Parramatta Over and Adjacent Station Development

Addendum Flooding Assessment

NSW GOVERNMENT

sydney METRO

Document Number: SMWSTEDS-SMD-PTA-SN600-WA-RPT-044004

REVISION	DATE	SUITABILITY CODE	TEAMBINDER DOCUMENT NUMBER	TB REVISION
B	22/05/2024	S4		

Approval Record

FUNCTION	POSITION	NAME	DATE
Author	Principal Water Resources Engineer	Suzanne Burow	22/05/2024
Reviewer	Technical Director - Water	Jeffrey Mail	23/05/2024
Technical Reviewer	Technical Director - Civil Engineering	Boon Soo	24/05/2024
Coordinator	Technical Director Environment	Tim Green	24/05/2024
Approver	EDATP Metro West Program Lead	Mariah Manuela	24/05/2024

Amendment Record

DATE	REVISION	AMENDMENT DESCRIPTION	AUTHOR
14/03/2024	A	Response to CoP EIS Comments	Suzanne Burow
22/05/2024	B	Address Sydney Metro Comments	Suzanne Burow

Contents

Glossary

Term	Definition
AEP	Annual Exceedance Probability - The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. In this study AEP has been used consistently to define the probability of occurrence of flooding.
AHD	Australian Height Datum - A common national surface level datum approximately corresponding to mean sea level.
ARR	Australian Rainfall and Runoff (ARR) is a national guideline document used for the estimation of design flood characteristics in Australia. Reference is made to either ARR1987 (3rd edition) or ARR2019 (4th edition) as specified.
ASD	Adjacent Station Development
Catchment	The land area draining through the mainstream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
CBD	Central Business District
CC	Climate Change
CoA	Conditions of Approval
Concept and Stage 1 CSSI Approval	SSI-10038, approved 11 March 2021, including all major civil construction works between Westmead and The Bays, including station excavation and tunnelling, associated with the Sydney Metro West railway line
Concept SSDA	A concept development application as defined in Section 4.22 the EP&A Act, as a development application that sets out concept proposals for the development of a site, and for which detailed proposals for the site or for separate parts of the site are to be the subject of a subsequent development application or applications.
CoPC	City of Parramatta Council
CSSI	Critical State Significate Infrastructure
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
DPHI	Department of Planning, Housing and Infrastructure
DRAINS	Software used for hydraulic modelling
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	NSW Environmental Protection Authority
ESD	Ecologically Sustainable Design

Term	Definition
EY	Exceedances per year - The number of times a flood event is likely to occur or be exceeded within any given year.
FERP	Flood Emergency Response Plan
FPL	Flood Planning Level
GFA	Gross floor area
Hydraulic modelling	Hydraulic modelling uses the rainfall, catchment and watercourse topography to predict flood behaviour including flood levels, flood extents, flood velocities and the duration of inundation in the catchment and watercourse.
Hydrology	The study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
LIDAR	Light Detection and Ranging
NSW	New South Wales
OSD	Over Station Development.
PLR	Parramatta Light Rail
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PRFS	Parramatta River Flood Study
RCP	Reference Climate Projection
RFI	Request For Information
SEARs	Secretary's Environmental Assessment Requirements
SES	State Emergency Services
SSD	State Significant Development
SSDA	State Significant Development Application
SSI	State Significant Infrastructure
Stage 3 CSSI Approval	SSI-22765520, approved 25 January 2023, including rail infrastructure, stations, precincts and operation of the Sydney Metro West line
TUFLOW	Hydraulic modelling software for flood, urban drainage, estuarine and coastal assessments

Executive Summary

This addendum report supports a Concept State Significant Development Application (Concept SSDA) submitted to the Department of Planning and Environment, now Department of Planning, Housing and Infrastructure (DPHI) pursuant to part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Sydney Metro is seeking to secure approval within the meaning of section 4.22 of the EP&A Act, for an over station development (OSD) and adjacent station development (ASD). The Concept SSDA is seeking consent for maximum building envelopes, proposed land uses, maximum building heights, maximum Gross Floor Area (GFA) and car parking. The proposed development comprises four buildings (Buildings A, B, C and D), consisting of three new commercial office buildings (Buildings A, C and D) and one residential accommodation building (Building B).

The Concept SSDA was lodged with the DPHI on 10 November 2022 and was placed on public exhibition for 28 days7 between 16 November 2022 and 13 December 2022. In total, advice was received from 11 State and local government agencies and 15 submissions were received from key stakeholders, community organisations and the community.

DPHI issued a letter to Sydney Metro on 16 December 2022 requesting a response to the issues raised during the public exhibition of the application. DPHI also issued a further Request for Further Information (RFI) on 6 February 2023 and the Submissions Report provides a response to these matters.

Agency advice have been received in response to the EIS. This addendum report addresses flood related issues raised in agency advice from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) and City of Parramatta Council (CoPC).

Future stages of design of the proposal would ensure that flood risks to occupants are comprehensively assessed, which would be outlined in a future Detailed SSDA. The detailed design would be consistent with the Parramatta Over and Adjacent Station Development Flooding Assessment including:

- Applicable flood criteria associated with the Stage 3 CSSI Conditions of Approval
- Stated mitigation measures.

The detailed design would also be consistent with the following additional mitigation measures outlined in this report including that:

- Building A and areas of buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station would aim to be consistent with the Parramatta Development Control Plan (DCP) 2023
- Detailed survey is obtained for the final precinct levels along with all the streets surrounding the precinct for the baseline and developed scenarios.
- Allowable flood increases are consistent with the Stage 3 CSSI CoA.

Modelling to support the Detailed SSDA would be undertaken in accordance with industry best practice at the time of the assessment. This would include:

- 2023 Flood Risk Management Manual and the Flood risk management toolkit including technical guidance discussed in the FB04 along with reports commissioned by the NSW Government which have informed FB04.
- Updated guidance on climate change to Australian Rainfall and Runoff Guidelines
- Updated modelling would be undertaken to inform detailed design and emergency planning based on the endorsed Parramatta River Flood Study model.

- Details of interfaces with the Stage 3 CSSI Operational Emergency Management Plan for flooding where relevant to the Detailed SSDA would be considered in hazard and risk assessments as part of the design process.

1 Introduction

1.1 Purpose and Scope

This addendum to the Flood Assessment report supports a Concept State Significant Development Application (Concept SSDA) submitted to the Department of Planning and Environment, now Department of Planning, Housing and Infrastructure (DPHI) pursuant to part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Sydney Metro is seeking to secure approval within the meaning of section 4.22 of the EP&A Act, for an over station development (OSD) and adjacent station development (ASD). The Concept SSDA is seeking consent for maximum building envelopes, proposed land uses, maximum building heights, maximum Gross Floor Area (GFA) and car parking. The proposed development comprises four buildings (Buildings A, B, C and D), consisting of three new commercial office buildings (Buildings A, C and D) and one residential accommodation building (Building B).

The Concept SSDA was lodged with the DPHI on 10 November 2022 and was placed on public exhibition for 28 days between 16 November 2022 and 13 December 2022. In total, advice was received from 11 State and local government agencies and 15 submissions were received from key stakeholders, community organisations and the community.

DPHI issued a letter to Sydney Metro on 16 December 2022 requesting a response to the issues raised during the public exhibition of the application. DPHI also issued a further Request for Further Information (RFI) on 6 February 2023 and the Submissions Report provides a response to these matters.

Advice from NSW government agencies have been received in response to the Concept SSDA EIS. This addendum report addresses flood related issues raised in agency advice from the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)[1] and City of Parramatta Council (CoPC).

This report responds to comments raised in agency advice received during the public exhibition of the Concept SSDA submitted to DPHI.

This addendum report is broken down into the following chapters:

- Chapter 1 – outlines an introduction to the project and this report.
- Chapter 2 – outlines the submissions or advice received from government agencies and public authorities and Sydney Metro's response to the issues raised
- Chapter 3 – outlines an updated flooding assessment following advice from DCCEEW and CoPC
- Chapter 4 – provides a conclusion to the report, summarising the outcomes within the report.

This report should be read in conjunction with the Parramatta Over and Adjacent Station Development EIS Appendix T – Flooding Assessment (Sydney Metro, 2022b) which details the methodology and proposed mitigation measures.

[1] Effective 1 January 2024, Department of Planning and Environment has been split to form two departments. Department of Climate Change, Energy, the Environment and Water (DCCEEW) is now the relevant agency.

2 Response to agency advice

During public exhibition, agency and public authority advice was received from DCCEEW and CoPC, proposed responses are outlined in this chapter.

2.1 DCCEEW Advice

Agency advice has been received from DCCEEW as outlined in the following sections.

All public domain work including the portion of the Parramatta Civic Link which runs through the proposed development site, forms part of the CSSI. Public domain works are not subject to approval under the Concept SSDA but are an important consideration in the requirements for on-site detention within buildings.

2.1.1 Flood Barriers

DCCEEW Comment

Flood barriers are proposed to protect the Building A basement from flooding up to the Probable Maximum Flood (PMF). Potential barriers for entries that form part of the Sydney Metro West Stage 3 Critical State Significant Infrastructure (SSI-22765520) are not discussed here. Basements should be afforded passive protection to the PMF level. It is likely that the risk of failure of barriers is even higher for commercial or residential buildings than for metro stations.

Response

Building A and areas of Buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station would aim to be consistent with the Parramatta Development Control Plan (DCP) 2023. Part 9.7 of the DCP provides for flood risk management in the Parramatta CBD including specific controls for the management of flood risk in carpark basements in flood prone areas. A range of criteria must be demonstrated to validate the appropriateness of the design. A Building Management System and Plan for the development must include all necessary measures to maintain, test and operate all flood protection devices and systems, flood refuges along with all necessary measures to maintain, test and operate the Flood Emergency Response Plan (FERP). These requirements support a framework for managing risk to life associated with development in the Parramatta River floodplain. Future Detailed SSDA(s) would demonstrate how requirements in the Parramatta DCP have been considered in the detailed design.

Areas of Buildings B, C and D which potentially provide a pathway for floodwaters to enter the metro station would be required to satisfy the Stage 3 CSSI Conditions of Approval (CoA)[2]. Whilst not the subject of this application, it is noted that these requirements include a detailed risk assessment for each active flood mitigation measure. The future Detailed SSDA(s) would contain details of any flood barriers subject of the Parramatta Over and Adjacent Station Development application.

[2] For further information refer to the NSW Major Projects portal: https://www.planningportal.nsw.gov.au/major-projects/projects/sydney-metro-west-rail-infrastructure-stations-precincts-and-operations

2.1.2 Flood Emergency Management

DCCEEW Comment

For the concept stage, proper consideration of flood emergency management is required for ground floor retail/commercial areas that do not have internal access to refuge areas, nor protection to the PMF. While the report recommends shelter in place, no detail has been provided for these areas. Noting the lack of warning time, internal access to refuge areas would be required. DCCEEW strongly recommends that the proponent demonstrate the development does not create an unacceptable risk to life. As a minimum, a set of principles should be provided and it should be checked that each of the tenancies or areas can comply with these principles.

Response

The Parramatta DCP includes comprehensive controls in Part 9.7 to manage the risk associated with intensification and occupation of the floodplain of the Parramatta River.

Control C.05 of Section 9.7.2 specifically requires that where commercial and/or retail uses have floor levels below the PMF and are set below the flood planning level (FPL) of the 1% AEP with 500mm freeboard that the development must be designed to minimise risk to life incorporating appropriate flood mitigation measures developed from flood hazard and risk assessment. Furthermore, Section 9.7.4 of the DCP contains specific requirements for commercial and residential developments in the Parramatta CBD regarding horizontal and vertical evacuation (sheltering-in-place) including the provision of a flood refuge above the PMF which is designed for stays of at least 72 hours in duration. Control C.02 of Section 9.7.4 defines what is required to be covered in a FERP.

Building A and areas of Buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station would aim to be consistent with the Parramatta DCP. Future Detailed SSDA(s) would demonstrate how requirements in the Parramatta DCP have been considered in the detailed design by:

- Presenting evidence-based analysis of the hazard, risk and harm to occupants and those in the surrounds, consistent with Section 2.2.3, with demonstration of how harmful factors would be mitigated
- Presenting FERP(s) as detailed in Section 2.2.3 which include specific details of evacuation pathways for ground floor retail/commercial areas along with triggers for commencing evacuations
- Discussing how the adopted ‘Horizontal’ evacuation pathways, including accessibility considerations, and/or ‘Vertical’ evacuation opportunities and shelter in place facilities above the PMF satisfy the intent of Part 9.7 of the DCP.

Areas of Buildings B, C and D which potentially provide a pathway for floodwaters to enter the metro station would be required to satisfy the Stage 3 CSSI CoA. Whilst not the subject of this application, it is noted that these requirements include an Operational Emergency Management Plan(s) developed in consultation with the SES. A future Detailed SSDA(s) would outline relevant interfaces between the Operational Emergency Management Plan and FERP(s) supporting the application along with consultation with other relevant agencies consistent with Control C.02 of Section 9.7.4 of the DCP.

DCCEEW Comment

The development introduces a large number of people onto the floodplain. DCCEEW strongly recommends the SES be consulted regarding emergency management issues.

Response

Building A and areas of Buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station would aim to be consistent with the Parramatta DCP. Control C.02 of Section 9.7.4 requires consultation with the SES as a relevant state agency when preparing FERP(s). Future Detailed SSDA(s) would demonstrate how requirements in the Parramatta DCP have been considered in the detailed design.

2.2 CoPC Advice

Advice has been received from CoPC as outlined in the following sections.

2.2.1 Supporting Materials

CoPC Comment

An electronic copy of all Drainage and Flood Models together with a copy of flood report must to be provided to CoPC for review. The design of the stormwater pit and pipe network should be modelled in DRAINS and all flood modelling should be undertaken using TUFLOW. It should include Pre and Post Development scenarios along with impact analysis and mapping. The models should be peer reviewed by independent flooding expert consultants.

Response

Flood model development and analysis for the Parramatta metro station precinct has been ongoing since 2022. The adopted model suite described in the Environmental Impact Statements (EIS) for the Rail infrastructure, stations, precincts and operations (Sydney Metro, 2022a) and the Parramatta Over and Adjacent Station Development Appendix T Flooding Assessment (Sydney Metro, 2022b) was initially developed for the Parramatta Light Rail EIS (Arup, 2017). The regional model for the estimation of the PMF for the Parramatta River was based on a combination of existing hydrology and hydraulic models developed for CoPC and/or the Upper Parramatta River Catchment Trust. During this period, the CoPC commissioned a flood study of the Parramatta River based on contemporary modelling methodology and tools and incorporating recent data. The draft Parramatta River Flood Study (PRFS) is expected to be finalised in May 2024. Subject to endorsement of the PRFS, the endorsed PRFS would be incorporated into the Sydney Metro West Stage 3 CSSI (with design changes occurring if required) to establish the ‘baseline’ scenario for the SSDA, before the ‘development’ scenario can be determined during the preparation of the Detailed SSDA. As such, it is recommended that the future Detailed SSDA flooding assessment:

- be based on the endorsed PRFS model (which was undertaken using TUFLOW)
- include impact analysis and mapping for the pre and post development scenarios outlined above.

The Parramatta Over and Adjacent Station Development Appendix W Integrated Water Management Plan (Sydney Metro, 2022c) and the Addendum to Appendix W Integrated Water Management Plan (Sydney Metro, 2024b) describe the drainage design for the proposal which has been undertaken using DRAINS. It is anticipated that any future design revisions required to support design changes would also use DRAINS.

Modelling to support the Detailed SSDA(s) would be undertaken in accordance 2023 Flood Risk Management Manual and the Flood risk management toolkit including relevant technical guidance on flood impact and risk assessment. the

2.2.2 Drainage Design

CoPC Comment

Underground drainage to Smith Street may need upgrading and detailed investigation needs to be undertaken to provide safe access to Civic Link and Metro Station in relation to flooding. There is an opportunity to utilise Civic Link as an additional underground stormwater system with safe overland flow to mitigate the existing flooding situation in surrounding areas including Macquarie St and Smith St. It is recommended that Sydney Metro consider this opportunity and ensure the overland flow/ improved drainage through the site is achieved in design so that there is no adverse flood impact to Parramatta Light Rail (PLR) in Macquarie St or any other property due to this development.

Response

Additional drainage systems have been provided within the Civil Link. Storage capacity has been supplemented by inclusion of onsite detention arrangements for Building C. Analysis has been undertaken which demonstrates the benefit of these design improvements to the existing drainage system.

Section 3 of the Addendum to Appendix W Integrated Water Management Plan (Sydney Metro, 2024b) summarises the key differences associated with the above design refinements.

CoPC Comment

The Macquarie Street drainage system has been updated recently due to drainage works conducted by the Parramatta Square development and drainage works by PLR along Macquarie Street in conjunction with the upgrade of the drainage system at Smith Street and Macquarie Street intersection, crossing the PLR corridor. These upgrade works should be some improvement to the flooding problem at the low point in Macquarie Street for the 5% AEP event, however there may still be flooding in larger storm events and the provision of an additional drainage system and overland flow path through the proposed Civil Link to drain overflows from Macquarie Street in the 1% AEP should also be included in this design.

Response

The drainage capacity of the existing stormwater network has been considered along with additional drainage systems within the Civil Link and onsite detention arrangements for Building C.

The Addendum to Appendix W Integrated Water Management Plan (Sydney Metro, 2024b) describes the benefits associated with these design refinements.

2.2.3 Flood Analysis

CoPC Comment

There is sag point at Macquarie Street (at close proximity to Building C) where water is expected to pond in the 1% AEP flood event. The flood levels available from other studies undertaken for sites such as 3 Parramatta Square refer to a flood level of approximately 10.4m AHD at this point. In Parramatta Square study the depth of water ponding at Macquarie Street in the 1% AEP event is approximately 0.75 to 1.0m deep whereas the Appendix T – Flooding Report, September 2022 (figure A-02) shows there is minimal flooding on the street. Refer to Figure 5 with annotations below. This is different from the Flooding figure under Chapter 8.4 of Appendix E-

Built form and urban Design report from the EIS documentation. The drainage capacity is limited on the street and therefore it must be further investigated to ensure a realistic representation of flood behaviour. Site survey must be utilised in the flood models, as LIDAR may have limited accuracy.

Response

Additional drainage systems have been provided within the Civil Link. Storage capacity has been supplemented by inclusion of onsite detention arrangements for Building C. Analysis has been undertaken which demonstrates the benefit of these design improvements to the existing drainage system. Section 3 of the Addendum to Appendix W Integrated Water Management Plan (Sydney Metro, 2024b) summarises the key differences associated with the above design refinements. These drainage improvements have been incorporated in the flood modelling presented in Section 3.1 and Appendix A.

CoPC comment in relation to modelling associated with other development applications is acknowledged however without access to these models the differences cannot be further investigated. This further supports the recommendations in Section 2.2.1 regarding the future Detailed SSDA flooding assessment using the endorsed PRFS model as this would provide improved consistency across proposals. It is also recommended that detailed survey is obtained for the final precinct levels along with the surrounding streets and be incorporated into the endorsed PRFS models so that the flooding assessment supporting the future Detailed SSDA is based on the most up to date information.

The flooding information referenced in the Parramatta Over and Adjacent Station Development Appendix E Built form and urban design report (Sydney Metro, 2021) was sourced from the CoPC Floodsmart ‘Know your flood risk’ web page at the time the report was written.

CoPC Comment

1% AEP Climate change scenario map (Figure 5, and section 5.3.1 Flooding Report, Sep 2022) shows no flooding or ponding which is unlikely given sag location in Macquarie Street and Smith Street drainage being under capacity. CoPC Flood Map shows flood water within Macquarie Street. Detailed investigation is required and consideration to comment 1 (ii) above should be given and updated statement to be included in EIS document.

Response

Concerns regarding flood representation at the sag in Macquarie Street and in Smith Street where drainage is undercapacity have been responded to earlier in this section along with Section 2.2.2.

CoPC Comment

Flooding Report, Sep 2022, section 3.1 indicates that climate change with Reference Climate Projection (RCP) 8.5 and Reference Year 2100 has been incorporated in the model. Is water ponding at this location realistic? Would it spill towards the sag point at Macquarie Street? Is water ponding at the centre of the road realistic? Water is expected to pond and spread towards the sag pit.

Climate change reference year should be representative of design life/service life of the development. Further, being critical infrastructure, it is important to adopt representative reference year for climate change. It is recommended that further advice is obtained from DCCEEW in relation to the application of climate change and potential to include climate change impact up to 2150. In addition, climate change should be included as design case and mitigation measures should be referenced with the inclusion of climate change.

Response

Concerns regarding flood representation at the sag in Macquarie Street and in Smith Street where drainage is undercapacity have been responded to earlier in this section and Section 2.2.2.

Areas of Buildings B, C and D which potentially provide a pathway for floodwaters to enter the metro station would be required to satisfy the Stage 3 CSSI CoA. Whilst not the subject of this application, it is noted that these requirements specify that the CSSI must be designed to withstand known impacts associated with climate change to the year 2100.

The Physical Science Basis report (Masson-Delmotte *et al*, 2021) of the Sixth Assessment by the Intergovernmental Panel on Climate Change (IPCC) assigns greater uncertainty on climate change beyond 2100. Consequently, the year 2100 was adopted to determine climate change uplift in accordance with Australian Rainfall and Runoff (Ball *et al*, 2019) as presented in Section 3.1 since this provided consistency across the CSSI and SSD proposals.

A draft update to the Climate Change Considerations chapter of Australian Rainfall and Runoff (ARR) was published in late 2023 in response to peer reviewed research published between 2022 and 2024. An updated approach to determine climate change uplifts for rainfall intensities is proposed including the application of climate change uplift to the Probable Maximum Precipitation (PMP), the design rainfall for the PMF event. It is anticipated that the draft update (DCCEEW, 2023) would be incorporated into ARR in the nearer term. For clarity, it is recommended that the future Detailed SSDA(s) flooding assessment adopt the draft update to the Climate Change Considerations chapter of Australian Rainfall and Runoff.

The current model suite has limited functionality due to how it was developed. It is premised on assumptions about the nature of flooding in the area with two separate models – a local model for more frequent events and a mainstream model for the PMF event. Consequently, the model suite cannot demonstrate important considerations such as whether the local or mainstream 1% AEP flood event produces a higher flood level. The mainstream hydraulic model was developed from a combination of existing models. This included inflow hydrographs extracted from hydrologic models based on the hydrological guidance at the time of development. As the associated hydrological models are not available, hydrographs cannot be recreated applying current hydrology design rainfall. Section 2.2.1 contains a recommendation that the flooding assessment for the future Detailed SSDA use the endorsed PRFS model.

CoPC Comment

Flood Modelling has been undertaken utilising ARR2019 methodology which seems resulting lower flood levels and flows. As advised in DRAFT Floodplain Risk Manual, 2022, sensitivity analysis with ARR1987 methodology should also be undertaken and appropriate measures to be incorporated.

Response

Modelling to support the Detailed SSDA(s) would be undertaken in accordance with broader industry best practice at the time of the assessment. That is, it would be consistent with the 2023 Flood Risk Management Manual and the Flood risk management toolkit including technical guidance discussed in the FB04 along with reports commissioned by the NSW Government which have informed FB04.

As outlined earlier in this section, due to limited functionality with the existing model suite it is proposed that the flooding assessment for the Detailed SSDA(s) would use the endorsed PRFS model which would facilitate the best practice recommendation above.

CoPC Comment

CoPC adopted flood levels for the PMF must also be investigated and compared to the calculated flood levels in this study. The station entrances must be protected up to the PMF flood event. It is recommended to raise the crest levels inside entrance points to prevent flood water entering the station and flood water may also enter basement levels via stairwells, lift shafts etc. which should also be protected up the PMF flood.

Response

CoPC comments in relation to the metro station are noted; however, the design of the metro station is not the subject of this application. The metro station and provisioning works associated with buildings B, C and D would be delivered in accordance with the Stage 3 CSSI CoA.

As indicated earlier in this section, the future Detailed SSDA(s):

- is proposed to use the endorsed PRFS (subject to endorsement of the PRFS) which is expected to inform CoPC adopted flood levels for the PMF event.
- would aim to be consistent with the Parramatta DCP for building A and areas of buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station.

CoPC Comment

The Concept SSD EIS document section 2.4 mentions that no significant development proposals, under assessment or approved within the immediate locality that need to be considered from a cumulative impact's perspective. It doesn't mention PLR. It should be included in the assessment under cumulative impacts.

Response

This assessment has been based on the models developed for the Parramatta Light Rail (PLR) project as outlined in Sydney Metro West Rail infrastructure, stations, precincts and operations Environmental Impact Statement Technical Paper 8: Hydrology, flooding and water quality (Sydney Metro, 2022a) and Parramatta Over and Adjacent Station Development Appendix T Flooding Assessment (Sydney Metro, 2022b). As the baseline case accounted for the development associated with PLR, it was not further discussed under the cumulative impact section.

CoPC Comment

The public domain area is impacted by the PMF flood and the depth of flooding is significant which may pose significant safety risks to public. A detailed flood emergency response plan (FERP) is recommended to be prepared for the site at early stages of the design so that the necessary measures can be implemented early in the process. The plan should be prepared in consultation with the local State Emergency Service (SES). Bureau of Meteorology flood warnings and CoPCs Flood Smart service should also be used in developing the plan to provide early flood warnings where possible. All passengers/workers/occupants must have access to a safe area of refuge above the PMF where they can remain until the flood event has passed and any subsequent disruption after the flood has been rendered safe and serviceable. A safe area of refuge can be within a communal area for workers and visitors. Off-site evacuation must be provided to and from the site and investigate/provide safe access points for emergency vehicles. Flood evacuation routes mapping should be prepared and submitted as part of the FERP. The plan should consider a range of floods and durations, each flood event could be different, some floods may have a slow onset and last for longer depending on the temporal pattern of the rainfall that caused the storm. The number of passengers visitors that

are expected in the proximity of the station should be calculated as part of the FERP to ensure timely evacuation of all passengers/workers including disabled persons.

Response

The public domain is not the subject of this application. However, the Detailed SSDA(s) would aim to be consistent with the Parramatta DCP through the development of flood emergency response plan(s) which address the following content:

- both warning and evacuation measures (horizontal or vertical) for all building occupants (residents, workers and visitors) that includes the most appropriate 'safe areas' and 'safe evacuation routes'
- measures to prevent evacuation from the site by private vehicle
- the most appropriate emergency response for flood and fire events that occur together
- a building flood emergency response plan, similar to a building fire evacuation drill, and measures to ensure this is tested at least annually
- details of any physical flood exclusion measures in the development including procedures and practices for their operation, inspection and maintenance in perpetuity
- a statement about the consistency of the submitted flood emergency response plan (FERP) with the FERP for the Parramatta City Centre
- evidence of consultation undertaken with relevant state and local agencies in the preparation of the FERP.

As outlined in Section 2.1.2, the application would also include details of interfaces with the Stage 3 CSSI Operational Emergency Management Plan for flooding where relevant to the Detailed SSDA(s).

2.2.4 Freeboard

CoPC Comment

Flooding Report, September 2022, section 6.2, Paragraph 4 states "For local stormwater flooding a freeboard of 0.3 metre freeboard above internal overland flow paths has been adopted for the Sydney Metro West project area". As per CoPCs current guidelines and current practice the minimum Habitable Finished Floor Level should be set as 1% AEP flood level with climate change plus 500 mm Freeboard. Freeboard less than 500 mm should not be used. The Finished Floor Level should be based on the higher of mainstream Flooding and local flood level allowing for 100% blockage of the underground drainage pipe system. In addition, flood protection up to PMF levels needs to be ensured and demonstrated how it could be achieved. This is more important being a critical infrastructure. Our preference would be to avoid mechanical flood barrier and to design entry levels to protect from all flood events up to and including the PMF.

Response

CoPC comments are noted; however, critical infrastructure such as the metro station is not the subject of this application and would be designed in accordance with the Stage 3 CSSI Approval. Flood protection to PMF event levels is required under the Stage 3 CSSI Approval and applies to any areas of Buildings B, C and D which could compromise the flood immunity of the metro. Active flood measures are proposed.

Since the submission of the EIS for the Concept SSDA, further refinement of the design for the provisioning works for Buildings B, C and D (associated with the

Parramatta metro station Stage 1 design) has been completed. Freeboard requirements for areas of Buildings B, C and D which potentially provide a pathway for floodwaters to enter the metro station are consistent with the Stage 3 CSSI CoA. The updated design has incorporated the freeboard requirements under the Parramatta DCP for entries to Buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station. In both situations, a freeboard of 0.5 metres has been applied to the 1% AEP flood event.

The Stage 3 CSSI COA do not apply to Building A as it is not included within the provisioning works. Further detailed design for Building A would occur at a future date and would aim to be consistent with the Parramatta DCP by:

- adopting a freeboard of 0.5 metres for the 1% AEP flood event
- basing detailed design floor levels on the higher of mainstream flooding from the Parramatta River and local flood level allowing for 100% blockage of the underground drainage pipe system.

2.2.5 Flood Impact

CoPC Comment

Flooding Report, Sep 2022, section 3.1 defines 'Not worsen' flooding on properties or infrastructure up to the 1% AEP climate change flood event. Not worsen is defined as:

- a maximum increase in flood levels of 50 mm
- a maximum increase in time of inundation on one hour
- no increase in potential soil erosion and scouring from any increase in flow velocity.

A maximum increase in flood levels of 50 mm is not acceptable and should be adopted as below:

- 0 mm in residential zoned land
- 0 mm in commercial/industrial zoned land
- 10 mm in public land.

Response

Section 3.1 of the Parramatta Over and Adjacent Station Development Appendix T Flooding Assessment (Sydney Metro, 2022b) included requirements associated with the Stage 3 CSSI Approval. The Stage 3 CSSI Conditions of Approval apply to the metro station and the provisioning works for Buildings B, C and D and define no worsening as:

- a maximum increase in inundation time of one hour during any flood event up to and including a one (1) per cent Annual Exceedance Probability (AEP) flood event;
- a maximum increase of 10 mm in inundation at properties where floor levels are currently exceeded during any flood event up to and including a 1% AEP flood event;
- a maximum increase of 50 mm in inundation at properties where floor levels would not be exceeded during any flood event up to and including a 1% AEP flood event; and
- no inundation of floor levels which are currently not inundated during any flood event up to and including a 1% AEP flood event.

The 50 mm maximum increase applies to events rarer than the 1% AEP flood event.

The Stage 3 CSSI COA do not apply to Building A as it is not included within the provisioning works. The potential impact that Building A has on flood behaviour within the precinct during the PMF event has been considered in the Stage 1 detailed design of the Parramatta metro station and provisioning works. Flood levels, to satisfy metro immunity, were conservatively based on the worst-case flood levels of the with and without Building A scenarios.

Flood impacts less then 10mm is typically considered within the model error (Austroads, 2023). It is therefore recommended that 10 mm is the adopted maximum allowable increase for flood events up to and including the 1% AEP flood event.

3 Flooding assessment

The scope of this section of the report is to summarise the further refinements of the design compared to the Concept SSDA EIS.

3.1 Assessment Approach

Flood analysis for the establishment of design flood levels was determined on the following basis:

- Updated building and public space layout as detailed in the Addendum to Appendix E Built form and urban design report (Sydney Metro, 2024a)
- Available LiDAR, site survey and design surface data for the precinct
- Existing guidelines including Australian Rainfall and Runoff 2019 and Bureau of Meteorology documentation for the estimation of the PMP.

The methodology has previously been described in the Environmental Impact Statements for the Rail infrastructure, stations, precincts and operations (Sydney Metro, 2022a) and the Parramatta Over and Adjacent Station Development Appendix T Flooding Assessment (Sydney Metro, 2022b). Additional commentary on the suite of models used for this assessment is contained in Section 2.2.1 and Section 2.2.3.

3.2 Assessment Analysis

This proposal has been reassessed following Stage 1 detailed design for the Parramatta metro station and provisioning works for buildings B, C and D. Flood impacts are fundamentally unchanged from the assessment contained in the Parramatta Over and Adjacent Station Development Appendix T Flooding Assessment (Sydney Metro, 2022b). Updated flood depth mapping based on the revised layout is contained in Appendix A.

In the 5% AEP and 1% AEP climate change flood events, shallow overland flow discharges and ponds in some of the streets adjacent to and within the site. The hydraulic model results indicate blocking and redirecting some of the overland flow in the 1% AEP climate change flood event would cause only minor localised increases in flood level of less than 10 mm on the streets adjacent to the site. Generally, these events do not impact the development as they are contained within the minor drainage network or within the major drainage network of the adjacent streets.

The PMF event would inundate the proposal without flood protection measures as it is associated with activation of the Parramatta River floodplain which includes the Parramatta CBD. The key difference between the baseline and developed scenarios for this proposal is the inclusion of Building A (since buildings B, C and D provisioning works include the flood impact of those buildings in the CSSI). The ‘With building A’ scenario represents the cumulative impact of all the buildings associated with the Parramatta Over and Adjacent Station development.

Appendix A contains PMF flood depth maps for the with and without Building A scenarios, annotated with spot levels, along with a colour coded depth map indicating how the inclusion of building A alters flood levels in and around the metro precinct. The design of the provisioning works for buildings B, C and D has been conservatively based on the maximum PMF event levels derived from the with and without building A scenarios.

This assessment is based on incorporating flood protection for the PMF event in the design of building A which is consistent with the requirements of the Parramatta DCP in relation to basement car parks in flood prone areas. As further development and infill occurs across the Parramatta CBD it could be reasonably assumed that there will be a cumulative reduction in floodplain storage during very rare and extreme flood events.

4 Conclusion and Recommendations

This Addendum to the Flooding Assessment report has been written to support the Concept SSDA Response to Submissions Report and to respond agency advice.

Agency advice on flood matters has been considered in this Addendum. Responses have been outlined in Section 2, along with additional commentary in Section 3, which responds to the specific agency comments associated with the current design and includes additional mitigation measures where appropriate.

Future stages of design of the proposal would ensure that flood risks to occupants are comprehensively assessed which would be outlined in a future Detailed SSDA. The detailed design would be consistent with the Parramatta Over and Adjacent Station Development Flooding Assessment including:

- Applicable flood criteria associated with the Stage 3 CSSI Conditions of Approval
- Stated mitigation measures.

The detailed design would also be consistent with the following additional mitigation measures outlined in this report including that:

- Building A and areas of buildings B, C and D which do not provide a pathway for floodwaters to enter the metro station would aim to be consistent with the Parramatta Development Control Plan (DCP) 2023
- Detailed survey is obtained for the final precinct levels along with all the streets surrounding the precinct for the baseline and developed scenarios.
- Allowable flood increases are consistent with the Stage 3 CSSI CoA.

Modelling to support the Detailed SSDA would be undertaken in accordance with industry best practice at the time of the assessment. This would include:

- 2023 Flood Risk Management Manual and the Flood risk management toolkit including technical guidance discussed in the FB04 along with reports commissioned by the NSW Government which have informed FB04.
- Updated guidance on climate change to Australian Rainfall and Runoff Guidelines
- Subject to endorsement of the PRFS, updated modelling would be undertaken to inform detailed design and emergency planning based on the endorsed Parramatta River Flood Study model.
- Details of interfaces with the Stage 3 CSSI Operational Emergency Management Plan for flooding where relevant to the Detailed SSDA would be considered in hazard and risk assessments as part of the design process.

5 References

Arup (2017) Parramatta Light Rail Environmental Impact Statement Technical Paper 7 Flooding

Austroads (2023) Guide to Road Design Part 5: Drainage – General and Hydrology Considerations

Ball, Babister, Nathan, Weeks, Weinmann, Retallick, Testoni (Editors) (2019) Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia

DCCEEW (2023) Discussion Paper: Update to Climate Change Considerations chapter in Australian Rainfall and Runoff: A Guide to Flood Estimation Discussion Paper, Department of Climate Change, Energy, the Environment and Water, Canberra, CC BY 4.0

Floodsmart Parramatta n.d., City of Parramatta Council, viewed 10 March 2024, https://www.cityofparramatta.nsw.gov.au/environment/floodsmart-parramatta/know-your-flood-risk

Sydney Metro (2021) Parramatta Over and Adjacent Station Development Appendix E Built form and urban design report

Sydney Metro (2022a) Rail infrastructure, stations, precincts and operations Environmental Impact Statement Technical Paper 8: Hydrology, flooding and water quality

Sydney Metro (2022b) Parramatta Over and Adjacent Station Development Appendix T Flooding Assessment

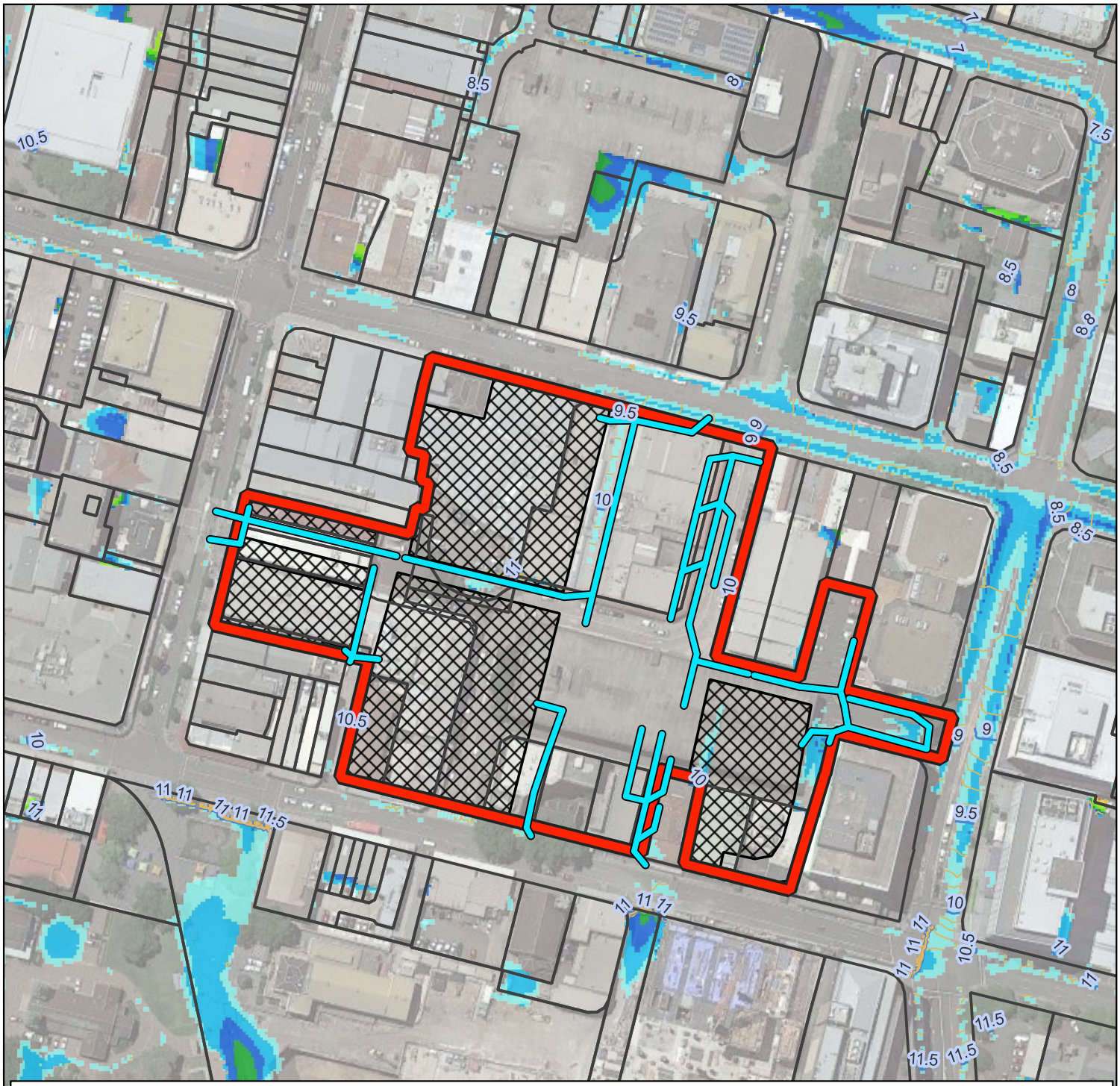
Sydney Metro (2022c) Parramatta Over and Adjacent Station Development Appendix W Integrated water management plan

Sydney Metro (2024a) Parramatta Over and Adjacent Station Development Addendum to Appendix E Built form and urban design report

Sydney Metro (2024b) Parramatta Over and Adjacent Station Development Addendum to Appendix W Integrated Water Management Plan

Masson-Delmotte, Zhai, Pirani, Connors, Péan, Berger, Caud, Chen, Goldfarb, Gomis, Huang, Leitzell, Lonnoy, Matthews, Maycock, Waterfield, Yelekçi, Yu, Zhou (Editors) (2021) Technical Summary: The Physical Science Basis. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA doi:10.1017/9781009157896.002

Appendix A Flood Depth and Hazard Mapping



TITLE

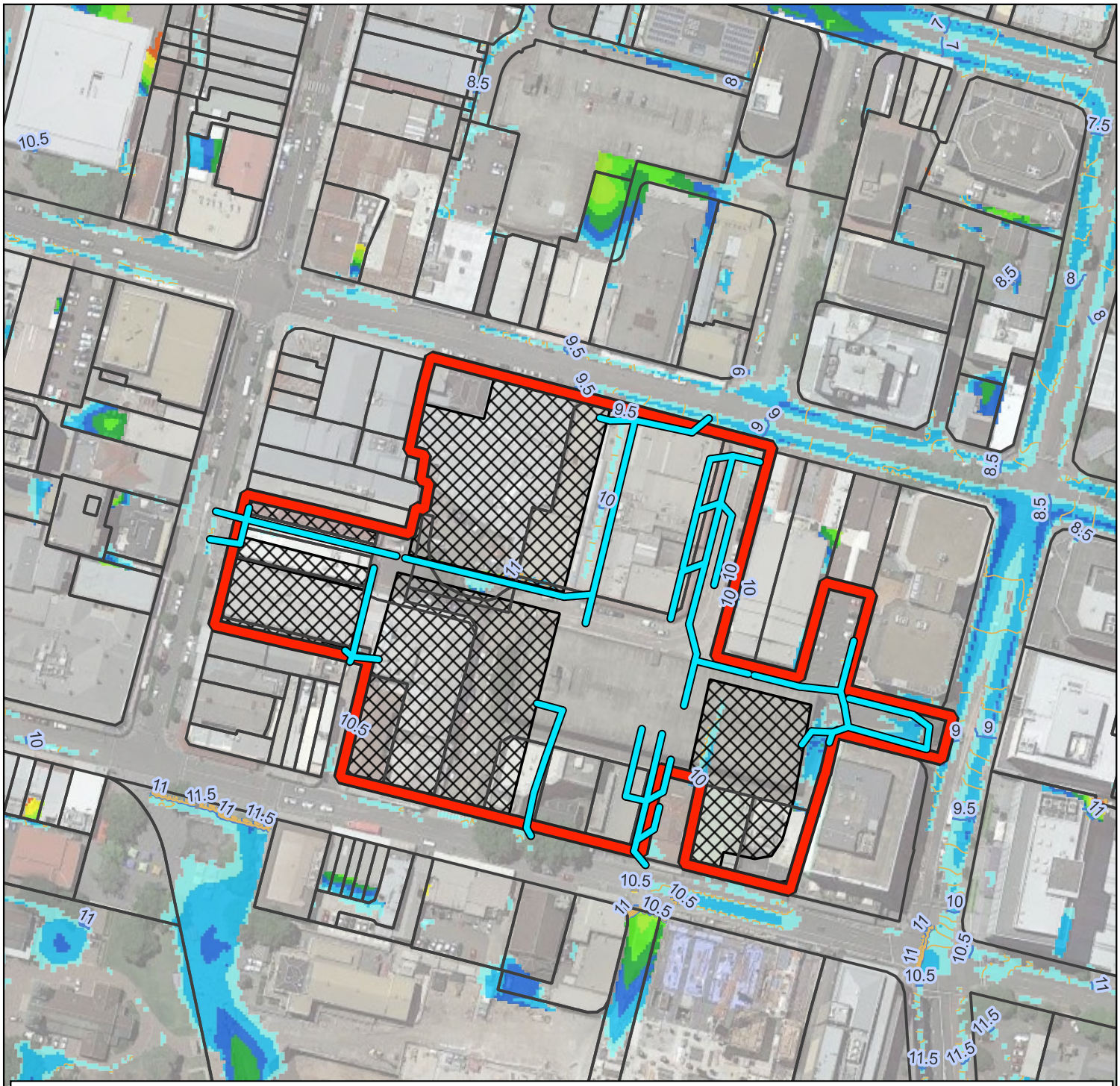
5% AEP Climate Change Developed Flood Depth

PROJECT

EDS - SWM - Parramatta

0 50 100 m

Date	Drawn	Check	Approved	Scale	Rev
06/11/2023	SC	SC	BS	1 : 2000	1



TITLE

1% AEP Climate Change Developed Flood Depth

PROJECT

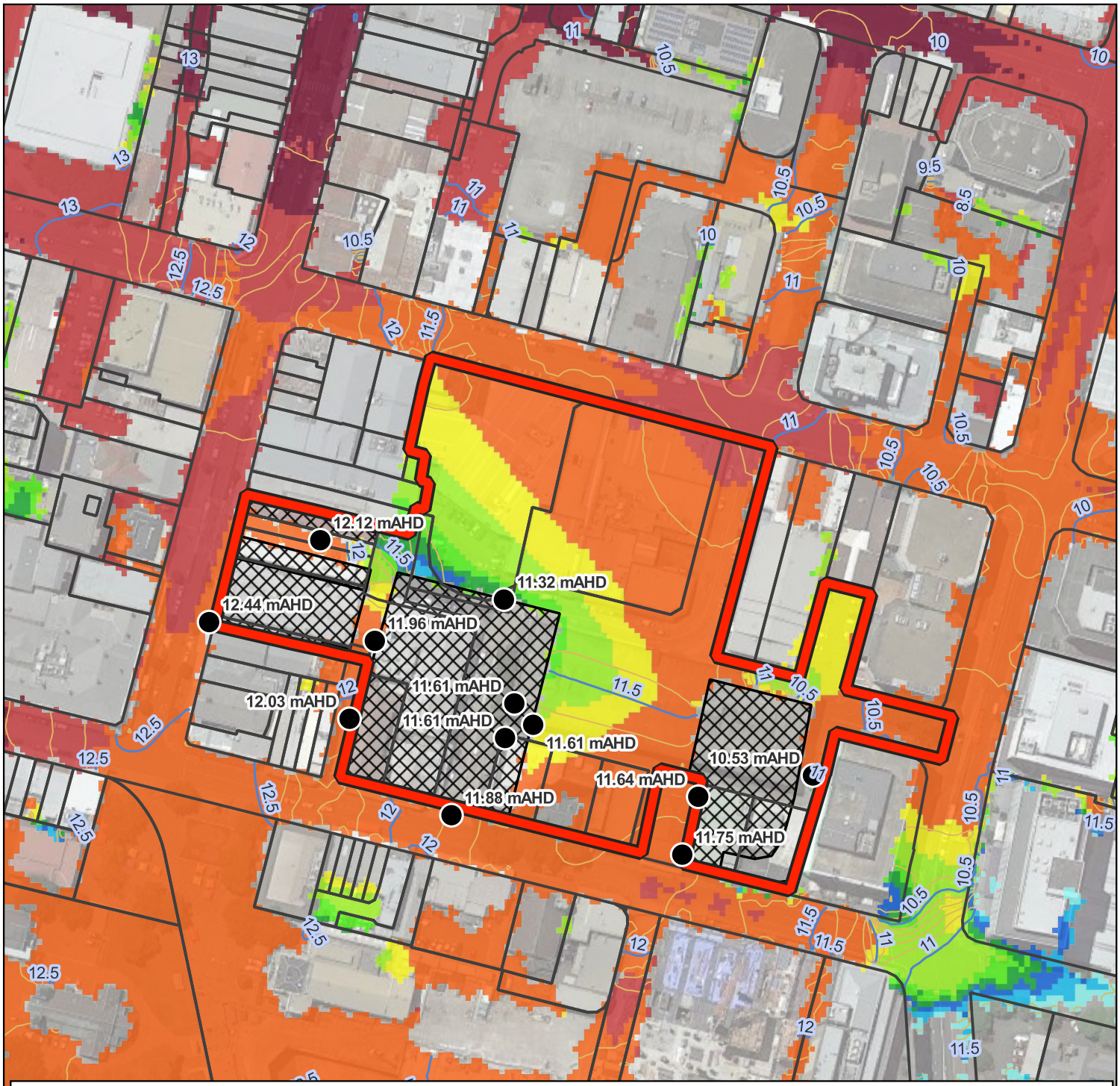
EDS - SWM - Parramatta

0 50 100 m

NSW GOVERNMENT

sydney METRO

Date	Drawn	Check	Approved	Scale	Rev
06/11/2023	SC	SC	BS	1 : 2000	1



Legend

- Site Extent
- Proposed Buildings
- WSL Major Contour (0.5m)
- WSL Major Contour (0.1m)
- Flood Depth (m)
  - <0.1
  - 0.1 - 0.2
  - 0.2 - 0.3
  - 0.3 - 0.4
  - 0.4 - 0.5
  - 0.5 - 0.75
  - 0.75 - 1
  - 1 - 2
  - 2 - 3
  - 3 - 4
  - >4
- PMF Water Level

TITLE

PMF Developed Flood Depth Map
Stage 1 - Excluding Building A

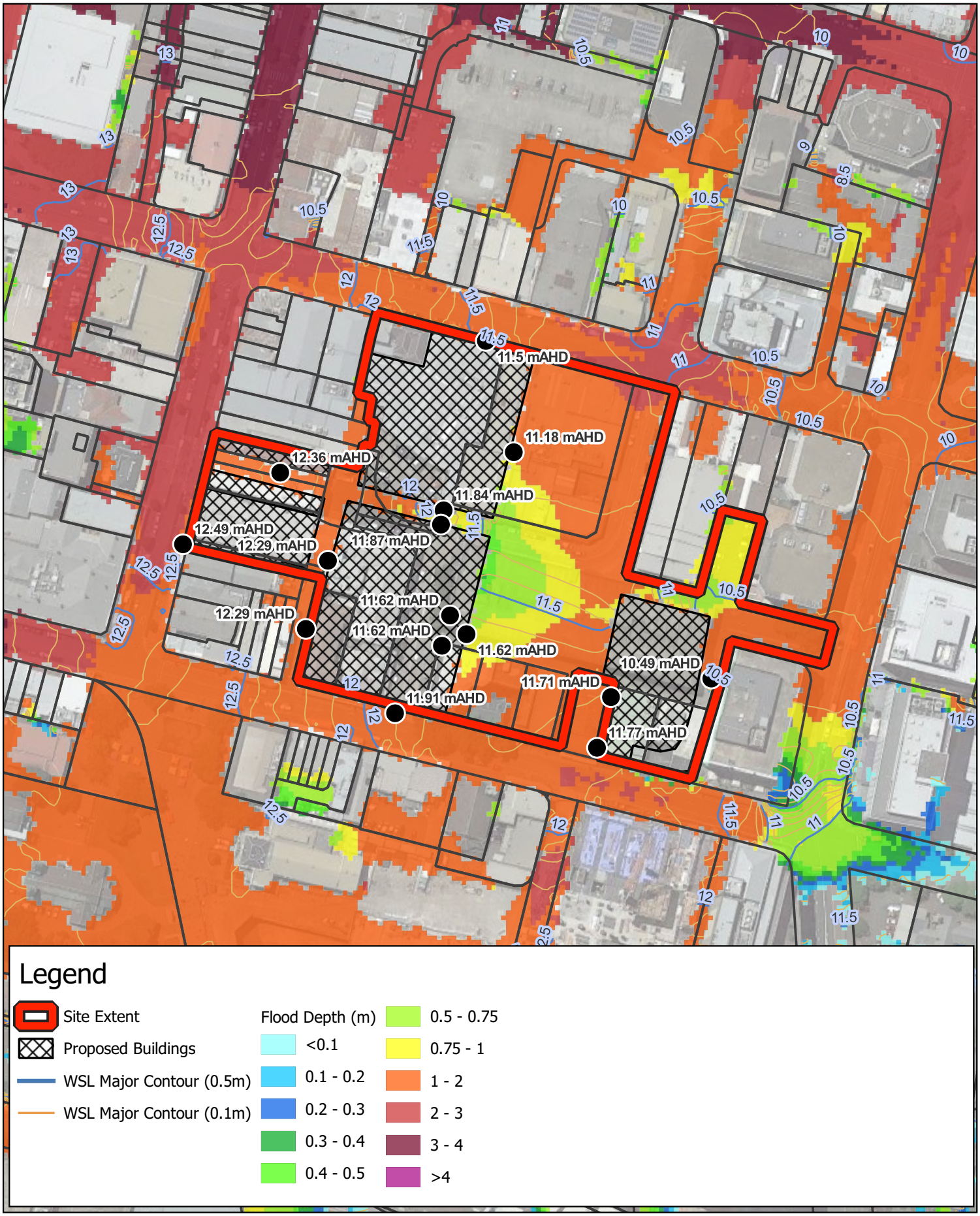
PROJECT

EDS - SWM - Parramatta

0 50 100 m

NSW GOVERNMENT | sydney METRO

Date	Drawn	Check	Approved	Scale	Rev
05/05/2023	LS	SC	HW	1 : 2000	1



Legend

- Site Extent
- Proposed Buildings
- WSL Major Contour (0.5m)
- WSL Major Contour (0.1m)

Flood Depth (m)

- <0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

TITLE

PMF Developed Flood Depth Map
Stage 1 - All Buildings

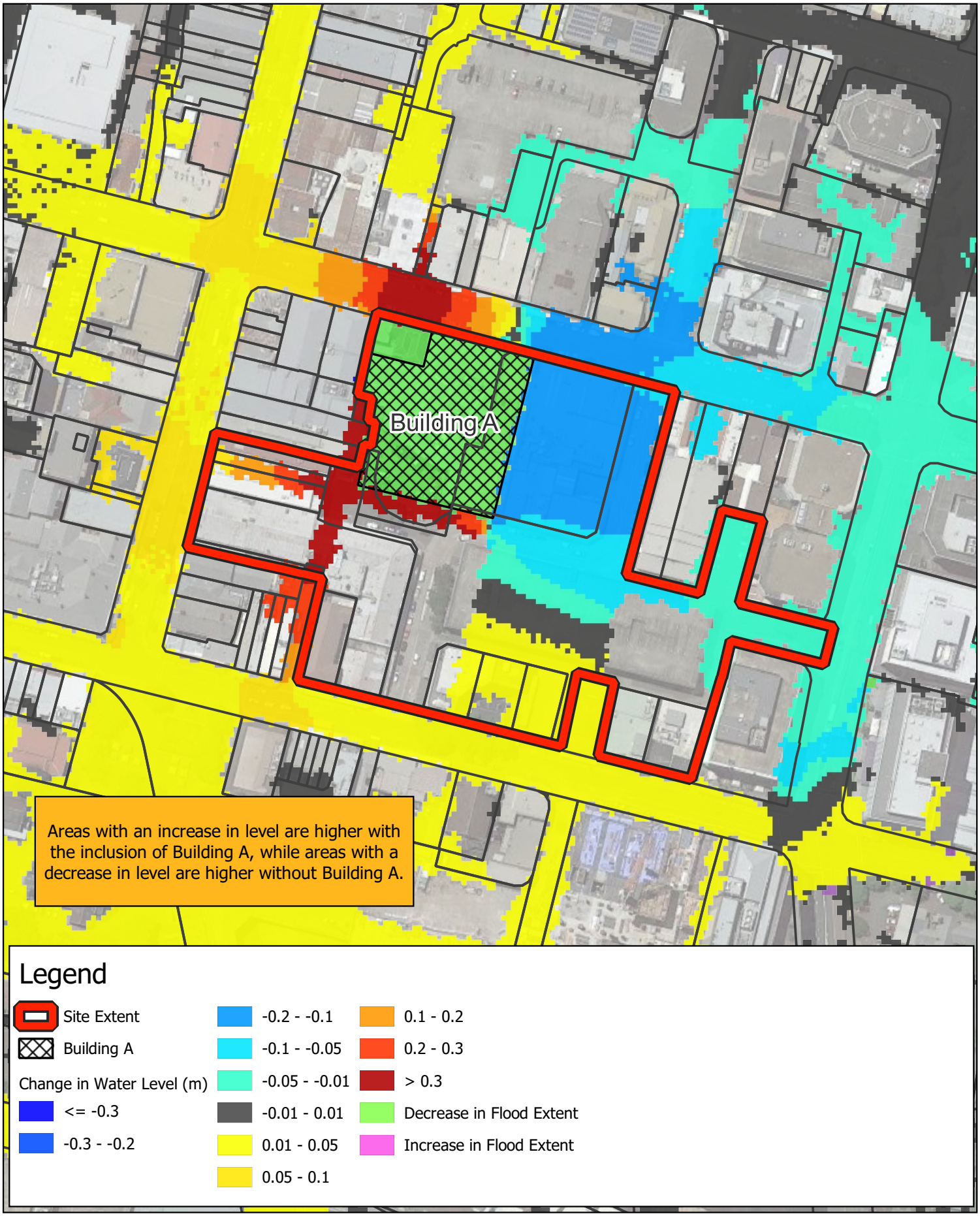
PROJECT

EDS - SWM - Parramatta

0 50 100 m

NSW GOVERNMENT | sydney METRO

Date	Drawn	Check	Approved	Scale	Rev
05/05/2023	LS	SC	HW	1 : 2000	1



TITLE

PMF Developed Flood Depth Map
Stage 1 - Building A Flood Impact

PROJECT

EDS - SWM - Parramatta

0 50 100 m

NSW GOVERNMENT | sydney METRO

Date	Drawn	Check	Approved	Scale	Rev
05/05/2023	LS	SC	HW	1 : 2000	1