



CIVIL ENGINEERING REPORT

ELECTRICAL ENGINEERING BUILDING CAPITAL RENEWAL AND MODERNISATION PROJECT (EEB_CRM)

for UNSW Australia

03 February 2016

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TABLE OF CONTENTS

1.0	INTRODUCTION	3
2.0	SITE	4
3.0	PROPOSED WORKS.....	4
4.0	LEGISLATION	4
5.0	FLOODING.....	4
5.1	PROPOSED ACCESS IMPROVEMENTS TO ELECTRICAL ENGINEERING.....	6
5.2	MODIFICATION OF WALL AT LIBRARY ROAD	8
6.0	STORMWATER QUANTITY.....	9
7.0	STORMWATER QUALITY	10
7.1	STORMWATER QUALITY DURING CONSTRUCTION	10
8.0	SUMMARY	11
APPENDIX A		12
APPENDIX B		13
APPENDIX C		14
APPENDIX D		15

1.0 INTRODUCTION

TTW has been commissioned by The University of New South Wales (UNSW Australia) to provide Civil Engineering advice for the proposed works for the Electrical Engineering Building Capital renewal and Modernisation Project (EEB_CRM).

This report has been prepared to address the Secretary's environmental assessment requirements (SEAR's) for the proposed EEC_CRM. This report is based on the concepts drawings developed by Hassell Studios and engineering assessment report prepared by Kustom Engineering.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS	RESPONSE
10. Sediment, Erosion and Dust controls (Construction and Excavation) Detail measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles. Relevant Policies and Guidelines: - Managing Urban Stormwater – Soils & Construction Volume 1 2004 (Landcom) - Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)	Refer Section 7.1, and Civil Plans Sheet C02.
14. Drainage and Flooding · Detail drainage associated with the proposal, including stormwater and drainage infrastructure demonstrating that the drainage concept is consistent with the Stormwater Strategy prepared for UNSW by ANA Technical Services Pty Ltd dated 28/11/2005, where relevant. · Assess any potential flooding impacts associated with the development and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), including the potential effects of climate change, sea level rise and increase in rainfall intensity.	Refer Sections 5.0, 6.0 and 7.0, and Civil plans Sheet C03.

2.0 SITE

The UNSW Australia Kensington Campus is located within Randwick Council local government area. UNSW Australia is proposing to refurbish the existing Electrical Engineering building G17 and adjacent Rex Vowels Theater (F17), located at the end of College Road bound by University Mall to the south and Library Road to the east, refer **Figure 1**.

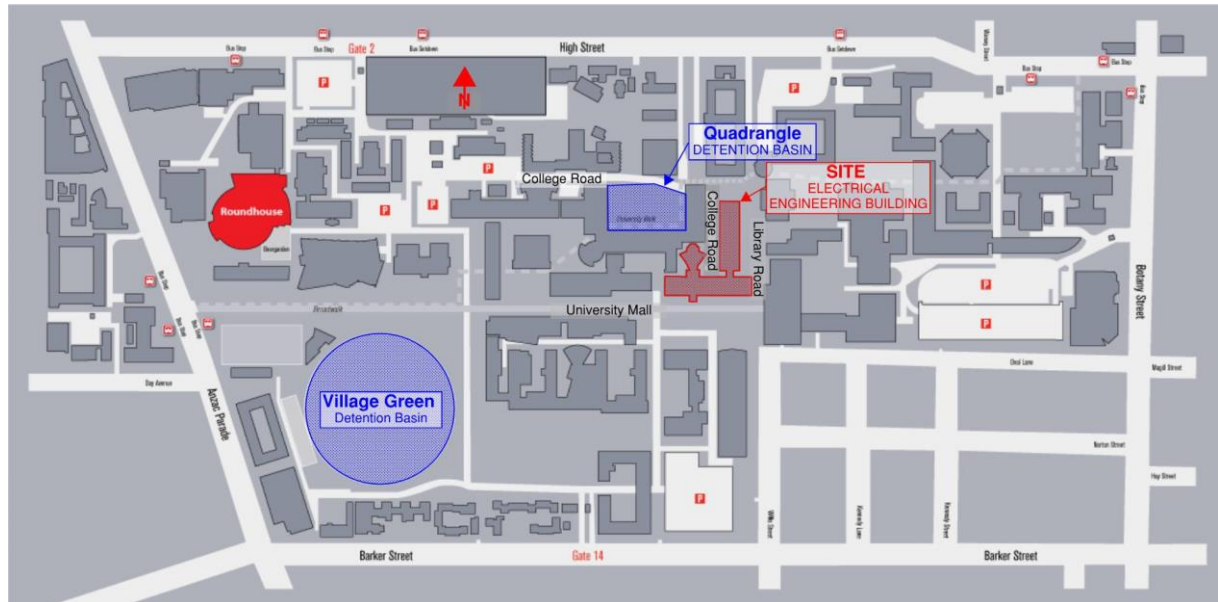


Figure 1 Location Map

3.0 PROPOSED WORKS

The works will consist of a comprehensive refurbishment of the existing Electrical Engineering Building and Rex Vowels Theater including minor landscape works to improve the accessibility to the existing building.

4.0 LEGISLATION

Randwick City Council has in place the Randwick Comprehensive Development Control Plan (DCP) 2013. A Stormwater Strategy was prepared for the Kensington campus by ANA Technical Services on 28 November 2005 which has been incorporated into Part E of the DCP.

All site development within the Kensington Campus must comply with the *UNSW Kensington Campus Stormwater Strategy Master Plan Campus 2020 – UNSW (2005)* (Stormwater Strategy Master Plan).

5.0 FLOODING

As mentioned above, any development within the Kensington campus must adhere to the Stormwater Strategy Master Plan. The campus is subdivided into 5 sub-catchment areas, the Electrical Engineering Building is located within sub-catchment A where all of the piped and overland flow is directed to the Village Green detention basin, refer **Appendix A**.

Significant overland flow paths (OFP) for storms up to the 100 year Average Recurrence Interval (ARI) event have been established throughout sub-catchment A. The OFP near the Electrical Engineering Building include:

- Library Road OFP
- College Road OFP

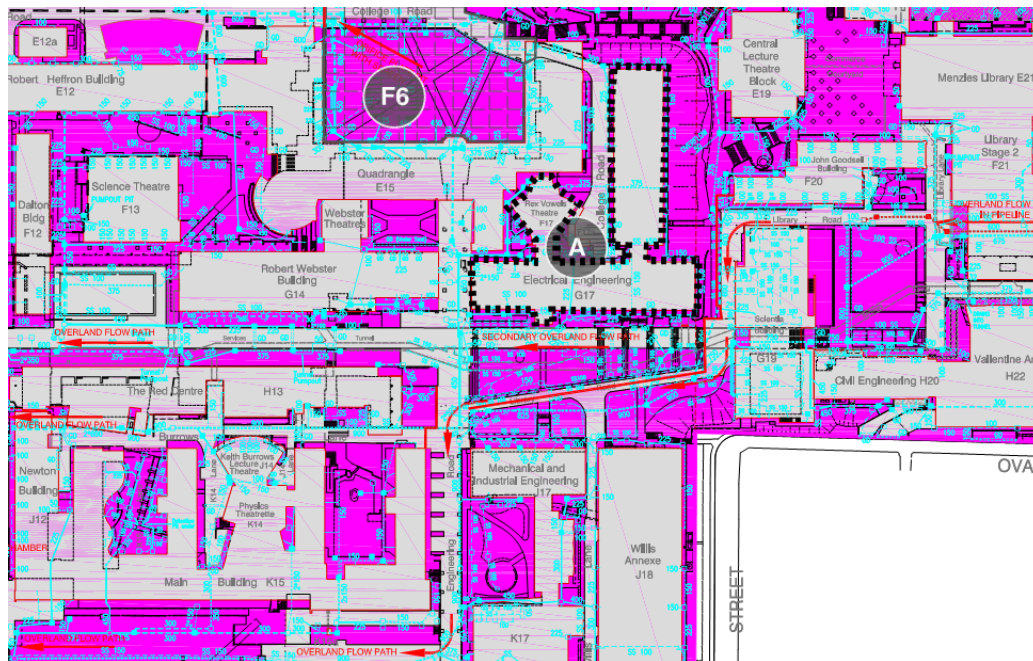


Figure 2 Figure from Stormwater Management Catchment Master Plan

Several “*Diversion Structures*” control the OFP within sub-catchment A, refer **Appendix B**, these include:

- Local high points along College Road to bund Quadrangle detention basin;
- “Unorthodox steps” arrangement at the entrance to the building on University Mall;
- College Rd levels locally raised to bound Quadrangle detention basin; and
- Wall at end of Library Road.



DIVERSION STRUCTURE DESCRIPTION

1. Kerb inlet pits and oversized pipe with surcharge outlet in Library Rd at Goodsell sizes for 100 yr ARI. Constructed when overland flow path cut off by infill or library breezeway
2. Pavement levels west of Goodsell raised and red Wall constructed to divert 100 yr ARI and prevent flooding of electrical Engineering.
3. Pavement depressed to stop overland discharge down University Mall
4. Unorthodox Steps at building entry to prevent flooding of Electrical Engineering.
5. Depression in centre of road to retain overland flow.
6. Brick wall and raised pavement in Burroughs Lane to divert flow down Engineering Rd.

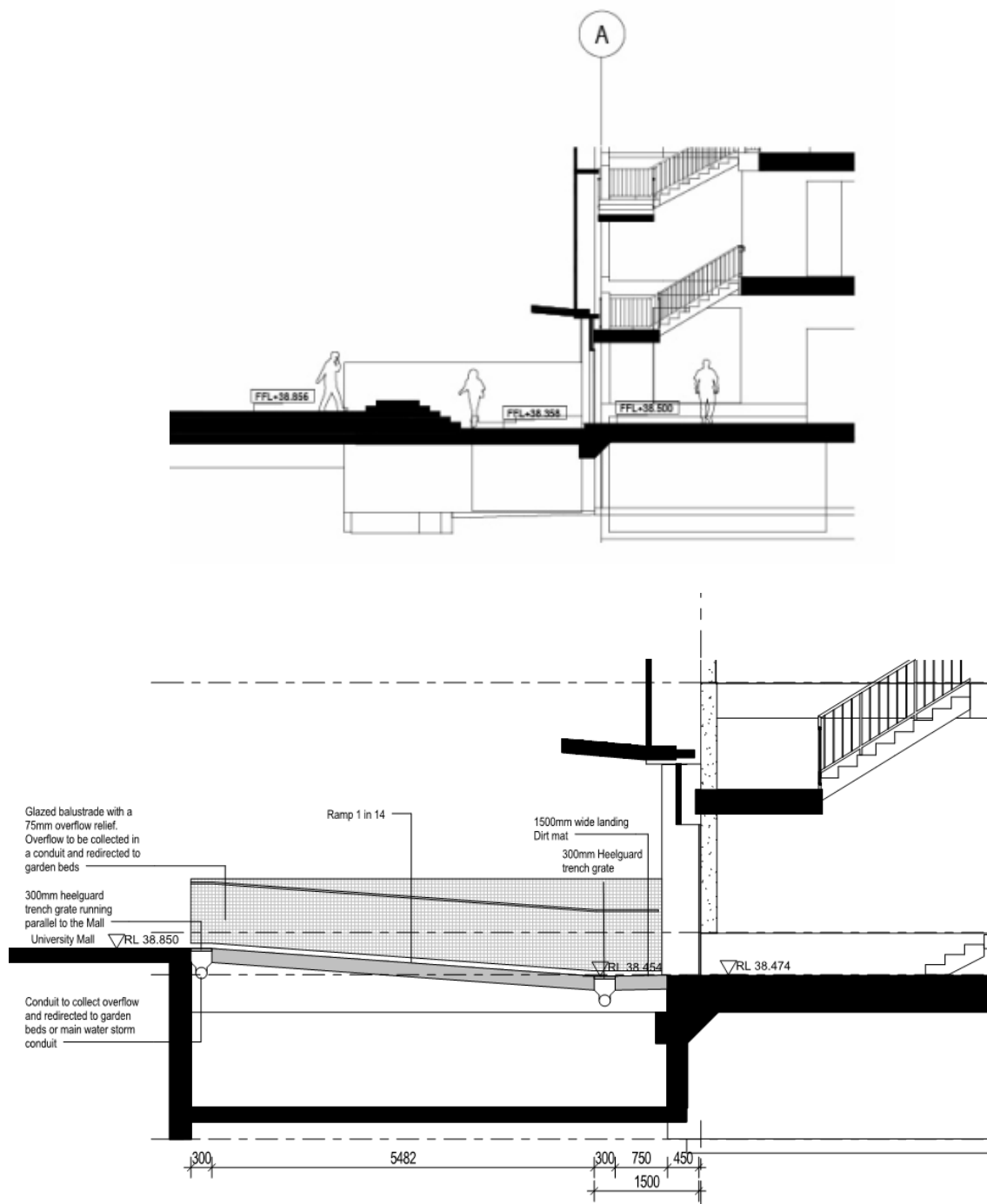
Figure 3 Stormwater Diversion Structures

Overland flows along the southern end of the building currently are blocked by a balustrade wall located to the west of the entry. This creates ponding near the entrance to the building and occasional flooding into the building near existing passenger lifts. The new access ramp is to have the following measures as shown in **Appendix C** to address this potential ponding issue:

- that inground pipe/pit system be provided at the bottom eastern edge of the ramp to capture stormwater runoff prior to runoff.
- it is proposed that the new western ramp balustrade is to have an opening to allow the overland flowpath through.
- that the bottom of the access ramp is to fall away from the building with fall in the westernly direction.

5.1 PROPOSED ACCESS IMPROVEMENTS TO ELECTRICAL ENGINEERING

To improve access to the Electrical Engineering Building the University has proposed to replace the “*Unorthodox Steps*” with a ramp, refer **Figure 4** showing current and proposed access into the building.



An Overland Flood Study undertaken by Kustom Engineering in August 2015 has noted that the *“flow depth along University Mall, against the steps, is estimated to be 56mm in the Blocked model”* for the 100 year ARI design storm event.

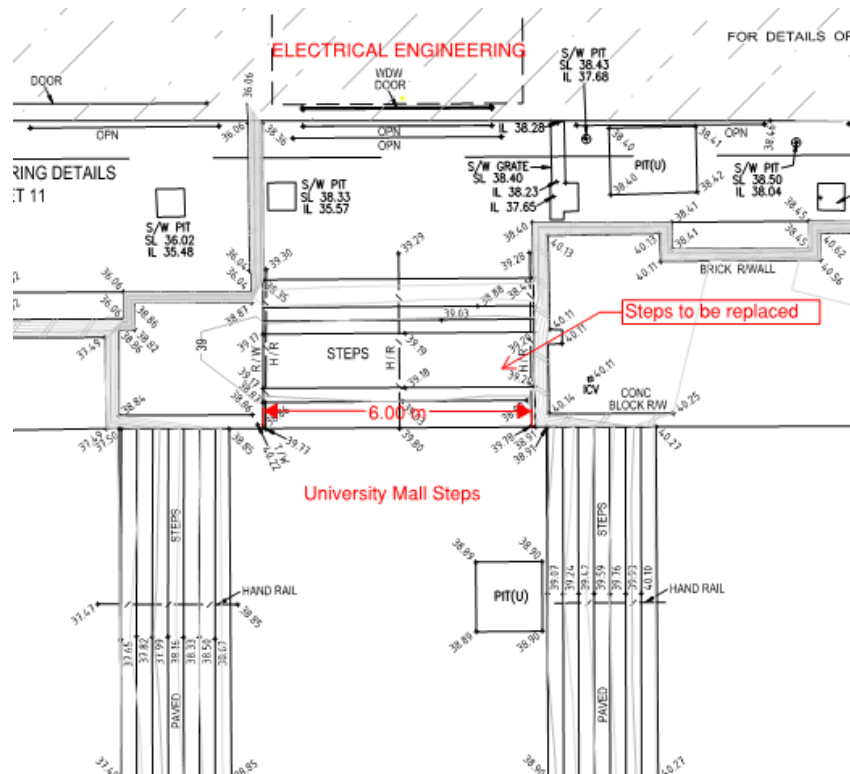


Figure 5 Location of Steps From Survey

A weir equation was used to calculate the amount of stormwater expected to flow towards the Electrical building once the stairs have been removed, refer calculation on the following page in **Table 1**.

$Q = cwh^{3/2}$	Weir Equation
$c =$	1.740 Sharp Crested Vertical up stream
$h =$	0.056 m
$w =$	6.000 m
$Q =$	0.138 cu.m
$Q =$	138.351 l/s

Table 1: Weir Flow Calculation

Based on this advice, a flood mitigation concept is developed and shown in **Appendix C**. It involves a crest near the top of the ramp as a primary flow diversion to cater for frequent storm events. For larger and rarer storm events up to and including the 100 year ARI, a combination of slot and grated drain system is proposed. This concept will be further developed during the detailed design development stage of the project incorporating access requirements.

5.2 MODIFICATION OF WALL AT LIBRARY ROAD

The University is also proposing to reduce the height of the existing wall at the end of Library Road. According to the Kustom Engineering study, the wall may be reduced to 250mm above the existing top of kerb level of the garden bed, refer image below. Final wall height should at minimum be 500mm above the garden bed including free board allowance from an overland flow path perspective, refer **Figure 6**. It is important to note that since this wall

provides a barrier for trucks, the final wall height will need to be determined during the detailed design phase giving due consideration to pedestrian safety.

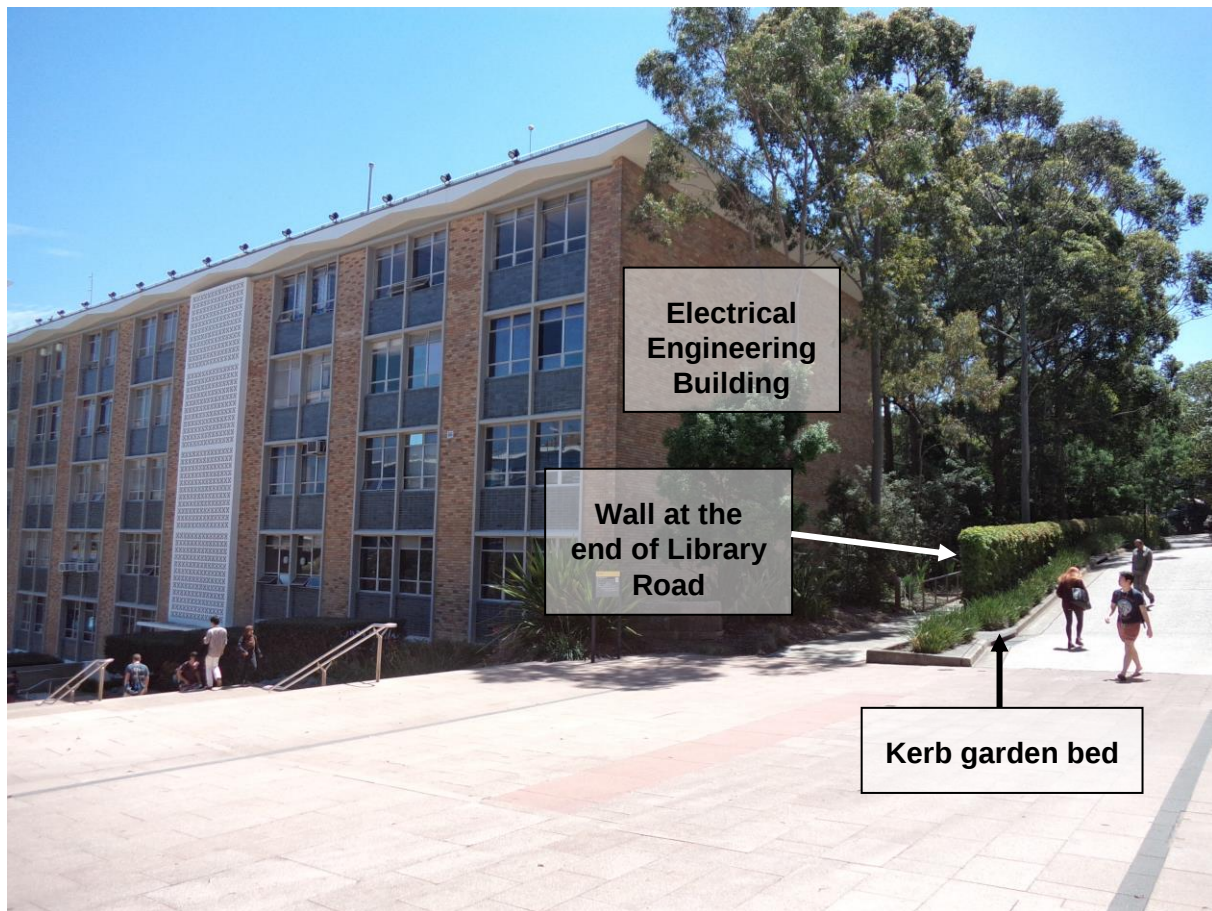


Figure 6: Location of Library Road Wall

Freeboard allowance above the calculated levels has been included in the design to account for the flooding impacts associated with the potential effects of climate change and increase in rainfall intensity. Additionally, the existing wall is a safety barrier for trucks, the final height of the wall will be determined so that it will continue to function as a barrier and a flood diversion structure.

Apart from removing the “Unorthodox Steps” arrangement and the reduction of the wall at the end of Library Road, the proposed works will maintain the above described “*Diversion Structures*” and the existing overland flow routes through catchment A.

6.0 STORMWATER QUANTITY

The proposed works consist primarily of internal refurbishments to the existing building. Minor adjustments to external levels and paving is proposed. Discharge from the existing building is conveyed to the Village Green detention basin as described in Section 5.0. No increase in impervious area is proposed.

Catchment boundaries within Kensington Campus will be maintained, no additional impervious area is proposed, it is not anticipated that the proposed works will affect the existing stormwater detention provided at the Village Green. A stormwater management plan

for the proposed works is included in the Civil drawing Set, refer **Appendix D**.

7.0 STORMWATER QUALITY

According to the Stormwater Strategy Master Plan stormwater quality discharge from the site is “*high*”, this is due to the already installed treatment devices such as litter pits and gross pollutant pits. Consequently, no additional permanent stormwater quality treatment is proposed.

7.1 STORMWATER QUALITY DURING CONSTRUCTION

During construction, an erosion and sediment control plan will be implemented to prevent sediment laden stormwater from entering the local and council drainage network. Stormwater controls on site will be detailed in an erosion and sediment control plan, generally in accordance with the “Blue Book” - Managing Urban Stormwater: Soils and Construction (Landcom NSW). The plan will vary based on construction staging and methodology, but will typically include:

- upstream clean water diversion;
- silt fences;
- sedimentation basin;
- dust control; and
- vehicle wash down.

The erosion and sediment control plan includes an inspection and maintenance schedule. The erosion and sediment control plan mitigates against sediment laden stormwater entering the council drainage system and the downstream environment. A sediment erosion control plan is included in the civil drawing set, refer **Appendix D**.

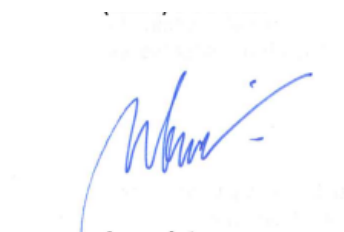
8.0 SUMMARY

We summarise the following:

- According to the Overland Flood Study produced by Kustom Engineering the existing wall at the end of Library Road can be reduced to a minimum height 250mm above the existing kerb level, free board allowance of an additional 250mm should be provided to account for Climate change effects. This study was preliminary and will need to be updated during detailed design and selection of the final scheme. The wall also acts as a barrier for trucks as a pedestrian safety measure. Final wall height will be established with consideration to flood protection and the safety of pedestrians;
- Flood mitigation measures will be implemented to continue to protect the existing Electrical Engineering Building due to the removal of the “Unorthodox Steps” at the entrance as detailed under section 5.1 of this report;
- Additional stormwater quantity and quality discharge management will not be required as outlined in the Stormwater Strategy Master Plan

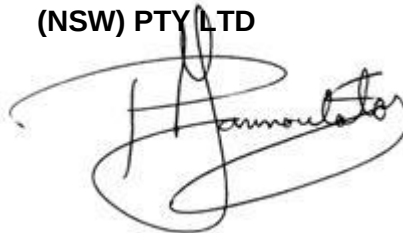
From a civil engineering perspective the proposed Electrical Engineering Building Capital Renewal and Modernisation Project is consistent with the Stormwater Strategy Master Plan.

Prepared by:
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Nemesio Biason
Engineer

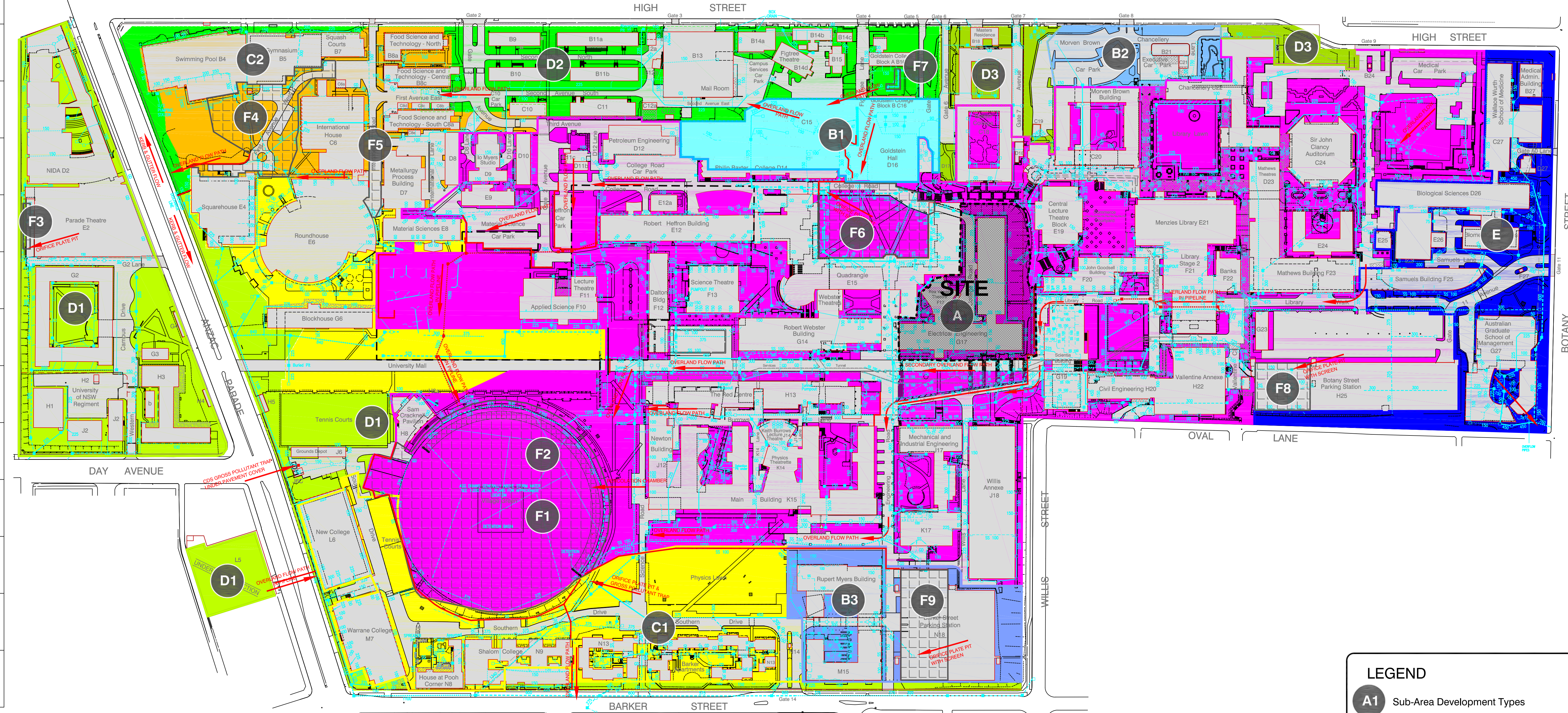
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Paul Yannoulatos
Technical Director

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APPENDIX A



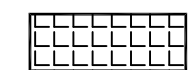
MAIN AREA GROUP CHARACTERISTICS

- AREA 'A' 100 yr ARI to Village Green detention basin.
- AREAS 'B' 5yr ARI to Village Green Detention Basin; 100 yr ARI to Council street drainage
- AREAS 'C' 5 yr ARI to percolation trench; 100yr ARI to Council street drainage
- AREAS 'D' 20yr ARI to percolation / piped street drainage; 100yr ARI to Council street drainage.
- AREA 'E' Requires full detention
- AREAS 'F' Detention basins & diversion structures to be retained

SUB-AREA DEVELOPMENT CONSTRAINTS

- AREA 'A' All stormwater run-off to Village Green Detention Basin, Areas F1, F2, F6, F8 & F9 and diversion structures are to be retained
- AREA 'B1' 5yr ARI to Village Green detention basin via piped drainage, 5 to 20yr ARI to Council kerb via piped drainage, 100 yr ARI to Anzac Pde North Council catchment. Retain diversion structures.
- AREA 'B2' 5yr ARI to Village Green detention basin via piped drainage, 20yr ARI to High St kerb via piped drainage, 100 yr ARI to Anzac Pde North Council catchment
- AREA 'B3' 5yr ARI to Village Green detention basin via piped drainage, 20yr ARI to Barker St kerb via piped drainage, 100 yr ARI to Anzac Pde South Council catchment. Retain detention basin F9
- AREA 'C1' 5yr ARI roof drainage to percolation trench, 20yr ARI to Council kerb via piped drainage, 100 yr ARI to Anzac Pde South Council catchment. Retain diversion structures

- AREA 'C2' 5yr ARI roof drainage to percolation trench, 20yr ARI to Council kerb via piped drainage, 100 yr ARI to Anzac Pde North Council catchment. Retain detention basins F4 & F5 and diversion structures
- AREA 'D1' 20yr ARI roof drainage to percolation trench with overflows to existing piped drainage, 100 yr ARI to Anzac Pde South Council catchment. Retain detention basin F3 & diversion structures.
- AREA 'D2' 20yr ARI roof drainages to percolation trench, with overflows to Council kerb or existing piped drainage, 100 yr ARI to Anzac Pde North Council catchment. Retain detention basin F7 and diversion structures.
- AREA 'D3' 20yr ARI to Council kerb via piped drainage. Discharges to Anzac Pde North Council catchment.
- AREA 'E' Drains to Botany St Catchment. All developments require full detention to Council standard requirements.



AREAS 'F' Detention basins & percolation trenches to be retained

- AREA 'F1' Village Green detention basin. All bank profiles and levels are protected. Banks can be raised, but not lowered. To be maintained and permanently retained.
- AREA 'F2' Percolation chamber serving Village Green detention catchment, to be maintained and permanently retained.
- AREA 'F3' Percolation / detention tank serving NIDA roof water discharge, to be maintained and permanently retained in some form.
- AREA 'F4' 5 yr ARI surcharge basin for stormwater surcharge pits in First Avenue West. Encroaches onto Swimming Pool Lawn. Must be maintained, and retained in some form.
- AREA 'F5' 5 yr ARI surcharge basin for stormwater surcharge pits in International Road. Must be retained in some form.
- AREA 'F6' Quadrangle Lawn detention basin with discharge orifice plate pit in College Rd. College Rd is raised below pit to retain overland flow. Must be maintained and retained in some form of equal capacity, as Village Green detention volume cannot be safely increased.
- AREA 'F7' Percolation trench serving Goldstein roof water discharge, to be maintained and permanently retained in some form of equal capacity.
- AREA 'F8' Upper Campus Car Park detention basin with discharge orifice pit in ground floor. Must be maintained and permanently retained, as Village Green detention volume cannot be safely increased.
- AREA 'F9' Barker Street Car Park detention basin with discharge orifice pit in ground floor. Must be maintained and permanently retained, as Village Green detention volume cannot be safely increased.

LEGEND

- A1 Sub-Area Development Types
- F1 Detention areas or percolation trenches

Read this drawing in conjunction with the following:

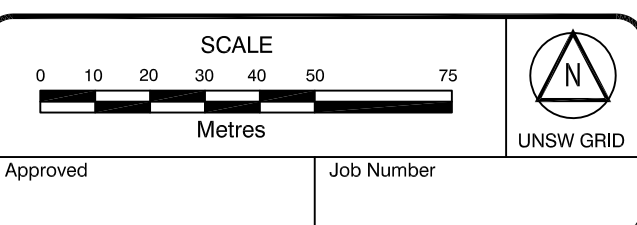
- Campus 2020 Master Plan Stormwater Strategy document
- Stormwater Diversion Structure Plan

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R Andrews
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R Andrews
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No.	DATE	DRAWN	CHKD	AMENDMENT	No.	DATE	DRAWN	CHKD	AMENDMENT
2	21.02.11	RJA	RJA	New drawing number					
1	28.11.05	RJA	RJA	Updated with RCC Development Engineer's comments					



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FACILITIES MANAGEMENT

SITE SERVICES

KENSINGTON CAMPUS			
MASTER PLAN			
STORMWATER CATCHMENT MANAGEMENT PLAN			
CAD Reference	Drawing No.	Last Revision	Revision
SS-HYD-STORMWATER	FME 0012 / H	21/02/2011	2

APPENDIX B