## Sydney Metro

## PITT STREET NORTH OVER STATION DEVELOPMENT

[Appendix S] Flood Impact Assessment Report

State Significant Development, Development Application (SSD DA)

Prepared for Pitt Street Developer North Pty LTD

1 July 2020

Revision C Issue for DPIE Document No: SMCSWSPS-AUR-OSN-CE-REP-000004





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#### **Reference documents**

- Flooding and Stormwater Management Plan dated August 2018 prepared by Cardno
- 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 flooding assessment has been undertaken to review the existing flood information and planning criteria to determine the flood levels for Pitt Street North Over Station Development and Pitt Street Station North. The flood design criteria are detailed in Section 3 of this report.

The flood impact assessment report details the inputs that have informed the current design including

- how entry levels have been designed to comply with the flood protection criteria; and
- the impacts of proposed pavement modifications associated with the Pitt Street North over station development on local area flooding

The design addresses compliance with the City of Sydney's Interim Floodplain Management Policy and the level of the Pitt Street North Over Station Development ground floor entries have been designed as a minimum to sit above the 1% Annual Exceedance Probability (AEP) flood event.

The updated flood model has been run for both the existing pavement levels as well as the proposed design pavement levels. These have been compared to determine the impact of the proposed pavement changes on local flooding in the area during the 1% AEP event. The impact has been assessed as acceptable and within guidelines.

All pavement modifications associated with the Sydney Metro Pitt Street Station are addressed via 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-OSN-CV-PLN-000001

#### SEARS

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARS) Dated 25 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	Refer to this report for the Flood assessment.		
	pian	The Stormwater Management Plan is		
		addressed separately in SMCSWSPS-CJA-OSN-		
		CV-PLN-000001 Stormwater Management		



	Plan prepared by CJ Arms.

#### **CONDITIONS OF CONSENT**

This report has also been prepared in response to the following Condition of Consent for the State Significant Development Concept (SSD 17\_8875) for the Pitt St North Over Station Development summarised in Table 2.

Table 2- Concept approval of Conditions of Consent				
Item	Description of Requirement	Section Reference (this report)		
B22 - Flooding and Stormwater	<ul> <li>Flood Impact Assessment addressing the conclusions and recommendations of the concept stage Flooding and Stormwater</li> <li>Management Plan dated</li> <li>August 2018 prepared by</li> <li>Cardno and providing the following:</li> <li>(a) Compliance with the</li> <li>City of Sydney's Interim</li> <li>Floodplain Management</li> <li>Policy including detailed</li> <li>reasoning for any non- compliances.</li> </ul>	Refer Sections 3, 4 and 5 of this report in addition to SMCSWSPS-CJA-OSN- CV-PLN-000001 Stormwater Management Plan by CJ Arms.		
B22 - Flooding and Stormwater	(b) Detailed stormwater and drainage design documentation including overland flow assessment and maintenance.	Refer Section 5 of this report in addition to SMCSWSPS-CJA-OSN- CV-PLN-000001 Stormwater Management Plan by CJ Arms.		

#### UPDATES SINCE PREVIOUS SUBMISSION

This section of the report describes the changes that have been made to this report since Round 1 Submission to Sydney Metro, due to the following reasons:

TABLE 1 – Updates since previous submission					
Type of Change         Description of Change         Section Reference					
Updated Metro Description	Update to Figure 2 – Sydney Metro Alignment Map to latest map.	Section 2.2 updated (Pg 4).			



New information	Flood model now updated for rainfall data, Sydney Light Rail and Climate change Additional information added re how climate change impacts assessed.	Section 3.3 updated (Pg 20).
New information	Impacts on adjacent properties and pre-development flood levels added.	Section 5.2 updated (Pg 27).
New information	Impacts on adjacent properties and pre-development flood levels added.	Section 5.2 updated (Pg 28).



## 2 Introduction

This report has been prepared to accompany a detailed State Significant Development (SSD) development application (DA) for a commercial mixed-use Over Station Development (OSD) above the new Sydney Metro Pitt Street North Station. The detailed SSD DA is consistent with the Concept Approval (SSD 17\_8875) 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 25 October 2019.

The detailed SSD DA seeks development consent for:

- Construction of new commercial tower of approximately 38 storeys
- The tower includes maximum GFA, excluding floor space approved in the CSSI.
- Integration with the approved CSSI proposal including though not limited to:
  - Structures, mechanical and electronic systems, and services; and
  - Vertical transfers.
- Use of spaces within the CSSI 'metro box' building envelope for the purposes of:
  - Retail tenancies;
  - Commercial lobby and commercial amenities;
  - Car parking spaces within the podium for the purposes of the commercial premises; and
  - Loading and services access.
- Utilities and services provision.
- Stratum subdivision (staged).

#### 2.1 The Site

The site is located within the Sydney CBD. It has three separate street frontages, Pitt Street to the west, Park Street to the south and Castlereagh Street to the east. The area surrounding the site consists of predominantly commercial high-density buildings and some residential buildings, with finer grain and heritage buildings dispersed throughout.

The site has an approximate area of 3,150.1sqm and is legally described as follows:

252 Pitt Street (Lot 20 in DP1255509)





#### Figure 2-1 – Location Plan

Source: Urbis

#### 2.2 Sydney Metro

Sydney Metro is Australia's biggest public transport program. A new standalone railway, this 21st century network will revolutionise the way Sydney travels.

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 – Western Sydney Airport

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

On 9 January 2017, the Minister for Planning approved the Sydney Metro City & Southwest - Chatswood to Sydenham project as a Critical State Significant Infrastructure project (reference SSI 15\_7400) (CSSI Approval). The terms of the CSSI Approval includes all works required to construct the Sydney Metro Pitt Street Station, including the demolition of existing buildings and structures on both sites (north and south). The CSSI Approval also includes construction of below and above ground works within the metro station structure for appropriate integration with over station developments.

The CSSI Approval included Indicative Interface Drawings for the below and above ground works at Pitt Street North 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 (East-West Section)





Figure 2-4 – Pitt Street Station – North (North-South Section)

LEGEN	D
	METRO PROPERTY BOUNDARY
	OSD DEVELOPMENT - SUBJECT TO SEPARATE ASSESSMENT PROCESS STATION
	SHARED ACCESS BETWEEN OSD AND STATION FOR LOADING AREA AND SERVICE LIFT

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 North.
- 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 North 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.





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**Figure 2-7 – Pitt Street North Concept SSD DA – Envelope – West Elevation** *Source: SSD 8875 Concept Stamped Plans* 



## 3 Flood protection

#### 3.1 Review of existing documents

A flooding assessment has been undertaken based on review of existing flood information and in coordination with the flood assessment undertaken for Pitt Street North Over Station Development and Pitt Street Station North. The following reports provide information which includes the subject area:

- Stage 1 Concept Flooding and Stormwater Management Plan dated August 2018 prepared by Cardno
- City of Sydney's Interim Floodplain Management Policy
- Sydney Metro System Requirements Specification, 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 Metro (Stage 1 Consent)

Table 3.1 over page is a summary of the requirements for floor protection as reflected in the above documentation.

The flooding behaviour at the Pitt St North site is discussed In Section 5.2.

#### **3.2 Discussion of existing documents**

#### 3.2.1 Stage 1 Concept Design Stage 1 Flooding and Stormwater Management Plan

A previous Flooding and Stormwater Management Plan prepared by Cardno for Sydney Metro for Concept Design Stage 1 (SSD 17\_8875 approved) was reviewed. This report was prepared in response to the SEARS issued for the Concept SSD Application. The report assessed existing flood information and considered flood assessment for the Pitt Street North site.

The previous flood model was based on 1987 rainfall data, did not address climate change scenarios and had not been updated to consider the impact of the Sydney Light Rail project. This report now addresses the above deficiencies.

#### 3.2.2 City of Sydney Interim Floodplain Management Policy

Flooding planning requirements for Pitt Street North OSD were reviewed in line with the City of Sydney Interim Floodplain Management policy requirements. For Commercial buildings the FPL is the 100-year ARI event as a minimum with any freeboard to be provided on a merits-based approach.



#### 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 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 2016 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 Seas Level Rise Policy Statement, February 2009

As required by the SWTC, the City of Sydney flood model for the City Area catchment has 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, 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 DDA (Disability Discrimination Act) requirements for maximum slopes within the station entry
- 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 agreed that it is neither feasible nor reasonable to achieve this 500mm freeboard.



Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected
SWTC Appendix B2	Section 2.3.4(a)	<ul> <li>The threshold level of all entrances, ventialtion openings, tunnel portals and other openings into underground railway infrastructure must be set:;</li> <li>(i) Above the probable maximum flood (PMF) level; and</li> <li>(ii) At least 300mm higher (crest protection) than the surrounding finsihed 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>	Highest of: Boundary + 300mm PMF	Station thresholds
City of Sydney – Interim Floodplain Manageme nt Policy, May 2014.	Section 5 - Table	Commercial Merits approach presented by the applicant with a minimum of the 1% AEP (Annual Exceedance Probability) flood level.	1% AEP with no freeboard	OSD Entrances
		Retail Floor Levels Merits approach presented by the applicant with a minimum of the 1% AEP flood. The proposal must demonstrate a reasonable balance between flood protection and urban design outcomes for street level activation.	1% AEP with no freeboard	OSD Entrances
		Critical Facilities – Floor Level 1% AEP flood level + 0.5m or the PMF (whichever is higher)	Highest of: 1% AEP flood level + 0.5m PMF	Fire Control Rooms

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



Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected	
Flooding and Stormwater Manageme nt Plan, August 2018, Cardno	Section 3 – Bullet Point 4	All the entrances to the over station development (OSD) should be above 100 year (Average Recurrence Interval) ARI plus 0.50m freeboard for the Residential habitable floors and 0.3m above surrounding ground if the proposed development is outside the flood extents. (Understood to apply to habitable floors only)	1% AEP with zero freeboard	OSD entrances	
	Section 3 – Bullet Point 6	A merits-based approach of minimum of 100 year ARI flood level to be adopted for commercial and retail entrances.	1% AEP with zero freeboard	OSD entrances	
REMM	FH10	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	1% AEP + 500mm	Station thresholds	
		where feasible and reasonable: Protect facilities that are identified as being critical to emergency response operations from the probable maximum flood level.	PMF	Critical Facilities	
Basis of DesignSection 5.1.1document (2017) prepared by Metron		General discussion.	Highest of: Boundary + 300mm PMF 1% AEP + 500mm	Station thresholds	
	Tables 5.1	<ul> <li>These stage 1 tables consider only:</li> <li>PMF</li> <li>Boundary + 300</li> <li>1% AEP</li> <li>Tables do not consider 1% AEP + 500mm.</li> </ul>	Highest of: PMF Boundary + 300 1% AEP	Station thresholds	



Document	Clause / Ref.	Requirement	Design Level Criteria	Space protected
Basis of Design document (2017) prepared by Metron (Stage 1)	Table 6.2 – SRT- 516	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. Refer summary table below. Sydney Metro has now confirmed that the 500mm freeboard on the 1% AEP level is not required.	<ul> <li>Highest of:</li> <li>Boundary + 300mm</li> <li>PMF</li> </ul>	Station thresholds



### 3.3 Summary of design criteria

Based on the above review, the criteria for the assessment of the minimum design levels for Pitt St North Over Station Development entry points are summarised as follows:

Table 3-2 – Summary of requirements for flood protection

Area	Requirement	Comment
Station entrances	Maximum of:	Includes:
	<ul><li>Boundary plus 300mm</li><li>PMF</li></ul>	<ul> <li>Lifts, stairways and escalators down into station</li> </ul>
		<ul> <li>Services risers to the underground structure that open at ground floor</li> </ul>
		Excludes:
		<ul> <li>Sealed hatches</li> </ul>
		<ul> <li>Pits for lifts and escalators that terminate at ground level</li> </ul>
		<ul> <li>Risers that are enclosed at ground level</li> </ul>
		<ul> <li>Gate lines</li> </ul>
Retail	1% AEP with zero freeboard	
OSD entrances	1% AEP with zero freeboard	
Critical facilities	Maximum of:	Adopted for Fire Control Rooms.
	1% AEP flood level + 0.5m	
	PMF	



### 4 External pavements, kerbs and gutters

#### 4.1 Reference documents

- SWTC Appendix B02 Civil and Structural Works
- SWTC Appendix G1 Utilities Service 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

5.9.3.2 TOLERANCES

- City of Sydney Technical Specification B5 Footways Construction
- AS1428.1:2009

#### 4.2 Summary of requirements – 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%

> 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 Footpath The deviation of the finished work from line or level shall not exceed 1. a. Surface Level 20mm in 10m · No steps in the footpath or between any two adjacent pavers shall be more than 2mm On curves or in shaped areas, the deviation of the finished work from a 3m straight edge shall not exceed 15mm at any point The slope at any point on the surface shall not be less that 1 per cent and not exceed 3 per cent 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. 2 Tie-in at features The finished surface shall be shaped to match existing features a. Surface Level e.g. pit covers, edgings and driveways, within 2 mm The alignment of the paving shall not differ from the specified line by more Paving Alignment 3 than +/-50mm, provided that the minimum pavement width is achieved at a. Surface level 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

Guide to Road Design Part 6A: Paths for Walking and Cycling

#### 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

In summary, where possible a cross fall of between 1 and 2.5% is achieved, however 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 3)
- The DDA requirements for maximum slopes within the station entry
- 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

In order to satisfy the above constraints, locally, some portions of footpath do need to be steeper. The current design contours have been provided to City of Sydney. These are included in Appendix B of this report.

## 4.3 Summary of requirements – Pavement longitudinal falls

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

#### 4.4 Works Authorisation Deed (WAD)

As part of the Pitt Street North Station project works there is a requirement to comply to the Sydney Metro City and Southwest Pitt Street project RMS Works Authorisation Deed (WAD). The Station and WAD / RMS related works include;

- Raising of the pavement at the western end of the station entry on Pitt St site to meet the flood protection criteria for station entrances; and
- The widening of the pavement on at the western end of the station entry on Pitt St site as required by the WAD

The current design drawings (plan, sections, long. sections) for these proposed kerb and pavement modifications 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 model (City Area catchment) has 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 model was then run for:

- the Baseline case, which considered the existing pavement levels around the North 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 adjacent properties.

The Flood Afflux Map (which graphically presents this difference) is included in Appendix A. It shows:

- that no adjacent privately-owned properties are experiencing increases in flood levels greater than 50mm for the 1% AEP event
- that there are some areas of roadway that are experiencing increases in flood levels higher than 50mm for the 1% AEP event:
  - on Park St, due to the widening of the footpath at the Pitt St intersection as required by the RMS Work Authorisation Deed (WAD)
  - on Pitt St adjacent the OSD entry

However, for both of these cases, we confirm that the flood risk category remains unchanged.

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 Pitt St North Over Station Development, Development Application only, including:

- a. how entry levels have been designed to comply with the flood protection criteria, and
- b. the impacts of proposed pavement modifications associated with the Pitt Street North over station development on local area flooding

The design addresses compliance with the City of Sydney's Interim Floodplain Management Policy and the level of the Pitt Street North Over Station Development ground floor entries have been designed as a minimum to sit above the 1% Annual Exceedance Probability (AEP) flood event.

The updated flood model has been run for both the existing pavement levels as well as the proposed design pavement levels. These have been compared to determine the impact of the proposed pavement changes on local flooding in the area during the 1% AEP event. The impact has been assessed as acceptable and within guidelines.

All pavement modifications associated with the Metro Station are addressed via 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-OSN-CV-PLN-000001.



# Appendices



Appendix A 1% AEP Event – Flood Afflux Map



A3 Scale: 1:600

11/5/2020 MGA 56

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#### Legend

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Pitt\_Street\_Metro\_Station



Notes:



Northern Entrance 1% AEP Event Afflux Map



Appendix B Pavement Contour Drawings – Proposed



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Northing	6250529.762 6250529.762 6250526.262 6250525.762	6250517.764 0.250517.764	6250509.783	6250500 803		6250493.165	6250487.989	
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REV.	BY	DATE	DESCRIPTION API	PPD.	SCALE 1:10		CCRNo		CDB	BATESSMART, OLCI	DESIGN CHECK <sup>D. BELL</sup>	15.06.2020
A1	Driginal	Co-ordina	te System: MGA Zone 56 Height Datum: A.H.D. This sheet may be	e prepa	ared using colour and may be i	ncomplete if copied	NOTE: Do not scale from this drawing. ALT. DRG No.	OXFC			APPROVEDJ. PEREIRA	15.06.2020



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 STATUS: DESIGN DEVELOPMENT
 SHEET 1
 OF
 3
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 15.06.2020
 METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG-005104
 REV.
 B

VERTICAL     3.405%     2.5%     3.257       HORIZONTAL     0     0     0     0       DATUM RL220     0     0     0     0     0       CONTROL LINE     0     0     0     0     0     0       EXISTING SURFACE     0     0     0     0     0     0       Northing     0     0     0     0     0     0       Easting     0     0     0     0     0     0       CHAINAGE     2     0     0     0     0     0								
DATUM RL22.0       CONTROL LINE       Office       O		VERTICAL HORIZONTAL			3.405%	~	< <sup>2.5%</sup> >	3.2579
Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state         Image: State of the state       Image: State of the state       Image: State of the state       Image: State of the state       Image: State       Image: State <td></td> <td>DATUM RL22.0</td> <td>23.192</td> <td>33.362</td> <td></td> <td>3.680</td> <td>23.697 23.743</td> <td></td>		DATUM RL22.0	23.192	33.362		3.680	23.697 23.743	
Northing     string       Easting     string       CHAINAGE     g       10     10       10     10       10     10		EXISTING SURFAC	E					
Easting     Big     Big       CHAINAGE     Big     P       BORIZONTAL SCALE 1:100       VERTICAL SCALE 1:10		Northing				5250481.699	5250481.425	
CHAINAGE 18 R R R R R R R R R R R R R R R R R R		Easting				334312.683 6	334315.168	
HORIZONTAL SCALE 1:100 VERTICAL SCALE 1:10		CHAINAGE	65	20		79.341	80 81.841	
JUNES JUNES			HORIZO	ONTAL SCALE 1:1 CAL SCALE 1:10	00			
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sydney	SERVICE PROVIDERS	DRAWNT. PILLAY	15.06.
	Foster + Partners	DESIGNEDP. HUNT	15.06.
ISDP	COX CJARMS	DRG CHECK	15.06.
cpB		DESIGN CHECK.D. BELL	15.06
		APPROVEDJ. PEREIRA	15.06.

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	60		15	40	840	13	
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			282	281	280	279	
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			477.49	478.72	479.84		
			6250	6250	6250		
			1.579	3.673	3.758		
			334358	334356	334355		
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6.2020 3 © REV. B STATUS: DESIGN DEVELOPMENT SHEET 2 OF 3 METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG-005105 5.2020

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Gwb.

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VERTICAL	-2.015%	-0.907% -0.972%	-1.582% -1.757% -1.139	%	-0.873% -1.217%	-1.474%	-1.433368%	-1.46%	-2.09%	
VERTICAL		>×<		<	L 64 661		<del></del>			
HORIZONTAL DATUM RL23.0										~~>
CONTROL LINE	24.313 24.273	24.209 24.205 24.196	24.073 24.065 24.069	24.042	23.954	23.852	23.785 23.778 23.766 23.766	23.706	23.662	
EXISTING SURFACE	24.279 24.273	24.209 24.205 24.196	24.073 24.065 24.069	24.042	23.954	23.852	23.785 23.778 23.7766 23.766	23.710	23.662	
Northing	6250483.168	6250490.148 6250490.646	6250498.125 6250498.125 6250498.122		62 505 18. 06 7		6250525.546 6250526.044 6250526.953		6250534.021	6250541.112
Easting	334359.01	334359.541 334359.579	334.360.147 334.360.147 334.360.222				334362.23 334362.268 334362.337		334.362.874	334363.412
CHAINAGE	130	139 139.5 140	147 1475 148	150	160 167 168	170	174.5 175 175.912	180	183	190

HORIZONTAL SCALE 1:100 VERTICAL SCALE 1:10

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			SCALES		CLIENT	The information shown on this drawing is for the purposes of the purpose. The Service Providers accept no liability arising from the	e Sydney Metro Project only. No warranty is given or implie he use of this drawing and the information shown thereon t	ed as to its suitability for any other for any purpose other than the Sydney	SYDNEY METRO CITY & SOUT	THWEST
						Metro Project.				
			1 0 2 4m		svdnev	SERVICE PROVIDERS	DRAWNT. PILLAY	15.06.2020		
			SCALE 1:100		NSW METRÓ	Foster + Partners	DESIGNED P. HUNT	15.06.2020	LONGSECTION RSN2	
			100 0 200 400mm		GOVERNMENT	COX CLARMS	DEGIGNED <u>C</u> <u>A</u> SMITH	15.06.2020		
B A.S.	15.06.2020	STAGE 3 J.P.	100 0 200 4001111		ISDP	DATECOMADT OLCI				
REV. BY	DATE	DESCRIPTION APPD.	SCALE 1:10	CCRNo	CPB		DESIGN CHECK <sup>D. BELL</sup>	15.06.2020	STATUS: DESIGN DEVELOPMENT SHEET 3 OF	3 ©
A1 Original	Co-ordina	ate System: MGA Zone 56 Height Datum: A.H.D. This sheet may be pre	pared using colour and may be incomplete if copied	NOTE: Do not scale from this drawing. ALT. DRG No.			APPROVEDJ. PEREIRA	15.06.2020	METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG-005106	REV. B

					L					
				÷						
			~							
/ERTICAL	2.38%	2.651%	2.385%	< 2.915%	< 2.771% >	< 2.773% >	< 2.766% ><	2.588%	<u> </u>	< 0.78
IORIZONTAL	<					L 81.	035			
DATUM RL21.0										
	22.580	22.832	22.951	23.097	23.235	23.374	23.512	23.642	23.712	
EXISTING SURFACE	.572	.824	.942	.002	.108	.243	.339	.435	532	
	789 22 248 22	707 22	.166 22	625 23	.085 23	544 23	.003 23	462 23	921 23	
Northing	6250481	6250480	6250480	6250479	6250479	6250478	6250478	6250477	6250476	
Fasting	7.618	7.559	2.53	7.5	2.471	7.442	2.412	7.383	2.354	
_aoting	33427	33428	334290	334297	334302	334307	334312	33431	334322	
CHAINAGE		<u>o</u>	م	Q	ິດ	Q	ŭ	9	<u>n</u>	
	2	-	~	7	N	ო	ო	4	4	

SCALE 1:1

SCALE 1:10

CCRNo

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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.

J.P.

APPD.

DESCRIPTION

Sydney METRO

SERVICE PROVIDERS

Foster + Partners

cox CJARMS BATESSMART, OLCI aurecon TTW

B A.S. 15.06.2020 STAGE 3

REV. BY DATE

byb



METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG-005107

REV.

В

gwb

			-					
	-							
VERTICAL	0.881	<u> %</u> 2.607%	~		<u> </u>	1.978%	0	994%
HORIZONTAL	_			L	81.035			~
DATUM RL23.0								
CONTROL LINE	23.834		23.964	24.057	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2	24.252	24.262
EXISTING SURFACE	23.832		23.936	24.053	2 0 1 0 1 0 1		24.280	24.288
Northing	6250475.298		6250474.757	6250474.216		0.0001	6250473.134	6250473.022
Easting	334337.266		334342.236	334347.207		11.1.200400	334357.148	334358.177
CHAINAGE	60		65	20	7	2	80	81.035

HORIZONTAL SCALE 1:100 VERTICAL SCALE 1:10

						DRAWING COLOUR CODEL	- PRINT ALL COPIES IN COLOU	
F					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 purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any Metro Project.
					1 0 2 4m		sydney	SERVICE PROVIDERS DRAWNT.PILLAY
E					SCALE 1:100			
B RE	A.S. V. BY	15.06.2020 DATE	STAGE 3 DESCRIPTION	J.P. APPD.	SCALE 1:10	CCRNo		
A	1 Original	Co-ordina	ate System: MGA Zone 56 Height Datum: A.H.D. This	is sheet may be prep	ared using colour and may be incomplete if copied	NOTE: Do not scale from this drawing. ALT. DRG No.		APPROVEDJ_PEREIRA

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	DRG No. SMCSWSPS-AUR-PSN-CE-DWG-12003	32		
to its suitability for any other y purpose other than the Sydney	SYDNEY METRO CITY	& SOUT	HW	/EST
15.06.2020	CIVIL SERVICES			
15.06.2020	LONGSECTION RSN8			
15.06.2020				
15.06.2020	STATUS: DESIGN DEVELOPMENT	SHEET 2 OF	2	©
15.06.2020	METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG	-005108	REV.	В









Centreline Data X = 334278.018 Y = 6250499.766 Z = 22.397 DATUM RL 21.500		
DESIGN	22.500	
SURVEY		
OFFSET	-1.741	
-		



SIZE

HORIZTONAL SCALE = 1:100

VERTICAL SCALE = 1:10



HORIZTONAL SCALE = 1:100















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 ALT. DRG No NOTE: Do not scale from this drawing.





	DRG No. SMCSWSPS-AUR-PSN-CE-DWG-14000	)1		
to its suitability for any other y purpose other than the Sydney	SYDNEY METRO CITY	& SOUT	HW	/EST
15.06.2020	CIVIL SERVICES			
15.06.2020	CONTROL LINE SECTIONS			
15.06.2020				
15.06.2020	STATUS: DESIGN DEVELOPMENT	SHEET 1 OF	2	©
15.06.2020	METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG	-005113	REV.	В



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as to its suitability for any other any purpose other than the Sydney 15.06.2020 15.06.2020 15.06.2020 15.06.2020	DRG No. SMCSWSPS-AUR-PSN-CE-DWG-140002  SYDNEY METRO CITY & SOUTHWEST PIT STREET ISD CIVIL SERVICES CONTROL LINE SECTIONS  STATUS: DESIGN DEVELOPMENT SHEET 2 OF 2 © METRO DRG No. SMCSWSPU-CPB-SPS-CE-DWG-005114 REV. B



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