

**Sydney Metro**

# **PITT STREET SOUTH OVER STATION DEVELOPMENT**

[S] Flood Impact Assessment Report

**State Significant Development,  
Development Application (SSD DA)**

Prepared for **Pitt Street Developer South Pty LTD**

19 May 2020

Revision C

Issue for SSD DA

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# Contents

<b>1</b>	<b>Executive Summary .....</b>	<b>1</b>
<b>2</b>	<b>Introduction.....</b>	<b>3</b>
2.1	The Site .....	3
2.2	Sydney Metro .....	4
2.2.1	Sydney Metro Northwest (formerly the 36km North West Rail Link).....	4
2.2.2	Sydney Metro City & Southwest.....	4
2.2.3	Sydney Metro West .....	5
2.2.4	Sydney Metro Greater West.....	5
2.3	Pitt Street South Over Station Development (OSD).....	8
<b>3</b>	<b>Flood Planning Requirements .....</b>	<b>12</b>
3.1	Review of existing documents .....	12
3.2	Further discussion of existing documents .....	17
3.2.1	Flooding and Stormwater Management Plan .....	17
3.2.2	Interim Floodplain Management Policy .....	17
3.2.3	SWTC Requirements.....	18
3.2.4	Revised Environmental Mitigation Measures (REMM).....	18
3.3	Summary of design criteria.....	19
<b>4</b>	<b>External pavements, kerbs and gutters .....</b>	<b>21</b>
4.1	Summary of design criteria – Pavement cross falls .....	21
4.2	Summary of design criteria – Pavement longitudinal falls.....	23
4.3	CSSI Works .....	24
<b>5</b>	<b>Flood impacts on other properties .....</b>	<b>25</b>
5.1	Reference Documents and Design Criteria.....	25
5.2	Impacts on adjacent properties .....	26
<b>6</b>	<b>Conclusion .....</b>	<b>27</b>

## Appendices

<b>Appendix A.....</b>	<b>29</b>
1% AEP Event – Flood Afflux Map.....	29
<b>Appendix B.....</b>	<b>30</b>
Pavement Contour Drawings – Proposed.....	30

## Figures

Figure 2-1 – Location Plan .....	4
Figure 2-2 – Sydney Metro Alignment Map.....	6
Figure 2-3 – Pitt Street Station (North-South Section) .....	7
Figure 2-4 – Pitt Street Station (East-West Section).....	7
Figure 2-5 – Pitt Street South Concept SSD DA – Building Section .....	9
Figure 2-6 – Pitt Street South Concept SSD DA – North South Section .....	10
Figure 2-7 – Pitt Street South Concept SSD DA – East West Section .....	11

Figure 4-1 – Extract from City of Sydney Technical Specification B5 Footways Construction .....	21
Figure 4-2 – Extract from AustRoads, Part 6A .....	22
Figure 4-3 – Extract from AS1428.1 – Design for access and mobility .....	22

## Tables

Table 3-1 – Review of documents informing the requirements for flood protection .....	13
Table 3-2 – Summary of requirements for flood protection .....	19

## Reference documents

- The Flooding and Stormwater Management Plan dated August 2018 prepared by GHD for the Stage 1 SSD DA and ;
- The Interim Floodplain Management Policy prepared by the City of Sydney
- Revised Environmental Mitigation Measured (REMM)
- Basis of Design document (2017) prepared by Metron (Stage 1)
- Sydney Metro Scope of Works and Technical Criteria (SWTC) Appendix B02 – Civil and Structural Works
- Works Authorisation Deed (WAD) – Sydney Metro City and Southwest Project Pitt St Works
- Sydney Metro City and Southwest Urban Works Interface Agreement - Pitt St Works.
- AustRoads Guide to Road Design Part 6A
- City of Sydney Technical Specification B5 Footways Construction
- AS1428.1:2009 - Design for access and mobility-General requirements for access - New building work



# 1 Executive Summary

A flood model of the proposed Pitt Street South Over Station Development was prepared to address any street level works which may have an impact on local flooding levels based on the models obtained from the City of Sydney.

A previous Flooding and Stormwater Management Plan prepared by GHD for Sydney Metro for Concept Design Stage 1 (SSD 17\_8876 approved) was reviewed. This report, based on the WMA 2016 modelling for City Of Sydney, City Area Catchment, provided some background information relevant to flood and stormwater management aspects of the project.

An assessment of the City of Sydney's Interim Floodplain Management Policy was undertaken.

This report has been developed to address the OSD SSD DA conditions only. The Stormwater Management Plan is prepared by CJ Arms and addressed separately in the following report SMCSWSPS-CJA-OSS-PL-REP-000001.

For further information regarding station environs, loading dock laybacks and footpath modifications associated with the station itself, please refer to the Critical State Significant Infrastructure (CSSI) DA and the RMS (Roads and Maritime Services) Works Authorisation Deed (WAD).

Note that compliance with guidelines relating to pavements falls will not be achieved in a number locations due to existing topography and stringent flood protection measures.

## SEARS

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARS) Dated 28 October 2019. Specifically, this report has been prepared to respond to the SEARS requirements summarised in Table 1

TABLE 1 – SEARs requirements		
Item	Description of Requirement	Section Reference (this report)
15 Plans and Documents	Flood assessment and stormwater management plan	The Stormwater Management Plan is prepared by CJ Arms and addressed in the following report SMCSWSPS-CJA-OSS-PL-REP-000001

## CONDITIONS OF CONSENT

This report has also been prepared in response to the following Condition of Consent for the State Significant Development Concept (SSD 8876) for the Pitt St South Over Station Development summarised in Table 2 below.

Table 2 - Concept approval of Conditions of Consent		
Item	Description of Requirement	Section Reference (this report)
B22 - Flooding and Stormwater	<p>Future detailed development application(s) shall be accompanied by a Flood Impact Assessment. The Flood Impact Assessment must address the conclusions and recommendations of the concept stage Flooding and Stormwater Management Plan dated August 2018 prepared by GHD and provide the following:</p> <p>(a) Compliance with the City of Sydney's Interim Floodplain Management Policy including detailed reasoning for any non-compliances.</p>	<p>Refer Sections 3, 4 and 5 of this report as well as the Stormwater Management Plan prepared by CJ Arms and addressed in the following report SMCSWSPS-CJA-OSS-PL-REP-000001.</p> <p>The GHD Reports recommends flood mitigation measures to address Bathurst Street entrance (this is addressed within the CSSI application) and does not directly relate to this application.</p>
B22 - Flooding and Stormwater	<p>(b) Detailed stormwater and drainage design documentation including overland flow assessment and maintenance.</p>	<p>Refer Section 5 of this report in addition to the Stormwater Management Plan prepared by CJ Arms and addressed in the following report SMCSWSPS-CJA-OSS-PL-REP-000001.</p>

## 2 Introduction

This report has been prepared to accompany a detailed State Significant Development (SSD) development application (DA) for a residential Over Station Development (OSD) above the new Sydney Metro Pitt Street South Station. The detailed SSD DA is consistent with the Concept Approval (SSD 17\_8876) granted for the maximum building envelope on the site, as proposed to be modified.

The Minister for Planning, or their delegate, is the consent authority for the SSD DA and this application is lodged with the NSW Department of Planning, Industry and Environment (NSW DPIE) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 28 October 2019.

The detailed SSD DA seeks development consent for the construction and operation of

- New residential tower with a maximum building height of RL 171.6, including residential accommodation and podium retail premises, excluding station floor space
- Use of spaces within the CSSI 'metro box' building envelope for the purposes of:
  - Retail tenancies;
  - Residential communal facilities, residential storage, bicycle parking, and operational back of house uses
  - Shared vehicle loading and service facilities on the ground floor
  - Landscaping
  - Utilities and services provision.
  - Stratum subdivision (Station/OSD)
- Integration with the approved CSSI proposal including though not limited to:
  - Structures, mechanical and electronic systems, and services; and
  - Vertical transfers;

### 2.1 The Site

The site is located within the Sydney CBD, on the corner of Bathurst Street and Pitt Street. It has two separate street frontages, Pitt Street to the west and Bathurst Street to the north. The area surrounding the site consists of predominantly residential high-density buildings and some commercial buildings, with finer grain and heritage buildings dispersed throughout.

The site has an approximate area of 1,710sqm and is now known as Lot 10 in DP 1255507. The street address is 125 Bathurst Street, Sydney.

## 2.2 Sydney Metro

## 2.2 Sydney Metro

There are four core components:

### 2.2.1 Sydney Metro Northwest (formerly the 36km North West Rail Link)

This project is now complete and passenger services commenced in May 2019 between Rouse Hill and Chatswood, with a metro train every four minutes in the peak. The project was delivered on time and \$1 billion under budget.

### 2.2.2 Sydney Metro City & Southwest

Sydney Metro City & Southwest project includes a new 30km metro line extending metro rail from the end of Metro Northwest at Chatswood, under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with

the ultimate capacity to run a metro train every two minutes each way through the centre of Sydney.

Sydney Metro City & Southwest will deliver new metro stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and new underground metro platforms at Central Station. In addition, it will upgrade and convert all 11 stations between Sydenham and Bankstown to metro standards.

In 2024, customers will benefit from a new fully-air-conditioned Sydney Metro train every four minutes in the peak in each direction with lifts, level platforms and platform screen doors for safety, accessibility and increased security.

### **2.2.3 Sydney Metro West**

Sydney Metro West is a new underground railway connecting Greater Parramatta and the Sydney CBD. This once-in-a-century infrastructure investment will transform Sydney for generations to come, doubling rail capacity between these two areas, linking new communities to rail services and supporting employment growth and housing supply between the two CBDs.

The locations of seven proposed metro stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays.

The NSW Government is assessing an optional station at Pyrmont and further planning is underway to determine the location of a new metro station in the Sydney CBD.

### **2.2.4 Sydney Metro Greater West**

Metro rail will also service Greater Western Sydney and the new Western Sydney International (Nancy Bird Walton) Airport. The new railway line will become the transport spine for the Western Parkland City's growth for generations to come, connecting communities and travellers with the rest of Sydney's public transport system with a fast, safe and easy metro service. The Australian and NSW governments are equal partners in the delivery of this new railway.

The Sydney Metro Project is illustrated in the figure below.



### Figure 2-2 – Sydney Metro Alignment Map

The CSSI Approval included Indicative Interface Drawings for the below and above ground works at Pitt Street South Metro Station site. The delineation between the approved Sydney Metro works, generally described as within the “metro box”, and the Over Station Development (OSD) elements are illustrated below. The delineation line between the CSSI Approved works and the OSD envelope is generally described below or above the transfer slab level respectively.

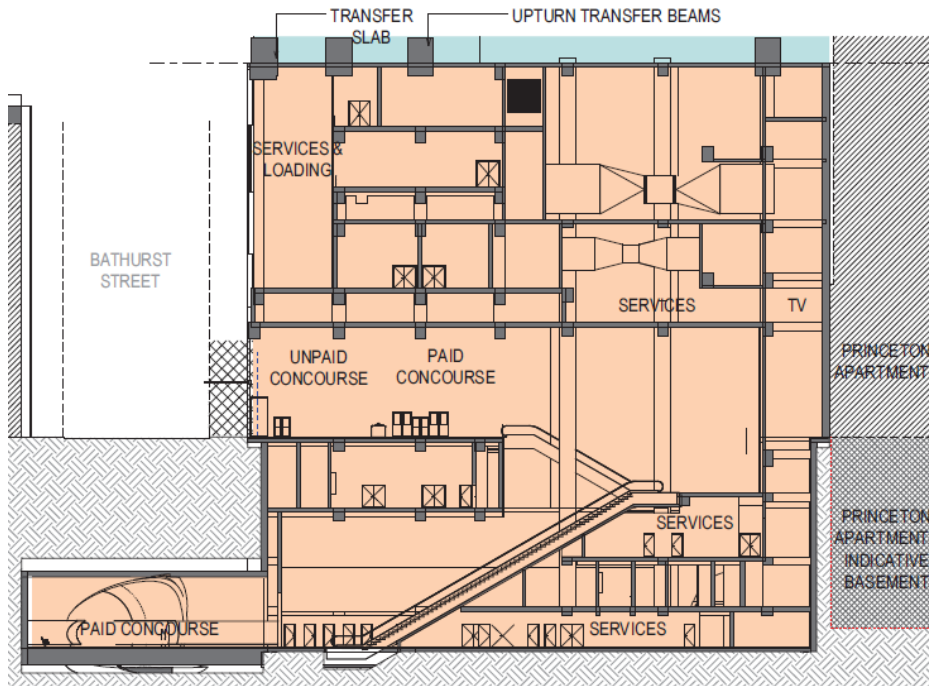


Figure 2-3 – Pitt Street Station (North-South Section)

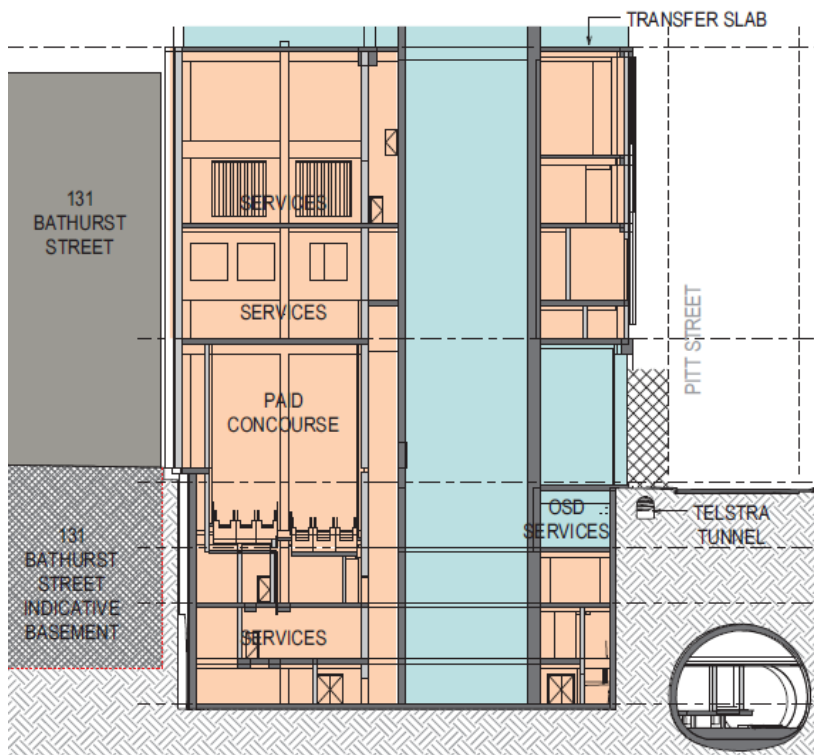





Figure 2-4 – Pitt Street Station (East-West Section)

## LEGEND

-  METRO PROPERTY BOUNDARY
-  OSD DEVELOPMENT -  
SUBJECT TO SEPARATE  
ASSESSMENT PROCESS
-  STATION

Source: CSSI Preferred Infrastructure Report (TfNSW)

The Preferred Infrastructure Report (PIR) noted that the integration of the OSD elements and the metro station elements would be subject to the design resolution process, noting that the detailed design of the “metro box” may vary from the concept design assessed within the planning approval.

As such in summary:

- The CSSI Approval provides consent for the construction of all structures within the approved “metro box” envelope for Pitt Street South.
- The CSSI Approval provides consent for the fit out and use of all areas within the approved “metro box” envelope that relate to the ongoing use and operation of the Sydney Metro.
- The CSSI Approval provides consent for the embellishment of the public domain, and the architectural design of the “metro box” envelope as it relates to the approved Sydney Metro and the approved Pitt Street South Station Design & Precinct Plan.
- Separate development consent however is required to be issued by the NSW DPIE for the use and fit-out of space within the “metro box” envelope for areas related to the OSD, and notably the construction and use of the OSD itself.

As per the requirements of clause 7.20 of the Sydney Local Environmental Plan 2012, as the OSD exceeds a height of 55 metres above ground level (among other triggers), development consent is first required to be issued in a Concept (formerly known as Stage 1) DA. This is described below.

## 2.3 Pitt Street South Over Station Development (OSD)

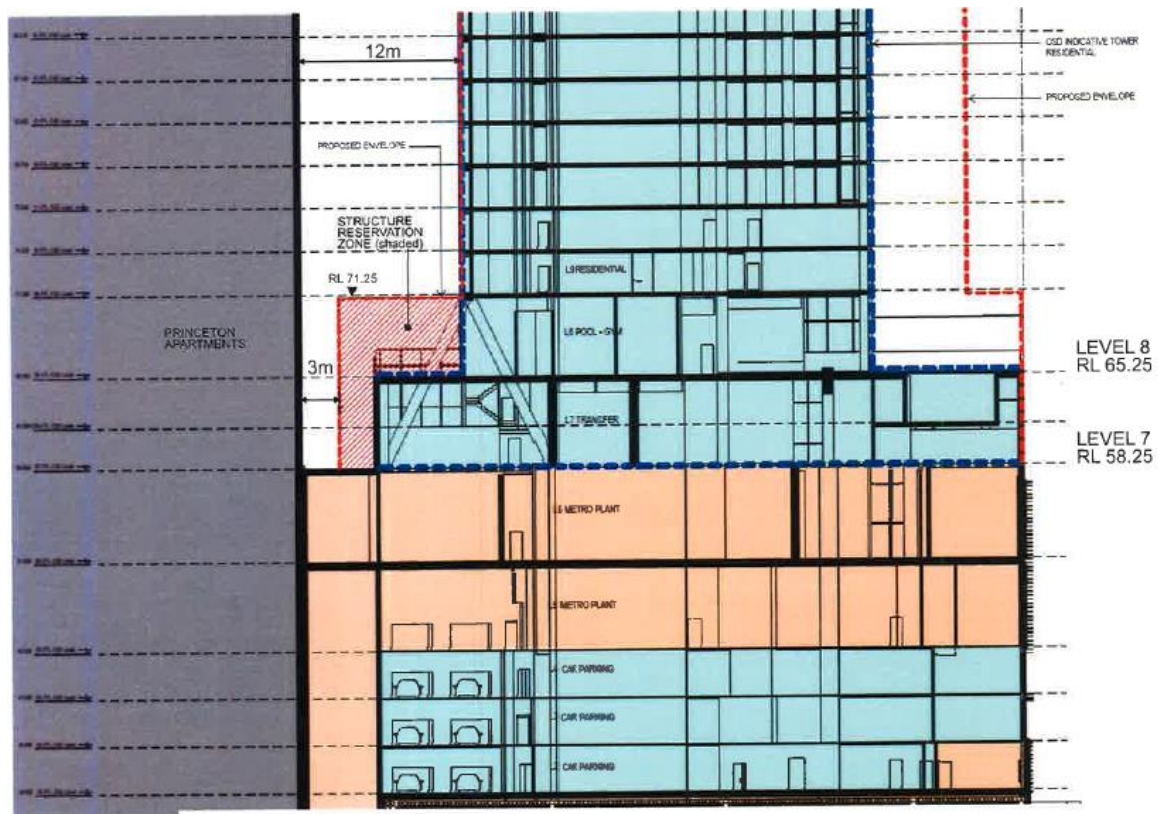
Development consent was granted on 25 June 2019 for the Concept Development Application (SSD 8876) for Pitt Street South OSD including:

- A maximum building envelope, including street wall and setbacks for the over station development.
- A maximum building height of RL171.6.
- Podium level car parking for a maximum of 34 parking spaces.
- Conceptual land use for either one of a residential or commercial scheme (not both). NO maximum Gross Floor Area was approved as part of SSD 8876.



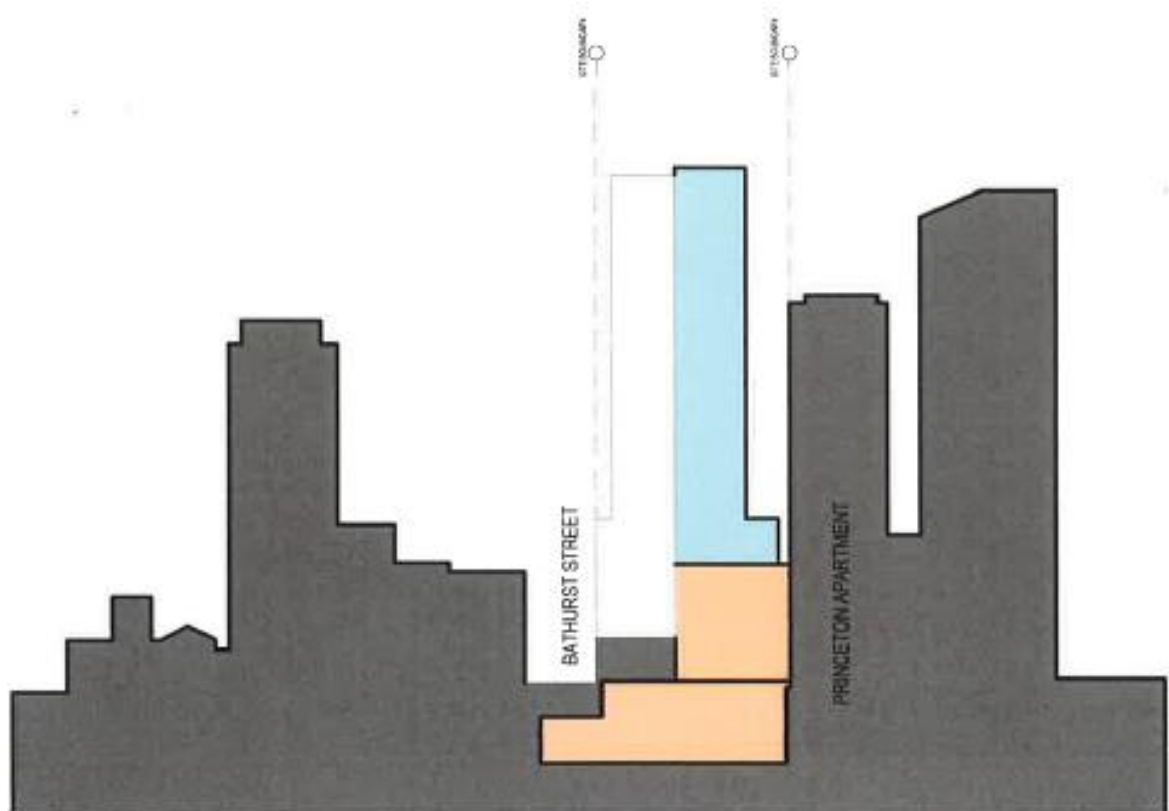
The building envelope approved within the Concept SSD DA provides a numeric delineation between the CCSI Approval “metro box” envelope and the OSD building envelope. As illustrated in the figures below, the delineation line between the two projects is defined at RL 58.25 (Level 7).

For the purposes of the Detailed (Stage 2) SSD DA, it is noted that while there are two separate planning applications that apply to the site (CCSI and SSD DA), this report addresses the full development across the site to provide contextual assessment.



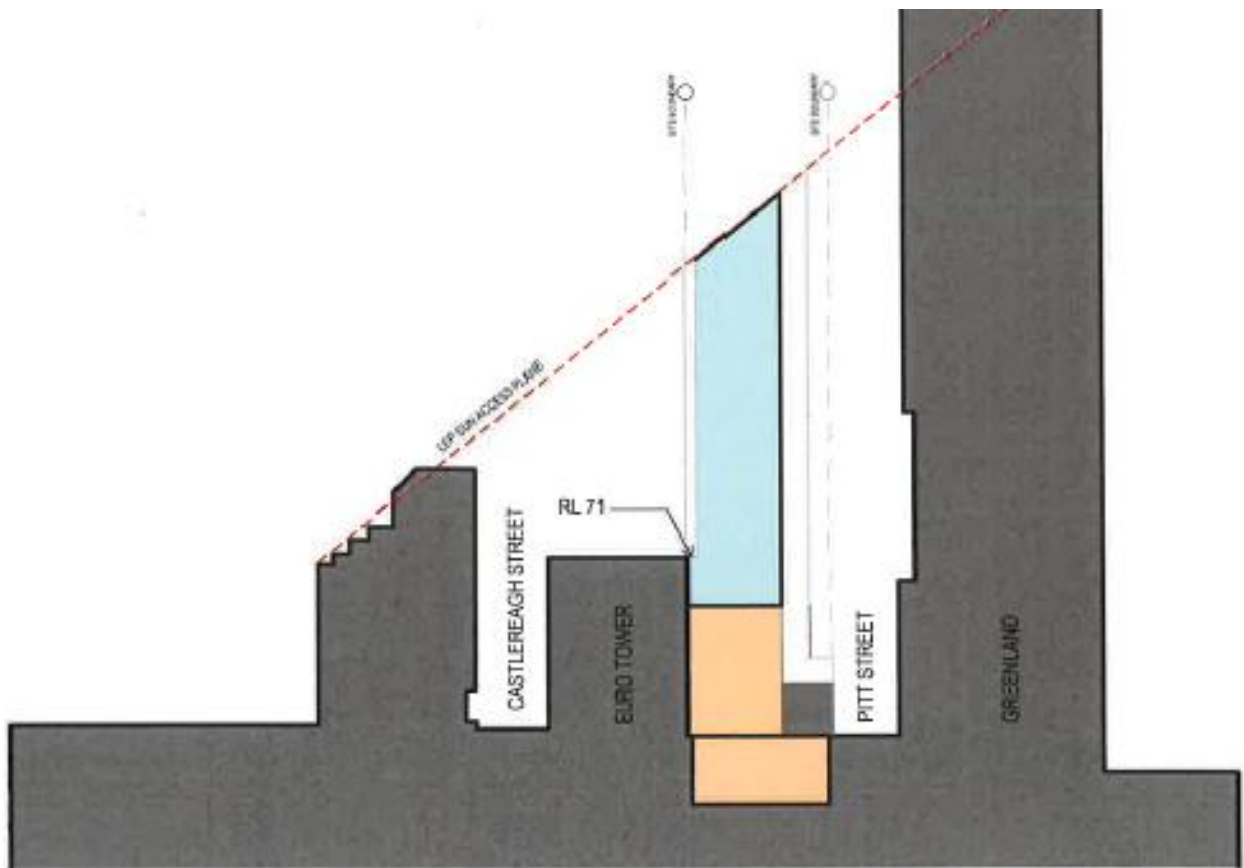
Source: SSD 8876 Concept Stamped Plans

**Figure 2-5 – Pitt Street South Concept SSD DA – Building Section**



Source: SSD 8876 Concept Stamped Plans

**Figure 2-6 – Pitt Street South Concept SSD DA – North South Section**



Source: SSD 8876 Concept Stamped Plans

**Figure 2-7 – Pitt Street South Concept SSD DA – East West Section**

## 3 Flood Planning Requirements

### 3.1 Review of existing documents

Aurecon has undertaken a review of the following documents to input into the assessment of the design levels required for protection of Pitt St station and South Over Station Development entrances:

- Flooding and Stormwater Management Plan dated August 2018 prepared by GHD for the Stage 1 SSD DA
- The Interim Floodplain Management Policy prepared by the City of Sydney
- Sydney Metro Scope of Works and Technical Criteria (SWTC) Appendix B02 – Civil and Structural Works
- Revised Environmental Mitigation Measures (REMM)
- Basis of Design document (2017) prepared by Metron (Stage 1)

Table 3.1 is a summary of the requirements for flood protection as reflected in the above 5 documents.

**Table 3-1 – Review of documents informing the requirements for flood protection**

Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected
<b>City of Sydney – Interim Floodplain Management Policy, May 2014.</b>	Section 5 - Table	Residential Floors There a no residential floors at street level.	1% AEP flood level +0.5m	Floors in tower
		Critical Facilities – Floor Level 1% Annual Exceedance Probability (AEP) flood level + 0.5m or the PMF (whichever is higher)	Highest of: <ul style="list-style-type: none"> <li>1% AEP flood level + 0.5m</li> <li>PMF</li> </ul>	Fire Control Rooms
<b>Flooding and Stormwater Management Plan, August 2018, GHD</b>	Whole document	This document makes reference to the City of Sydney, “City Area” Catchment Report, but makes no recommendations in relation to design level criteria.	-	-

Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected
<b>SWTC</b> <b>Appendix B2</b>	Section 2.3.4(a)	<p>The threshold level of all entrances, ventilation openings, tunnel portals and other openings into underground railway infrastructure must be set::</p> <ul style="list-style-type: none"> <li>(i) Above the probable maximum flood (PMF) level; and</li> <li>(ii) At least 300mm higher (crest protection) than the surrounding finished ground level or sufficient to prevent local flash flooding entering the underground structures. At the Station entrances, this requirement must be met by sloping the surface away from the threshold and not by a step.</li> </ul>	<p>Highest of:</p> <ul style="list-style-type: none"> <li>■ Boundary + 300mm</li> <li>■ PMF</li> </ul>	Station thresholds
<b>REMM</b>	FH10	<p>...where feasible and reasonable:</p> <p>Locate station and service entrances to underground stations above the greater of the 100 year annual recurrence interval flood level plus 500mm or the probable maximum flood level</p>	1% AEP + 500mm	Station thresholds
		<p>...where feasible and reasonable:</p> <p>Protect facilities that are identified as being critical to emergency response operations from the probable maximum flood level.</p>	PMF	Critical Facilities

Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected
Basis of Design document (2017) prepared by Metron (Stage 1)	Section 5.1.1	General discussion.	Highest of: <ul style="list-style-type: none"> <li>■ Boundary + 300mm</li> <li>■ PMF</li> <li>■ 1% AEP + 500mm</li> </ul>	Station thresholds
	Tables 5.2	These stage 1 tables consider only: <ul style="list-style-type: none"> <li>■ PMF</li> <li>■ Boundary + 300</li> <li>■ 1% AEP</li> </ul> Tables do not consider 1% AEP + 500mm.	Highest of: <ul style="list-style-type: none"> <li>■ PMF</li> <li>■ Boundary + 300</li> <li>■ 1% AEP</li> </ul>	Station thresholds

Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected
	Table 6.2 – SRT-516	<p>For all CBD Stations, City of Sydney Council Flood studies have been reviewed and used as the Basis of Design. The flooding assessment included consideration of a 10% increase in rainfall intensity. Threshold level of all entrances, ventilation openings, tunnel portals and other openings into underground railway infrastructure have been set or above the higher of the Probable Maximum Flood (PMF) water level or 100 year ARI water level plus 500mm or, where flooding does not occur, 300mm above surrounding ground level. At Station entrances this requirement has been met by sloping the surface away from the threshold rather than by steps.</p> <p>Refer summary table below. Sydney Metro has now confirmed that the 500mm freeboard on the 1% AEP level is not required.</p>	<p>Highest of:</p> <ul style="list-style-type: none"> <li>■ Boundary + 300mm</li> <li>■ PMF</li> </ul>	Station thresholds



## 3.2 Further discussion of existing documents

### 3.2.1 Flooding and Stormwater Management Plan

A previous Flooding and Stormwater Management Plan prepared by GHD for Sydney Metro for Concept Design Stage 1 (SSD 17\_8876 approved) was reviewed. This report was prepared in response to the SEARS issued for the Concept SSD Application.

The GHD report:

- References the previous flood modelling report undertaken by WMA Water for the City Area Catchment, which impacts the Bathurst St side of the proposed development, but not the Pitt St side.

Note that this previous flood model:

- Was based on the data and methodologies in the Australian Rainfall and Runoff Guidelines (1987)
- Did not address climate change scenarios
- Had not been updated to include the Sydney Light Rail project

It has now been superseded by the modelling undertaken by Aurecon, which addresses the above deficiencies.

- Does not reference the Darling Harbour Catchment, which is relevant for the Pitt St side of the development (OSD entry and loading dock)
- Notes the PMF (Probable Maximum Flood) event, but not the 1% AEP (Annual Exceedance Probability) event, which is relevant for the OSD entries.
- Provides no minimum station or OSD entry levels for flood protection
- Makes no statement about the impact of the proposed works on flooding of adjacent properties
- Concludes that:

*The maximum possible flood level shows that the proposed new development may be subject to flooding along Bathurst Street, but not along Pitt Street. The main entry to the site is along Pitt Street, outside the flood extent, therefore the building and underlying metro station are not at risk of flooding from Pitt Street. However, there is a potential exit from the OSD on Bathurst Street and flood mitigation measures as required for the station entry will be put in place for this exit.*

This will be addressed within the CSSI and is a separate planning application for the Station.

### 3.2.2 Interim Floodplain Management Policy

Flooding planning requirements for Pitt Street South OSD were reviewed in line with the City of Sydney Interim Floodplain Management policy requirements in particular the requirements around,

- *Section 5, Residential* - All flood planning levels be the 1% AEP flood level +0.5m.

Note, there are no residential floors at street level.

All openings and entrances to the Station are addressed within a separate planning application, addressed in the CSSI.

### 3.2.3 SWTC Requirements

The following additional points are noted from the SWTC, Appendix B2:

- Section 1.2(c)(vi) – The flood model must include the City of Sydney flood model including the Sydney Light Rail project.
- Section 2.1(n) - The Project Works must be designed, constructed and able to be operated and maintained so as to prevent flooding of the Sydney Metro City & Southwest from the probable maximum flood (PMF):
  - (i) as defined in the Australian Rainfall and Runoff Guidelines 2019 – A Guide to Flood Estimation, Commonwealth of Australia
  - (ii) in accordance with the Department of Environment & Climate Change (DECC) Floodplain Risk Management Guideline – Practical Consideration of Climate Change, version 1 October 2007; and
  - (iii) in accordance with DECC's Draft Sea Level Rise Policy Statement, February 2009

As required by the SWTC, the City of Sydney flood models, for both City Area and Darling Harbour catchments have been updated to reflect the data and recommendations in the Australian Rainfall and Runoff Guidelines (2016), including considerations for climate change, as well as the topographic changes associated with the Sydney Light Rail project.

The impacts of climate change have been incorporated into the assessment in accordance with the recommendations in the *Floodplain Management Guideline- Practical Consideration of Climate Change* (NSW Department of Climate Environment & Climate Change, 2007). The trajectory years 2090-2100 (ocean) and 2070 (rainfall) timeframes have been selected as the basis for the purpose of the current assessment.

These changes have been applied assuming a conservative *High* representative concentration pathway (RCP8.5) emission scenario, and are in form of:

- An increase of 30% in peak rainfall and storm volume
- An increase of 0.91m in sea level rise

Sensitivity analysis was also undertaken on combined effect of sea level rise and factored rainfall.

### 3.2.4 Revised Environmental Mitigation Measures (REMM)

As noted in Table 3.1 above, the REMM states:

*...where feasible and reasonable:*

*Locate station and service entrances to underground stations above the greater of the 100 year annual recurrence interval flood level plus 500mm or the probable maximum flood level*

A number of geometric constraints render this requirement unfeasible:

- The minimum flood protection level for station entries, retail, OSD and critical facilities (Refer Section 7)
- The DDA (Disability Discrimination Act) requirements for maximum slopes within the station entry
- Steps are not permitted – Refer SWTC – Appendix B2, Section 2.3.4(a)(ii) – *At the Station entrances, this requirement must be met by sloping the surface away from the threshold and not by a step steps are not permitted at the station entry*
- The desire to maintain existing kerb and roadway levels, except where these are being modified to the requirements of the Works Agreement Deed (WAD) with RMS
- City of Sydney limitations in the permissible falls on the footpath

Sydney Metro has now agreed that it is neither feasible nor reasonable to achieve this 500mm freeboard.

### 3.3 Summary of design criteria

Based on the above review of the SWTC requirements, the Interim Flood Management Plan, REMM and the GHD report prepared for the Stage 1 SSD DA, the criteria for the assessment of the minimum design levels for Pitt St South Over Station Development entry points are summarised as follows:

**Table 3-2 – Summary of requirements for flood protection**

Area	Requirement	Comment
<b>Station entrances</b>	Maximum of: <ul style="list-style-type: none"> <li>■ Boundary + 300mm</li> <li>■ PMF</li> </ul>	Includes: <ul style="list-style-type: none"> <li>■ Lifts, stairways and escalators down into station</li> <li>■ Services risers to the underground structure that open at ground floor</li> </ul> Excludes: <ul style="list-style-type: none"> <li>■ Sealed hatches</li> <li>■ Pits for lifts and escalators that terminate at ground level</li> <li>■ Risers that are enclosed at ground level</li> <li>■ Gatelines</li> </ul>

<b>Retail</b>	1% AEP with zero freeboard	
<b>OSD entrances</b>	1% AEP with zero freeboard	
<b>Critical facilities</b>	Maximum of: <ul style="list-style-type: none"> <li>■ 1% AEP flood level + 0.5m</li> <li>■ PMF</li> </ul>	Adopted for Fire Control Rooms.

## 4 External pavements, kerbs and gutters

### 4.1 Summary of design criteria – Pavement cross falls

For crossfall, the following requirements are given for new works where they can be achieved. These are provided as background only, but for works within an established city environment with steep topography, they are not always achievable.

- City of Sydney Technical Specification B5 Footways Construction, CI 5.9.3.2 specifies that the cross fall of the pavement must be no less than 1% and no greater than 3%

#### 5.9.3.2 TOLERANCES

All surfaces shall be finished in conformity with the lines, grades, thicknesses and cross-sections shown on the drawings or specified or directed by the City's Representative within the following limits:

Item	Activity	Tolerances
1.	<b>Footpath</b> a. Surface Level	<ul style="list-style-type: none"> <li>The deviation of the finished work from line or level shall not exceed 20mm in 10m</li> <li>No steps in the footpath or between any two adjacent pavers shall be more than 2mm</li> <li>On curves or in shaped areas, the deviation of the finished work from a 3m straight edge shall not exceed 15mm at any point</li> <li>The slope at any point on the surface shall not be less than 1 per cent and not exceed 3 per cent</li> <li>Unless otherwise specified or directed, the finished surfaces shall be shaped to shed surface water from the entire area in the directions of the natural slope or towards the constructed surface drains.</li> </ul>
2.	<b>Tie-in at features</b> a. Surface Level	The finished surface shall be shaped to match existing features, e.g. pit covers, edgings and driveways, within 2 mm
3.	<b>Paving Alignment</b> a. Surface level	The alignment of the paving shall not differ from the specified line by more than +/-50mm, provided that the minimum pavement width is achieved at all points throughout the construction.

**Figure 4-1 – Extract from City of Sydney Technical Specification B5 Footways Construction**

- AustRoads Guide to Road Design Part 6A, Clause 5.6, for paved pedestrian paths, crossfall may vary from flat (0%) to 2.5%, however, DDA requirements should be considered

## 5.6 Crossfall and Drainage

### 5.6.1 Crossfall

Water ponding on paths has a significant impact on the level of service provided to cyclists as spray leads to grit on both bicycle and rider and pedestrians, who may have to travel off the path to avoid the ponded water. On straight sections crowning of the pavement is preferable as it results in less accumulation of debris. On sealed surfaces a crossfall of 2–4% should be adequate to effectively dispose of surface water whereas unsealed surfaces may require 5% to prevent puddles of water from developing.

The crossfall of a paved pedestrian path may vary from flat (but achieving an adequately drained surface) to 2.5%. Provided that drainage is satisfactory, a lower crossfall is preferred (i.e. 1.0%) as a higher crossfall may cause problems for some people. Where paths are for pedestrian use or shared use, the needs of other path users (e.g. mobility impaired pedestrians) should be considered. In particular, AS 1428.1:2009 specifies that a path crossfall should not exceed 2.5% (1 in 40) or 3.3% (1 in 33) if the path has an asphalt surface.

A two-way crossfall on a path with a central crown, may provide an opportunity for wheelchair users to obtain relief from one-way crossfalls.

Section 5.3 provides information on the horizontal radius of curves and the corresponding superelevation that is required. With reference to Table 5.7 there is limited value in using higher rates of superelevation, and as such it is generally preferable to use a low path crossfall and thereby accommodate the needs of a range of path users.

**Figure 4-2 – Extract from AustRoads, Part 6A**

- AS1428.1:2009, Clause 10.1(d) states that crossfall should not exceed 2.5% (1:40)

## 10 WALKWAYS, RAMPS AND LANDINGS

### 10.1 General

Walkways, ramps and landings that are provided on a continuous accessible path of travel shall be as follows:

- (a) Sharp transitions shall be provided between the planes of landings and ramps, as shown in Figure 14.
- (b) Landings shall be provided at all changes in direction in accordance with Clause 10.8.
- (c) Landing or circulation space shall be provided at every doorway, gate, or similar opening.
- (d) For walkways and landings having gradients in the direction of travel shallower than 1 in 33, a camber or crossfall shall be provided for shedding of water and shall be no steeper than 1 in 40, except that bitumen surfaces shall have a camber or crossfall no steeper than 1 in 33.

NOTE: For requirements for ground surfaces, see Clause 7.

NOTE: A summary of requirements for walkways, ramps and landings is provided in Appendix C.

**Figure 4-3 – Extract from AS1428.1 – Design for access and mobility**

Summing the above, a new project should seek to achieve a cross fall of between 1 and 2.5%. However, as noted above, where works are conducted in an established brownfield environment with fixed topography and established roadways, it is recognised that these standards cannot always be achieved. In some instances, the existing falls are in excess of 1:20.

There are a number of fixed geometric constraints that must be satisfied:

- The minimum flood protection level for station entries, retail, OSD and critical facilities (Refer Section 7)
- The DDA requirements for maximum slopes within the station entry
- Steps are not permitted – Refer SWTC – Appendix B2, Section 2.3.4(a)(ii) – *At the Station entrances, this requirement must be met by sloping the surface away from the threshold and not by a step steps are not permitted at the station entry*
- The desire to maintain existing kerb and roadway levels, except where these are being modified to the requirements of the Works Agreement Deed (WAD) with RMS

Further, it is logical to seek to maintain existing pavement grades where possible to minimise the need to adjust pit lids.

Where the above Standards and Guidelines can't be satisfied, the expectation and common practice is that grades should be no worse than existing, however, in order to satisfy the above constraints, locally, some portions of footpath do need to be steeper.

A definitive range of grades therefore cannot be given here. The final design will include plans and cross sections that show the existing and actual grades for comparison.

The current design contours have been provided to City of Sydney for discussion. These are included in Appendix B of this report.

## 4.2 Summary of design criteria – Pavement longitudinal falls

For longitudinal fall, there are no specified or recommended maximum grades for an existing road. It is intended that kerblines are maintained as per existing, except where footpath widening occurs.

### 4.3 CSSI Works

Separate to the OSD South SSD DA, Station and public domain works are being delivered as part of the overall Pitt St South Metro Station development. These are delivered under the Critical State Significant Infrastructure approvals process (CSSI):

- The Station and WAD / RMS related works include:
  - The raising of the pavement at the western end of station entry on Bathurst
  - The widening of the footpath outside the station entry, as required by the WAD
  - A new layback for the loading dock on Pitt St
- The OSD South related works for which this report has been prepared, are delivered under the State Significant Development (SSD) Development Application (DA) process. These include:
  - A minor adjustment to the pavement levels on the Pitt St OSD entry

The current design drawings for the proposed kerb and pavement modifications, prepared by Aurecon, are included in Appendix B to this report.



## 5 Flood impacts on other properties

### 5.1 Reference Documents and Design Criteria

- SWTC Appendix C2 – Section 2.9.1(c) – Overland flow paths to convey major flows up to 100-year ARI design storm event must be provided in accordance with the NSW Floodplain Development Manual (2005) and the relevant Authority standards.
- SWTC Appendix C2 – Section 2.9.1(d) – The drainage systems must ensure that additional runoff, stormwater or spillage is not directed onto other properties and the flood levels of the development upstream and downstream of the project for any storm event are not increased by the Project Works and the Contractor's Activities
- REMM – FH9 – States as follows:
  - Design of the project would be reviewed to, where feasible and reasonable, not worsen existing flooding characteristics up to and including the 100-year annual recurrence interval event in the vicinity of the project. Detailed flood modelling would consider:
    - Potential changes to flood prone land and flood levels
    - Potential changes to overland flow paths
    - Redistribution of surface runoff as a result of project infrastructure
    - Behaviour of existing stormwater runoff
    - Potential changes required to flood evacuation routes, flood warning systems and signage.
  - Flood modelling to support detailed design would be carried out in accordance with the following guidelines:
    - Floodplain Development Manual (NSW Government, 2005b)
    - Floodplain Risk Management Guideline: Practical Consideration of Climate Change (DECC, 2007b)
    - Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments (DECCW, 2010c)
    - New guideline and changes to section 117 direction and EP&A Regulation on flood prone land, Planning Circular PS 07-003 (NSW Department of Planning, 2007).
- Flood modelling and consideration of mitigation measures would be carried out in consultation with the relevant local councils, the Office of Environment and Heritage and the State Emergency Services.
- Not worsen is defined as:
  - A maximum increase flood levels of 50mm in a 100-year Average Recurrence Interval (ARI) flood event
  - A maximum increase in time of inundation of one hour in a 100-year ARI flood event
  - No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100-year ARI flood event.

## 5.2 Impacts on adjacent properties

As required by the SWTC, the City of Sydney models (City Area and Darling Harbour Catchments) have both been updated for:

- The recommendations in the Australian Rainfall and Runoff Guidelines (2016) (the previous version was 1987)
- Climate change scenarios
- The topographic changes due to the Sydney Light Rail project

The 2-dimensional TUFLOW models were then run for:

- the Baseline case, which considered the existing pavement levels around the South Station building
- the Design case, which then uses the proposed pavement design contours, as per the drawings in Appendix B

These ‘before’ and ‘after’ scenarios were then compared to determine the impacts of the proposed pavement works on local flooding in the area, and in particular, adjacent properties.

The Flood Afflux Map (which graphically presents this difference) is included in Appendix A. It shows that there are no increases in flood levels greater than 50mm for the 1% AEP event.

We further confirm that maximum increase in time of inundation for the 1% AEP flood event is less than 1 hour.

## 6 Conclusion

This report has been prepared to summarise the inputs that have informed the current design associated with the Pitt Street South Over Station Stage 2 Development, Development Application only, including:

- a. how entry levels have been designed for flood protection
- b. impacts of proposed pavement modifications associated with the OSD tower on local area flooding

All pavement modifications associated with the Metro Station are covered by the Critical State Significant Infrastructure (CSSI) DA and the RMS Works Authorisation Deed (WAD).

A Stormwater Management Plan has been prepared by CJ Arms in a separate report, SMCSWSPS-CJA-OSS-PL-REP-00000.

- Our assessment of the 1%AEP with climate change indicates the pavement modifications associated with the OSD Tower will not have any impact on local area flooding
- The design addresses compliance with the City of Sydney's Interim Floodplain Management Policy and
- The level of the OSD ground floor entries have been designed to sit above the 1% Annual Exceedance Probability (AEP) flood event

Note that compliance with guidelines relating to pavements falls will not be achieved in a number locations due to existing topography and stringent flood protection measures.

A large, abstract geometric shape composed of several overlapping polygons in various shades of green and yellow, creating a sense of depth and movement. The shape is positioned on the left side of the page, with its right edge following a diagonal path from the top left towards the bottom right.

# Appendices

## Appendix A

### 1% AEP Event – Flood Afflux Map



**Legend**

Afflux (m)

<= -0.1

-0.1 - -0.05

-0.05 - 0.05

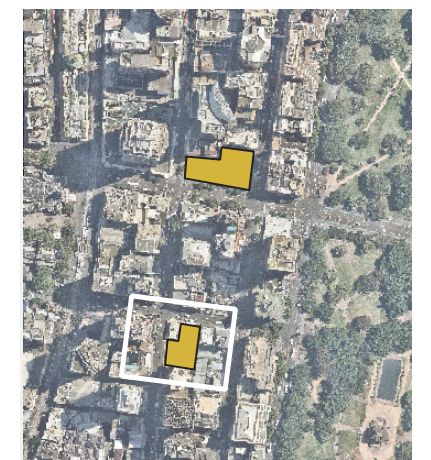
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> 0.1

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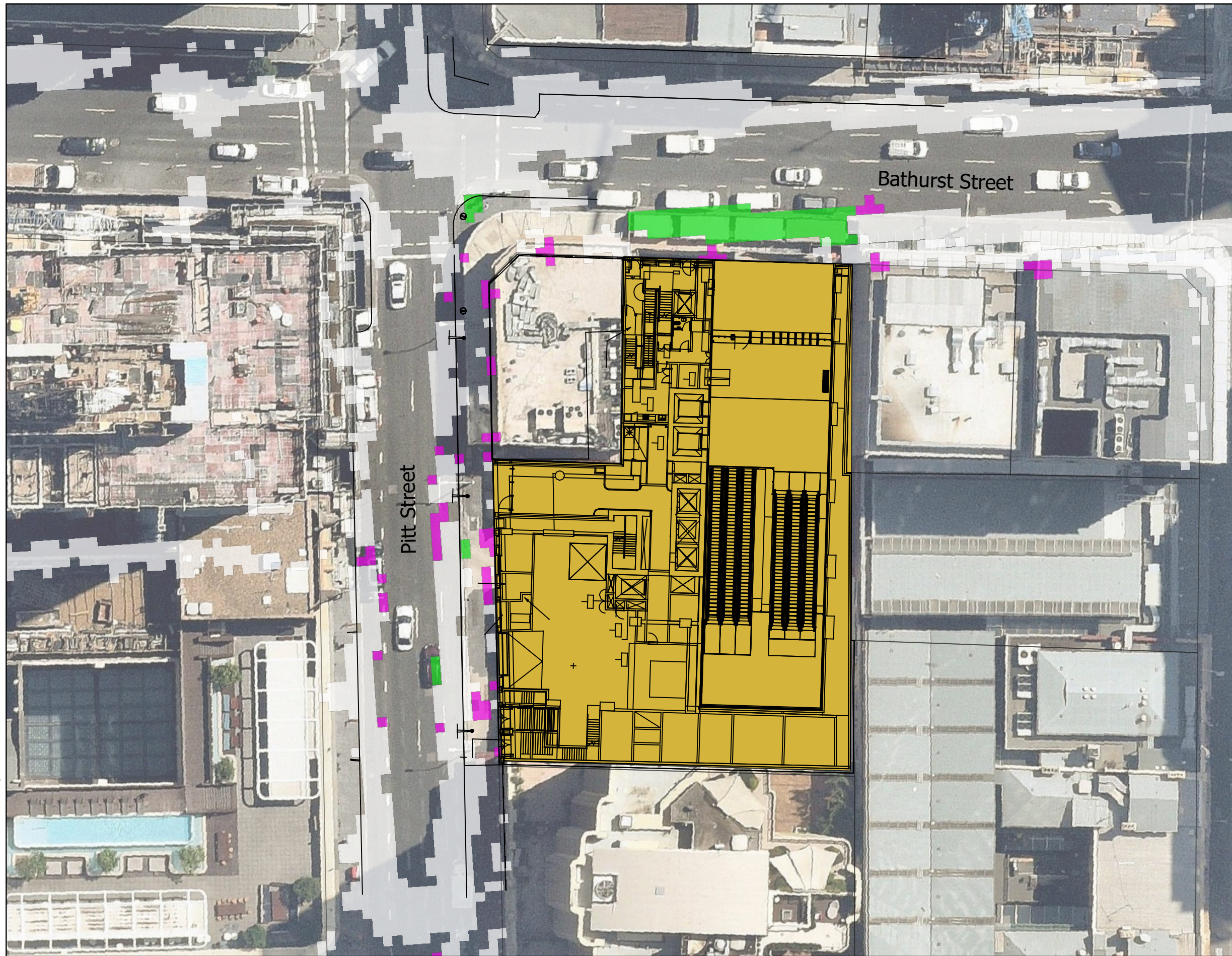
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Pitt\_Street\_Metro\_Station



**Southern Entrance**

**1% AEP Event Afflux Map**



0 16 32 m

A3 Scale: 1:400

11/5/2020 MGA 56

Study

Map by: Sepideh Jafari



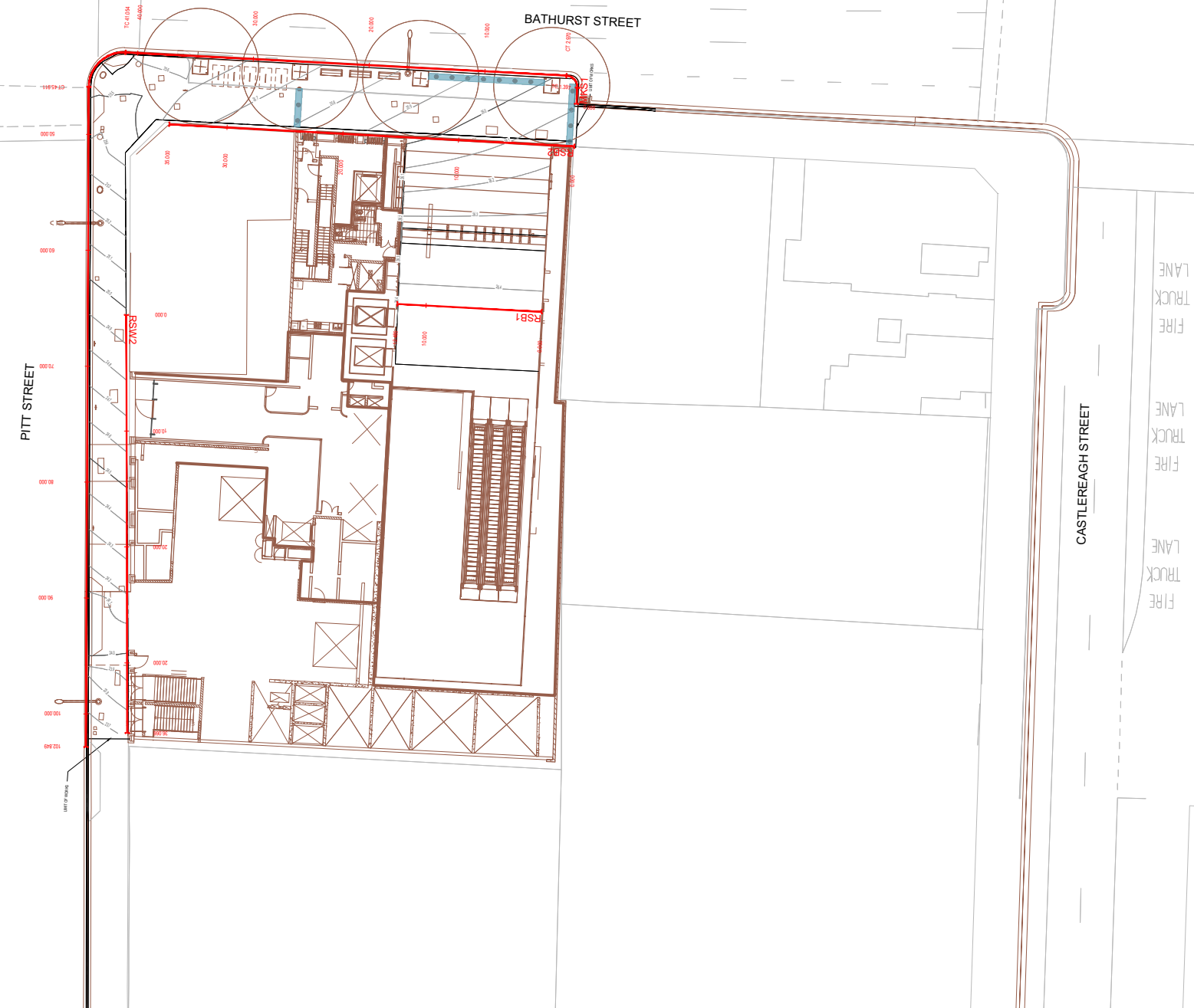
## Appendix B

### Pavement Contour Drawings – Proposed

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- VERIS SURVEY, METRO STATION SOUTH, PITT ST, SYDNEY, DATED 29.11.2019.



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FIRE TRUCK LANE  
FIRE TRUCK LANE  
FIRE TRUCK LANE

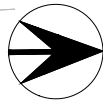
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- VERIS SURVEY, METRO STATION SOUTH, PITT ST, SYDNEY, DATED 29.11.2019.

PITT STREET

LIMIT OF WORKS

INDICATIVE BOLLARD ZONE

BATHURST STREET

LIMIT OF WORKS

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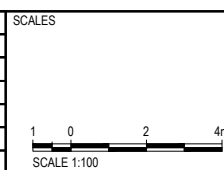
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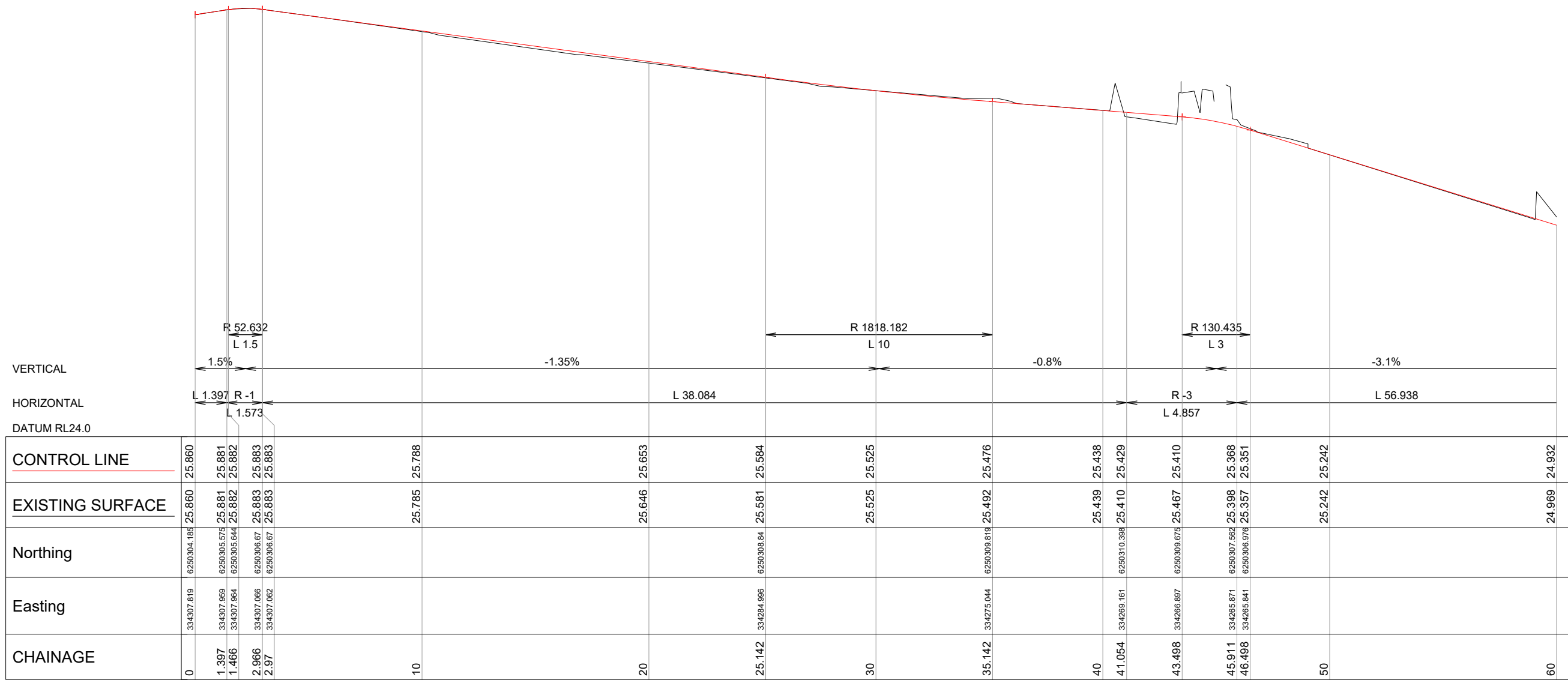
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DESIGN CHECK	A. SABA	06.04.2020
APPROVED	J. PEREIRA	06.04.2020

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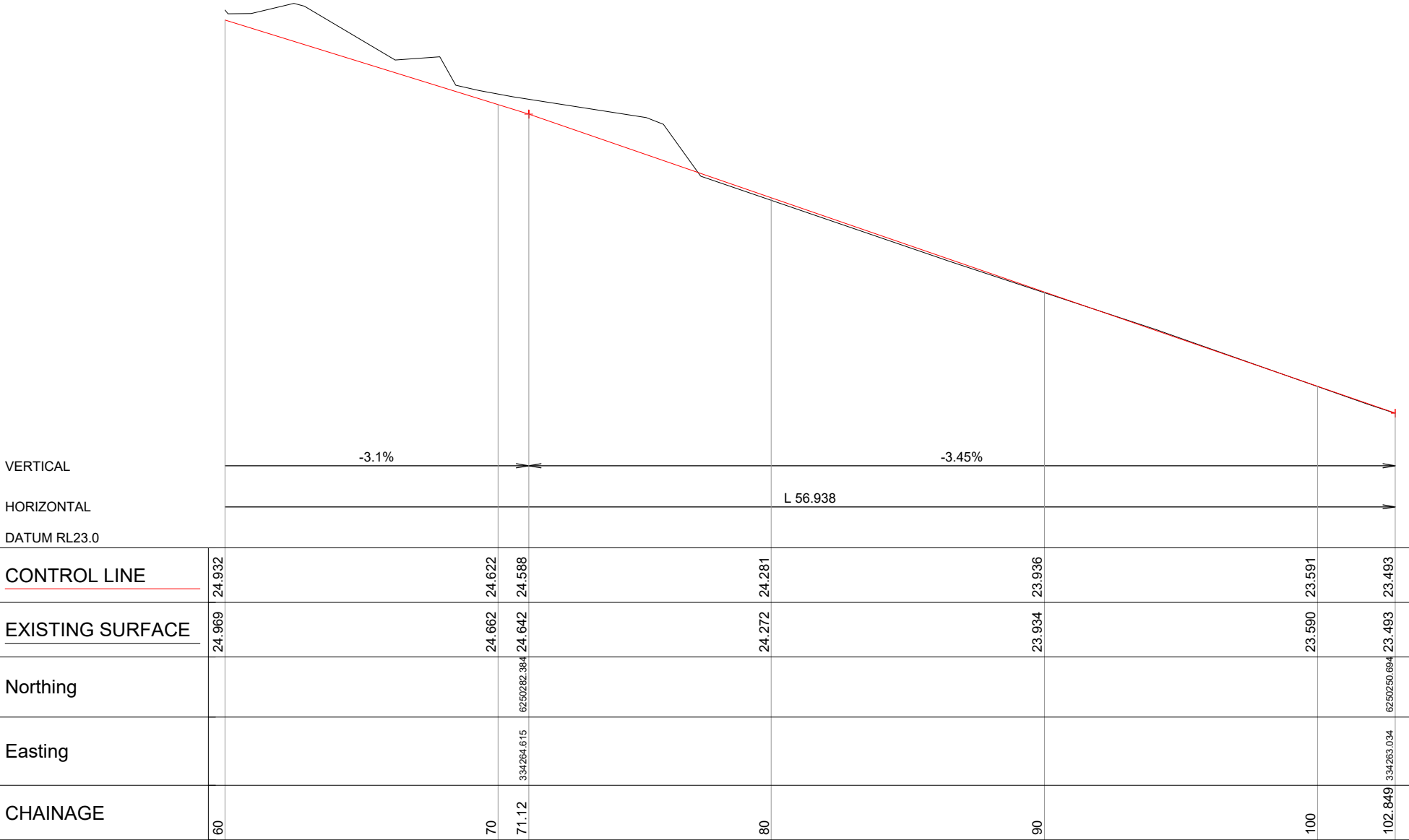


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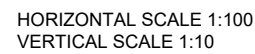
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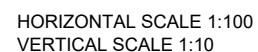
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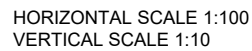
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Z = 25.982

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CHAINAGE 10

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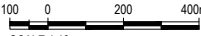
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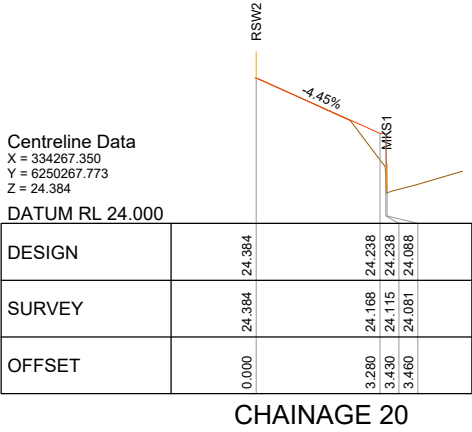
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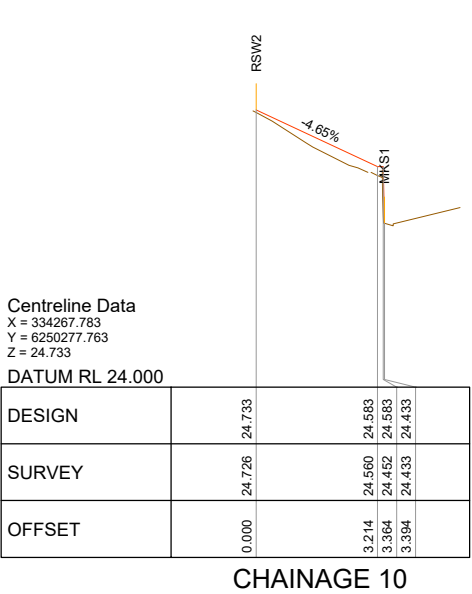
CLIENT	The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.
SERVICE PROVIDERS	
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BATESMART.	
aurecon	
drawn by T. PILLAY	06.04.2020
designed by P. HUNT	06.04.2020
DRG CHECK A. SMITH	06.04.2020
DESIGN CHECK A. SABA	06.04.2020
APPROVED J. PEREIRA	06.02.2020



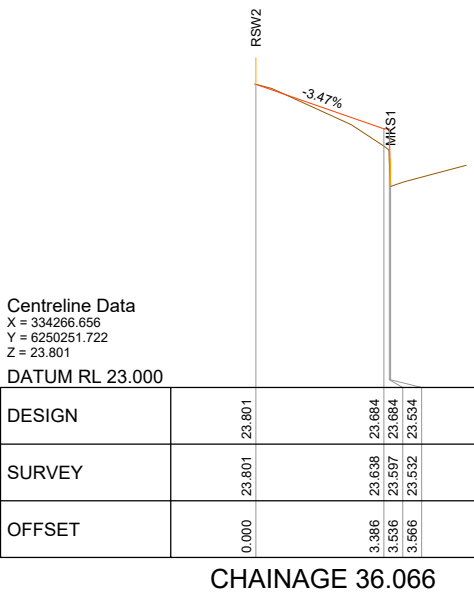
Cad File: C:\Users\adele.smith\Aurecon Group\507262 - PIT St ISD - 5 Deliver Design\502 Modelling\Civil\DesignSheets\SMCSWSPS-AUR-PSN-CE-DWG-130011 CROSSSECTION RSW2.dwg  
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100mm AT FULL SIZE



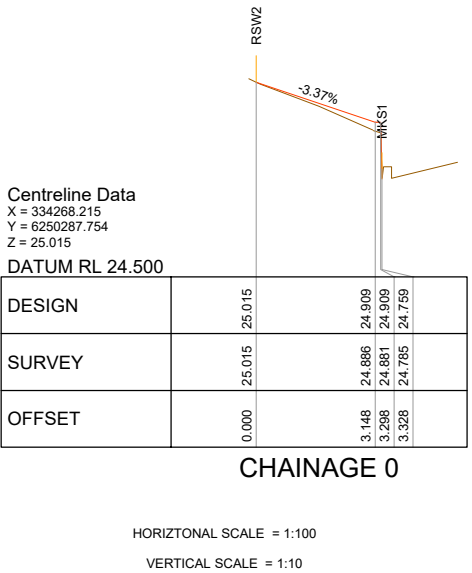
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VERTICAL SCALE = 1:10



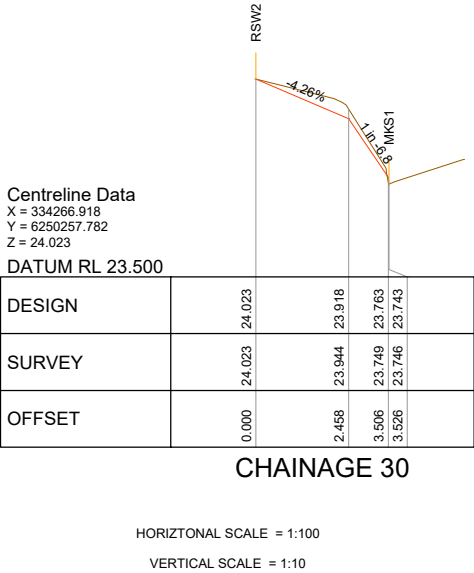
HORIZONTAL SCALE = 1:100  
VERTICAL SCALE = 1:10



HORIZONTAL SCALE = 1:100  
VERTICAL SCALE = 1:10



HORIZONTAL SCALE = 1:100  
VERTICAL SCALE = 1:10



HORIZONTAL SCALE = 1:100  
VERTICAL SCALE = 1:10

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

REV	BY	DATE	DESCRIPTION	APPD.
A2	A.S.	04.05.2020	ISSUED FOR REVIEW	J.P.
A1	A.S.	06.04.2020	85% ISSUE	J.P.

WORK IN PROGRESS

SCALES

7.5 0 15 30m

SCALE 1:750

CCRN0

NOTE: Do not scale from this drawing.

ALT: DRG No.

CLIENT

NSW GOVERNMENT | sydney METRO

ISDP

oxford | CPB CONTRACTORS

SERVICE PROVIDERS

Foster + Partners

cox | CJ ARMS

BATESSMART. | LCI

aurecon | TTW

DRAWN: T. PILLAY 06.04.2020

DESIGNED: P. HUNT 06.04.2020

DRG CHECK: A. SMITH 06.04.2020

DESIGN CHECK: A. SABA 06.04.2020

APPROVED: J. PEREIRA 06.02.2020

DRG No. SMCSWSPS-AUR-PSN-CE-DWG-130011

**SYDNEY METRO CITY & SOUTHWEST**

PIT STREET ISD

CIVIL SERVICES

CROSSSECTIONS RSW2

STATUS: DESIGN DEVELOPMENT

SHEET 1 OF 1

METRO DRG No.

REV. A2

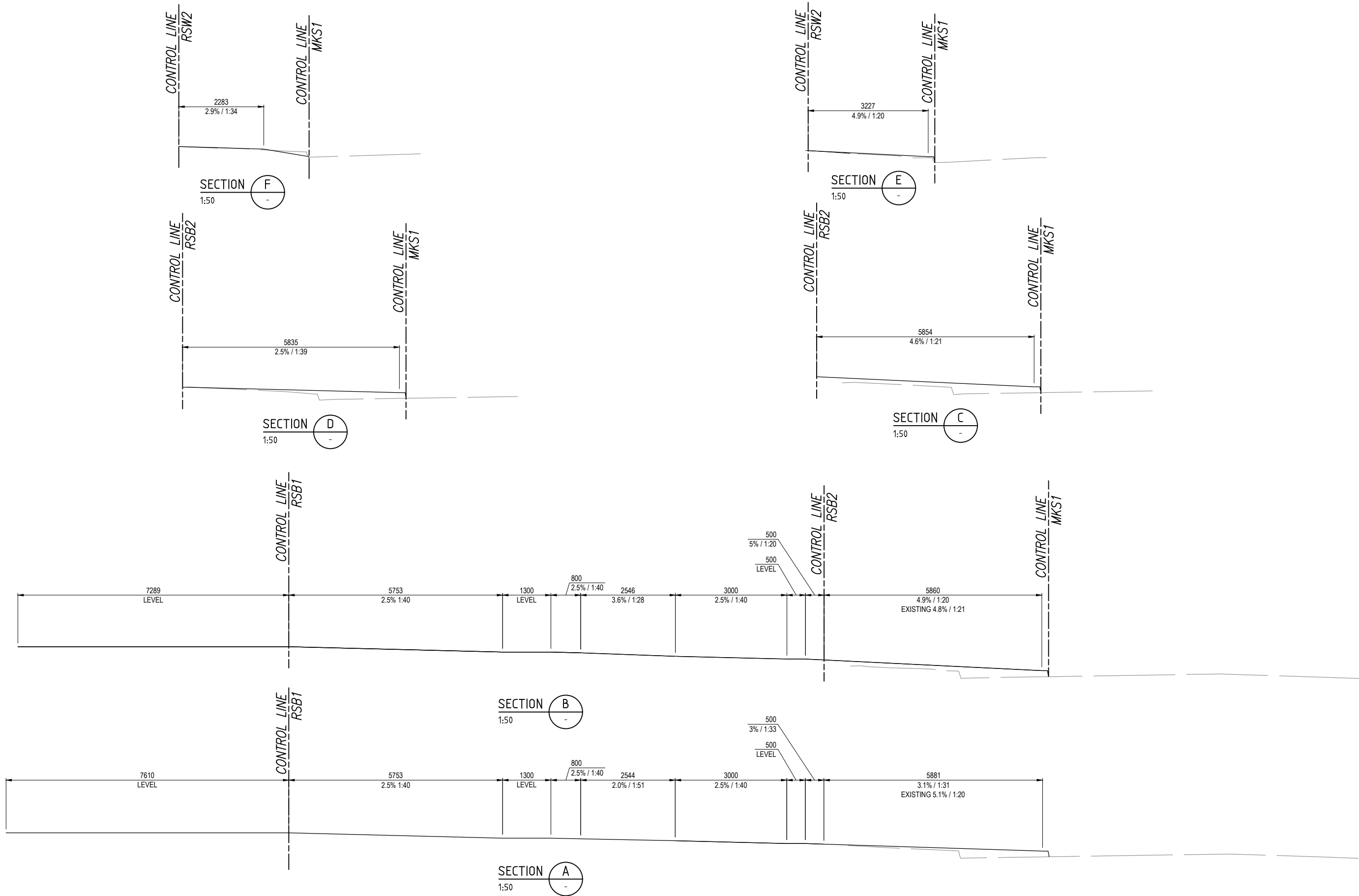


Cad File: C:\Users\adele.smith\Aurecon Group\507262 - PIT St ISD - 5 Deliver Design\502 Modelling\Civil\DesignSheets\SMCSWSPS-AUR-PSS-CE-DWG-140001 CONTROL LINE.dwg

Plot Date: 4/05/2020 2:57:41 PM

100mm AT FULL SIZE

100mm AT FULL SIZE



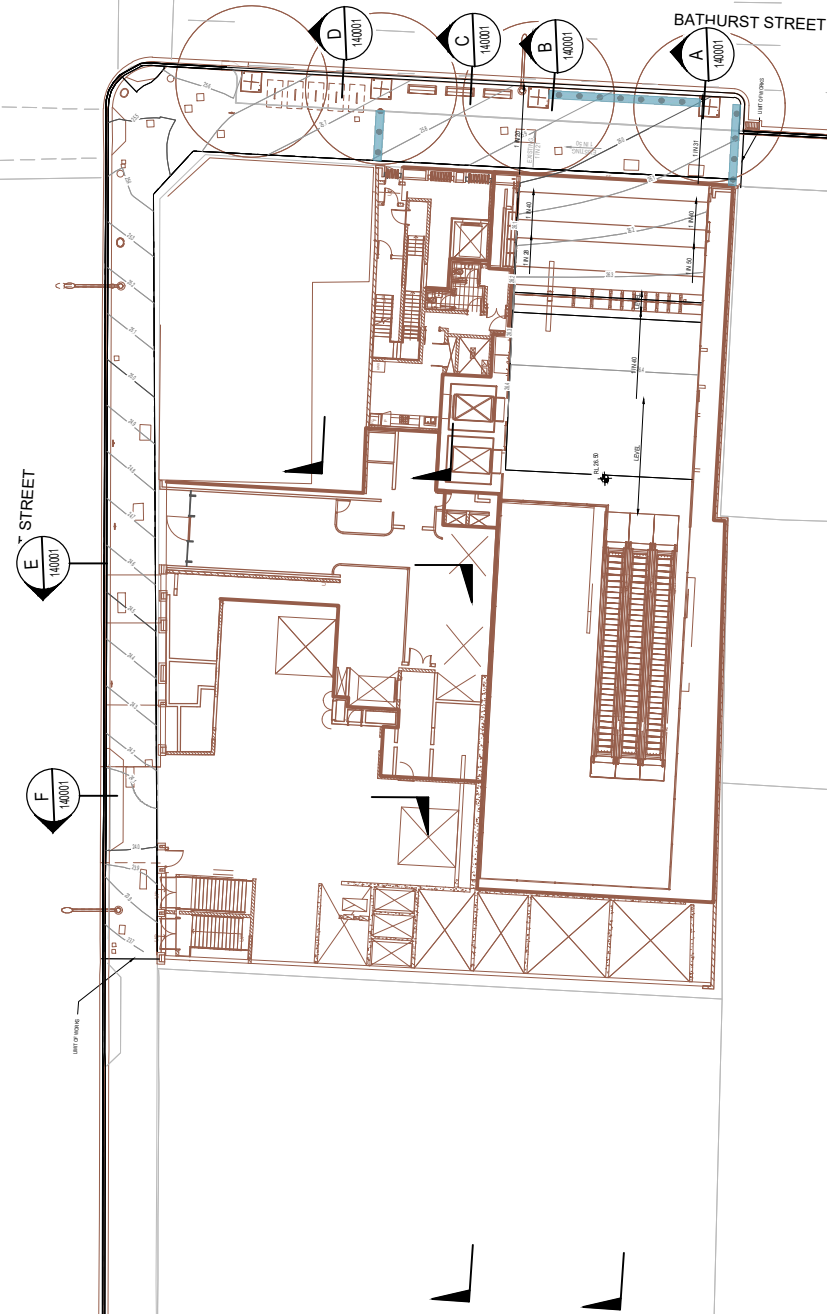
DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

				SCALES				CLIENT		The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.		SYDNEY METRO CITY & SOUTHWEST PIT STREET ISD CIVIL SERVICES CONTROL LINE SECTIONS
								SERVICE PROVIDERS				
								DRAWN		T. PILLAY		
								DESIGNED		P. HUNT		
								DRG CHECK		A. SMITH		
								DESIGN CHECK		A. SABA		
								APPROVED		J. PEREIRA		
</												

Cad File: C:\Users\adele.smith\Aurecon Group\507262 - Pitt St ISD - 5 Deliver Design\502 Modelling\Civil\DesignSheets\SMCSWSPS-AUR-PSS-CE-DWG-200011 CONTOUR PLAN.dwg  
Plot Date: 4/05/2020 2:57:51 PM  
100mm AT FULL SIZE



THIS DRAWING TO BE READ IN CONJUNCTION WITH:  
- BATES SMART DRAWING SMCSWSPS-BAT-OSS-AT-DWG-930041.  
- SUE BARNESLEY DESIGN DRAWING SMCSWSPS-SBD-PSS-LA-DWG-0000-04.  
- VERIS SURVEY, METRO STATION SOUTH, PITT ST, SYDNEY, DATED 29.11.2019.



NOTE:  
1. ALL EXISTING KERB RL's REMAIN UNCHANGED.

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

					SCALES				CLIENT		<div>The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.</div> <div><div><div>NSW GOVERNMENT</div><div>sydney METRO</div></div><div><div>ISDP</div><div>oxford CPB CONTRACTORS</div></div></div> <div><div><div><div>Foster + Partners</div><div>cox CJ ARMS</div><div>BATESSMART. LCI</div><div>airecon TTW</div></div><div><div>DRAWN</div><div>T. PILLAY</div><div>06.04.2020</div></div><div><div>DESIGNED</div><div>P. HUNT</div><div>06.04.2020</div></div><div><div>DRG CHECK</div><div>A. SMITH</div><div>06.04.2020</div></div><div><div>DESIGN CHECK</div><div>A. SABA</div><div>06.04.2020</div></div><div><div>APPROVED</div><div>J. PEREIRA</div><div>06.04.2020</div></div></div><div><div>SYDNEY METRO CITY &amp; SOUTHWEST</div><div>PIT STREET ISD</div><div>CIVIL SERVICES</div><div>CONTOUR PLAN</div><div>SOUTH GROUND FLOOR PLAN ZONE 11</div><div><div>STATUS: DESIGN DEVELOPMENT</div><div>SHEET 1 OF 1</div><div>©</div></div><div><div>METRO DRG No.</div><div>REV.</div><div>A2</div></div></div></div>			
A2	A.S.	04.05.2020	ISSUED FOR REVIEW	J.P.	<div>2.5 0 5 10m</div> <div>SCALE 1:250</div>		CCRN0							
A1	A.S.	06.02.2020	85% ISSUE	J.P.										
REV.	BY	DATE	DESCRIPTION	APPD.										
A1 Original	Co-ordinate System: MGA Zone 56	Height Datum: A.H.D.	This sheet may be prepared using colour and may be incomplete if copied		NOTE: Do not scale from this drawing.		ALT. DRG No.							

WORK IN PROGRESS



Foster + Partners



SERVICE PROVIDERS  
DRAWN T. PILLAY 06.04.2020  
DESIGNED P. HUNT 06.04.2020  
DRG CHECK A. SMITH 06.04.2020  
DESIGN CHECK A. SABA 06.04.2020  
APPROVED J. PEREIRA 06.04.2020

Document prepared by

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*Bringing ideas  
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