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CONSULTING ENGINEERS

Flood Risk Assessment Report

Alexandria Park Community School

9 March 2018 | 16-217

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Document control

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1.0 Introduction

This Flood Risk Assessment Report has been prepared by Woolacotts Consulting Engineers on behalf of the NSW Department of Education (the 'Applicant'). It accompanies an Environmental Impact Statement (EIS) prepared in support of State Significant Development Application SSD 17_8373 for the redevelopment of 'Alexandria Park Community School' at 7-11 Park Road, Alexandria (the 'Site'). The EIS seeks development consent for the following works:

The redevelopment of the Alexandria Park Community School ('the School') will address issues of capacity for schools in the inner city areas of Sydney and is also driven by the population growth resulting from the large number of residential developments that are transforming the former industrial precincts of Zetland, Waterloo and Alexandria.

The new school has been briefed to accommodate up to 1,000 primary school students and up to 1,200 secondary school students on one campus in an integrated and fully connected school building.

Specifically, this project includes:

- Demolition of all existing buildings on-site, including the temporary pop-up schools;
- Remediation of specific areas of the site containing contaminated fill;
- Construction of multiple school buildings of up to five stories, arranged along the western and southern parts of the site comprising:
    - Classroom home bases;
    - Collaborative learning spaces;
    - Specialist learning hubs;
    - Learning support spaces;
    - Offices for teachers and administrative staff;
    - Library; and
    - Student canteen.
- Construction of a sports hall and multiple outdoor sports courts;
- An all-weather multipurpose synthetic sports field;
- Informal play spaces and Covered Outdoor Learning Space or COLA;
- A community centre;
- A pre-school for 39 children;
- Site landscaping including green links, community garden and open space;
- Construction of a new on-site car park and associated vehicular access point off Belmont Street; and
- Augmentation and construction of ancillary infrastructure and utilities as required.

Delivery of the project will be undertaken in sequential phases to maintain an operational school on the Park Road Campus and will involve enabling works separate to this application followed by three main construction phases for the new building and external works.

The purpose of this report is to provide an assessment of the proposal as described above and detailed within the EIS.

This report discusses flood related issues associated with the development, as the site is flood affected by both PMF and 1%AEP storm events. Recommendations on all precautions to minimise risk to personal safety of occupants, and the risk of property damage of the total development in the event of a flood will be investigated.

Figure 1 – Site Location

2.0 Flood management and impacts

2.1 Flood information

Flood information relating to the site has been obtained from the Alexandra Canal floodplain risk management plan, risk management study and flood study adopted by City of Sydney in March 2014.

The information within the above reports includes the following:

- 1% AEP flood depth and extent
- PMF depth and extent
- Freeboard requirement for flood planning level
- 1% AEP flood hazard
- PMF hazard
- 1% AEP maximum velocity

The following table outlines flood level information specific to the site:

Flood Level Information	
Design flood level (1% AEP)	13.33m AHD
Freeboard	0.5m
Flood Planning Level (FPL)	13.83m AHD (1% AEP + 0.5m Freeboard)
Probable Maximum Flood (PMF)	13.77m AHD

Refer to Figures 2 to 6 for various flood extents, depths and hazards. Figures 2 to 5 have been taken from the Alexandria Canal Floodplain Risk Management Plan dated 20 May 2014. Figure 6 has been taken from Council's TUFLOW model.

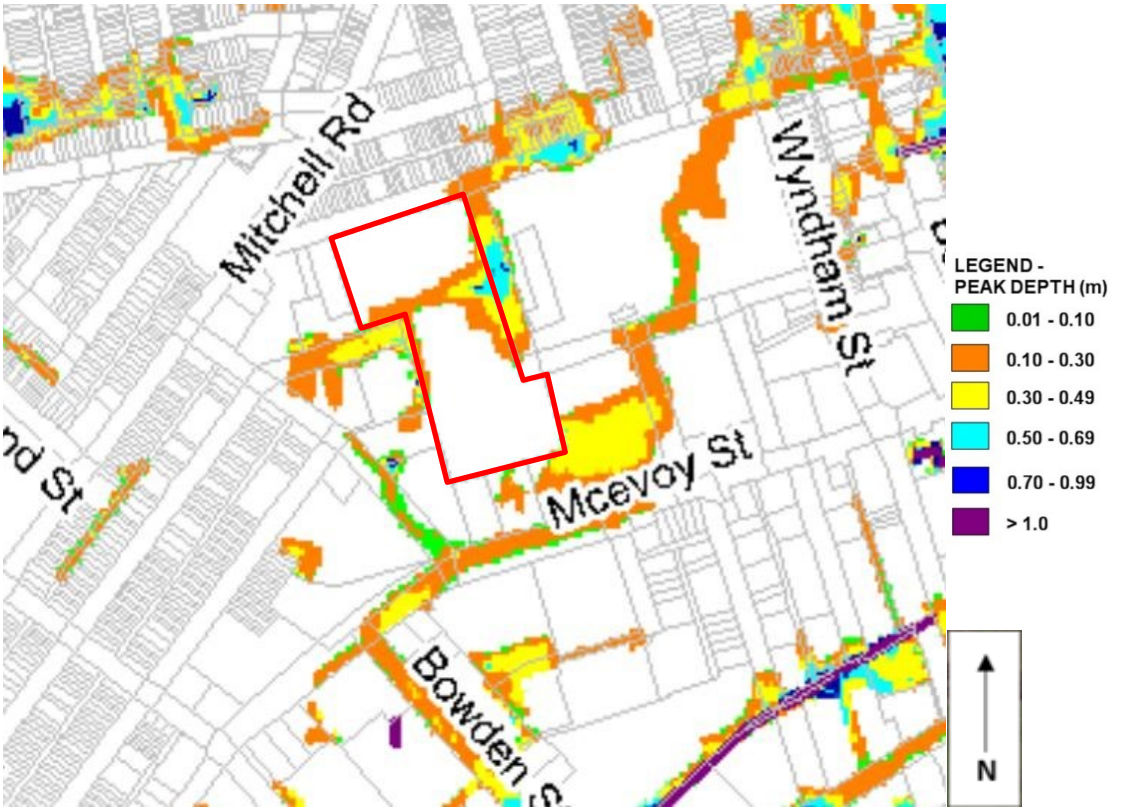

Figure 2 – 1% AEP Flood Depth & Extent

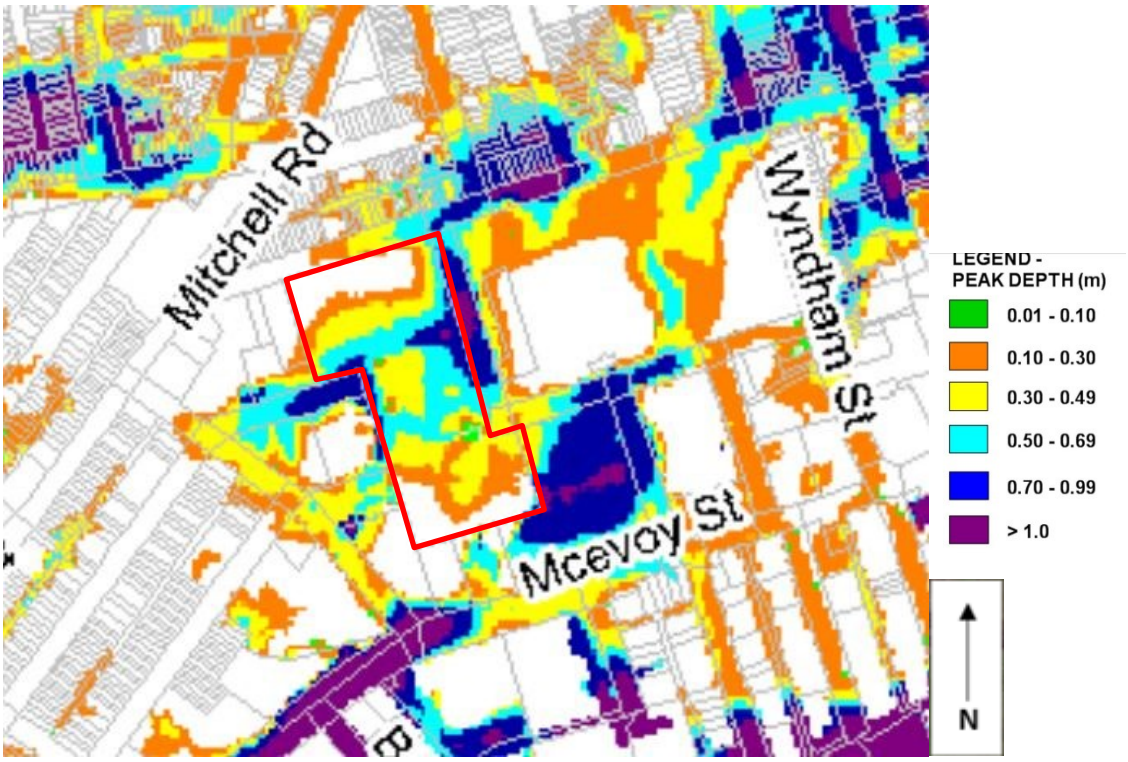

Figure 3 – PMF Flood Depth & Extent

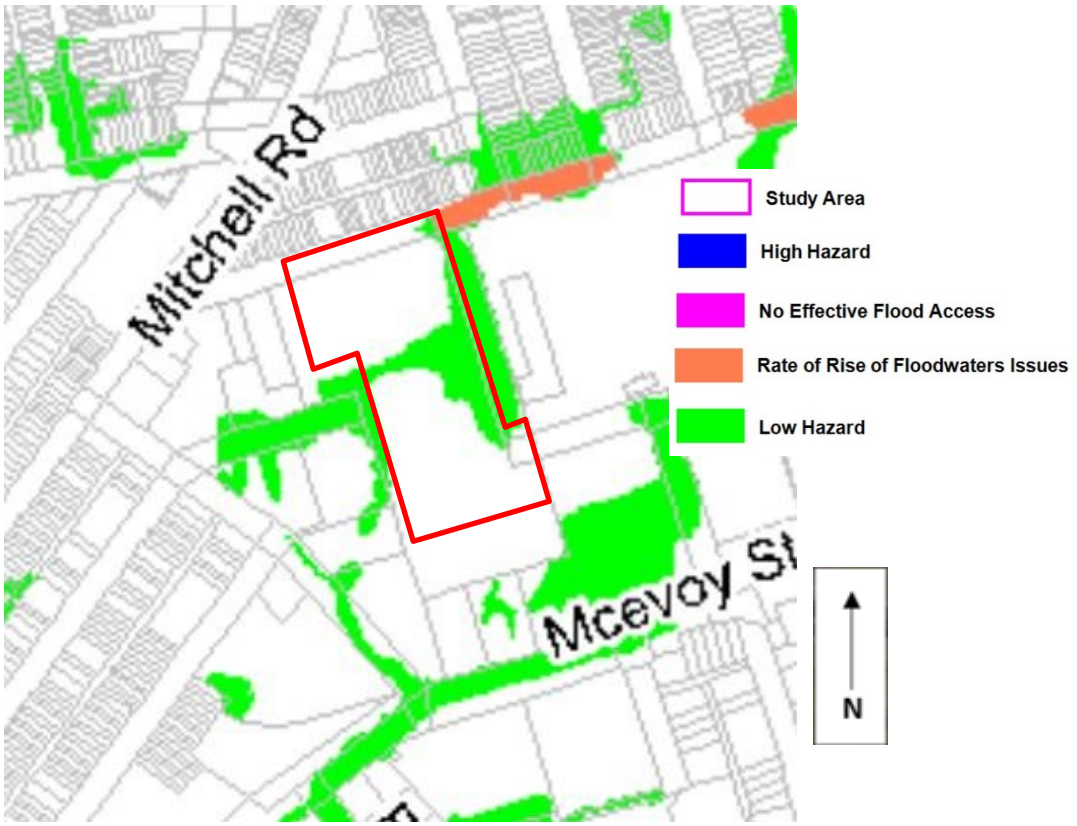

Figure 4 – 1% AEP Flood Hazard

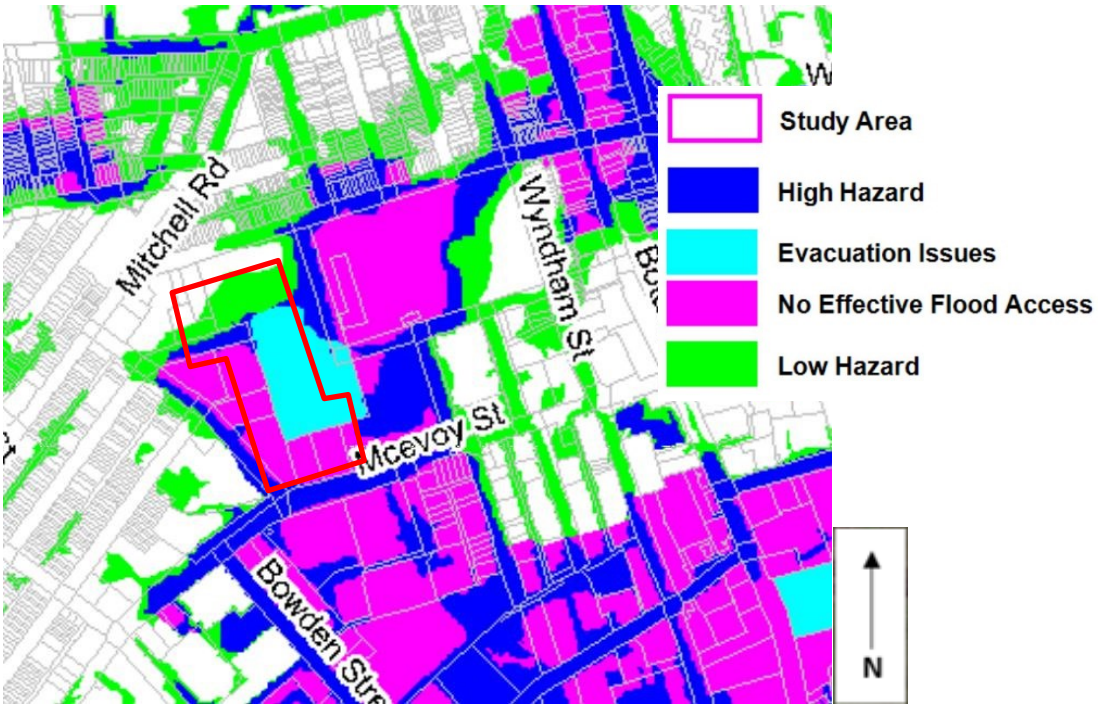

Figure 5 – PMF Hazard

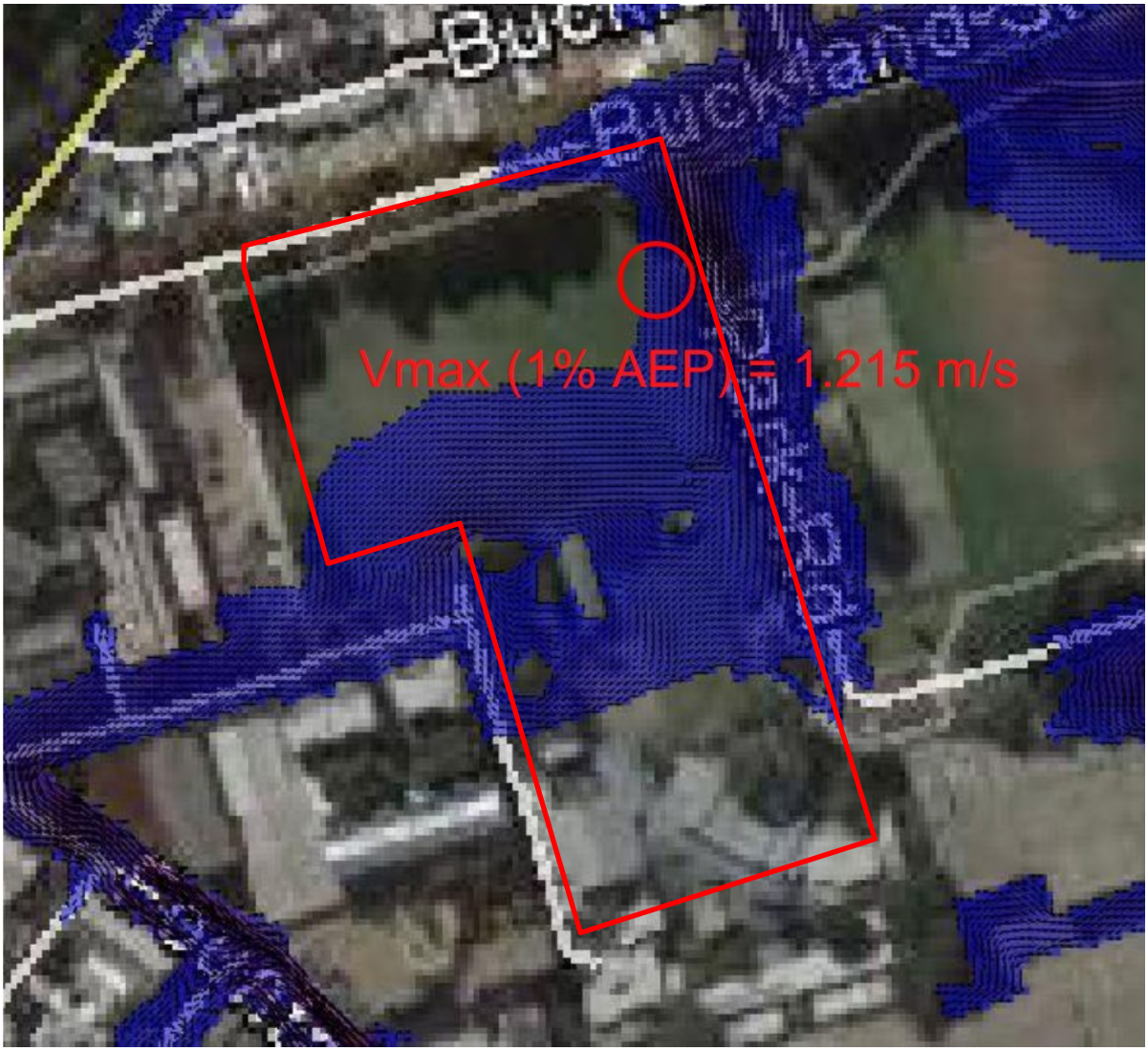

Figure 6 – 1% AEP Maximum Velocity

As depicted in the images above, a portion of the site is affected by 1% AEP flood event and a significant portion of the site is affected by PMF event.

The site is identified as a low hazard for 1% AEP flood and high hazard for PMF.

The site has a maximum 1% AEP velocity of 1.215 m/s

2.2 Floodplain Risk Management Plan

Alexandra Canal Floodplain Risk Management Study and Plan outlines various measures for floodplain risk management options. It includes flood modification measures, property modification measures as well as emergency response measures. Appropriate measures that are applicable to the proposed development are outlined below:

- Flood Planning Level

  Floor levels of the proposed development to be set at a minimum of the PMF or FPL, whichever is greater. For the proposed development, the flood planning level is 13.83.

- Flood Proofing Guidelines

  All structural elements below the flood planning level shall be constructed from flood compatible materials.

  All structures must be designed and constructed to ensure structural integrity for immersion and impact of debris up to the 1% AEP flood event. If the structure is to be relied upon for shelter-in-place evacuation then structural integrity must be ensured up to the level of the PMF.

  All electrical equipment, wiring, fuel lines or any other service pipes and connections must be waterproofed to the flood planning level.

- Evacuation

  Flood free access to the evacuation centres.

- Flood Warning Signs

  Appropriate flood warning signs are to be posted.

- Flood Awareness and Education

  School needs to maintain an adequate level of flood awareness during the extended periods when flooding does not occur. Flood awareness extends to the students, staff and parents.

3.0 Flood Evacuation/Shelter in Place Plan

The site has been identified as being flood affected by both 1% AEP and PMF storm events. Warnings of an upcoming flood may occur through numerous avenues. The Bureau of Meteorology issue thunderstorm and severe weather warnings when such events are expected to develop or move into the area under threat. The NSW State Emergency Service (SES) receive updated weather information and notify the general public through numerous forms. The SES commonly distributes flood bulletins to the media who will broadcast information regarding what is expected to happen during a flood.

School staff are encouraged to seek out updated information regarding current weather status and severity in the event of heavy rain. Common forms of communicating flooding information include door knocks from emergency services, TV/radio and other media, word of mouth, and the SES emergency alert.

It is critical that staff are able to identify when to follow the evacuation plan. Evacuation routes require flood free access to evacuation centres. However during both the 1% AEP flood and PMF events, access to the external roads (Belmont Street to the west and Park Road to the east) are inundated. Thus in a major storm event, all staff and students should evacuate before flood levels inundate the evacuation route. Evacuation, via the Park Road entrance, should commence when flood levels start inundating the site.

Should water levels rise too quickly, the staff and students should shelter in place inside the school buildings, which all have a floor level above the flood planning level and the PMF, and contact the SES or other relevant authority and await safe evacuation. All buildings on the site will be connected at the upper levels, allowing students and staff to be readily relocated to any point, to best suit evacuation requirements.

Appropriate flood warning signs are to be posted, to include the following information:

> DO NOT attempt to access the site if flood waters are rising rapidly or if flood waters are approaching the building. Move immediately to higher ground and leave the area, as per the evacuation plan.
>
> DO NOT walk through flood waters to access the building.
>
> Follow any instructions given by the police or SES.
>
> Ensure all staff and students gather at a known location to confirm all have been accounted for and safely out of the flood area.

3.1 Emergency contacts

Police 000

SES 132 500

4.0 Flood Impact Assessment

The majority of the existing buildings at the site are not located within the 1% AEP flood extent but are within the PMF flood extent. The new development will include buildings located within both the 1% AEP and PMF flood extents.

During a 1% AEP event, there are overland flow paths into the site from the end of Belmont Street to the west and from the side of Park Road to the east. Water levels at both roads need to rise before overflowing into and across the site to the existing connection to the stormwater culvert within the Sydney Water easement running through the site.

Based on discussions with Sydney Water, we understand that ground levels over the easement have been raised over time and as per Sydney Water's request, as part of the new development the external ground levels will be lowered by up to 200mm over part of the easement to allow overland flow to fall back to the eastern end.

Overland flow from the end of Belmont Street in a major storm event is to be redirected around the new buildings via the driveway along the eastern boundary and over the stormwater easement to a series of new pits and connections to the culvert, concentrated at the new raingarden located over and adjacent to the eastern end of the easement.

The proposed overland flow path for the development has been assessed for the 1% AEP flood event, refer Calculations in Appendix B. At the narrowest point of the new overland flow path there is sufficient capacity to transfer the peak flow rate without inundating adjacent school buildings or neighbouring properties.

Overland flow from Park Road into the site is be unchanged, with the existing boundary levels to remain.

The levels at the external landscaped areas, raingarden and sports field have been lowered significantly in order to create additional floor storage for the site. In a 1% AEP flood event, we calculate that the redeveloped site will have an increase in available flood storage capacity of approximately 2,300m^3.

The re-developed site will not have any adverse impact on the neighbouring properties during a flood event.

5.0 Conclusion

The objectives set out in Alexandra Canal Floodplain Risk Management Study and Plan have been investigated/ satisfied with the following design measures:

- Proposed structure FFL is 13.83m AHD minimum. This is 500mm higher than 1% AEP flood level and higher than PMF flood level of 13.77m AHD.
- All structural elements below the flood planning level (13.83m AHD) shall be constructed from flood compatible materials.
- All building are to be relied upon for shelter-in-place evacuation, thus structural integrity must be ensured up to the level of the PMF.
- All electrical equipment, wiring, fuel lines or any other service pipes and connections must be waterproofed to the flood planning level.
- The Flood Evacuation Plan outlines shelter-in-place during the 1% AEP and PMF event. Refer to Section 3.0 for further detail.
- Appropriate flood warning signs are to be posted.

As part of the development, the levels for the external landscaped area and sports filed will be lowered and new connections made to the existing stormwater culvert which will increase the flood storage volume and provide quicker drainage of the site. The development will modify overland flow paths but will maintain existing overland flow rates into the site in a flood event, preventing any adverse impact on the neighbouring properties.

Appendix A

Calculations/Drawings

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Job Alexandria Park Date 9/3/18

* OVERLAND FLOW PATH CROSS SECTION.

TUFLOW MODEL : $Q_{100_{MAX}} = 2.521\ m^3/s$

* CROSS SECTION CAPACITY OF OVERLAND FLOW PATH

METHOD 1 : WEIR FLOW

$$Q = 1.7\, w.h^{1.5}$$

$$= 17 \times 8.879 \times (0.31)^{1.5}$$

$$= 2.605\ m^3/s.$$ ∴ Depth = 0.31m

METHOD 2: MANNINGS CHANNEL CAPACITY

$$Q = \frac{A\, R^{\frac{2}{3}} . S^{\frac{1}{2}}}{n}$$ let depth = 0.31m

$A = 8.879 \times 0.31$
$= 2.752\ m^2$

$wp = (0.31 \times 2) + 8.879$
$= 9.499m$

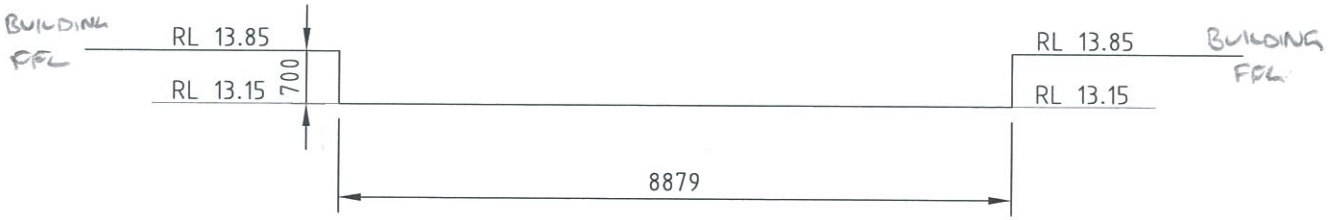
$R = 0.290$

$S = 0.01$ (assumed %) ∴ $Q = \frac{2.752 \times 0.290^{\frac{2}{3}} \times 0.01^{\frac{1}{2}}}{0.013} = 9.275 m^3/s$

$n = 0.013$ > $Q_{100\,MAX}$.

SUMMARY @ depth = 0.31m, Narrowest location of proposed Overland flow path will transmit Q_{100} flowrate without inundating adjacent floor levels.

Designed JS Job no. 16-217 Sheet no.



* CROSS SECTION: NARROWEST OVERLAND FLOW PATH A—A

Job Alexandria Park Date 9/3/18

* FLOOD STORAGE INFORMATION

TOTAL SURFACE AREA OF FLOOD EXTENT (RL 13.33) = 11,580 m² 100YR ARI

EXISTING SITE: FLOOD STORAGE VOLUME.

Average Depth = 13.33 − [(13.30 + 13.20 + 13.28 + 13.23 + 13.20 + 13.00 + 12.80 ... + 13.00 + 12.70 + 13.00 + 12.40 + 13.44 + 13.10 + 12.80 ... + 13.00 + 13.21 + 13.15 + 13.00 + 13.25)/19]

≈ 0.27m

∴ Vol. Approx = 11,580 × 0.27 ≈ 3,127 m³

PROPOSED SITE: FLOOD STORAGE VOLUME

Average Depth = 13.33 − [(13.30 + 13.20 + 13.28 + 13.15 + 13.00 + 13.00 + 12.90 ... + 12.78 + 12.80 + 12.73 + 12.76 + 12.70 + 12.55 + 12.40 ... + 12.25 + 13.00 + 12.35 + 13.00 + 13.25)/19]

≈ 0.47m

∴ Vol Approx = 11,580 × 0.47 ≈ 5,443 m³

∴

POST DEVELOPED SITE FLOOD STORAGE VOLUME > PRE DEVELOPED SITE FLOOD STORAGE VOLUME.

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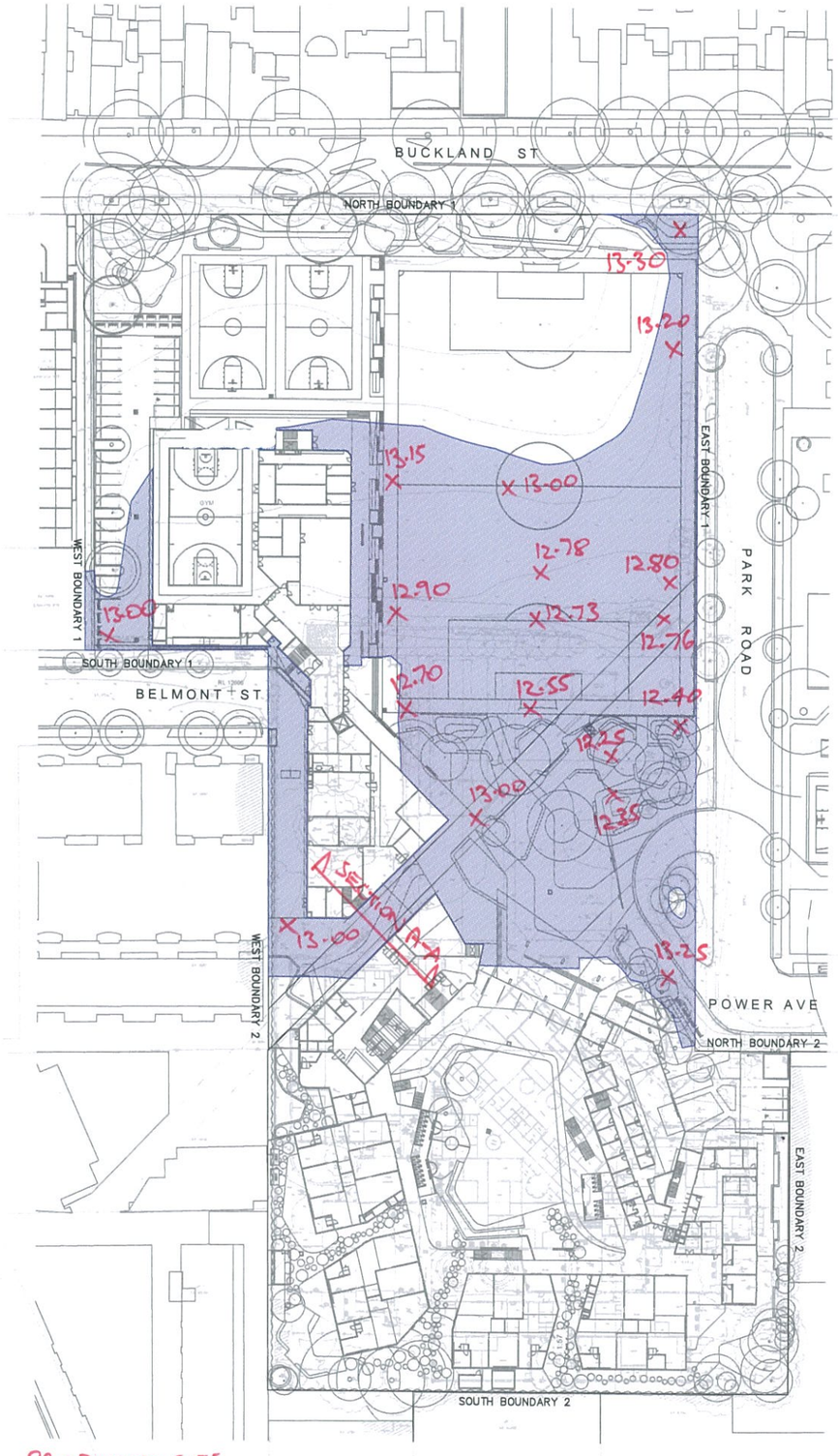
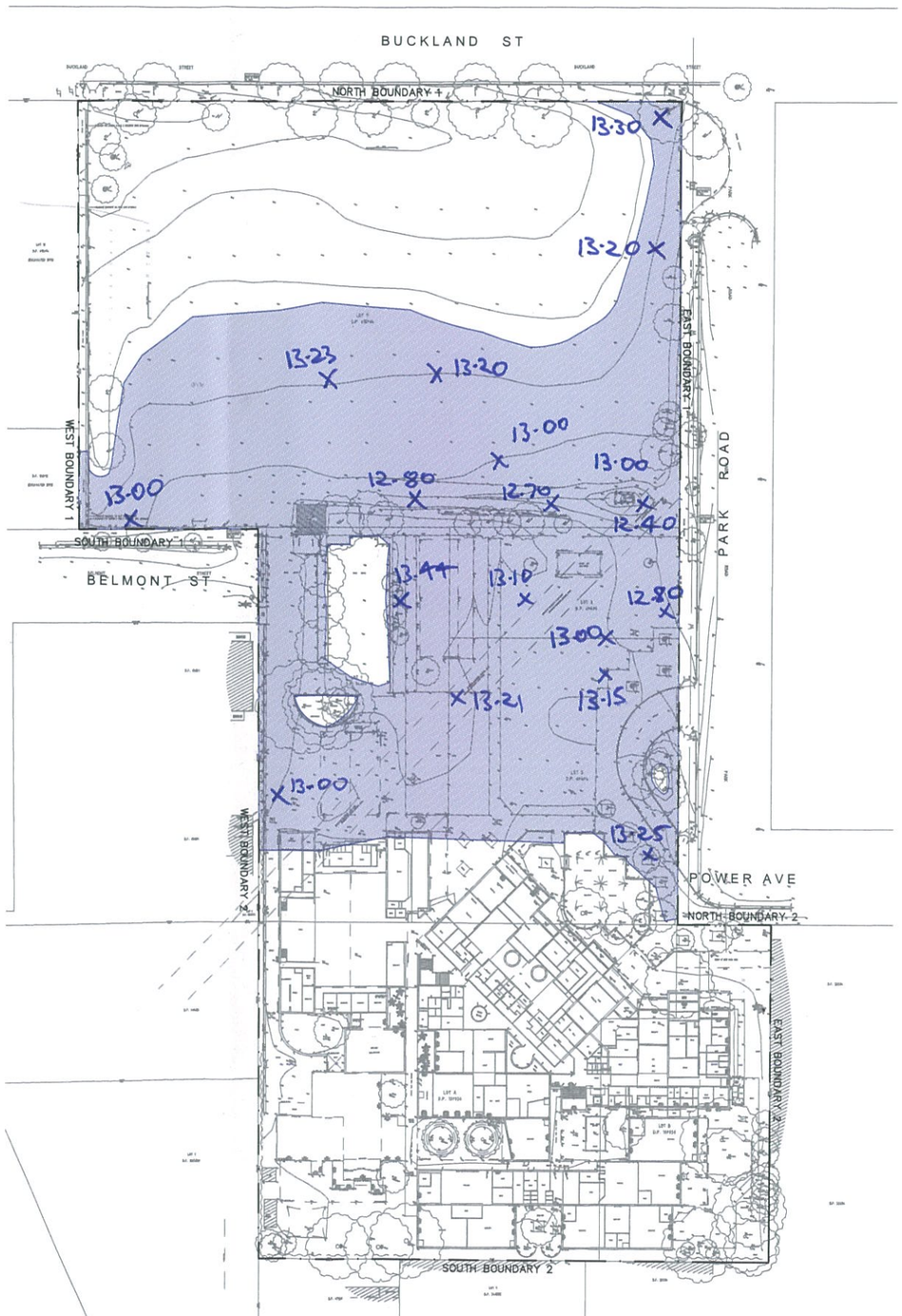


PROPOSED SITE



EXISTING SITE

LEGEND

FLOOD EXTENT
100YR ARI TWL = 13.33

X EXISTING GROUND LEVELS (RL)

X PROPOSED GROUND LEVELS (RL).

NTS