessway by TAFE vehicles and consolidation to form a single lot with the existing MDC site.

2. Stormwater Management

As the aim of this SSDA is to subdivide the existing TAFE site (2 Greens Road) and consolidate the proposed Block J into the existing MDC site (172 Showground Road), the following information is regarding the existing MDC site only.

2.1 Objectives and Controls

The Department of Planning, Industry and Environment have issued Secretary's Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement for the proposed development. This report has been prepared having regard to the SEARs as noted in Table 1 below.

Table 1 - SEARs Requirements and Section Reference

SEAR	Where Addressed
Include an assessment and proposed management of the flooding, stormwater, drainage and groundwater issues associated with the site, environs and the proposed development, including an integrated water management strategy that incorporates waste water, rainwater and stormwater runoff	• Infrastructure Management Report • Section 2.4 • Section 2.5 • Section 2.6
Prepare a stormwater management report demonstrating how stormwater would be appropriately managed in accordance with Council's requirements, including future stormwater runoff to be attenuated to existing flow in line with Council's on-site detention requirements	• Section 2.3 • Section 2.4 • Section 2.5 • Section 2.6
Assess water quality and hydrology impacts of the development, including any downstream impacts for both surface and groundwater and any impacts on natural processes and functions.	• Section 2.3 • Section 2.4 • Section 2.5 • Section 2.6

The stormwater strategy for the Powerhouse Museums Discovery Centre development has also been developed in accordance with The Hills Shire Council Development Plan (DCP) and Water Sensitive Urban Design guidelines.

The DCP outlines the following objectives:

1. To ensure that commercial/retail development does not impact on the water quality of adjacent properties or creeks in accordance with Council's ESD objective 2.

2. To ensure that development does not increase downstream flooding.

3. To encourage reuse, recycling and harvesting of stormwater to reduce wastage of water in accordance with Council's ESD objective 2.

4. To encourage the re-use of stormwater for the irrigation of landscaped areas, particularly during establishment periods in accordance with Council's ESD objective 2.

5. To provide for the disposal of stormwater from the site in efficient, equitable and environmentally sensible ways.

2.2 Existing Stormwater Infrastructure

The existing site currently contains an existing in-ground stormwater system including an OSD tank that drains via existing easements through the neighbouring TAFE site in the North Eastern corner of the site. The existing site drainage and aforementioned easements are show below in Figure 2. The existing overland flow routes generally follow the existing in-ground system and drain out towards the North Western corner of the site.

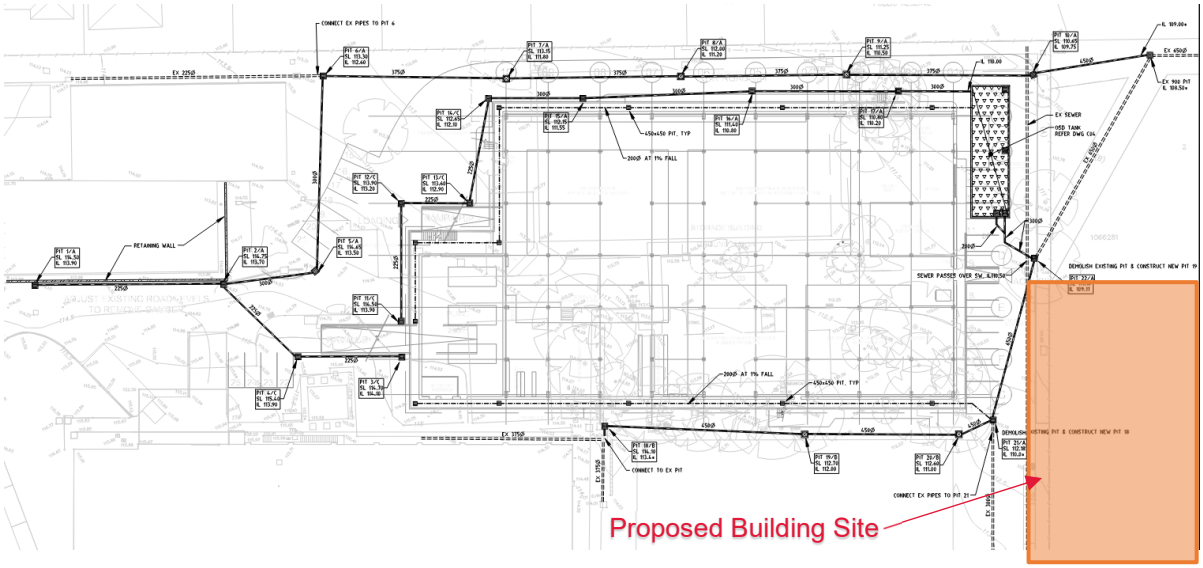

Figure 2 - Existing Site Stormwater Infrastructure

2.3 Proposed Stormwater System

Stormwater runoff associated with the new building will be conveyed via a below-ground pit and pipe system to the proposed OSD tank located under the new loading dock and driveway prior to discharging into the existing stormwater system. A separate system will convey all roof water to the proposed 25kL rainwater tank (refer hydraulic documentation and infrastructure Services Report for details) for re-use with any overflow directed towards the proposed OSD tank.

In accordance with council's design guidelines and the Upper Parramatta River Catchment Trust's (UPRCT) OSD handbook, the inground pipe system has been designed to convey the 1% AEP storm event. Overland flow has also been considered in case of blockage, with overland flow routes provided away from the building.

The system has been modelled using the ILSAX hydrological model within DRAINS using rainfall IFD data from Bureau of Meteorology.

No groundwater issues are anticipated to be experienced on the site, as noted in Geotech report groundwater was not encountered during bore hole investigations up to a depth of 5.5m. A subsoil drainage line will be included in the retaining wall along the Eastern side of the building to allow any potential surface run-off infiltration to freely drain and prevent hydrostatic pressure build-up.

For more details refer to Northrop's civil design drawings (Attachment A).

2.4 Stormwater Quantity Management

In accordance with Council requirements, the DRAINS software package has been used to model the hydrologic and hydraulic characteristics of stormwater runoff and flow across the site and the UPRCT's OSD handbook has been used to determine the storage requirements for On-Site Detention (OSD).

2.4.1 Proposed OSD

In accordance with the UPRCT's OSD handbook and Council guidelines, the proposed OSD has been designed according to their design method. The site is located within the Hawkesbury Catchment and therefore the adopted principles for design are shown in Table 2 below.

Table 2 - OSD Design Parameters

Design Parameter	Value
Site Slope	5% (from survey)
PSD (L/s/ha)	92
SSR (m^3/ha)	396

The above parameter's and site information was used to determine the site specific storage requirement and permissible discharge as shown below:

- Permissible Site Discharge – 43L/s
- Site Storage Requirement – 190m^3

The site specific values given above were used in accordance with the UPRCT's OSD design handbook to determine the orifice size. However, the proposed tank's hydraulic performance has been assessed using the DRAINS software to account for the downstream tailwater condition. The downstream tail water condition is RL 109.80 for the 1% AEP storm event and was determined using a previously completed site drainage model for the latest site development works. The value takes into account the site catchment as well as further downstream water levels. The proposed orifice size was adjusted accordingly to ensure that the design still maintained the maximum site discharge and that the required storage would be adequate. The resulting orifice is as shown below:

- Orifice (Ø125mm) Centre-Line – RL 109.31

The OSD tank is to be located underneath the proposed loading dock driveway in combination with the rainwater re-use tank as shown in Figure 3 below. For more detail refer to Northrop's civil design drawings (Attachment A).

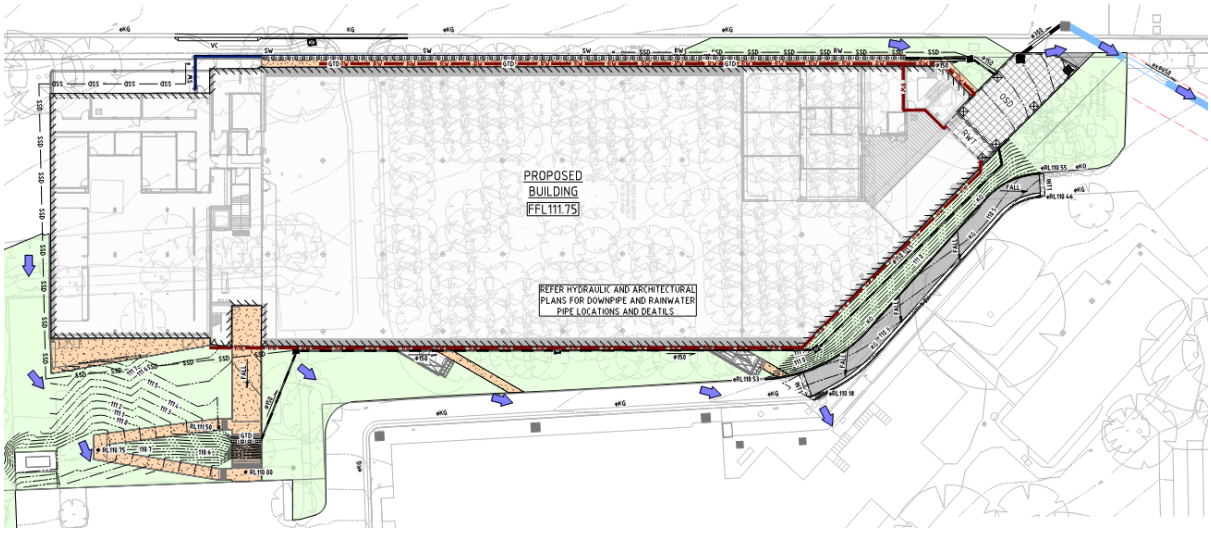

Figure 3 - Proposed OSD & Rainwater Tank Location

2.5 Stormwater Quality Management

2.5.1 Adopted Water Quality Objectives

The stormwater quality management aims to reduce the pollutant load of stormwater runoff using a series of treatment devices prior to discharge into receiving waters.

Stormwater quantity and quality management measures have been modelling using MUSIC software. Both the Council DCP and the Greenstar Design & as-built submission guidelines v1.3 outline different required water quality targets for the development, with the limiting targets being those outlined in the Greenstar Design & as-built submission guidelines v1.3. Therefore, the values outlined in Greenstar Design & as-built submission guidelines v1.3 table 26.2 pollution reduction targets column B have been adopted for this design and are presented in Table 3.

Table 3 - Water Quality Targets

Pollutant	% Reduction Post-Development Average Annual Load Reduction
Gross Pollutants	90
Total Suspended Solids (TSS)	80
Total Phosphorous (TP)	60
Total Nitrogen (TN)	45

2.5.2 Stormwater Quality Management Scheme

The proposed water quality treatment train incorporated to meet the required targets includes a rainwater re-use tank, proprietary stormfilters and proprietary pit baskets.

The proposed rainwater re-use tank will have re-use for both irrigation and internal non-potable uses to reduce the requirement for mains water usage. The rainwater tank details have been taken from the hydraulic design for input into the treatment train. For details on the rainwater tank and water balance, refer to the infrastructure services report.

Pit baskets have been provided as a pre-treatment to target the pollutant reduction of gross pollutants, litter, grit, sediments and associated oils prior to stormwater discharging into OSD tank where the stormfilters are located to provide tertiary treatment.

2.5.3 Rainfall Data

Historical rainfall records were obtained from the Bureau of Meteorology for Station No. 66124 at Parramatta North (Masons Drive). The MUSIC analysis was undertaken using a 6-minute time step for a 10 year time period from 2000 to 2010.

The Evapotranspiration values have been entered as the industry standard for the Sydney area.

2.5.4 Methodology

The water quality modelling software MUSIC v6.3.0 was adopted for the study. Figure 4 shows the layout of the treatment train in the MUSIC Model.

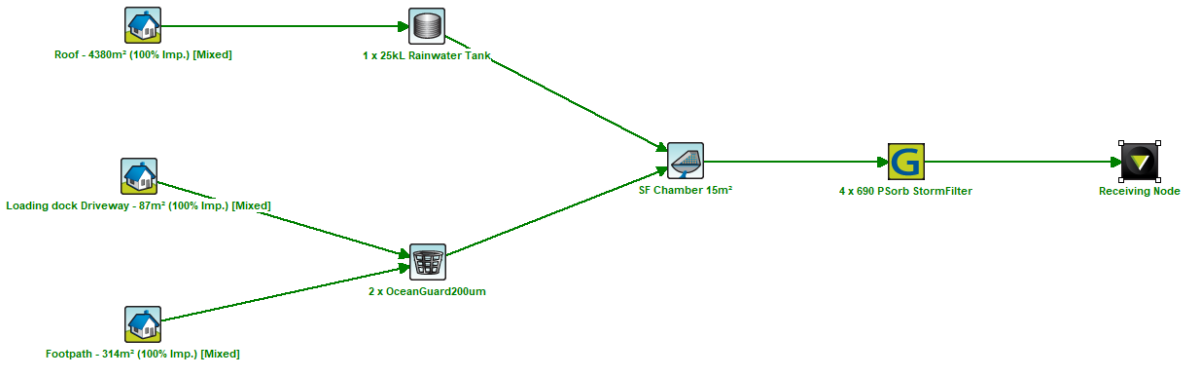

Figure 4 - MUSIC Link and Node Diagram

The following rainfall and runoff parameters have been adopted.

Table 4 - Rainfall Runoff Parameters

Parameter	Recommended Values
Rainfall Threshold (mm/day)	0.3
Soil Storage Capacity (mm)	120
Initial Storage (% of Capacity)	30
Field Capacity (mm)	80
Infiltration Capacity Coefficient – a	200
Infiltration Capacity Exponent – b	1
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow Rate (%)	5
Daily Deep Seepage Rate (%)	0

The pollutant concentration parameters used in the model are listed in Table 5:

Table 5 - Water Quality Parameters for MUSIC Source Nodes

Land- Use Category		Log TSS (mg/L)		Log TP (mg/L)		Log TN (mg/L)	
		Storm Flow	Base flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Roof Areas	**Mean**	1.30	1.20	-0.89	-0.85	0.30	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12
Road Areas	**Mean**	2.43	1.20	-0.30	-0.85	0.34	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12

2.5.5 MUSIC Model Results

The results of the analysis show the treatment train will achieve the water quality targets set out in the Greenstar Design & as-built submission guidelines v1.3. The water quality model provides an

indication of the pollutant removal rates expected when the nominated treatment train of water quality measures is applied to the proposed development. The results are presented in Table 6.

Table 6 - MUSIC Model Results Extract from JWP's Report

Pollutant	Before Treatment	After Treatment	% Reduction	% Objective	Compliance
Gross pollutants (kg/yr.)	104	0	100	90	OK
Total Suspended Solids (kg/yr)	146	28	80.8	80	OK
Total Phosphorus (kg/yr)	0.596	0.195	67.3	60	OK
Total Nitrogen (kg/yr)	7.82	3.81	51.3	45	OK

2.6 Flood Risk

Northrop have undertaken an investigation to understand the mainstream and local area flooding constraints associated with the site – for the purpose of this site 'Mainstream' & 'Overland Flow' flooding is been defined below.

1. Mainstream Flooding – flooding within the greater catchment area around the site which is defined by water that flows over banks of creeks and lagoons
2. Overland Flow Flooding – defines as surface runoff before it enters a water way. It is caused by rainfall which flows downhill and concentrates in catchment low points

Council has not provided any available flood mapping in the vicinity of the site; however, it is noted that the site is located in the upper portion of the local catchment. As such, the site is not believed to be affected by mainstream or overland flooding.

Overland flow paths and site grading will also be designed to ensure that all existing and new buildings and habitable areas are not impacted in major storms or in the event of the piped system being blocked.

3. Conclusion

A stormwater management strategy has been derived for the proposed development in accordance with AS/NZS 3500.3:2018 Plumbing and Stormwater Drainage and Council's Development Control Plans. Stormwater runoff from the proposed development is to be directed into the proposed underground pit and pipe system and OSD and connect into the existing sites stormwater system. A 190m³ OSD storage system has been designed in accordance with the UPRCT's OSD handbook and Council guidelines.

A treatment train has been developed using MUSIC software to demonstrate that the stormwater pollutant load reduction targets are achieved in accordance with the Greenstar Design & as-built submission guidelines v1.3 and Council guidelines. The treatment train consists of proprietary pit baskets installed at each proposed grated inlet pit and 4 proprietary stormfilter cartridges will be added to the OSD tank.

3.1 Mitigation Measures

Proposed Measure	Timing
Prepare a soil and erosion control plan that includes treatment for water quality during construction.	Concept design completed as part of SSDA submission by civil engineer (refer Appendix A for current design). Final design completed prior to commencement of construction by Contractor.
Water Quantity Control System including an On-Site Detention (OSD) system.	This will be completed as part of the design process as described in the above report.
Water Quality Control System including proprietary treatment devices and a rainwater re-use tank.	This will be completed as part of the design process as described in the above report.

Appendix A – Civil SSDA Plans

POWERHOUSE MUSEUM DISCOVERY CENTRE

172 SHOWGROUND RD, CASTLE HILL NSW 2154
CIVIL ENGINEERING WORKS PACKAGE

SOURCE : NEARMAP.COM.AU (©2018)

DRAWING SCHEDULE

DRG No.	DRAWING TITLE
DA1.01	COVERSHEET, DRAWING SCHEDULE AND LOCALITY PLAN
DA1.11	GENERAL ARRANGEMENT PLAN
DA2.01	CONCEPT SEDIMENT AND EROSION CONTROL PLAN
DA2.11	SEDIMENT AND EROSION CONTROL DETAILS
DA2.21	BULK EARTHWORKS PLAN
DA3.01	SITEWORKS AND STORMWATER MANAGEMENT PLAN
DA3.02	SITEWORKS AND STORMWATER MANGEMENT PLAN - SHEET 2
DA3.11	CARPARK TURNING PATHS
DA4.01	OSD DETAILS - SHEET 1
DA4.02	OSD DETAILS - SHEET 2

DRAWN: J.PHILLIPS DESIGNED: E.FLACK JOB MANAGER: E.FLACK VERIFIER: -

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR SSDA COORDINATION	E.F		E.F	26.06.20
2	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	24.07.20
3	ISSUED FOR SSDA	J.P		E.F	14.01.21

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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: COVERSHEET, DRAWING SCHEDULE AND LOCALITY PLAN

JOB NUMBER: 181569

DRAWING NUMBER: DA1.01 REVISION: 3

DRAWING SHEET SIZE = A1

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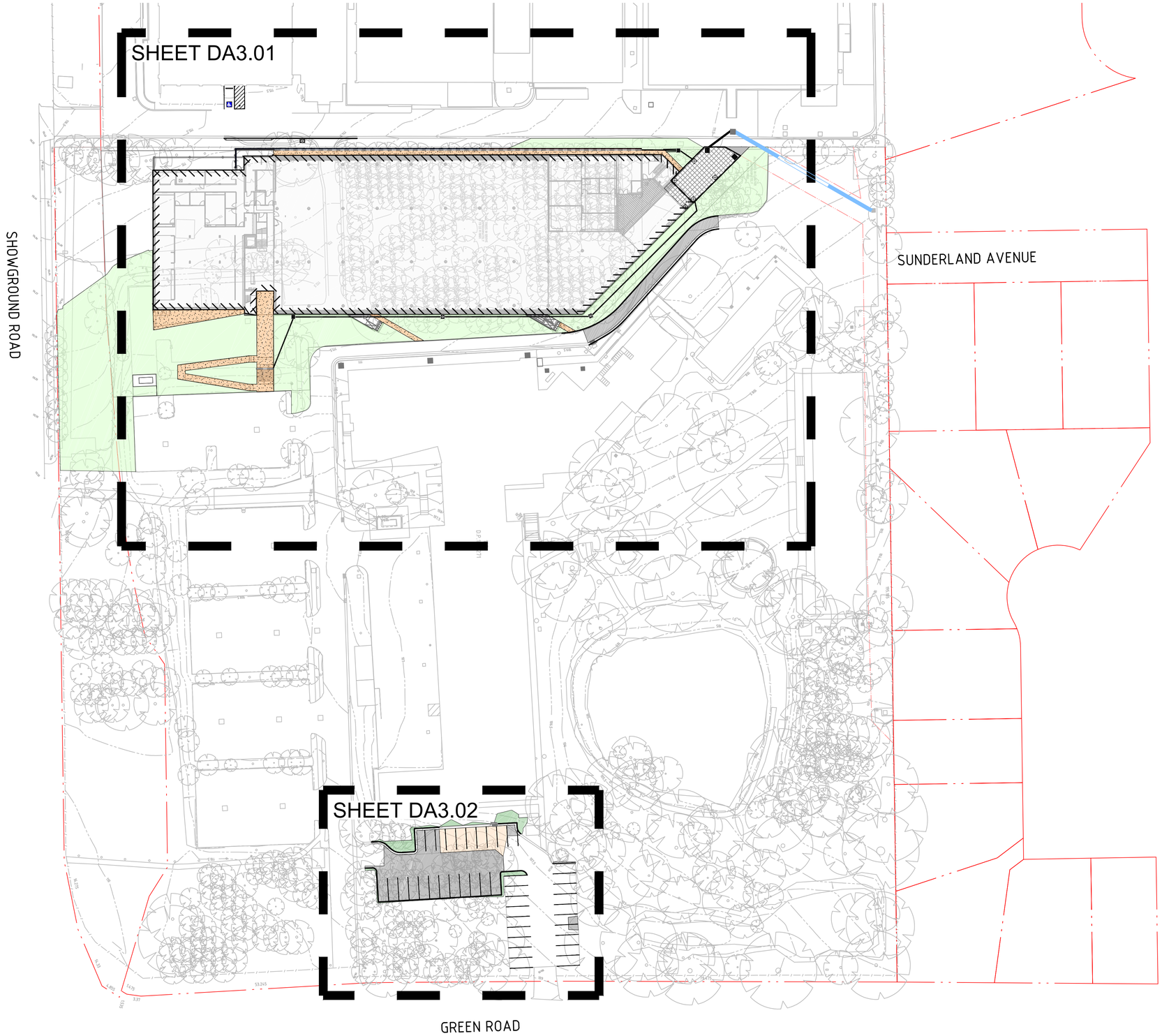

DRAWN: J.PHILLIPS
DESIGNED: E.FLACK
JOB MANAGER: E.FLACK
VERIFIER:-

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PROJECT
POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE
GENERAL ARRANGEMENT PLAN

JOB NUMBER 181569
DRAWING NUMBER DA1.11
REVISION 3
DRAWING SHEET SIZE = A1

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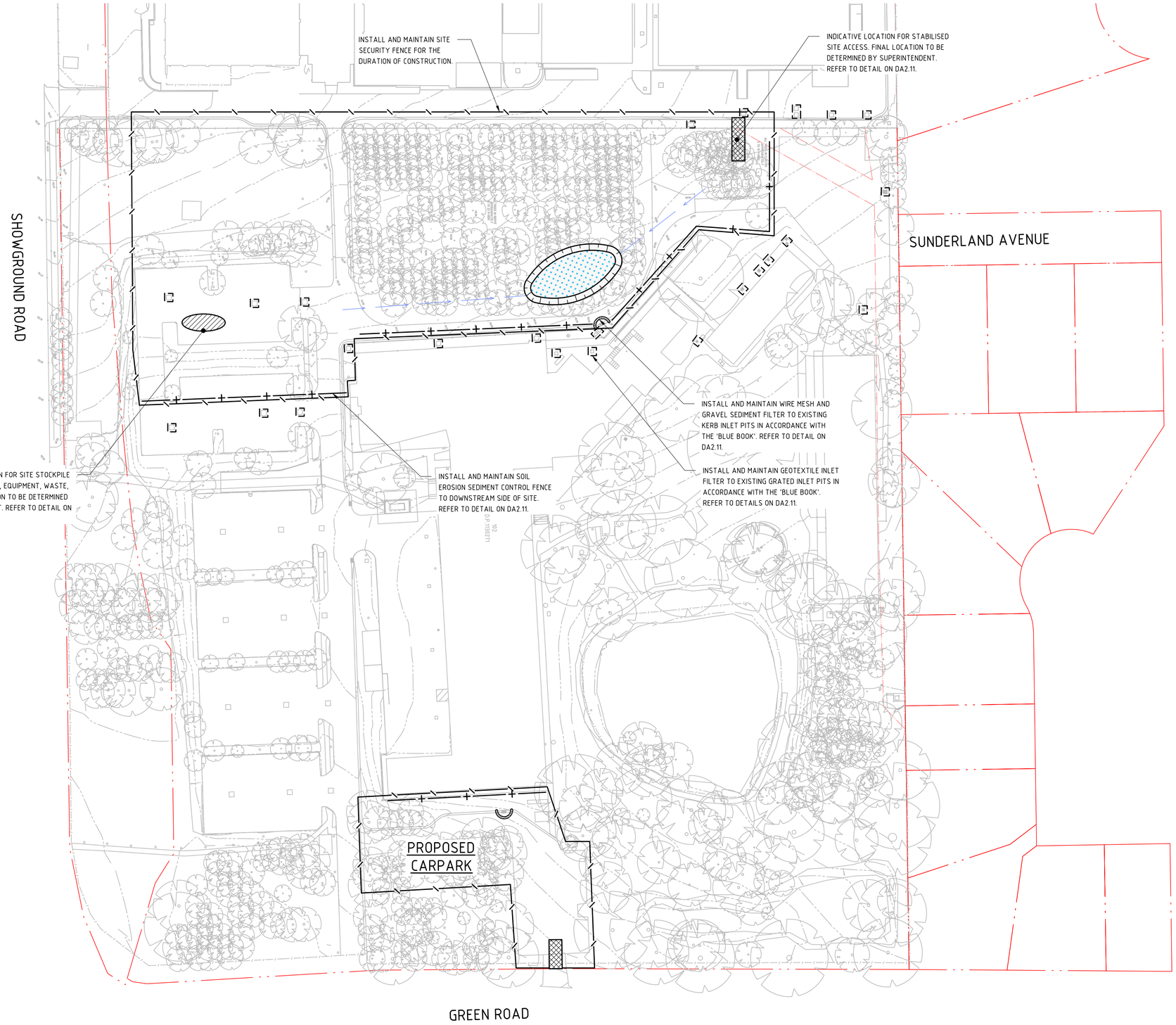

LEGEND

- PROPOSED BOUNDARY LINE
- EASEMENT LINE
- EXISTING CONTOURS
- SEDIMENT FENCE
- SECURITY FENCE
- WIRE MESH AND GRAVEL SEDIMENT FILTER
- DROP INLET SEDIMENT TRAP
- STABILISED SITE ACCESS
- STOCKPILE
- SEDIMENT BASIN

GENERAL NOTES:

1. REFER SPECIFICATIONS NOTES FOR SEDIMENT AND SOIL EROSION CONTROL GENERAL REQUIREMENTS.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
3. ALL SEDIMENT AND SOIL EROSION CONTROL MEASURES TO BE INSTALLED IN ACCORDANCE WITH THE 'BLUE BOOK'. CONTRACTOR TO ENSURE THESE MEASURES ARE IN PLACE AND MAINTAINED AT ALL TIMES DURING CONSTRUCTION WORKS.
4. CONTRACTOR TO PROVIDE 'WIRE MESH AND GRAVEL SEDIMENT FILTER' TO ALL PAVED / ROAD AREAS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'.
5. CONTRACTOR TO PROVIDE 'GEOTEXTILE INLET FILTER TRAPS' TO ALL STORMWATER DRAINAGE INLETS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'
6. SEDIMENT BASIN SIZING BASED ON 5 DAY, 85TH PERCENTILE DESIGN RAINFALL EVENT.

6.1. SEDIMENT BASIN CALCS

SOIL TYPE D

$V_{REQUIRED}$, V_{SB} = 145m³

$V_{PROVIDED}$ = 147m³

DRAWN: J.PHILLIPS DESIGNED: E.F.LACK JOB MANAGER: E.F.LACK VERIFIER: -

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR SSDA COORDINATION	E.F		E.F	26.06.20
2	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	24.07.20
3	ISSUED FOR SSDA	J.P		E.F	14.01.21

CLIENT: NSW GOVERNMENT Planning & Environment

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ARCHITECT: lahznimmo architects

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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

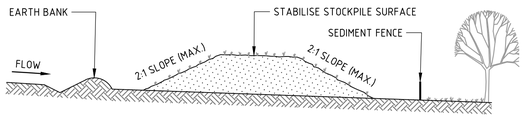
DRAWING TITLE: CONCEPT SEDIMENT AND EROSION CONTROL PLAN

JOB NUMBER: 181569

DRAWING NUMBER: DA2.01 REVISION: 3

DRAWING SHEET SIZE = A1

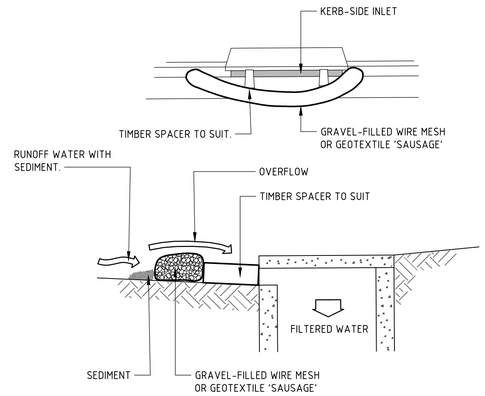
Date: 14-1-21 11:52am Plotted By: jphillips Found: W:\#jobs\2018\181569 - Powerhouse Museum\0-Drawings\0-Northrop\C-CIVIL\2-CURRENT CAD FILES\SSDA\181569_DA2.01_CONCEPT SEDIMENT AND EROSION CONTROL PLAN.dwg



CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2m (PREFERABLY 5m) FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE.

STOCKPILES (SD 4-1)

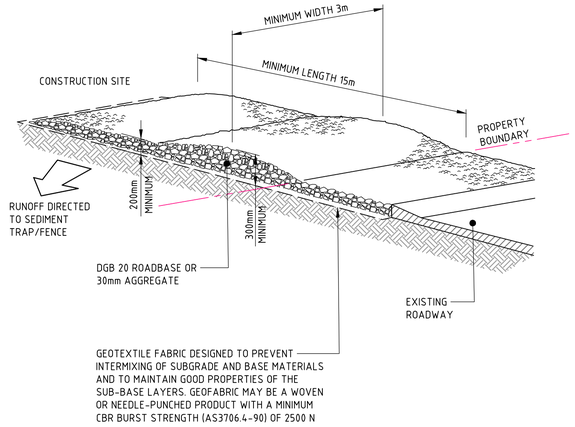


NOTE:THIS PRACTICE ONLY TO BE USED WHERE SPECIFIED IN APPROVED SWMP/ESCP.

CONSTRUCTION NOTES

1. INSTALL FILTERS TO KERB INLETS ONLY AT SAG POINTS.
2. FABRICATE A SLEEVE MADE FROM GEOTEXTILE OR WIRE MESH LONGER THAN THE LENGTH OF THE INLET PIT AND FILL IT WITH 25mm TO 50mm GRAVEL.
3. FORM AN ELLIPTICAL CROSS-SECTION ABOUT 150mm HIGH x 400mm WIDE.
4. PLACE THE FILTER AT THE OPENING LEAVING AT LEAST A 100mm SPACE BETWEEN IT AND THE KERB INLET. MAINTAIN THE OPENING WITH SPACER BLOCKS.
5. FORM A SEAL WITH THE KERB TO PREVENT SEDIMENT BYPASSING THE FILTER.
6. SANDBAGS FILLED WITH GRAVEL CAN SUBSTITUTE FOR THE MESH OR GEOTEXTILE PROVIDING THEY ARE PLACED SO THAT THEY FIRMLY ABUT EACH OTHER AND SEDIMENT-LADEN WATERS CANNOT PASS BETWEEN.

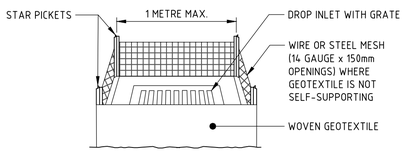
MESH AND GRAVEL INLET FILTER (SD 6-11)

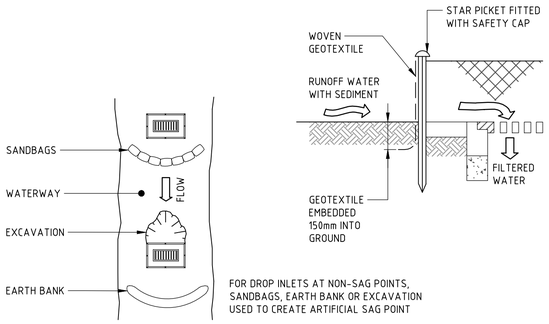


CONSTRUCTION NOTES

1. STRIP THE TOPSOIL, LEVEL THE SITE AND COMPACT THE SUBGRADE.
2. COVER THE AREA WITH NEEDLE-PUNCHED GEOTEXTILE.
3. CONSTRUCT A 200mm THICK PAD OVER THE GEOTEXTILE USING ROAD BASE OR 30mm AGGREGATE.
4. ENSURE THE STRUCTURE IS AT LEAST 15 METRES LONG OR TO BUILDING ALIGNMENT AND AT LEAST 3 METRES WIDE.
5. WHERE A SEDIMENT FENCE JOINS ONTO THE STABILISED ACCESS, CONSTRUCT A HUMP IN THE STABILISED ACCESS TO DIVERT WATER TO THE SEDIMENT FENCE.

STABILISED SITE ACCESS (SD 6-14)



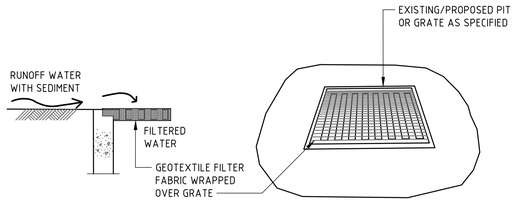


FOR DROP INLETS AT NON-SAG POINTS, SANDBAGS, EARTH BANK OR EXCAVATION USED TO CREATE ARTIFICIAL SAG POINT

CONSTRUCTION NOTES

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. FOLLOW STANDARD DRAWING 6-7 AND STANDARD DRAWING 6-8 FOR INSTALLATION PROCEDURES FOR THE STRAW BALES OR GEOFABRIC. REDUCE THE PICKET SPACING TO 1 METRE CENTRES.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DO NOT COVER THE INLET WITH GEOTEXTILE UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

GEOTEXTILE INLET FILTER (SD 6-12)



CONSTRUCTION NOTES

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE FILTER MATERIAL.
2. GEOTEXTILE PIT FILTERS TO BE USED ON PIT LOCATED ON ROAD LANEWAY SURFACE.

GEOTEXTILE FILTER WRAP

SWMP Commentary, Detailed Calculations

4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{x\text{-day},\ y\text{-}\%ile}\ (m^3)$$

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

$R_{x\text{-day},\ y\text{-}\%ile}$ = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

Sediment Storage Zone Volume

In the detailed calculation on Soil Loss Classes 1 to 4 lands, the sediment storage zone can be taken as 50 percent of the settling zone capacity. Alternately designers can design the zone to store the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)). However, on Soil Loss Classes 5, 6 and 7 lands, the zone must contain the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(iii).

Place an "X" in the box below to show the sediment storage zone design parameters used here:

x	50% of settling zone capacity,
	2 months soil loss calculated by RUSLE

Total Basin Volume

Site	C_v	$R_{x\text{-day},\ y\text{-}\%ile}$	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
Bdg J	0.64	32.2	0.47	96.8576	48	145.2864

Note that designers should achieve a minimum 3:1 length:width ratio in Type D or F basins

Sediment_Basin_Design_Detailed_V6 1

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1	ISSUED FOR SSDA COORDINATION	E.F		E.F	26.06.20
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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: SEDIMENT AND EROSION CONTROL DETAILS

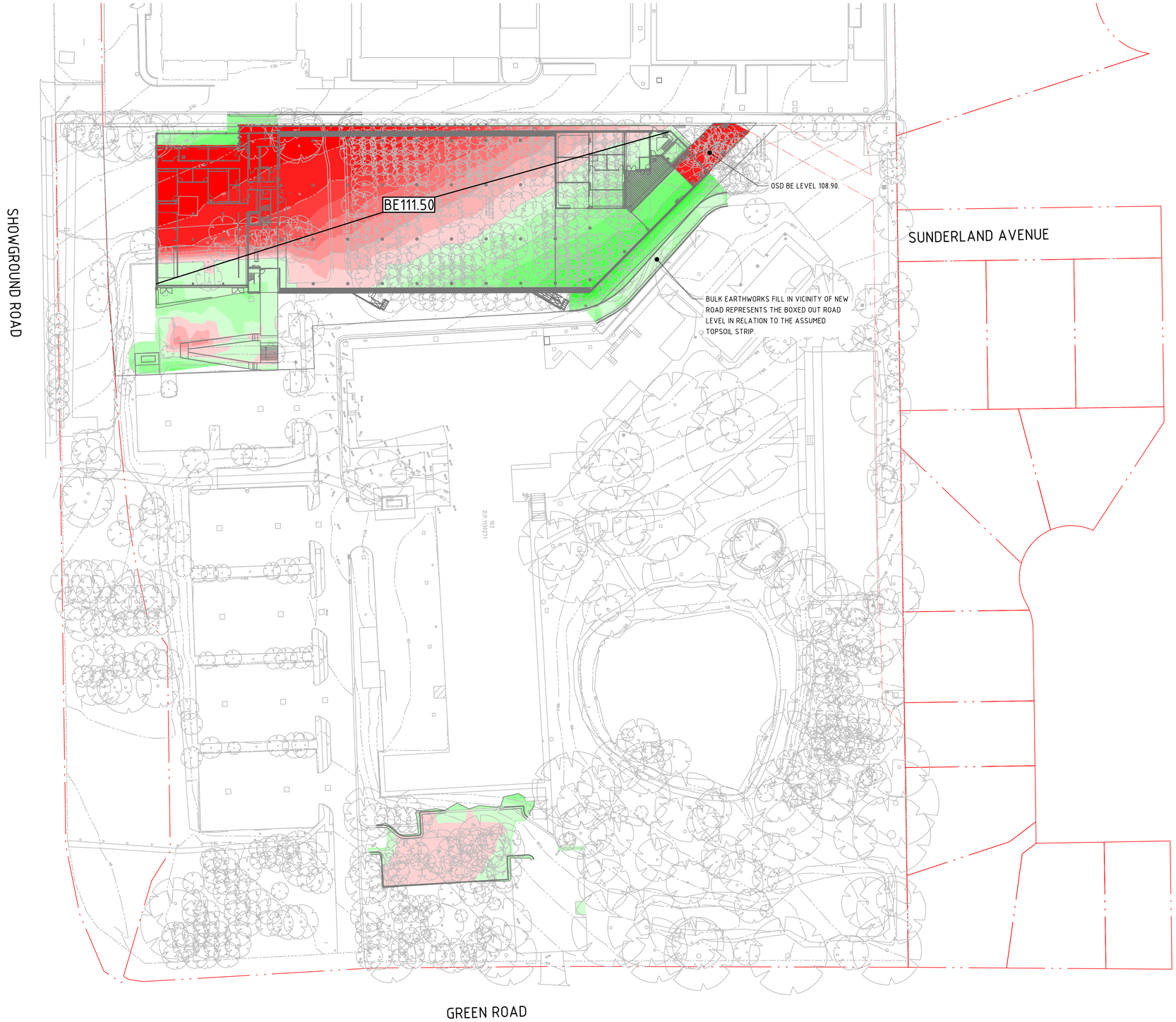
JOB NUMBER: 181569

DRAWING NUMBER: DA2.11 REVISION: 3

DRAWING SHEET SIZE = A1

VERIFIER: - JOB MANAGER: E.FLACK DESIGNED: E.FLACK DRAWN: J.PHILLIPS

Date: 14-1-21 11:52am Plotted By: jphillips Found: W:\#jobs\2018\181569 - Powerhouse Museum\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\SSDA\181569_DA2.11_SEDIMENT AND EROSION CONTROL DETAILS.dwg



LEGEND

- BOUNDARY LINE
- BEXX.XX — BULK EARTHWORKS PAD LEVEL
- XXXX — CONTOURS

DEPTH OF CUT

- -3.5m TO -2.0m
- -2.0m TO -1.5m
- -1.5m TO -1.25m
- -1.25m TO -1.0m
- -1.0m TO -0.75m
- -0.75m TO -0.5m
- -0.5m TO -0.25m
- -0.25m TO -0.0m

DEPTH OF FILL

- 0.0m TO 0.25m
- 0.25m TO 0.5m
- 0.5m TO 0.75m
- 0.75m TO 1.0m
- 1.0m TO 1.25m
- 1.0m TO 1.50m

GENERAL NOTES:

1. REFER SPECIFICATIONS NOTES FOR EARTHWORKS GENERAL REQUIREMENTS.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
3. CAD FILES / DTM FILES TO BE SUPPLIED IN AUTOCAD FORMAT FOR SETOUT PURPOSES (UPON REQUEST).
4. NO ALLOWANCE HAS BEEN MADE FOR BULKING FACTORS. NOTE ALL VOLUMES DEPICTED ARE SOLID VOLUMES ONLY AND MAY NOT REFLECT DETAILED EARTHWORKS.
5. NO ALLOWANCE HAS BEEN MADE FOR DETAILED EARTHWORKS; ie SERVICE TRENCHING, DETAILED EXCAVATION, FOOTINGS, RETAINING WALLS, TEMPORARY BATTERS AND THE LIKE. CONTRACTOR IS TO ALLOW FOR REMOVAL OF ALL EXCESS MATERIAL GENERATED BY THE WORKS.
6. REFER TO STRUCTURAL ENGINEERS DRAWINGS FOR SHORING WALL DETAILS.
7. THE CONTRACTOR SHALL USE FINAL SURFACE LEVELS AND TYPICAL PAVEMENT DETAILS FOR ACTUAL EARTHWORKS LEVELS.
8. BULK EARTHWORKS ARE BASED ON THE FOLLOWING DEPTHS FROM FINISHED SURFACE LEVELS;
   - 8.1. ASPHALT PAVEMENT 330mm
   - 8.2. BUILDING SLAB 150mm (REFER STRUCTURAL DWGS)
   - 8.3. FOOTPATH PAVEMENT 200mm
   - 8.4. LANDSCAPE AREA NO ALLOWANCE HAS BEEN MADE FOR EARTHWORKS IN LANDSCAPED AREAS
9. APPROXIMATE BULK EARTHWORK VALUES AS FOLLOWS;
   - 9.1. CUT ~3610 cu.m
   - 9.2. FILL 1192 cu.m
   - 9.3. BALANCE ~2418 cu.m CUT
   - 9.4. NOTE: SITE STRIPPING VOLUMES ARE SEPARATE TO ABOVE CALCULATIONS.
   - 9.5. SITE STRIPPING VOLUME DEPTH ~2739 cu.m CUT
   - 9.6. STRIP EXISTING TOPSOIL AND FILL IN CONSULTATION WITH THE GEOTECHNICAL ENGINEER/REPORT. FOR THE PURPOSES OF EARTHWORKS CALCULATIONS A TOPSOIL STRIPPING DEPTH OF 600mm HAS BEEN ASSUMED.

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DRAWN: J.PHILLIPS | DESIGNED: E.FLACK | JOB MANAGER: E.FLACK | VERIFIER: -

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR SSDA COORDINATION	E.F		E.F	26.06.20
2	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	17.07.20
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4	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	24.07.20
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ARCHITECT: lahznimmo architects

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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: BULK EARTHWORKS PLAN

JOB NUMBER: 181569

DRAWING NUMBER: DA2.21 | REVISION: 5

DRAWING SHEET SIZE = A1

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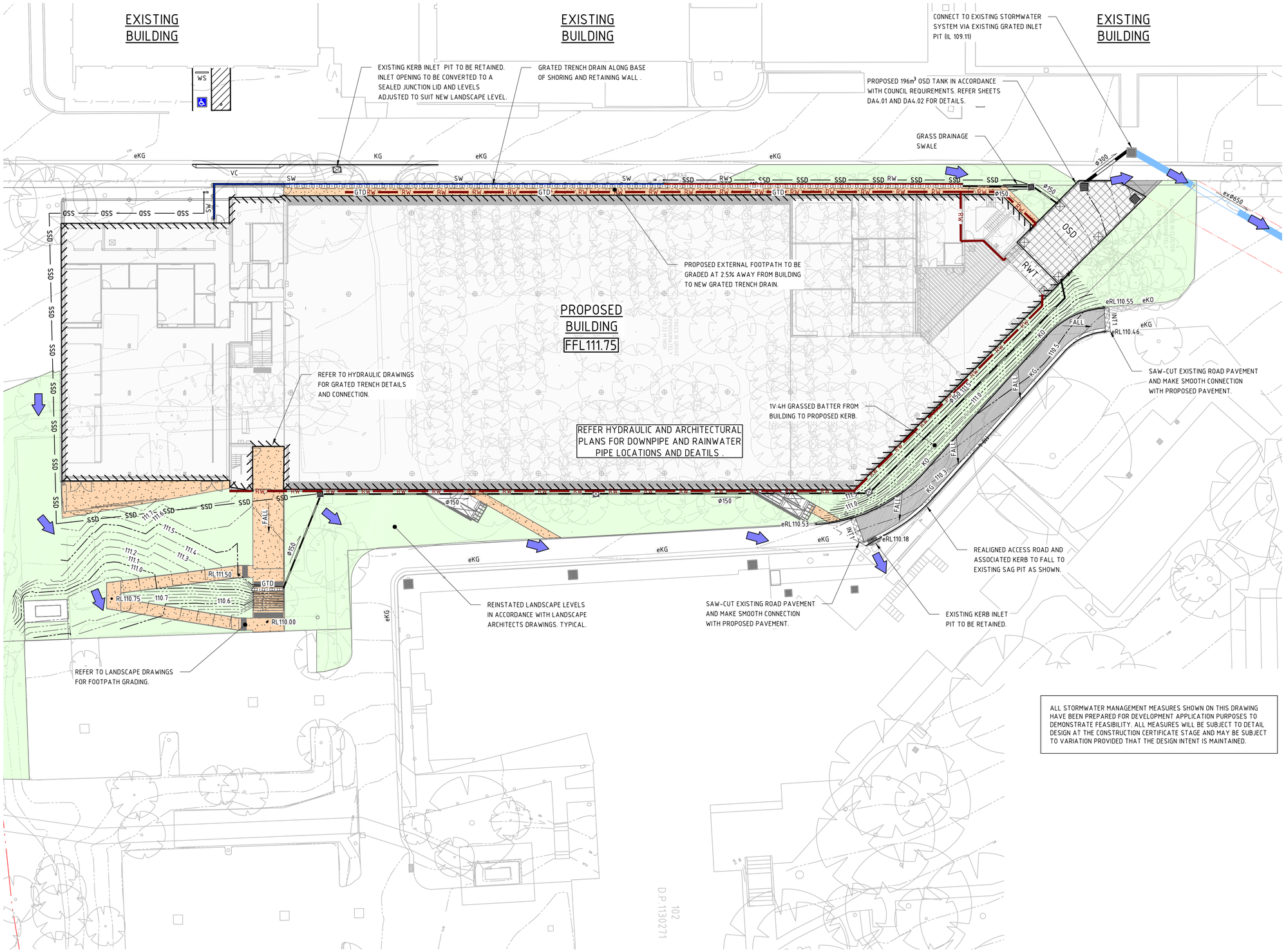

LEGEND

- BOUNDARY LINE
- EASEMENT LINE
- EXISTING CONTOURS (0.5m INTERVALS)
- PROPOSED CONTOURS (0.1m INTERVALS)
- EXISTING STORMWATER PIPE
- GRATED INLET PIT (NEW / EXTG)
- KERB INLET PIT (NEW / EXTG)
- STORMWATER PIT TAG STRUCTURE No / LINE ID
- STORMWATER PIPE
- OVERLAND FLOW
- RAINWATER PIPE - REFER TO HYDRAULIC DOCUMENTS FOR DETAILS
- SUBSOIL DRAINAGE LINE
- SUBSOIL DRAINAGE CLEAROUT
- GTD — 100mm WIDE PROPRIETARY GRATED TRENCH DRAIN
- DRAINAGE SWALE
- OSD — ON-SITE DETENTION TANK
- RWT — RAINWATER TANK - REFER TO HYDRAULIC DOCUMENTS FOR DETAILS
- eKG — EXISTING KERB AND GUTTER
- KG — PROPOSED KERB AND GUTTER
- RW — PROPOSED RETAINING WALL - REFER TO STRUCTURAL DOCUMENTS FOR DETAILS
- SW — PROPOSED SHORING WALL - REFER TO STRUCTURAL DOCUMENTS FOR DETAILS
- WS — PROPRIETARY WHEEL STOP
- FFLXX.XX — PROPOSED FINISHED FLOOR LEVEL
- INT1 — SAWCUT AND PAVEMENT INFILL
- PROPOSED ASPHALT PAVEMENT TYPE 1
- PROPOSED CONCRETE FOOTPATH PAVEMENT TYPE 2 - REFER TO LANDSCAPE DOCUMENTS FOR FINISHES.
- PROPOSED LANDSCAPING - REFER TO LANDSCAPE DOCUMENTS

ALL STORMWATER MANAGEMENT MEASURES SHOWN ON THIS DRAWING HAVE BEEN PREPARED FOR DEVELOPMENT APPLICATION PURPOSES TO DEMONSTRATE FEASIBILITY. ALL MEASURES WILL BE SUBJECT TO DETAIL DESIGN AT THE CONSTRUCTION CERTIFICATE STAGE AND MAY BE SUBJECT TO VARIATION PROVIDED THAT THE DESIGN INTENT IS MAINTAINED.

GENERAL NOTES

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH OTHER SUCH WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DIMENSIONS ARE IN MILLIMETRES & ALL LEVELS ARE IN METRES, UNO (UNLESS NOTED OTHERWISE).

NO DIMENSION SHALL BE OBTAINED BY SCALING THE DRAWINGS.

ALL LEVELS AND SETTING OUT DIMENSIONS SHOWN ON THE DRAWINGS SHALL BE CHECKED ON SITE PRIOR TO THE COMMENCEMENT OF THE WORK.

DETAIL SURVEY DATA WAS SUPPLIED BY YSCO GEOMATICS, DRAWING DATED DECEMBER 2018.

EXISTING SERVICES WHERE SHOWN HAVE BEEN PLOTTED FROM SUPPLIED DATA AND SUCH THEIR ACCURACY CAN NOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF WORK.

ON COMPLETION OF STORMWATER INSTALLATION, ALL DISTURBED AREAS MUST BE RESTORED TO ORIGINAL CONDITION, INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AND GRASSED AREAS AND ROAD PAVEMENTS, UNLESS DIRECTED OTHERWISE.

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1	ISSUED FOR CONCEPT COORDINATION	J.P		E.F	08.03.19
2	RE - ISSUED FOR CONCEPT COORDINATION	J.P		E.F	28.02.20
3	ISSUED FOR SSDA COORDINATION	E.F		E.F	26.06.20
4	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	24.07.20
5	ISSUED FOR SSDA	J.P		E.F	14.01.21

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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: SITEWORKS AND STORMWATER MANAGEMENT PLAN

JOB NUMBER: 181569

DRAWING NUMBER: DA3.01 REVISION: 5

DRAWING SHEET SIZE = A1

DRAWN: J.PHILLIPS DESIGNED: E.FLACK JOB MANAGER: E.FLACK VERIFIER: -

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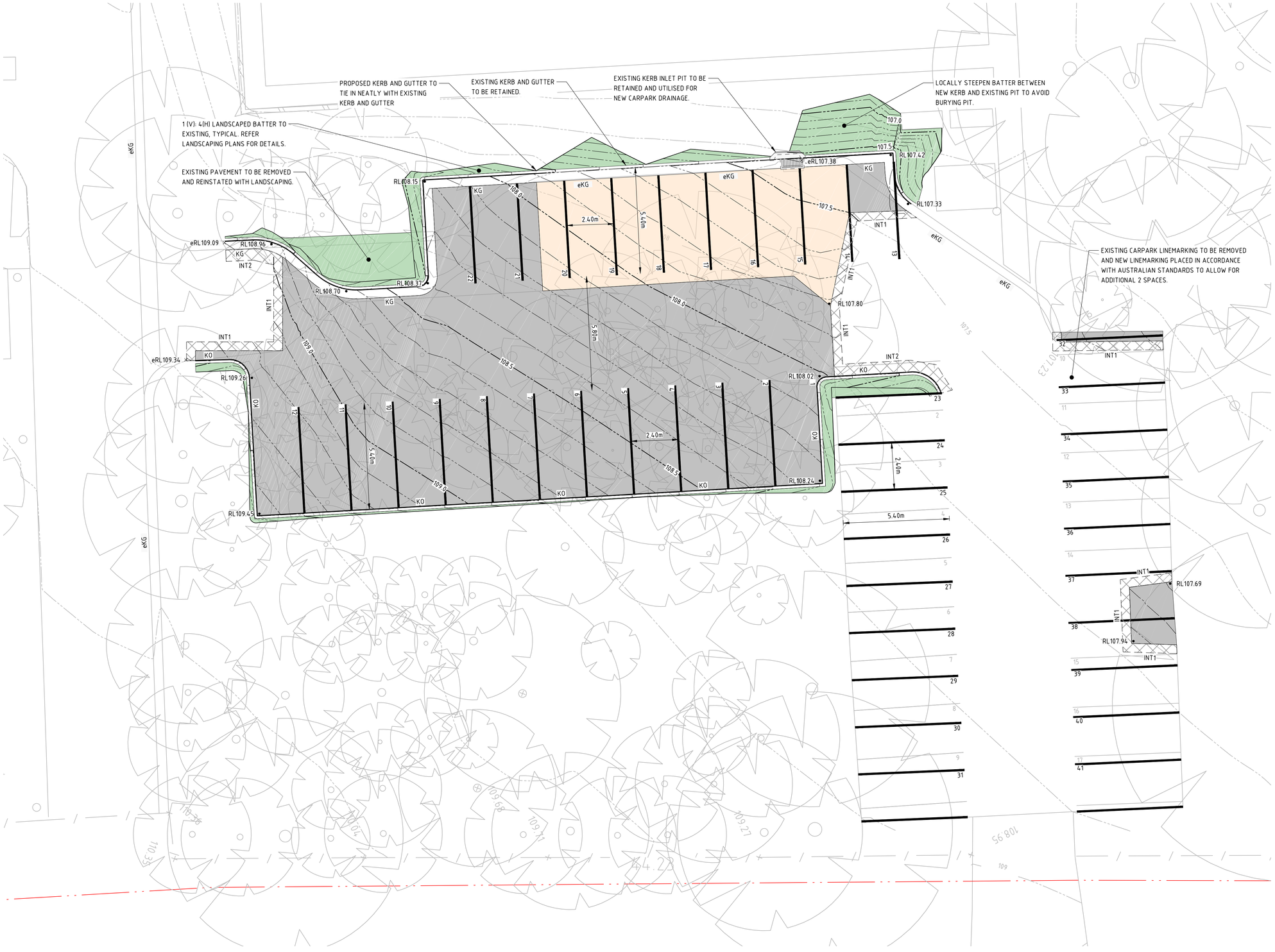

LEGEND

- BOUNDARY LINE
- EXISTING CONTOURS (0.5m INTERVALS)
- PROPOSED CONTOURS (0.1m INTERVALS)
- KERB INLET PIT (EXTG)
- eKG — EXISTING KERB AND GUTTER
- KG — PROPOSED KERB AND GUTTER
- KO — PROPOSED KERB ONLY
- × eRL.XX.XX — EXISTING SPOT HEIGHT
- • RL.XX.XX — PROPOSED SPOT HEIGHT
- PAVEMENT INTERFACE
- PROPOSED ASPHALT - PAVEMENT TYPE 1
- PROPOSED MILL AND RESHEET - PAVEMENT TYPE 2
- LANDSCAPING

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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: SITEWORKS AND STORMWATER MANGEMENT PLAN - SHEET 2

JOB NUMBER: 181569

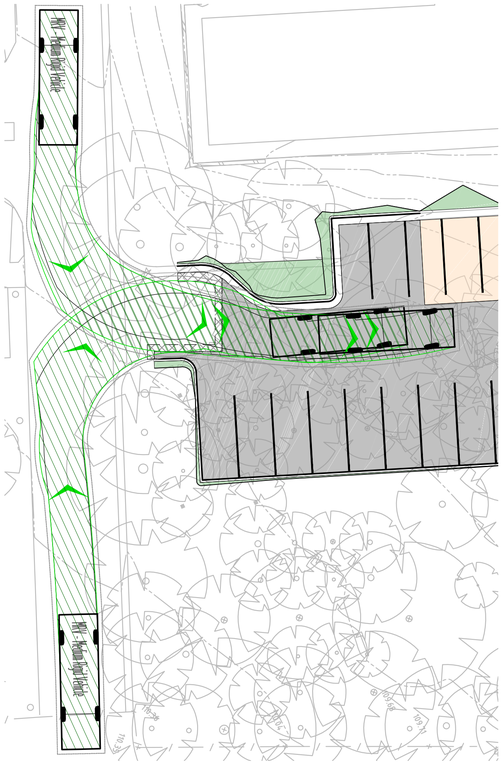
DRAWING NUMBER: DA3.02

REVISION: 4

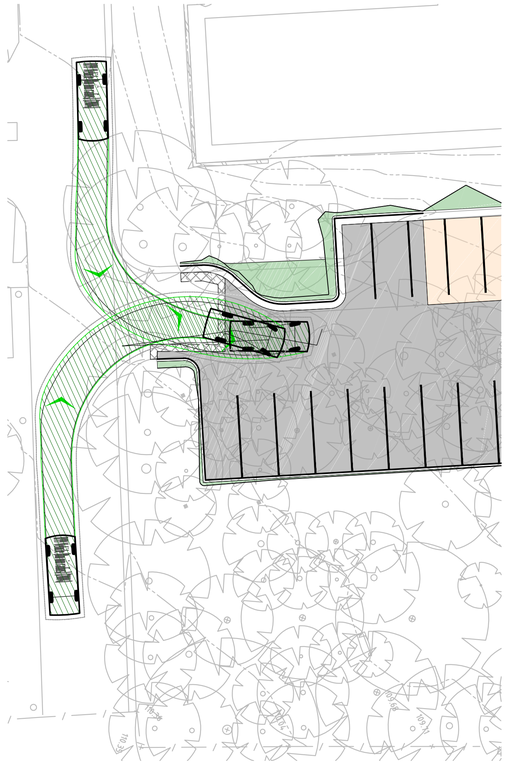
DRAWING SHEET SIZE = A1

DRAWN: J.PHILLIPS DESIGNED: E.FLACK JOB MANAGER: E.FLACK VERIFIER: -

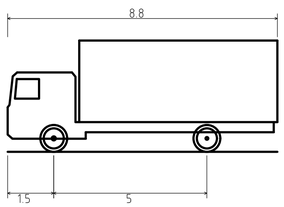
Date: 14-1-21 4:08pm Plotted By: jphillips Found: C:\Users\JPHILL~1\AppData\Local\Temp\AcPublish_25496\181569_DA3.02_SITEWORKS AND STORMWATER MANGEMENT PLAN - SHEET 2.dwg



MEDIUM RIGID VEHICLE
(MRV) TURNING PATHS

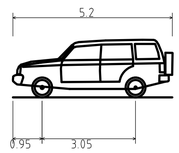


B99 VEHICLE
TURNING PATHS



MRV - Medium Rigid Vehicle

Overall Length	8.800m
Overall Width	2.500m
Overall Body Height	3.633m
Min Body Ground Clearance	0.428m
Track Width	2.500m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	10.000m



B99 Vehicle (8m min radius) (2004)

Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	1.878m
Min Body Ground Clearance	0.272m
Track Width	1.840m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	8.000m

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR SSDA COORDINATION	E.F		E.F	26.06.20
2	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	24.07.20
3	ISSUED FOR SSDA	J.P		E.F	14.01.21

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SCALE 1:100 @ A1 0 1 2 3 4 5m

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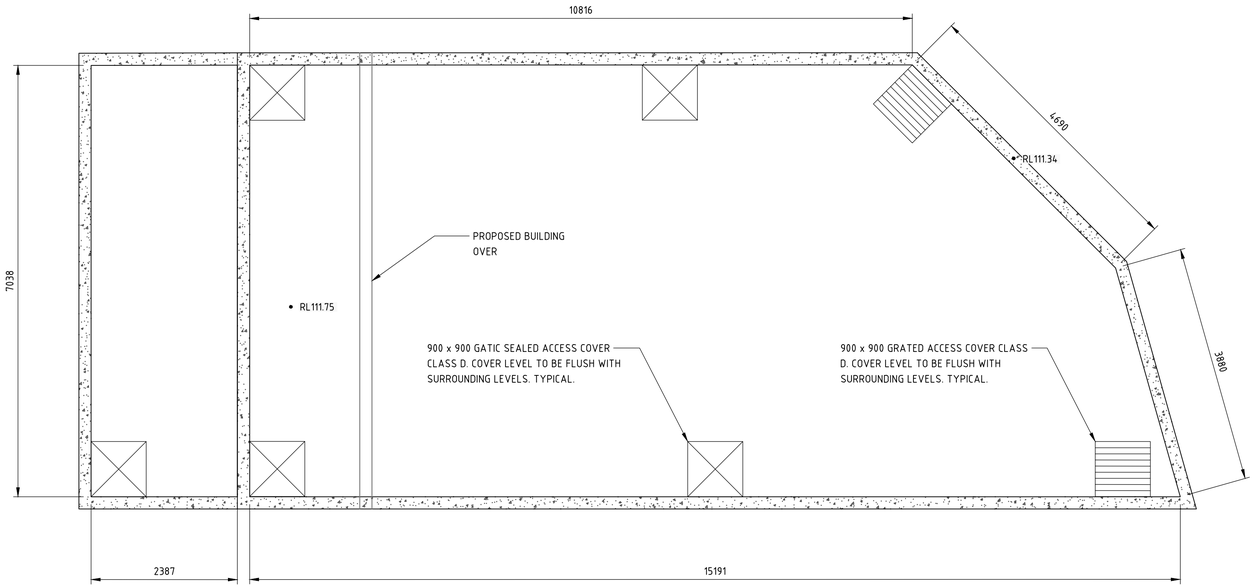
PROJECT
POWERHOUSE MUSEUM
DISCOVERY CENTRE

DRAWING TITLE
CARPARK TURNING PATHS

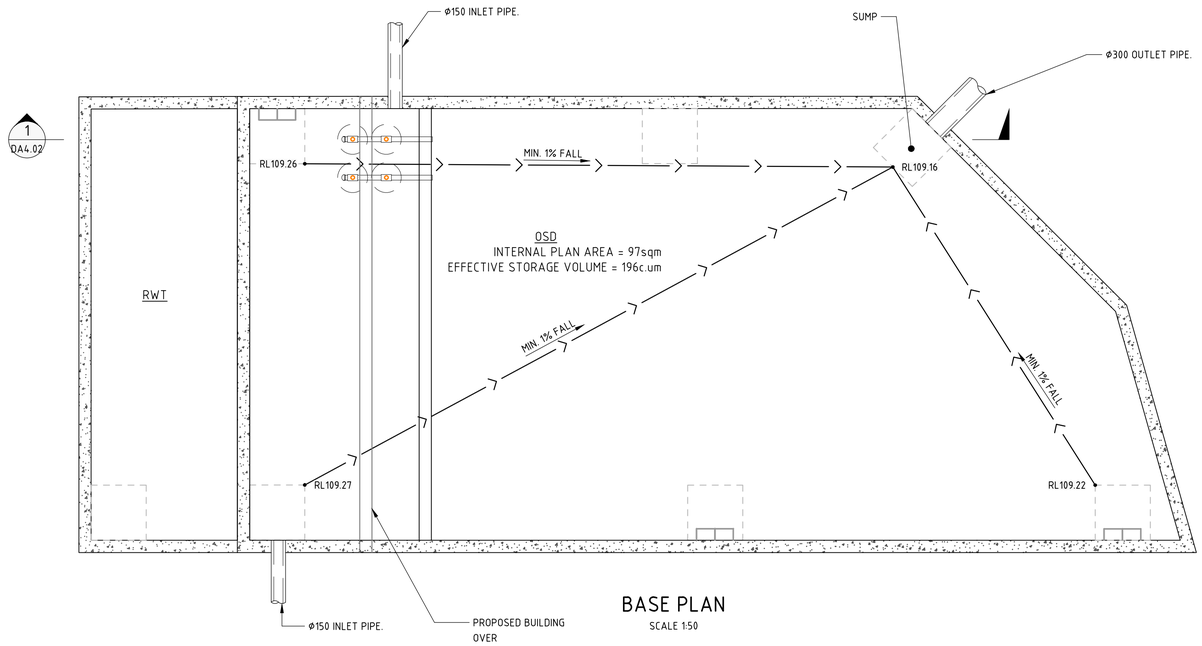
JOB NUMBER 181569
DRAWING NUMBER DA3.11
REVISION 3
DRAWING SHEET SIZE = A1

Date : 14-1-21 11:53am Plotted By: jphillips Found : W:\Jobs\2018\181569 - Powerhouse Museum\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\SSDA\181569_DA3.11_CARPARK TURNING PATHS.dwg



ROOF PLAN

SCALE 1:50



BASE PLAN

SCALE 1:50

DESIGN SUMMARY

CATCHMENT CALCULATIONS:

	PRE-DEVELOPMENT	POST-DEVELOPMENT
TOTAL AREA	4781m²	4781m²
IMPERVIOUS AREA	1080m² (23%)	4781m² (100%)
PERVIOUS AREA	3701m² (77%)	0m² (0%)

ON-SITE DETENTION:

DESIGN BASIS:
- COUNCIL GUIDELINES BASED ON UPPER PARRAMATTA RIVER CATCHMENT TRUST OSD HANDBOOK

AVERAGE SITE SLOPE = 5%

HAWKESBURY CATCHMENT STORAGE RATE = 396m³/ha

THEREFORE SITE STORAGE REQUIREMENT = 190m³
ON-SITE DETENTION STORAGE PROVIDED = 196m³

HAWKESBURY CATCHMENT DISCHARGE RATE = 92L/s/ha

THEREFORE PERMITTED SITE DISCHARGE = 44L/s

ON-SITE DETENTION SUMMARY:
- BELOW GROUND BLOCK WORK TANK

ORIFICE DIAMETER ORIGINALLY CALCULATED USING THE UPRCT METHOD, THEN ASSESSED AND ADJUSTED USING DRAINS MODELLING SOFTWARE TO ACCOUNT FOR THE DOWNSTREAM TAIL WATER LEVEL (109.80), ENSURING COMPLIANCE WITH THE PSD.

TOP WATER LEVEL = 111.15
ORIFICE CENTRELINE = 109.31
ORIFICE DIAMETER = 125mm

SITE DISCHARGE CALCULATIONS:

	10 YEAR ARI	100 YEAR ARI
WITHOUT OSD	180 L/s	277 L/s
WITH OSD	30 L/s	40 L/s

WATER QUALITY:

MUSIC MODEL SUMMARY:

SOURCE NODE	CATCHMENT	AREA
URBAN	ROOF AREA 1	4380m²
URBAN	PAVED AREA 1	87m²
URBAN	PAVED AREA 2	314m²
		TOTAL 4781m²

TREATMENT NODES:

- RAINWATER RE-USE TANK
- ON-SITE DETENTION TANK
- OCEAN PROTECT 'STORMFILTER 690mm PSorb' x4
- OCEAN PROTECT 'OCEAN GUARD' x2

TREATMENT STANDARDS:

POLLUTANT	REDUCTION STANDARDS	REDUCTION ACHIEVED
GROSS POLLUTANTS	90%	100%
TOTAL SUSPENDED SOLIDS	80%	80.8%
TOTAL PHOSPHORUS	60%	67.3%
TOTAL NITROGEN	45%	51.3%

MUSIC MODEL PARAMETERS IN ACCORDANCE WITH THE NSW MUSIC MODELLING GUIDELINES REF: R.B17048.001.05 DATED AUGUST 2015.

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DESIGNED: E.FLACK
JOB MANAGER: E.FLACK
VERIFIER: -

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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: OSD DETAILS - SHEET 1

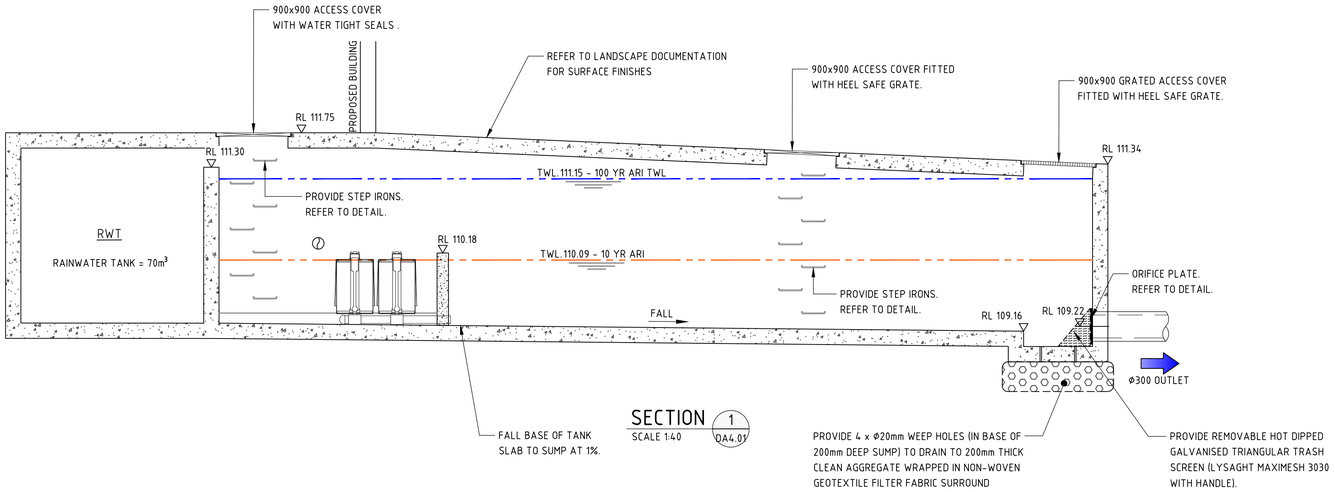
JOB NUMBER: 181569

DRAWING NUMBER: DA4.01

REVISION: 3

DRAWING SHEET SIZE = A1

Date: 14-1-21 3:58pm Plotted By: jphillips Found: W:\Mjobs\2018\181569 - Powerhouse Museum\0-Drawings\0-Northrop\C-CIVIL\2-CURRENT CAD FILES\SSDA\181569_DA4.01_OSD DETAILS - SHEET 1.dwg



SECTION 1 DA4.01
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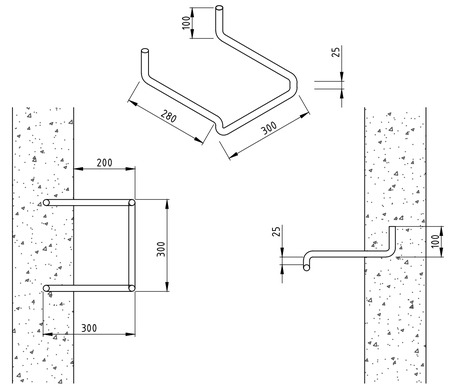
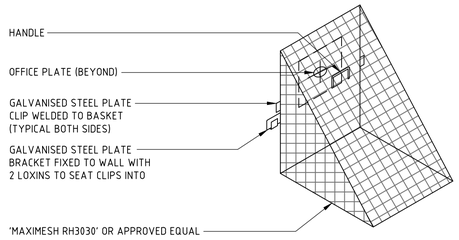
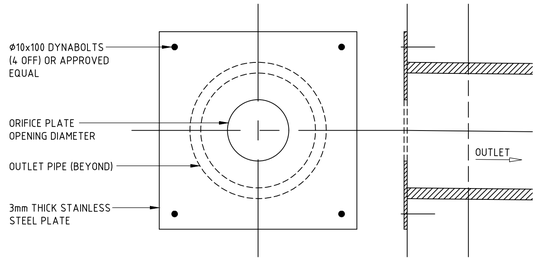


STEP IRON DETAIL

STEP IRON OF 20mm GALVANISED STEEL MADE TO SHAPE AND DIMENSIONS AS SHOWN, PLACED AT 300 CENTRES AND STAGGERED HORIZONTALLY FOR ALL PITS DEEPER THAN 1.0m. THE USE OF PROPRIETARY STEP IRONS ARE ACCEPTABLE PROVIDED THE PRODUCT IS IN ACCORDANCE WITH AUSTRALIAN STANDARDS



TRASH SCREEN DETAIL



ORIFICE PLATE DETAIL

- ORIFICE PLATE - Φ 125mm

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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2	RE - ISSUED FOR SSDA COORDINATION	J.P		E.F	24.07.20
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PROJECT: POWERHOUSE MUSEUM DISCOVERY CENTRE

DRAWING TITLE: OSD DETAILS - SHEET 2

JOB NUMBER: 181569

DRAWING NUMBER: DA4.02 REVISION: 3

DRAWING SHEET SIZE = A1

Date: 14-1-21 3:59pm Plotted By: jphillips Found: W:\Mjobs\2018\181569 - Powerhouse Museum\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\SSDA\181569_DA4.02_OSD DETAILS - SHEET 2.dwg