

WSU – Indigenous Centre of Excellence

171 Victoria Road, Parramatta

Stormwater SSD Report

State Significant Development No. 64916225

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For Western Sydney University

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1.0 Executive Summary

This report addresses the SEARs requirements related to stormwater with respect to the proposed Indigenous Centre of Excellence State Significant Development Application (SSDA) at Western Sydney University Parramatta Campus.

Stormwater

Stormwater will be collected on site, conveyed and discharged to the existing Council drainage network. City of Parramatta's Development Control Plan (DCP) requires stormwater runoff from the site to be restricted to 40 L/s/ha in the 1.5-year ARI event and 190 L/s/ha in the 100-year ARI event. The new development has a proposed catchment area of 1.0 ha which results in allowable discharges of 40 L/s and 190 L/s in the 1.5-year ARI and 100-year ARI events respectively. On-site detention (OSD) is proposed to meet the site permissible discharge requirements with a total volume of 415 m³, via OSD tanks and a constructed wetland.

Water quality pollution reduction targets as per the City of Parramatta DCP are 90% gross pollutants, 85% total suspended solids, 65% total phosphorus, 45% total nitrogen. Water sensitive urban design (WSUD) elements included within the proposed development include a rainwater harvesting tank, swales and a wetland.

Flooding

The site is subject to flooding due to its proximity to the Vineyard Creek on the northern side of the Parramatta River. Flood modelling has been undertaken by GRC Hydro confirming a 1% AEP flood level of 8.3 mAHD for the proposed condition. The Flood Planning Level (FPL) for this development which includes 0.5 m of freeboard on top of the 1% AEP flood level is 8.8 mAHD. The proposed building has a finished floor level of 9.0 mAHD which provides an additional 0.2m of freeboard which is a key risk mitigation measure for the proposed development.

Site levels will be set to minimise net fill to retain flood storage and to not obstruct conveyance of flood water across the site. This ensures the development will not adversely impact upstream and downstream assets and watercourses.

Existing Utility Infrastructure

There are existing authority stormwater and sewer services traversing the new building and wetland. It is proposed to divert both services in accordance with authorities requirements.

2.0 Introduction

This report will address the SEARS stormwater requirements in relation to the Western Sydney University (WSU) – Indigenous Centre of Excellence (ICoE) development. The relevant requirements of City of Parramatta's Development Control Plan (DCP) and engineering specifications are also referenced.

2.1 Existing Site

The site is located on the northern boundary of the WSU Parramatta Campus, which is an existing carpark. It is located at 171 Victoria Road, Parramatta. The site is bounded by Victoria Road to the north, Fifth Street to the south, Railway Street to the East, and Bridge Street to the west (Figure 1).

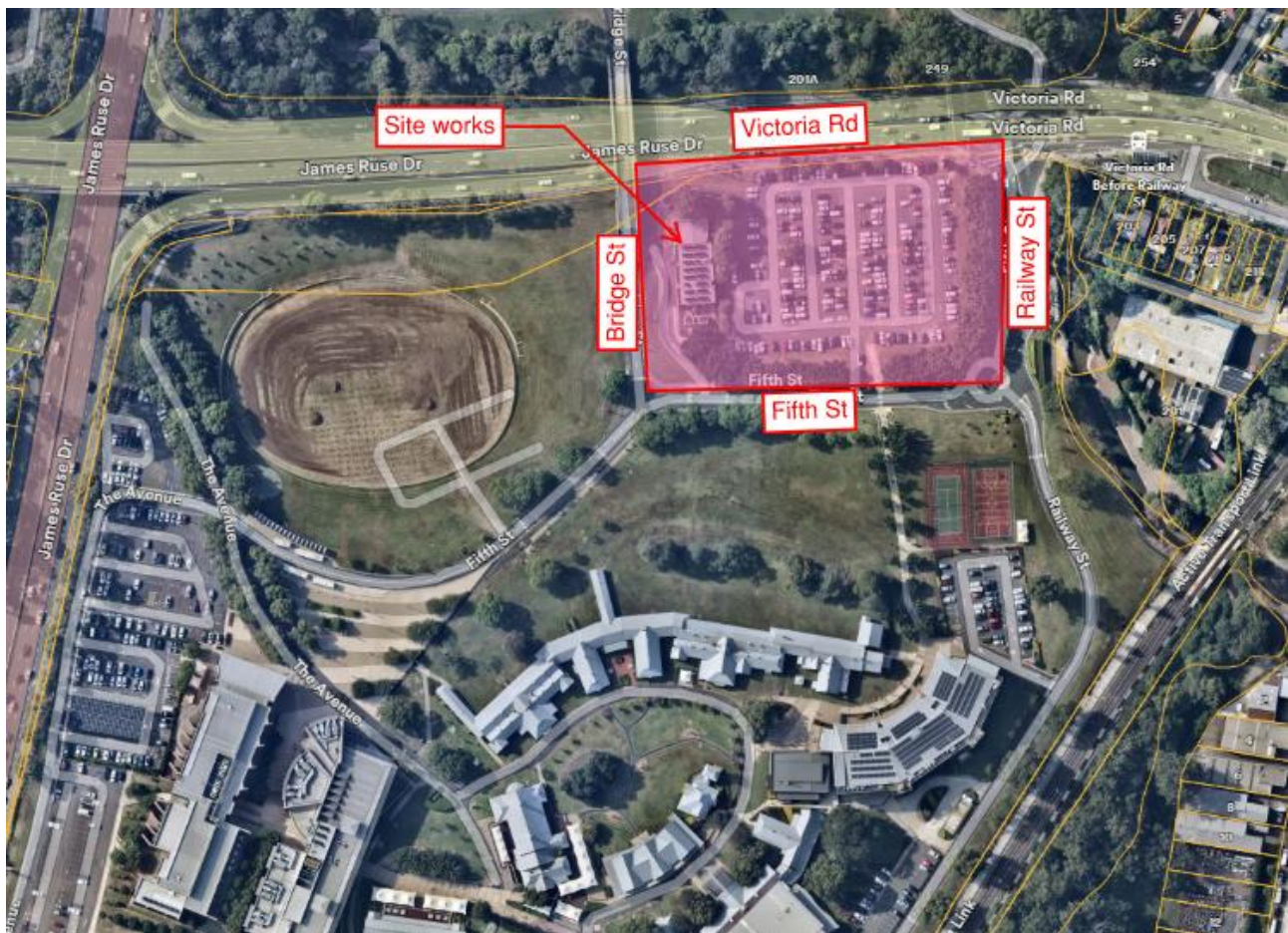


Figure 1 - Site location.

2.2 Existing Council Stormwater Network

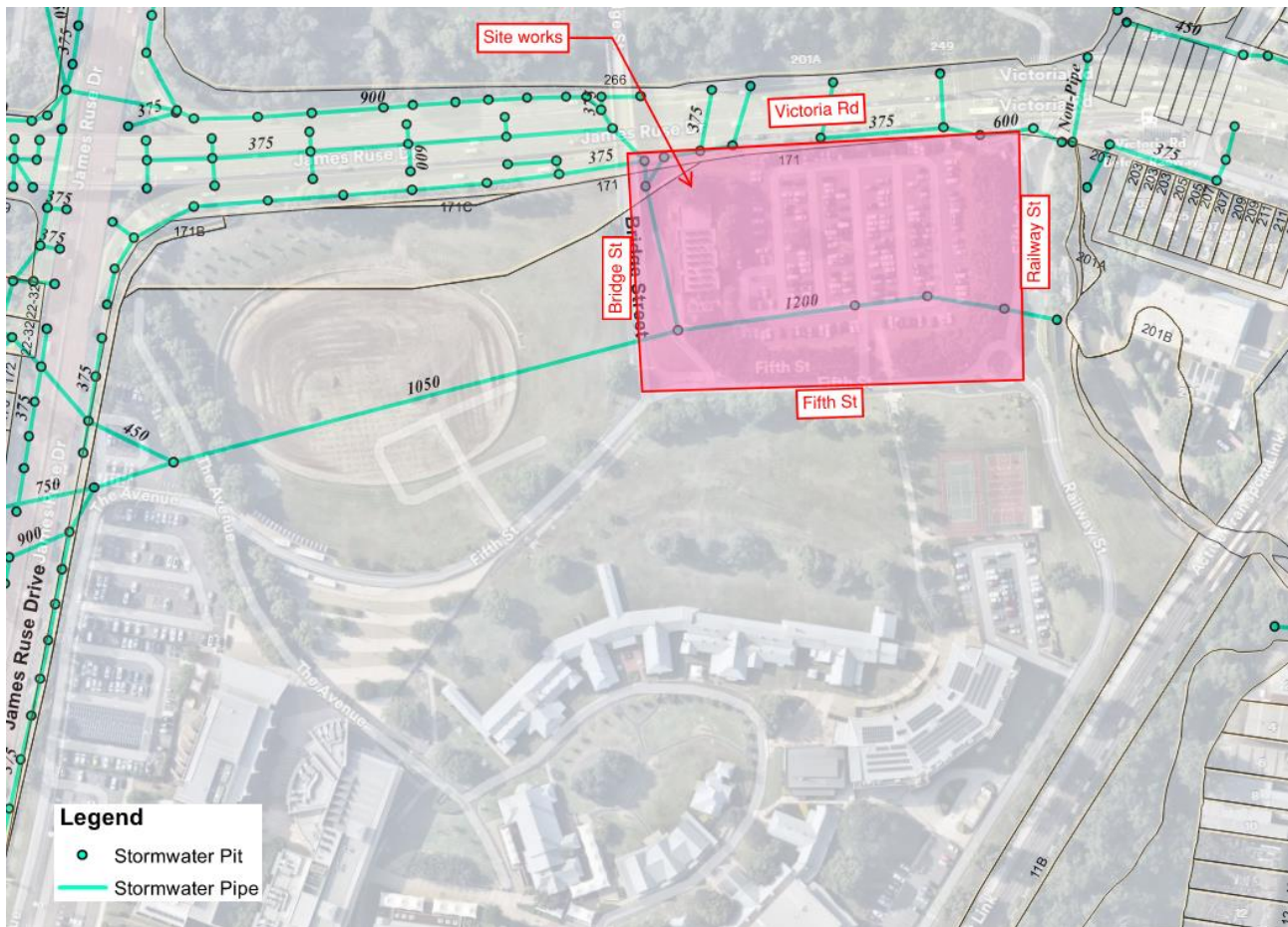


Figure 2 - City of Parramatta Council stormwater drainage system diagram.

The City of Parramatta Council Stormwater Drainage System Diagram (Figure 2) indicates that there is Council stormwater drainage network on the northern (Victoria Road) and western (Bridge Street) boundaries of the site, and a 1200dia pipe network through the site in the east-west direction discharging into Vineyard Creek.

2.3 Proposed Works

The proposed development includes construction of a four-storey building including car park, landscaping and associated infrastructure.

The proposed civil works component of the wider SSDA proposal comprise:

- New stormwater collection and treatment;
- Flood mitigation;
- New pavements;
- Coordination with existing services;
- Coordination with the flood planning levels which impact the site; and
- Compliance with Development Control Plan (DCP) requirements.

2.4 SEARS Requirements

The development falls under a State Significant Development (SSD) application (SSD No. 64916225). The stormwater related requirements for tertiary institutions required as part of the Industry Specific Planning Secretary's Environmental Assessment Requirements (SEARS) are included in Table 1 below. These requirements are addressed in the following sections to support the SSD submission.

Table 1 - Industry specific (tertiary institutions) SEARS.

| SEARS Requirements | Refer Section |
|--|--|
| 13. Ground and Water Conditions | |
| Provide a Surface and Groundwater Impact Assessment that assesses potential impacts on surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses. | 3.0 Stormwater Management 4.0 Flooding Risk |
| 14. Water Management | |
| Provide an Integrated Water Management Plan for the development that: <ul style="list-style-type: none"> Is prepared in consultation with the local council and any other relevant drainage or water authority. Details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality measures, and the nominated discharge points. Demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse impacts. | 3.0 Stormwater Management |
| Where drainage infrastructure works are required that would be handed over to local council, or other water drainage authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority. | 3.0 Stormwater Management Appendix A - Civil Drawings |
| 22. Infrastructure Requirements and Utilities | |
| In consultation with relevant service providers: <ul style="list-style-type: none"> Assess the impacts of the development on existing utility infrastructure and service provider assets surrounding the site. | 5.0 Existing Utility Infrastructure |

2.5 Guidance documents

The following documents have been reviewed and referenced in preparing this report:

- City of Parramatta (CoP) Development Control Plan (DCP) 2023;
- CoP Development Engineering Design Guidelines 2018;
- CoP Storm Water Disposal;

- Upper Parramatta River Catchment Trust (UPRCT) On-site Stormwater Detention Handbook Fourth Edition December 2005;
- AS3500.3 Plumbing and Drainage Part 3
- Australian Rainfall and Runoff 2019; and
- Blue Book – Managing Urban Stormwater Soils and Construction (Landcom NSW);

3.0 Stormwater Management

3.1 Stormwater Quantity

Stormwater quantity controls are outlined in the City of Parramatta Storm Water Disposal. Stormwater discharge is to replicate pre-development flows where appropriate and is to be conveyed primarily through the street network in accordance with Council's Water Sensitive Urban Design Development Control Plan.

Stormwater flows are to be conveyed around site using site grading, surface inlet pits (SIP's) and in-ground pipes. Overland flow will be directed to inlet pits with exceedance flows directed safely through to the eastern side of the site. Roof catchments are to be collected through the use of gutters and downpipes directed to the rainwater harvesting tank for reuse.

Stormwater detention will be included as per Council requirements. OSD requirements for the site are covered in the following section.

3.1.1 Onsite Stormwater Detention (OSD)

CoP Development Control Plan demonstrated that OSD must be designed in accordance with either 3rd or 4th edition of the Upper Parramatta River Catchment Trust (UPRCT) OSD Handbook. All OSD systems shall be designed with consideration to the major/minor system design principle in Australian Rainfall & Runoff.

The map from CoP Engineer Design Guidelines shown in Figure 3 below outlines the 10 separate catchments in City of Parramatta LGA. WSU falls into 'Vineyard Creek' catchment.



Figure 3 - OSD catchments of former Parramatta City Council area.

OSD is to be designed in line with the Council OSD requirement outlined in UPRCT OSD Handbook and provided below.

Table 2 - City of Parramatta OSD storage requirements.

| Catchment | SRD_L (L/s/ha) | SSR_L (m³/ha) | SRD_U (L/s/ha) | SSR_T (m³/ha) |
|--|-------------------------------------|---|-------------------------------------|---|
| Toongabbie Creek & Brickfield Creek | 40 | 300 | 150 | 455 |
| Clay Cliff Creek | 40 | 246 | 150 | 396 |
| Vineyard Creek | 40 | 262 | 150 | 415 |
| A'Becketts Creek | 40 | 278 | 150 | 432 |
| Duck Creek | 40 | 285 | 150 | 439 |
| Subiaco Creek | 40 | 284 | 150 | 438 |
| Terry's Creek | 40 | 233 | 150 | 382 |
| Devlin's Creek | 40 | 224 | 150 | 371 |
| Parramatta River (South side) | 40 | 212 | 150 | 358 |
| Parramatta River North side (Charles Street to Vineyard Creek) | 40 | 190 | 150 | 334 |
| Parramatta River North side (East of Vineyard Creek) | 40 | 245 | 150 | 396 |

Stormwater design of the proposed development will therefore be restricted to the following discharge:

- 40 L/s/ha Site Reference Discharge from primary outlet.
- 150 L/s/ha Site Reference Discharge from secondary outlet.
- The minimum OSD storage is 415 m³/ha during the 100-year ARI.
- As the new development has a catchment of approximate 1.0 ha, the following parameters are to define the stormwater design of site:

Table 3 - Discharge and storage requirements for the proposed development.

| Storm Event | Required Discharge (L/sec) | Minimum Storage Volume (m³) |
|--------------------|---|---|
| ▪ 50% AEP | ▪ 40 | ▪ 262 |
| ▪ 1% AEP | ▪ 190 (40 from primary outlet, 150 from secondary outlet) | ▪ 415 |

The proposed stormwater network of the site has been modelled using the program DRAINS in line with requirements outlined in the UPRCT OSD Handbook. The model used alongside annotations for both the 50% AEP and 1% AEP events is provided in Figure 4 below.

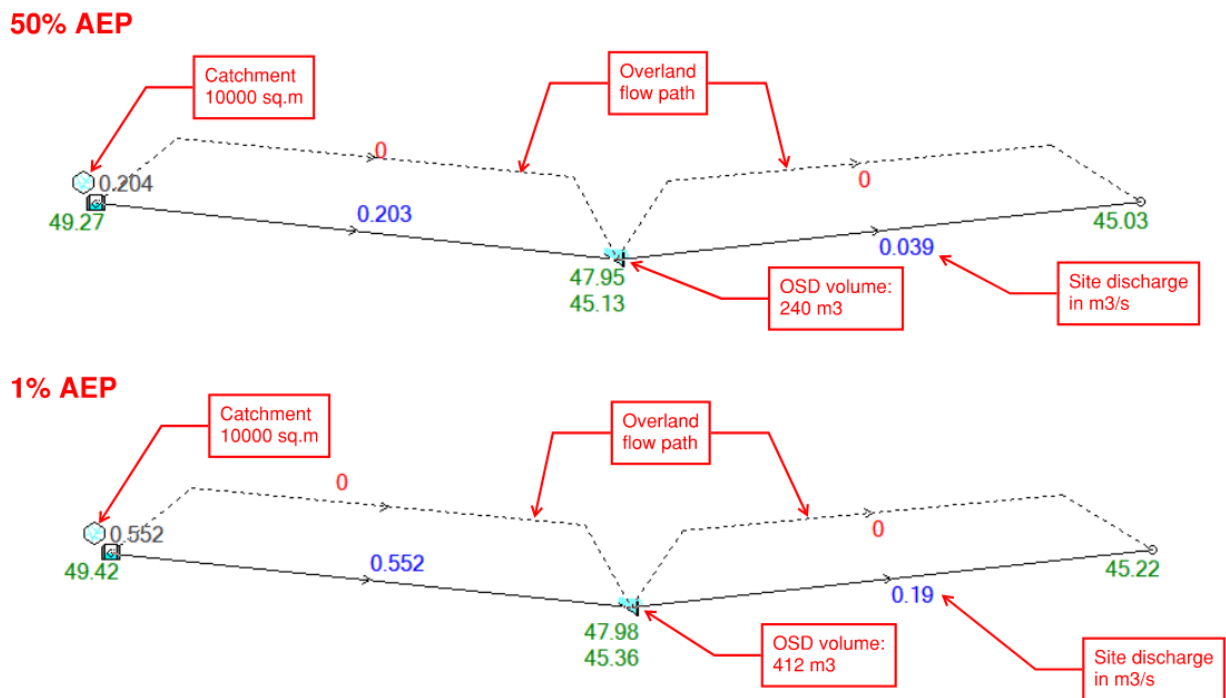


Figure 4 - DRAINS model detailing 50% AEP (top) and 1% AEP (bottom) stormwater flows leaving site.

Stormwater flows generated from site catchments are to be conveyed to the OSD before discharging to Council stormwater drainage network. Design of OSD is to comply with details listed in section 3.5 from Upper Parramatta River Catchment Trust On-Site Detention Handbook.

A summary of site discharge and OSD storage volume requirements is as follows:

Table 4 - Proposed OSD site discharge and storage volumes

| Storm Event | Orifice Size (mm) | Site Discharge (L/sec) | Storage Volume (m³) |
|-------------|-------------------|------------------------|---------------------|
| ▪ 50% AEP | ▪ 135 | ▪ 39 | ▪ 240 |
| ▪ 1% AEP | ▪ 290 | ▪ 190 | ▪ 412 |

Noted the OSD storage volumes incorporate the climate change rainfall factor as described in Section 3.1.2.

As the storage volume is lower than the required volume, a detention volume of 415 m³ is proposed.

A constructed wetland with detention volume of approximately 200 m³ is proposed to attenuate stormwater and serve as a water sensitive urban design (WSUD) treatment device. WSUD is covered in Section 3.2.1.

The remaining OSD volume will be captured by two separate OSD tanks for the loading bay and roof catchments respectively as demonstrated in civil works site plan in Appendix A.

3.1.2 Climate Change

A climate change factor of RCP 8.5 for 2070 was used for the design of the stormwater system which resulted in using a rainfall multiplier of 14.2%.

3.2 Stormwater Quality

Stormwater quality treatment is required to comply with the requirements outlined in Table 5.1.2.2 of the Parramatta Development Control Plan 2023 Part 5 Environmental Management. Water quality treatment devices on site must therefore achieve the water quality targets outlined in Table 5 below.

Table 5 - Required Pollution Reduction Targets for City of Parramatta Council.

Table 5.1.2.2 – Water Pollution reduction targets

| Parameter | Water pollution reduction targets |
|--|---|
| Gross Pollutants | 90% Reduction in the post development mean annual load of total gross pollutants load (greater than 5mm). |
| Total Suspended Solids | 85% reduction in the post development mean annual load of Total Suspended Solids (TSS). |
| Total Phosphorus | 65% reduction in the post development mean annual load of Total Phosphorus (TP). |
| Total Nitrogen | 45% reduction in the post development mean annual load of Total Nitrogen (TN). |
| Hydrocarbons, motor oils, oil and grease | 90% reduction in the post development mean annual load of hydrocarbons, oils, and grease. |

3.2.1 Water Sensitive Urban Design

Design and modelling of Water Sensitive Urban Design (WSUD) elements has been undertaken by E2. To achieve the reduction targets, the WSUD initiatives nominated includes the following:

- a. Rainwater Tank (RWHT)

A 100kL rainwater harvesting tank is proposed to collect roof runoff from the new building. Water collected in the RWHT will be used for toilet flushing and irrigation.
- b. Swale

1.5 m wide swale rock lined with ephemeral species planting is proposed to capture runoff from the building and landscape areas. The swale treats and conveys stormwater into the constructed wetland.
- c. Wetland

An approximately 350 m² wetland is incorporated southeast of the site, corner of Railway Street and Fifth Street. The inlet pond helps with removing coarse sediment while the plants in the macrophyte zone further removes fine particles and dissolved pollutants.

3.3 Construction Phase – Erosion and Sediment Control

During the construction stage of the project, an erosion and sediment control plan is to be implemented to prevent sediment laden stormwater from flowing into adjoining properties, landscape, roadways or receiving water bodies. Stormwater control onsite will be detailed in erosion and sediment control plans which will be in accordance with relevant regulatory authority guidelines including NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book").

4.0 Flooding Risk

A flood impact assessment has been done by GRC hydro, which indicates that the site is subject to flooding due to its proximity to the Vineyard Creek on the northern side of the Parramatta River. Flood modelling results indicate the 1% AEP and PMF flood levels of 8.3 mAHD and 10.4 mAHD respectively. The Flood Planning Level (FPL) for this development which includes 0.5 m of freeboard on top of the 1% AEP flood level is 8.8 mAHD. The proposed building has a finished floor level of 9.0 mAHD which provides an additional 0.2m of freeboard which is a key risk mitigation measure for the proposed development.

Additionally, site levels have been set to be close to existing levels to retain flood storage. The building will be suspended allowing floodwaters to pass through under the building to mitigate impacts to flood storage and conveyance of flows.

5.0 Existing Utility Infrastructure

An existing 1200dia Council stormwater drain traverses through the site in an east-west direction without a formal easement and sits within the footprint of the proposed building and wetland. This stormwater drain is proposed to be diverted to the south of the building footprint to comply with Council's Development Engineering Design Guidelines Section 4.6 and advice that Council does not normally allow buildings to be constructed over existing stormwater drainage pipes. The details of the diversion in terms of drain alignment, invert levels and hydraulic performance will be formalised post-lodgement. The proposed realignment is detailed in the civil works site plan in Appendix A.

Pre-lodgement consultation has occurred with Council and their engineering team were not present to provide input.

Additionally, there is an existing Sydney Water sewer drain that services Western Sydney University that also runs under the footprint of the proposed building and wetland.

It is recommended that both stormwater and sewer pipes undergo CCTV inspection and the option to relocate the line to not conflict with site amenities is progressed. This will mitigate any conflicts with the building foundations and WSUD devices.

6.0 Conclusion

The following summarises the response to SEARS 13. Ground and Water Conditions:

- The proposed building has a finished floor level of 9.0 mAHD, which provides a total 0.7 m of freeboard on top of the 1% AEP flood level to mitigate flood risk.
- Site levels will be set to minimise net fill to retain flood storage to not obstruct conveyance of flood water across the site and to not adversely impact both upstream and downstream watercourses.
- Refer to Appendix A for cut and fill plan.

The following summaries the response to SEAR 14. Water Management:

- OSD of total volume of 415 m³ is proposed to attenuate stormwater discharge to Council's requirements. This will be achieved with two OSD tanks and a constructed wetland.
- WSUD elements include a rainwater harvesting tank, swales and a wetland.
- Proposed discharge points are to the retained section of the Council drain located on the eastern boundary and to the existing Council grated pit at the north-west corner of the site.
- Refer to Appendix A for civil works site plan.

The following summaries the response to SEAR 22. Infrastructure and Utilities:

- The existing 1200mm diameter stormwater drain will be diverted around the building footprint as per civil works site plan which details the proposed realignment.

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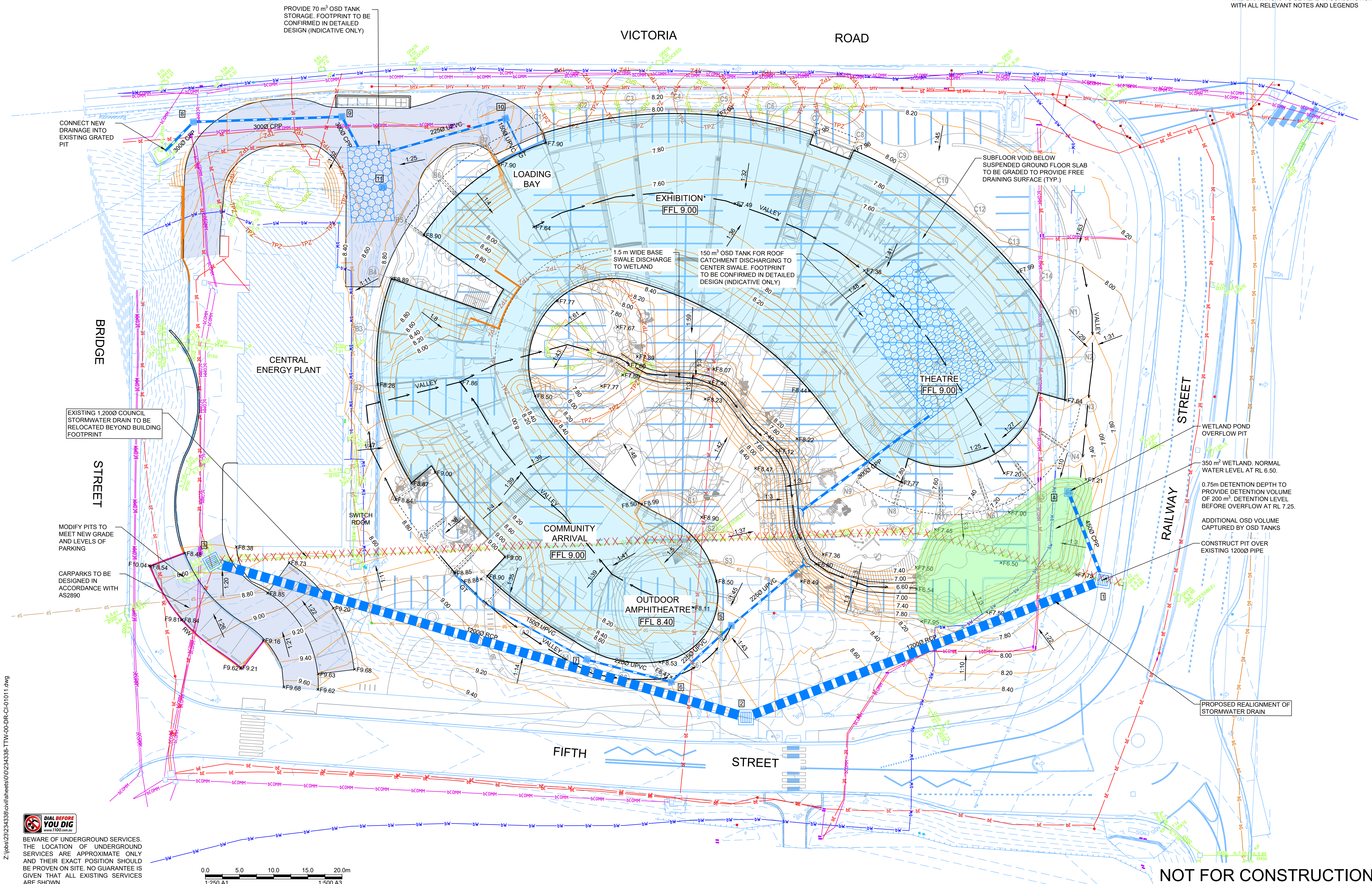
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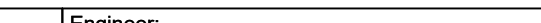
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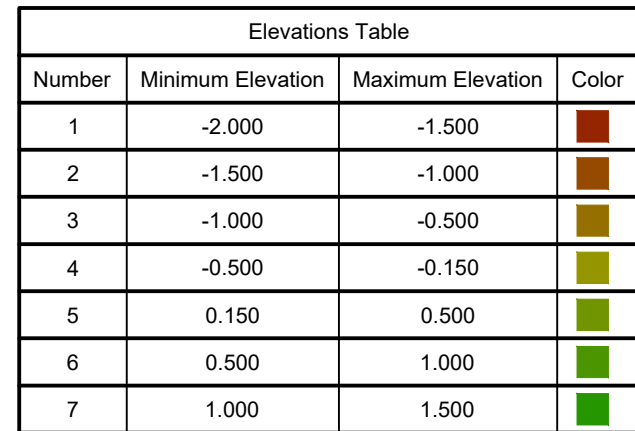
EARTHWORKS CUT AND FILL VOLUMES PLAN

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NOT FOR CONSTRUCTION

[illegible]

Appendix A

Civil Drawings



GENERAL
234338-TTW-00-DR-CI-00001
234338-TTW-00-DR-CI-00002
234338-TTW-00-DR-CI-00003

CIVIL WORKS
234338-TTW-00-DR-CI-01011

EARTHWORKS
234338-TTW-00-DR-CI-02011

EARTHWORKS CUT AND FILL VOLUMES PLAN

[illegible]

GENERAL NOTES

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING AND ARCHITECTURAL DRAWINGS.
2. ANY OBSERVED DISCREPANCY IS TO BE REFERRED TO THE SUPERINTENDENT PRIOR TO COMMENCING WORKS.
3. THESE DRAWINGS SHALL ALSO BE READ IN CONJUNCTION WITH THE CIVIL SPECIFICATION.
4. DO NOT SCALE FROM THE DRAWINGS.
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL LEVELS ARE EXPRESSED TO THE AUSTRALIAN HEIGHT DATUM (AHD).
7. THE CONTRACTOR SHALL SEEK APPROVAL FROM THE **SUPERINTENDENT** FOR ANY SUBSTITUTIONS OF PRODUCTS AND MATERIALS NOTED IN THE DRAWINGS.

SURVEY AND SERVICES INFORMATION

SURVEY

ORIGIN OF LEVELS : CONTACT THE SURVEYOR

DATUM OF LEVELS: CONTACT THE SURVEYOR

COORDINATE SYSTEM: MGA 2020

SURVEY PREPARED BY : LTS

SETOUT POINTS: CONTACT THE SURVEYOR

TTW DOES NOT GUARANTEE THAT THE SURVEY INFORMATION SHOWN ON THESE DRAWINGS IS ACCURATE AND WILL ACCEPT NO LIABILITY FOR ANY INACCURACIES IN THE SURVEY INFORMATION PROVIDED TO US FROM ANY CAUSE WHATSOEVER.

THE CONTRACTOR IS TO GET APPROVAL FROM THE RELEVANT STATE SURVEY DEPARTMENT, TO REMOVE/ADJUST ANY SURVEY MARK. THIS INCLUDES BUT IS NOT LIMITED TO; STATE SURVEY MARKS (SSM), PERMANENT MARKS (PM), CADASTRAL REFERENCE MARKS OR ANY OTHER SURVEY MARK WHICH IS TO BE REMOVED OR ADJUSTED IN ANY WAY.

TTW PLANS DO NOT INDICATE THE PRESENCE OF ANY SURVEY MARK. THE CONTRACTOR IS TO UNDERTAKE THEIR OWN SEARCH.

UNDERGROUND SERVICES - WARNING

THE LOCATIONS OF UNDERGROUND SERVICES SHOWN ON TTW'S DRAWINGS HAVE BEEN PLOTTED FROM DIAGRAMS PROVIDED BY SERVICE AUTHORITIES. THIS INFORMATION HAS BEEN PREPARED SOLELY FOR THE AUTHORITIES OWN USE AND MAY NOT NECESSARILY BE UPDATED OR ACCURATE.

THE POSITION OF SERVICES AS RECORDED BY THE AUTHORITY AT THE TIME OF INSTALLATION MAY NOT REFLECT CHANGES IN THE PHYSICAL ENVIRONMENT SUBSEQUENT TO INSTALLATION.

TTW DOES NOT GUARANTEE THAT THE SERVICES INFORMATION SHOWN ON THESE DRAWINGS SHOWS MORE THAN THE PRESENCE OR ABSENCE OF SERVICES, AND WILL ACCEPT NO LIABILITY FOR INACCURACIES IN THE SERVICES INFORMATION SHOWN FROM ANY CAUSE WHATSOEVER.

THE CONTRACTOR MUST CONFIRM THE EXACT LOCATION AND EXTENT OF SERVICES PRIOR TO CONSTRUCTION AND NOTIFY ANY CONFLICT WITH THE DRAWINGS IMMEDIATELY TO THE ENGINEER/SUPERINTENDENT.

THE CONTRACTOR SHALL NOTIFY THE RELEVANT SERVICE AUTHORITY FOR ANY REQUIRED MODIFICATION WORKS TO THEIR ASSETS. ALL SERVICE MODIFICATION WORKS SHALL BE UNDERTAKEN IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT SERVICE AUTHORITY.THE CONTRACTOR SHALL PROVIDE ALL NECESSARY PROTECTION MEASURES TO EXISTING SERVICES THAT ARE TO BE RETAINED. THE CONTRACTOR IS LIABLE FOR RECTIFICATION/REINSTATEMENT COSTS FOR DAMAGE TO EXISTING SERVICES.

BOUNDARY AND EASEMENT NOTE

THE PROPERTY BOUNDARY AND EASEMENT LOCATIONS SHOWN ON TTW'S DRAWINGS HAVE BEEN BASED FROM INFORMATION RECEIVED FROM :

TTW MAKES NO GUARANTEES THAT THE BOUNDARY OR EASEMENTINFORMATION SHOWN IS CORRECT. TTW WILL ACCEPT NO LIABILITIES FOR BOUNDARY INACCURACIES. THE CONTRACTOR/BUILDER IS ADVISED TO CHECK/CONFIRM ALL BOUNDARIES IN RELATION TO ALL PROPOSED WORK PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. BOUNDARY INACCURACIES FOUND ARE TO BE REPORTED TO THE SUPERINTENDENT PRIOR TO CONSTRUCTION STARTING.

BOUNDARY AND EASEMENT NOTE

- INCLUDES ALL KERBS, CHANNELS, SPOON DRAINS, CROSSINGS AND EDGES.
1. CONCRETE KERBS SHALL BE CONSTRUCTED USING GRADE 32MPA CONCRETE U.N.O.
2. ALL KERBS, CHANNELS, SPOON DRAINS AND CROSSINGS TO BE CONSTRUCTED ON MINIMUM 75MM GRANULAR BASECOURSE COMPACTED TO MINIMUM 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1.

3. EXPANSION JOINTS (EJ) TO BE FORMED FROM 10MM COMPRESSIBLE FILLER BOARD FOR THE FULL DEPTH OF THE SECTION AND CUT TO PROFILE.
EXPANSION JOINTS TO BE LOCATED AT DRAINAGE PITS, ON TANGENT POINTS OF CURVES AND ELSEWHERE AT 12M CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE EXPANSION JOINTS ARE TO MATCH THE JOINT LOCATIONS IN SLABS.
4. SAW CUT JOINTS TO BE MIN 3MM WIDE AND LOCATED AT 3M CENTRES EXCEPT FOR INTEGRAL KERBS WHERE WEAKENED PLANE JOINTS ARE TO MATCH THE JOINT LOCATIONS IN SLABS.
5. BROOM FINISHED TO ALL RAMPED AND VEHICULAR CROSSINGS, ALL OTHER KERBING OR DISH DRAINS TO BE STEEL FLOAT FINISHED.
6. IN THE REPLACEMENT OF KERBS - EXISTING ROAD PAVEMENT IS TO BE SAWCUT 350MM FROM LIP OF UPON COMPLETION OF NEW KERBS, NEW BASECOURSE AND SURFACE IS TO BE LAID 350MM WIDE TO MATCH EXISTING MATERIALS AND THICKNESSES. EXISTING ALLOTMENT DRAINAGE PIPES ARE TO BE BUILT INTO THE NEW KERB WITH A 100MM DIA HOLE. EXISTING KERBS ARE TO BE COMPLETELY REMOVED WHERE NEW KERBS ARE SHOWN.

STORMWATER DRAINAGE NOTES

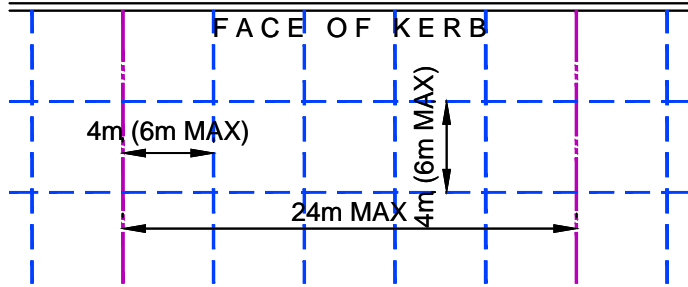
1. ALL NEW DRAINAGE PIPES EQUAL TO OR GREATER THAN 450 TO BE RUBBER RING JOINTED RCP UNLESS NOTED OTHERWISE IN DRAWINGS
- 1.1. RCP PIPES SUBJECT TO PEDESTRIAN LOADING ONLY TO BE CLASS 3 UNLESS NOTED OTHERWISE.
- 1.2. RCP PIPES SUBJECT TO TRAFFIC LOADING TO BE MIN. CLASS 4 UNLESS NOTED OTHERWISE
2. PIPES UP TO 375 SHALL BE HDPE OR SEWER GRADE UPVC WITH SOLVENT WELDED JOINTS UNLESS NOTED OTHERWISE IN DRAWINGS. SOME OF OUR PIPES ARE CPP. IN AREAS OF EXPANSIVE SOILS, UPVC PIPES MUST BE RUBBER RING JOINTED.
3. EQUIVALENT STRENGTH VCP OR FRP PIPES MAY BE USED SUBJECT TO APPROVAL.
4. PRECAST PITS MAY BE USED EXTERNAL TO THE BUILDING SUBJECT TO APPROVAL BY THE SUPERINTENDENT.
5. ENLARGERS, CONNECTIONS AND JUNCTIONS TO BE MANUFACTURED FITTINGS WHERE PIPES ARE LESS THAN 300 DIA.
6. SUBSOIL DRAINS TO BE SLOTTED FLEXIBLE 100DIA UPVC U.N.O.
7. WHERE SUBSOIL DRAINS ARE SHOWN AS UNSLOTTED, UNSLOTTED 100DIA UPVC SEWER GRADE PIPE IS TO BE USED.
8. SUBSOIL DRAINS TO BE LOCATED BEHIND ALL RETAINING WALLS AND NEW KERBING SHALL BE CONNECTED TO NEAREST STORMWATER PIT.
9. GRATES AND COVERS SHALL CONFORM WITH AS 3996-2006, AND AS 1428.1 FOR ACCESS REQUIREMENTS. ALL PITS WITHIN FOOT TRAFFICABLE AREA TO HAVE MINIMUM SLIP RESISTANCE OF R10 OR R11.
10. CONCRETE PIPES ARE TO BE INSTALLED IN ACCORDANCE WITH AS 3725. ALL BEDDING TO BE TYPE H2 U.N.O.
11. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
12. ALL STORMWATER PIPES TO BE 150 DIA AT 1 IN 100 MIN FALL U.N.O.
13. ADOPT INVERT LEVELS FOR PIPE INSTALLATION (GRADES SHOWN ARE ONLY NOMINAL).
14. ALL DRAINS AND OTHER SERVICE INFRASTRUCTURE TRENCHES BENEATH ROAD PAVEMENTS, DRIVEWAYS, FOOTPATHS OR CONCRETE STRUCTURES SLABS, OR WITHIN 1.0M OF CONCRETE STRUCTURES OR OTHER COUNCIL ASSETS, INCLUDING KERB, FOOTPATH, DRAINS, ETC MUST BE BACKFILLED WITH CLASS 2 FCR, COMPACTED AND TESTED TO THE SATISFACTION OF THE SUPERINTENDENT.
15. LITTER TRAPS TO BE INSTALLED IN ALL NEW GRATED PITS WITHIN LANDSCAPE AREAS.
16. ALL GRATED PITS WITHIN PAVED PEDESTRIAN AREAS TO BE HEEL GUARD BOLT DOWN COVER UNLESS SPECIFIED OTHERWISE ON PLANS.
17. ALL DOWNPIPES TO BE CONNECTED TO ADJACENT INGROUND STORMWATER DRAINAGE INFRASTRUCTURE. REFER TO HYDRAULIC DRAWINGS FOR DOWN PIPE LOCATION IF NOT DETAILED ON CIVIL PLANS.
18. ALL EXISTING ACTIVE DOWNPIPES, WHERE INGROUND STORMWATER HAS BEEN ABANDONED, TO BE CONNECTED TO NEW INGROUND STORMWATER DRAINAGE NETWORK.
19. PRIOR TO COMMENCING ANY STORMWATER DRAINAGE WORKS ON SITE THE CONTRACTOR MUST CONFIRM THE CONNECTION TO THE LEGAL POINT OF DISCHARGE AUTHORITY DRAIN AS DOCUMENTED BY:
- 19.1. VERIFICATION OF THE EXISTING INVERT LEVEL OF THE LEGAL POINT OF DISCHARGE TO COUNCIL DRAIN.
- 19.2. VERIFICATION THAT THE PROPOSED STORMWATER DRAIN INVERT LEVELS CAN ACHIEVE THE COUNCIL STANDARD CONNECTION DETAIL IN ACCORDANCE WITH COUNCIL STANDARDS
- 19.3. VERIFICATION THAT THE ROUTE IS CLEAR OF ALL OBSTRUCTIONS AND EXISTING SERVICES.
- THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT IF ANY OF THE ABOVE CANNOT BE ACHIEVED PRIOR TO COMMENCING WORKS ON SITE.
20. THE INTERNAL BASE OF ALL DRAINAGE PITS SHALL BE BENCHED AND SHAPED TO ALLOW FREE FLOW OF WATER THROUGH TO THE PIT OUTLET PIPE.
21. PITS DEEPER THAN 1.0M SHALL BE FITTED WITH STEP IRONS.

CONCRETE FINISHING NOTES

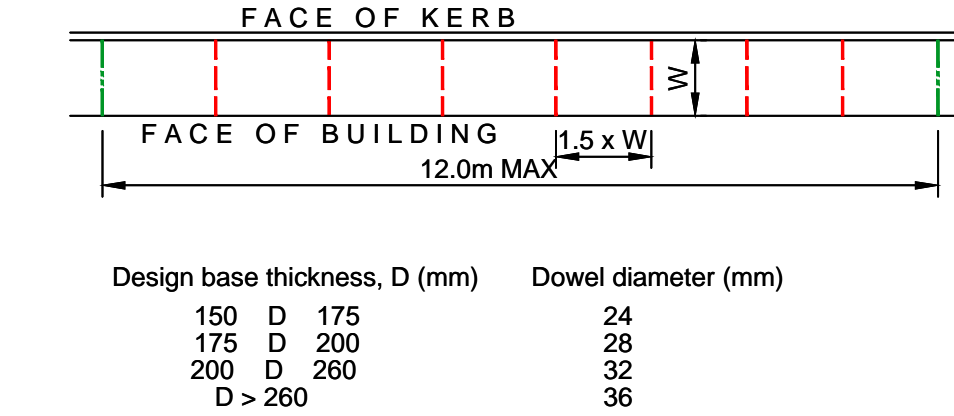
1. ALL EXPOSED CONCRETE PAVEMENTS ARE TO BE BROOMED FINISHED U.N.O REFER ARCHITECTURAL / LANDSCAPE DRAWINGS FOR PAVEMENT FINISHES.
2. ALL EDGES OF THE CONCRETE PAVEMENT INCLUDING KEYED AND DOWELLED JOINTS ARE TO BE FINISHED WITH AN EDGING TOOL.
3. CONCRETE PAVEMENTS WITH GRADES GREATER THAN 1:10 SHALL BE HEAVILY BROOM FINISHED.
4. CARBORUNDUM TO BE ADDED TO ALL STAIR TREADS AND RAMPED CROSSINGS U.N.O.

JOINTING NOTES

- VEHICULAR PAVEMENT JOINTING
1. ALL VEHICULAR PAVEMENTS TO BE JOINTED AS SHOWN ON DRAWINGS.
2. SAWCUT JOINTS SHOULD GENERALLY BE LOCATED AT A MAXIMUM OF 6.0M CENTRES.
3. SAW CUT JOINTS SHOULD GENERALLY BE LOCATED AT A MAXIMUM OF 6.0M CENTRES OR 1.5 X THE SPACING OF KEYED JOINTS, WHERE KEY JOINT SPACING IS LESS THAN 4.0M, WITH DOWELLED EXPANSION JOINTS AT MAXIMUM OF 24M CENTRES.
4. PROVIDE 10MM WIDE FULL DEPTH ISOLATION JOINTS BETWEEN BUILDINGS, STRUCTURES AND KERBS.
5. THE TIMING OF THE SAW CUT IS TO BE CONFIRMED BY THE CONTRACTOR ON SITE. SITE CONDITIONS WILL DETERMINE HOW MANY HOURS AFTER THE CONCRETE POUR BEFORE THE SAW CUTS ARE COMMENCED. REFER TO THE SPECIFICATION FOR WEATHER CONDITIONS AND TEMPERATURES REQUIRED.
6. INDICATIVE VEHICULAR PAVEMENT JOINTING AS FOLLOWS.



- PEDESTRIAN FOOTPATH JOINTING
1. SAWCUT JOINTS ARE TO BE LOCATED WHERE POSSIBLE AT TANGENT POINTS OF CURVES AND ELSEWHERE.
2. SAW CUT JOINTS ARE TO BE LOCATED AT A MAX 1.5 X WIDTH OF THE PAVEMENT.
3. WHERE POSSIBLE JOINTS SHOULD BE LOCATED TO MATCH KERBING AND / OR ADJACENT PAVEMENT JOINTS.
4. ALL PEDESTRIAN FOOTPATH JOINTINGS AS FOLLOWS (U.N.O).
5. JOINTS SPACING ARE INDICATIVE ONLY AND THE CONTRACTOR TO REFER LANDSCAPE ARCHITECTURAL PLAN FOR FINAL LOCATION.



- PEDESTRIAN FOOTPATH JOINTING
1. CONTRACTOR TO REFERENCE GEOTECHNICAL REPORT FOR SUBGRADE PREPARATION REQUIREMENTS.
2. ALL BATTERS AT A MAXIMUM SLOPE TO BE CONFIRMED AND SUBJECT TO GEOTECHNICAL ENGINEER ADVICE.
3. EXCAVATED MATERIAL MAY BE USED AS STRUCTURAL FILL PROVIDED,
- 3.1. IT COMPLIES WITH THE SPECIFICATION REQUIREMENTS FOR FILL MATERIAL,
- 3.2. THE PLACEMENT MOISTURE CONTENT COMPLIES WITH THE GEOTECHNICAL CONSULTANTS REQUIREMENTS, AND ALLOWS FILLING TO BE PLACED AND PROOF-ROLLED IN ACCORDANCE WITH THE SPECIFICATION. WHERE NECESSARY THE CONTRACTOR MUST MOISTURE CONDITION THE EXCAVATED MATERIAL TO MEET THESE REQUIREMENTS.

| 4. COMPACT FILL AREAS AND SUBGRADE TO NOT LESS THAN: | | |
|--|--------------------------------------|--------------------------------|
| LOCATION | STANDARD DRY DENSITY (AS 1289 5.1.1) | OPTIMUM MOISTURE CONTENT (OMC) |
| UNDER BUILDING SLABS ON GROUND | 98% | 2% |
| UNDER ROADS AND CARPARKS | 98% | 2% |
| LANDSCAPE AREAS: | 95% | 2% |

5. BEFORE PLACING FILL, PROOF ROLL EXPOSED SUBGRADE WITH A 10 TONNE MINIMUM ROLLER TO TEST SUBGRADE AND THEN REMOVE SOFT SPOTS (AREAS WITH MORE THAN 3MM MOVEMENT UNDER ROLLER). SOFT SPOTS TO BE REPLACED WITH GRANULAR FILL UNLESS NOTED OTHERWISE.
6. CONTRACTOR SHALL PLACE SAFETY BARRIERS AROUND EXCAVATIONS IN ACCORDANCE WITH RELEVANT SAFETY REGULATIONS.
7. BULK EARTHWORKS DRAWINGS ARE NOT TO BE USED FOR DETAILED EXCAVATION IN LANDSCAPE ZONES. CONTRACTOR TO MAKE ALLOWANCE FOR ADDITIONAL FILL OR CUT THROUGH LANDSCAPE ZONES.
8. CONTRACTOR TO REVIEW LANDSCAPE DRAWINGS TO CONFIRM SOFTSCAPE PROFILE DEPTHS.
9. STRIP ALL TOPSOIL FROM THE CONSTRUCTION AREA. ALL STRIPPED TOPSOIL SHALL BE DISPOSED OF OFFSITE UNLESS DIRECTED OTHERWISE.
10. MAKE SMOOTH CONNECTION WITH ALL EXISTING WORKS
11. COMPACT SUBGRADE UNDER BUILDINGS AND PAVEMENTS TO MINIMUM 98% STANDARD MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS1289.5.1.1. COMPACTION UNDER BUILDINGS TO EXTEND 2.0M MINIMUM BEYOND BUILDING FOOTPRINT.
12. TEMPORARY STORMWATER CONTROL AND CONNECTIONS TO BE MANAGED ONSITE BY THE BUILDER/CONTRACTOR.
13. SITE TO BE FREE DRAINING AND SUBGRADE TO BE PROTECTED FROM MOISTURE INGRESS.
14. DEWATERING TO BE MANAGED BY CONTRACTOR AT ALL TIMES.
15. QUANTITIES TO UNDERLYING GEOLOGY SUCH AS ROCK OR NATURAL CLAY ARE INDICATIVE ONLY AND BASED ON THE GEOTECHNICAL INFORMATION AVAILABLE AT THE TIME OF ISSUE. UNDERLYING NATURAL CLAY AND ROCK LEVELS CAN BE HIGHLY VARIABLE BETWEEN GEOTECH SAMPLE LOCATIONS.
16. ALL EARTHWORKS ACTIVITIES SHALL BE UNDERTAKEN WITH LEVEL 1 SUPERVISION IN ACCORDANCE WITH AS3798 (2007) BY A SUITABLY QUALIFIED GEOTECHNICAL INSPECTION AND TESTING AUTHORITY (GITA) ENGAGED BY THE CONTRACTOR. AS A MINIMUM, THE FREQUENCY AND LOCATION OF TESTING SHALL BE IN ACCORDANCE WITH TABLE 8.1 OF AS3798 (2007). THE GITA IS TO MAINTAIN DAILY SITE RECORD SHEETS AS SET OUT IN AS3798 (2007).

EROSION AND SEDIMENT CONTROL

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING AND ARCHITECTURAL DRAWINGS.

1. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH:
- A. LOCAL AUTHORITY REQUIREMENTS,
- B. EPA - POLLUTION CONTROL MANUAL FOR URBAN STORMWATER,
2. EROSION AND SEDIMENT CONTROL ARE TO BE PROVIDED FOR THE WHOLE OF THE WORKS BY THE CONTRACTOR. SHOULD THE CONTRACTOR STAGE THESE WORKS THEN THE DESIGN MAY BE REQUIRED TO BE MODIFIED. VARIATION TO THESE DETAILS MAY REQUIRE APPROVAL BY THE RELEVANT AUTHORITIES. THE EROSION AND SEDIMENT CONTROL SHALL BE IMPLEMENTED AND ADOPTED TO MEET RELEVANT EPA AND/OR AUTHORITY GUIDELINES
3. MAINTAIN ALL EROSION AND SEDIMENT CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.
4. WHEN STORMWATER PITS ARE CONSTRUCTED PREVENT SITE RUNOFF ENTERING THE PITS UNLESS SILT FENCES ARE ERECTED AROUND PITS.
5. MINIMISE THE AREA OF SITE BEING DISTURBED AT ANY ONE TIME.
6. PROTECT ALL STOCKPILES OF MATERIALS FROM SCOUR AND EROSION. DO NOT STOCKPILE LOOSE MATERIAL IN ROADWAYS, NEAR DRAINAGE PITS OR IN WATERCOURSES.
7. ALL SOIL AND WATER CONTROL MEASURES ARE TO BE PUT BACK IN PLACE AT THE END OF EACH WORKING DAY, AND MODIFIED TO BEST SUIT SITE CONDITIONS.
8. CONTROL WATER FROM UPSTREAM OF THE SITE SUCH THAT IT DOES NOT ENTER THE DISTURBED SITE.
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE VIA THE TEMPORARY CONSTRUCTION ENTRY/EXIT.
10. ALL VEHICLES LEAVING THE SITE SHALL BE CLEANED AND INSPECTED BEFORE LEAVING.
11. MAINTAIN ALL STORMWATER PIPES AND PITS CLEAR OF DEBRIS AND SEDIMENT. INSPECT STORMWATER SYSTEM AND CLEAN OUT AFTER EACH STORM EVENT.
12. CLEAN OUT ALL EROSION AND SEDIMENT CONTROL DEVICES AFTER EACH STORM EVENT.

SURVEY

1. PRIOR TO COMMENCEMENT OF EXCAVATION THE FOLLOWING SOIL MANAGEMENT DEVICES MUST BE INSTALLED.
- 1.1. CONSTRUCT SILT FENCES BELOW THE SITE AND ACROSS ALL POTENTIAL RUNOFF SITES.
- 1.2. CONSTRUCT TEMPORARY CONSTRUCTION ENTRY/EXIT AND DIVERT RUNOFF TO SUITABLE CONTROL SYSTEMS.
- 1.3. CONSTRUCT MEASURES TO DIVERT UPSTREAM FLOWS INTO EXISTING STORMWATER SYSTEM.
- 1.4. CONSTRUCT SEDIMENTATION TRAPS/BASIN INCLUDING OUTLET CONTROL AND OVERFLOW.
- 1.5. CONSTRUCT TURF LINED SWALES.
- 1.6. PROVIDE SANDBAG SEDIMENT TRAPS UPSTREAM OF EXISTING PITS.

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2. CONSTRUCT GEOTEXTILE FILTER PIT SURROUND AROUND ALL PROPOSED PITS AS THEY ARE CONSTRUCTED.
3. ON COMPLETION OF PAVEMENT PROVIDE SAND BAG KERB INLET SEDIMENT TRAPS AROUND PITS.
4. PROVIDE AND MAINTAIN A STRIP OF TURF ON BOTH SIDES OF ALL ROADS AFTER THE CONSTRUCTION OF KERBS.

SERVICE TRENCHES

EXCAVATION

1. BEFORE EXCAVATING TRENCHES THROUGH EXISTING PAVEMENT, SAW-CUT EXISTING CONCRETE AND BITUMINOUS SURFACES ON EACH SIDE OF THE TRENCH TO PROVIDE A STRAIGHT EVEN JOINT. LIFT AND STORE UNIT PAVING FOR LATER REINSTATEMENT.
2. EXCAVATE FOR UNDERGROUND SERVICES, TO REQUIRED LINES, LEVELS AND GRADES. GENERALLY MAKE THE TRENCHES STRAIGHT BETWEEN MANHOLES, INSPECTION POINTS AND JUNCTIONS, WITH VERTICAL SIDES AND UNIFORM GRADES. EXCAVATION OF SERVICE TRENCHES SHALL BE COMPLETED PRIOR TO LIME STABILIZATION OF THE SUBGRADE. NOTIFY THE CONTRACT ADMINISTRATOR IF ANY TRENCHES ARE BE TO EXCAVATED IN STABILISED GROUND. ANY TRENCHES IN STABILISED GROUND TO BE BACKFILLED AS SPECIFIED IN THE "BACKFILLING" NOTES.
3. KEEP TRENCH WIDTHS TO THE MINIMUM CONSISTENT WITH THE LAYING AND BEDDING OF THE RELEVANT SERVICE AND CONSTRUCTION OF PERSONNEL ACCESS WAYS AND PITS.
4. EXCAVATE TRENCHES IN SECTIONS OF SUITABLE LENGTH.
5. TRENCH DEPTHS TO BE CONSTRUCTED AS REQUIRED BY THE RELEVANT SERVICE AND ITS BEDDING METHOD.
6. IF EXCAVATION IS NECESSARY BELOW THE LEVEL OF ADJACENT FOOTINGS, GIVE NOTICE, AND PROVIDE NECESSARY SUPPORT FOR THE FOOTINGS.
7. CLEAR TRENCHES OF SHARP PROJECTIONS. CUT BACK ROOTS ENCOUNTERED IN TRENCHES TO AT LEAST 600MM CLEAR OF SERVICES. REMOVE OTHER OBSTRUCTIONS INCLUDING STUMPS AND BOULDERS WHICH MAY INTERFERE WITH SERVICES OR BEDDING.
8. KEEP TRENCHES FREE OF WATER. PLACE BEDDING MATERIAL, SERVICES AND BACKFILLING ON FIRM GROUND FREE OF SURFACE WATER.
9. IF TRENCH EXCAVATION EXCEEDS THE CORRECT DEPTH, REINSTATE TO THE CORRECT DEPTH AND BEARING VALUE USING COMPACTED BEDDING MATERIAL OR GRADE 20MPA CONCRETE.

EXCAVATION

THESE REQUIREMENTS APPLY TO BACKFILL TO STORMWATER DRAINAGE TRENCHES AND SERVICE ACCESS POINTS. BEDDING AND OVERLAY TO A MINIMUM DEPTH OF 200MM ABOVE THE SERVICE SHALL BE PIPE BEDDING AS SPECIFIED BELOW UNLESS SPECIFIED OTHERWISE IN RELEVANT SERVICE SPECIFICATION. TRENCH BACKFILL ABOVE THIS LEVEL SHALL BE BACKFILL MATERIAL AS SPECIFIED BELOW. BEDDING, OVERLAY AND TRENCH BACKFILL TO BE COMPACTED IN ACCORDANCE WITH THE COMPACTION SCHEDULE. PLACE FILLING IN LAYERS NOT EXCEEDING 200MM COMPACTED LAYER THICKNESS.

PIPE BEDDING:
UNLESS NOTED OTHERWISE IN "STORMWATER DRAINAGE" NOTES, PIPE BEDDING TO BE GRANULAR MATERIAL (CLEAN SHARP WASHED RIVER SAND OR CLEAN UNWEATHERED HARD BASALTIC OR SEDIMENTARY CRUSHED ROCK, FREE OF SALT, CLAY OR ORGANIC CONTAMINANTS) OR CEMENTITIOUS MATERIAL (MORTAR OR CONCRETE) AS SPECIFIED.

| SLEVE APERTURE (mm) TO AS 1152 | PERCENTAGE PASSING (BY MASS) |
|--------------------------------|------------------------------|
| 9.50 | 98 TO 100 |
| 6.70 | 50 TO 100 |
| 4.75 | 15 TO 75 |
| 2.36 | 0 TO 40 |
| 1.16 | 0 TO 5 |

CEMENT MORTAR BEDDING: 1 PORTLAND CEMENT: 4 SAND.
CONCRETE BEDDING: NOT LESS THAN 20 MPA.


BACKFILL MATERIAL

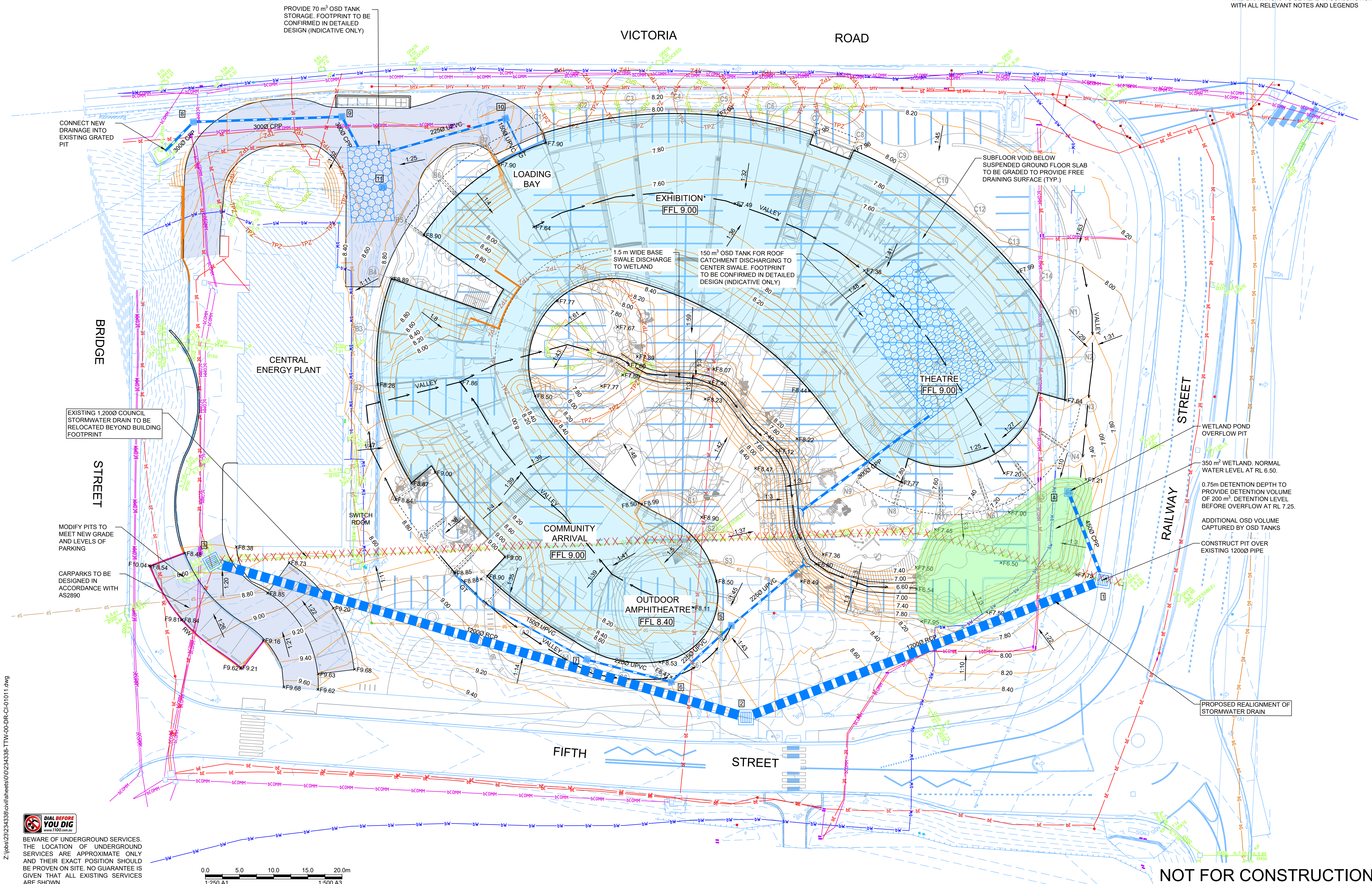
GENERAL: GENERAL FILL EXCEPT WITH NO STONES GREATER THAN 25 MM OCCURRING WITHIN 150 MM OF THE SERVICE, OR OTHER MATERIALS AS REQUIRED FOR PARTICULAR SERVICES OR LOCATIONS. WELL GRADED, INORGANIC, NON-PERISHABLE MATERIAL, MAXIMUM SIZE 75 MM, PLASTICITY INDEX * 55% AND CLASSIFIED AS CLASS A OR CLASS S MATERIAL IN TABLE 2.1 OF AS 2870. FILL MATERIAL TO HAVE A MINIMUM 4 DAY SOAKED CBR OF 4% IN ACCORDANCE WITH AS 1239.6.1.1 UNLESS NOTED OTHERWISE ON DRAWINGS. MATERIAL TO BE NON-DISPERSIVE (A RATING OF NIL AS DEFINED BY THE DISPERSION TEST AS 1239.3.8.1).

UNDER ROADS AND PAVED AREAS: COARSE SAND, FINE CRUSHED ROCK, OR 3% CEMENT STABILISED SAND.


IN TOPSOIL AREAS: COMPLETE THE BACKFILLING WITH TOPSOIL FOR AT LEAST THE TOP 50 MM.

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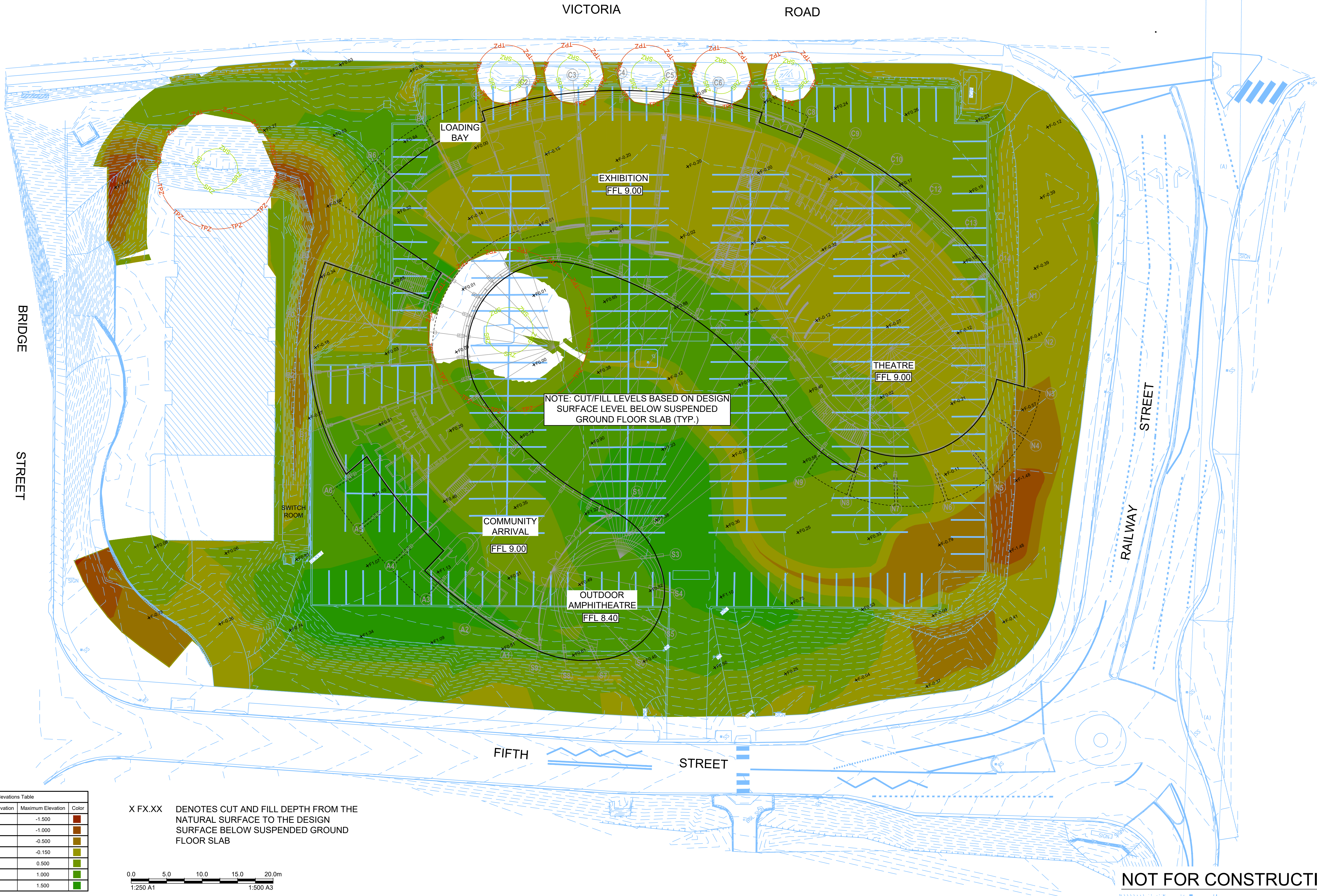
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| | | | | | | Client: JACKSON CLEMENT BURROWS ARCHITECTS 345 SWAN STREET, RICHMOND 3121 | | | Engineer:  612 9439 7288 Level 6, 73 Miller Street, North Sydney, NSW 2060 | | | Project: WSU INDIGENOUS CENTRE OF EXCELLENCE | | | Drawing Title: GENERAL NOTES AND LEGEND, SHEET 1 | | | Scale at A1 NA | | | Drawn VV | | | Designed JLE | | | Approved RP | | |
| P1 ISSUED FOR SSDA | | | JLE AE 08.05.2024 | | | | | | | | | | | | | | | 234338-TTW-00-DR-CI-00002-P1 | | | 08.05.2024 | | | 5:41 PM | | | | | |
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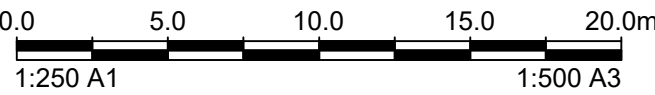
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| | | | | | | Client: | | | Project: | | | Drawing Title: | | | Scale at A1 | | | Drawn | | | Designed | | | Approved | | | | | | | | | | | | | | |
| | | | | | | JACKSON CLEMENT | | |  Structural Civil Traffic Façade | | | WSU | | | CIVIL WORKS | | | 1:250 | | | VV | | | JLE | | | RP | | | | | | | | | | | |
| | | | | | | BURROWS ARCHITECTS | | | INDIGENOUS CENTRE | | | SITE PLAN | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | 345 SWAN STREET, RICHMOND 3121 | | | OF EXCELLENCE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P1 ISSUED FOR SSDA | | | | | | JLE AE 08.05.2024 | | | 612 9439 7288 Level 6, 73 Miller Street, North Sydney, NSW 2060 | | | | | | | | | Project No | | | Originator | | | Zone | | | Type | | | Role | | | Sheet No. | | | Re | | |
| Rev | | Description | | Eng Draft | | Date | | Rev | | Description | | Eng Draft | | Date | | 234338-TTW-00-DR-CI-01011-F | | 16.05.2024 | | 9:50 AM | | | | | | | | | | | | | | | | | | |

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| Elevations Table | | | |
|------------------|-------------------|-------------------|-------|
| Number | Minimum Elevation | Maximum Elevation | Color |
| 1 | -2.000 | -1.500 | |
| 2 | -1.500 | -1.000 | |
| 3 | -1.000 | -0.500 | |
| 4 | -0.500 | -0.150 | |
| 5 | 0.150 | 0.500 | |
| 6 | 0.500 | 1.000 | |
| 7 | 1.000 | 1.500 | |

X FX.XX DENOTES CUT AND FILL DEPTH FROM THE NATURAL SURFACE TO THE DESIGN SURFACE BELOW SUSPENDED GROUND FLOOR SLAB



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