## Appendix U

# Integrated Water Management and Water Quality Plan

Hunter Street West Over Station Development Integrated Water Management and Water Quality Plan

Appendix U

November 2022



### **Document Number:** SMWSTEDS-SMD-SCB-SN100-WA-RPT-044004

REVISION	DATE	SUITABILITY CODE	TEAMBINDER DOCUMENT NUMBER	TB REVISION
D	28/10/2022	S4	SMWSTEDS-SMD-SCB- SN100-WA-RPT-044004	D

## **Approval Record**

POSITION	NAME	DATE
Principal Engineer Civil Engineer	Heather Walker Winston Phan Jerry Zhang	28/10/2022
Principal Engineer	Juan Wood	28/10/2022
Principal Engineer	Lisa Karwoski	28/10/2022
Senior Environmental Advisor	Jonathon Cook	31/10/2022
EDATP Metro West Package Lead	Adrian Garnero	02/11/2022
	POSITIONPrincipal Engineer Civil EngineerPrincipal EngineerPrincipal EngineerSenior Environmental AdvisorEDATP Metro West Package Lead	POSITIONNAMEPrincipal Engineer Civil EngineerHeather Walker Winston Phan Jerry ZhangPrincipal EngineerJuan WoodPrincipal EngineerLisa KarwoskiSenior Environmental AdvisorJonathon CookEDATP Metro West Package LeadAdrian Garnero

## Amendment Record

DATE	REVISION	AMENDMENT DESCRIPTION	AUTHOR
20/05/2022	А	First Draft	Jerry Zhang
08/07/2022	В	Second Draft	Jerry Zhang
20/09/2022	С	Third Draft	Jerry Zhang
28/10/2022	D	Final Draft	Jerry Zhang

Mott MacDonald Australia Pty Ltd

Limitation: This document is issued for the party which commissioned it and for specific purposes connected with the above captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of the document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

## Contents

Glo	ssary	iv
Exe	ecutive	e summaryvi
1	Introc 1.1 1.2 1.3	Juction1Sydney Metro West1Background and planning context11.2.1Critical State Significant Infrastructure11.2.2State Significant Development application21.2.3Planning Proposal22Purpose of the report2
2	The s 2.1 2.2	ite and proposal
3	Metho 3.1 3.2 3.3 3.4 3.5 3.6	odology7Design standards8Basis of design8Consultation8Design criteria9Stormwater quantity control requirements10City of Sydney Development Control Plan 201210
4	Asses 4.1 4.2 4.3 4.4	ssment12Baseline investigations124.1.1Existing drainage network124.1.2Catchment and topography124.1.3Existing stormwater performance13Stormwater quantity154.2.1Stormwater strategy154.2.2Proposed stormwater design154.2.3Proposed stormwater works16Stormwater quality164.3.1Existing stormwater quality measures164.3.2Proposed stormwater quality strategy174.3.3Rainfall data and model parameters184.3.4Proposed treatment train18Authority consultation20
5	Conc	lusion 21

Appendix A Existing stormwater network

## List of Figures

Figure 1-1 Sydney Metro West	1
Figure 2-1 Location of the site	4
Figure 2-2 Proposed Concept SSDA development and CSSI scope	6
Figure 4-1 Catchment area	13
Figure 4-2 DRAINS model	14
Figure 4-3 MUSIC model treatment train	19

## List of Tables

Table 2-1 Site legal description	5
Table 2-2 Proposed development overview Table 3-1 Stormwater Design Standards	с 8
Table 3-2 Stormwater basis of design	8
Table 3-3 Stormwater design criteria	9
Table 3-4 Sydney Water quantity control requirements	10
Table 4-1 Hunter Street West catchment areas	12
Table 4-2 Tail water levels of the site	15
Table 4-3 On-site detention summary	16
Table 4-4 On-site detention catchment flow rates	16
Table 4-5 Existing water quality conditions of watercourses relevant to the site	17
Table 4-6 Proposed treatment train	18
Table 4-7 Water quality catchment areas of the site	19
Table 4-8 MUSIC results for the site	20

## Glossary

Term	Definition
AEP	Annual Exceedance Probability is 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. The following relationships between AEP and ARI applies to this study (Ball et al, 2019).
ARI	Average Recurrence Interval is long-term average number of years between the occurrences of a flood as big as or larger than the selected flood event. For example, floods with a discharge as great as or greater than the 20-year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. Also refer to Average Exceedance Probability (AEP), which is the industry standard terminology for definition of design flood events.
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.
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.
CC	Climate Change
Concept and Stage 1 CSSI Application	Application SSI-10038 including all major civil construction works between Westmead and The Bays, including station excavation and tunnelling, associated with the Sydney Metro West 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.
Council	City of Sydney
CSSI	Critical Stage Significant Infrastructure
DCP	Development Control Plan
DPE	Department of Planning and Environment
DRAINS	Software used for hydraulic modelling
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
ESD	Ecologically Sustainable Design
FSR	Floor space ratio
GFA	Gross Floor Area
Hydrologic modelling	Hydrologic modelling refers to the conversion of the design rainfall and runoff into flow hydrographs that are applied to the hydraulic model to define flood depths, flood extents, velocities and hazards for a range of design storms.
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.

Term	Definition
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.
IWMP	Integrated Water Management Plan
LEP	Local Environmental Plan
OSD	Proposed Hunter Street Over Station Development
POEO Act	Protection of the Environment Operations Act 1997
PMF	Probable Maximum Flood
PSD	Permissible Site Discharge
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2009
SSDA	State Significant Development Application
SSI	State Significant Infrastructure
Stage 2 CSSI Application	Application SSI-19238057, including major civil construction works between The Bays and Hunter Street Station
Stage 3 CSSI Application	Application SSI-22765520, including rail infrastructure, stations, precincts and operation of the Sydney Metro West line
Sydney Metro West	Construction and operation of a metro rail line and associated stations between Westmead and the Sydney CBD as described in section 1.1
TfNSW	Transport for New South Wales
TN	Total Nitrogen
ТР	Total Phosphorus
TSS	Total Suspended Solids
WQ	Water Quality Treatment
WSUD	Water Sensitive Urban Design

## **Executive summary**

This Integrated Water Management Plan supports a Concept State Significant Development Application (Concept SSDA) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Concept SSDA is made under section 4.22 of the EP&A Act.

Sydney Metro is seeking concept approval for a commercial tower above the Hunter Street Station western site (the site), otherwise known as the over station development (OSD).

The Concept SSDA seeks consent for a building envelope and its use for a commercial and retail premises, a maximum building height of 51 storeys (213 m/reduced level 220.0), a maximum gross floor area (GFA) of 69,863 m<sup>2</sup>, pedestrian and vehicular access, circulation arrangements and associated car parking and the strategies and design parameters for the future detailed design of development.

This Integrated Water Management Plan responds specifically to the Secretary's Environmental Assessment Requirements (SEARs) and involves the analysis of the existing stormwater quantity and water quality conditions for Hunter Street West OSD (referred to hereafter as 'the proposed development'). The report aims to provide a hydraulic and water quality analysis and preliminary design of on-site detention systems and water quality treatment measures according to relevant stormwater and water quality standards.

The baseline investigations involved analysing the existing drainage network, catchment and topography, and the existing stormwater performance. Sydney Water was consulted on the on-site detention and Permissible Site Discharge (PSD) for the site. Sydney Water advised for the site a minimum site storage of 59m<sup>3</sup> is to be provided with a maximum PSD of 138 L/s. A DRAINS model was set up to analyse the 5% and 1% AEP storm events including climate change and bypass.

The initial design of the on-site detention involved modelling the storage requirements set by Sydney Water and assessing PSD compliance. The modelling results indicated that a larger on-site detention tank would be required to account for the increase in rainfall from climate change to ensure post-development flows do not exceed the pre-development state. The design of on-site detention for the site was optimised to 90m<sup>3</sup>.

MUSIC software was used to model the existing catchment for both sites and design the treatment train to meet City of Sydney water quality targets. The proposed treatment process involves treating stormwater runoff through filter cartridges within the on site detention tank. Bypass area will be treated by treatment channels before discharging to council's system. The model results indicate that the design is compliant with Green Star and City of Sydney Water Quality reduction targets.

Future work that is required to finalise the stormwater and water quality design, will be part of the Detailed SSDA design process. This will include the following:

- design of connection to existing council drainage system
- final on-site detention requirements based on the finalised architectural scheme
- further authority coordination as required.

## 1 Introduction

## 1.1 Sydney Metro West

Sydney Metro West will double rail capacity between Greater Parramatta and the Sydney Central Business District (CBD), transforming Sydney for generations to come. The once in a century infrastructure investment will have a target travel time of about 20 minutes between Parramatta and the Sydney CBD, link new communities to rail services and support employment growth and housing supply.

Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street.



Sydney Metro West station locations are shown in Figure 1-1 below.

#### Figure 1-1 Sydney Metro West

## **1.2 Background and planning context**

Sydney Metro is seeking to deliver Hunter Street Station under a two part planning approval process. The station fit out infrastructure is to be delivered under a Critical State Significant Infrastructure (CSSI) application subject to provisions under Division 5.2 of the EP&A Act, while the over station developments are to be delivered under a State Significant Development (SSD) subject to the provisions of Part 4 of the EP&A Act. It is noted a Planning Proposal request has been submitted to the City of Sydney Council to amend the planning controls on the site (refer to section 1.2.3).

## 1.2.1 Critical State Significant Infrastructure

The state significant infrastructure (SSI) planning approval process for the Sydney Metro West metro line, including delivery of station infrastructure, has been broken down into a number of planning application stages, comprising the following:

- Concept and Stage 1 CSSI Approval (SSI-10038) All major civil construction works between Westmead and The Bays including station excavation, tunnelling and demolition of existing buildings (approved 11 March 2021)
- Stage 2 CSSI Application (SSI- 19238057) All major civil construction works between The Bays and Hunter Street Station (approved 24 August 2022)

 Stage 3 CSSI Application (SSI- 22765520) – Tunnel fit-out, construction of stations, ancillary facilities and station precincts between Westmead and the Hunter Street Station, and operation and maintenance of the Sydney Metro West line (under assessment).

## 1.2.2 State Significant Development application

The SSD will be undertaken as a staged development with the subject Concept State Significant Development Application (Concept SSDA) being consistent with the meaning under section 4.22 of the EP&A Act and seeking conceptual approval for a building envelope, land uses, maximum building heights, a maximum gross floor area, pedestrian and vehicle access, vertical circulation arrangements and associated car parking. A subsequent Detailed SSDA/s is to be prepared by a future development partner which will seek consent for detailed design and construction of the development.

## 1.2.3 Planning Proposal

A Planning Proposal request has been submitted to the City of Sydney Council to amend the planning controls that apply to the Hunter Street Station under the Sydney Local Environmental Plan 2012 (LEP). Hunter Street Station includes both a western site (this application) and an eastern site.

The Planning Proposal request seeks to enable the development of a commercial office building on the site that would:

- comprise a maximum building height of between reduced level (RL) 213m and RL 220.0m (as it varies to comply with the relevant sun access plane controls)
- deliver a maximum gross floor area (GFA) of 69,912 m2 (resulting in a maximum floor space ratio (FSR) of 18.71:1), measured above ground level.
- facilitate the adaptive reuse of the existing Former Skinners Family Hotel within the overall development.
- include site specific controls which ensure the provision of employment and other non-residential land uses
- require the mandatory consideration of a site-specific Design Guideline
- allow for the provision of up to 70 car parking spaces
- establish an alternative approach to design excellence

The Planning Proposal request was submitted to the City of Sydney in May 2022 and is currently under assessment.

## **1.3** Purpose of the report

This Integrated Water Management Plan supports a Concept SSDA submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the EP&A Act. The Concept SSDA is made under section 4.22 of the EP&A Act.

This report has been prepared to specifically respond to the Secretary's Environmental Assessment Requirements (SEARs) issued for the Concept SSDA on 8 August 2022 which states that the environmental impact statement is to address the following requirements.

SEARs requirements	Where addressed
<ul><li>Provide an Integrated Water Management Plan for the development that:</li><li>is prepared in consultation with the local council and any other relevant drainage or water authority</li></ul>	Section 3 and 4 – This proposal
<ul> <li>details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality management measures, and the nominated discharge points</li> </ul>	
<ul> <li>demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties.</li> </ul>	

The purpose of this report is to summarise the design approach, key assumptions, relevant references and standards applied to the development of the concept stormwater design documentation for the proposed development.

These concept stormwater works are for the permanent works for the proposed development. Enabling and temporary works have not been included within this concept design report and package.

This report has been developed to:

- describe how input data has been obtained, collected and interpreted
- discuss the key design standards used for the design
- present the stormwater strategies that have been developed within the station precinct
- how key interfaces with other disciplines and stakeholders, including details on any external coordination meetings. Detail required next steps and further civil engineering work required to develop the design in subsequent stages.

## 2 The site and proposal

## 2.1 Site location and description

Hunter Street Station is in the northern part of the Sydney CBD, within the commercial core precinct of Central Sydney and within the Sydney Local Government Area (LGA). The Hunter Street Station includes two sites – the western site and the eastern site. This report relates to the western site only.

The Hunter Street Station western site (the site) is on the corner of George and Hunter Street. It includes De Mestre Place, the heritage listed former Skinners Family Hotel, and land predominantly occupied by the existing Hunter Connection retail plaza. The site is occupied by commercial office buildings, restaurants, shops, as well as a range of business premises and employment and medical/health services premises.

The site area is 3,736 m2 and will be cleared of all buildings and utilities prior to commencement of station construction activities. The site location is shown in Figure 2-1.



Figure 2-1 Location of the site

Table 2-1 sets out the address and legal description of the parcels of land that comprise the site.

Table 2-1 Site legal description

Address	Lot and DP
296 George Street, Sydney	Lot 1, DP438188
300 George Street, Sydney	CP and Lots 1-43, SP596
312 George Street, Sydney	Lot 1, DP211120
314-318 George Street, Sydney	Lot 13, DP622968
5010 De Mestre Place, Sydney (Over Pass)	Lot 1, DP1003818
9 Hunter Street, Sydney	Lot 2, DP850895
5 Hunter Street, Sydney (Leda House & Hunter Arcade)	CP and Lots 1-63, SP71068
5 Hunter Street, Sydney (Leda House & Hunter Arcade)	CP and Lots 1-14, SP65054
7-13 Hunter Street, Sydney (Hunter Connection)	CP and Lots 1-53, SP50276
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 57 and 58, SP61007
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 54, 55 and 56, SP60441
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 59, 60 and 61, SP62889
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 62, 63, 64 and 65, SP69300
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 66 and 67, SP77409
7-13 Hunter Street, Sydney (Hunter Connection)	Lot 2, SP50276
De Mestre Place, Sydney	N/A
	Total Area: 3,736 m <sup>2</sup>

## 2.2 Overview of the proposal

The Concept SSDA will seek consent for a building envelope above the site (the proposed development). As detailed in Table 2-2 and Figure 2-2.

Table 2-2 Proposed development overview

Built form component	Proposed development outcome
Site area	3,736m <sup>2</sup>
Height	Building height of 213.0m (RL 220.00)
Gross floor area	Up to 69,863m <sup>2</sup>
Land use(s)	Commercial office and retail
Carparking	Up to 70 car parking spaces



Figure 2-2 Proposed Concept SSDA development and CSSI scope

## 3 Methodology

The scope of this report is to summarise existing stormwater and water quality conditions and detail required upgrades, infrastructure and protection measures required to satisfy the relevant stormwater and water quality standards.

The stormwater and water quality requirements are summarised below along with the location where they have been addressed within this report:

- stormwater discharge from development site shall have no adverse impacts on upstream and downstream drainage system as per City of Sydney DCP 2012. Further details outlined in section 3.6
- · provision of on-site detention system as required by Sydney Water
- development site stormwater quality to meet City of Sydney targets as outlined in section 3.6.

It is noted that this assessment relates to the proposed building envelopes and associated reference design of the on-site detention for the Concept SSD. Additionally, this report identifies preliminary development staging and stormwater consultation, the final staging and delivery of stormwater and water quality infrastructure will form part of subsequent design stages.

The stormwater and water quality assessment involved:

- undertaking a desktop review of publicly available data to characterise existing surface water (baseline) conditions at the proposal site including climate, catchment history, topography, hydrology, the soil landscape and environmental values
- reviewing relevant legislation, plans, policies and guidelines for water management within NSW and local council
- identifying the types of surface water impacts which may occur due to the proposal
- identifying mitigation measures to address potential surface water impacts.

A separate Hunter Street Preliminary Flooding Report (Appendix Y to the EIS)) has been developed for this site.

A separate Hunter Street Ecologically Sustainable Development (ESD) Report (Appendix S to the EIS) has been developed for this site. Key indicatives that might be applicable for this site include:

- target a 5+ star Green Star Buildings rating
- commit to a 6 Star NABERS Energy for Offices and 4.5 star NABERS Water for Offices performance, respectively
- deliver a 40% reduction in annual water consumption when compared to a reference building

## 3.1 Design standards

The design has been undertaken in compliance with relevant Australian standards and local government guidelines. City of Sydney standards have generally been adopted for the development. Key documents used as guidance for the design are summarised below in Table 3-1.

Document No.	Document name	Version or date
City of Sydney	Sydney Streets Technical Specifications: A4 Stormwater Drainage Design	2016
RMS R11	RMS Specification R11	2021
AR&R	Australian Rainfall and Runoff: A Guide to Flood Estimation	2019
AS 3500.3	Australian Standard AS3500.3: Plumbing and Drainage Code – Stormwater Drainage (2003)	2021

#### Table 3-1 Stormwater Design Standards

## 3.2 Basis of design

In developing the civil concept design, information from a variety of sources has been used. A summary of this information is contained below in Table 3-2.

Table 3-2	Stormwater	basis	of	design
-----------	------------	-------	----	--------

Document No.	Document name	Version or date
NA	City of Sydney Development Control Plan	2012
NA	Local Planning for Healthy Waterways using NSW Water Quality Objectives	June 2006
NA	City of Sydney Water Sensitive Urban Design (WSUD) Technical Guidelines	2014

## 3.3 Consultation

The Integrated Water Management Plan (IWMP) integrates correspondence and comments from Sydney Water. Comments include the detention storage and permissible discharge requirement from the proposed development.

## 3.4 Design criteria

The design criteria applied to the stormwater works are summarised in Table 3-3 below:

Table 3-3 Stormwater design
-----------------------------

Item	Standard	Adopted
Hydrology & hydraulics		
Hydrological model	Sydney Street Technical Specifications: A4 Stormwater Drainage	DRAINS model Time and Area method - ILSAX
Minor design storm	Sydney Street Technical Specifications: A4 Stormwater Drainage	20yr Average Recurrence Interval (5% AEP)
Major design storm	Sydney Street Technical Specifications: A4 Stormwater Drainage	100yr Average Recurrence Interval (1% AEP)
Design rainfall	Sydney Street Technical Specifications: A4 Stormwater Drainage	AR&R 2016 values
Urban rainfall losses	AR&R Datahub	Pervious IL = 28mm Pervious CL = 0.64mm/h Imperv. IL = 1mm Imperv. CL = 0.0mm/h
Pipe size	Sydney Street Technical Specifications: A4 Stormwater Drainage	Min 150mm diameter (pipes located in private property) Min 375mm diameter (pipes owned by City of Sydpov)
Pit spacing	Sydney Street Technical Specifications: A4 Stormwater Drainage	Max. 40m (pipes 375mm to 750mm dia.) Max. 60m (pipes 750mm to 1500 mm dia.)
Pit losses	Sydney Street Technical Specifications: A4 Stormwater Drainage	Missouri Charts
Pit blockage factors	Sydney Street Technical Specifications: A4 Stormwater Drainage	Grated Inlet Pits: 90% Kerb Inlet Pits <=1.0 m • On-Grade: 50% • Sag: 70% Kerb Inlet Pits > 1.0 m • On-Grade: 20% • Sag: 50%
Overland flow safety criteria	AR&R	Max Depth x Velocity = 0.4m <sup>2</sup> /s
Climate change rainfall factor	AR&R 2019	1.213 multiplier to rainfall intensities
Water quality		

ltem	Standard	Adopted
Hydrology & hydraulics		
Pollution reduction targets	TfNSW City of Sydney DCP 2012 Green Star	Gross Pollutants 90% TSS 85% TP 65% TN 45%

## 3.5 Stormwater quantity control requirements

Sydney Water (the authority responsible for stormwater quantity control requirements for City of Sydney) has advised of the required stormwater quantity controls for the sites, summarised below in Table 3-4.

#### Table 3-4 Sydney Water quantity control requirements

On-site detention	Permissible site discharge (PSD)
59m <sup>3</sup>	138L/s

Sydney Water has further clarified that the above requirement in an email dated 29 September 2021. It states that:

'Approval for the On-Site Detention would only be given as part of the section 73 application for this development. The On-Site Detention is to be designed according to the above values and submitted to Sydney Water for approval with the section 73 application.'

The CSSI approval includes space provisioning within the station for the future OSD including facilities such as onsite stormwater detention systems.

## 3.6 City of Sydney Development Control Plan 2012

The provisions of Sydney Development Control Plan 2012 (SDCP 2012) have been used as a guide and are considered in the preparation of this report to demonstrate that a suitable stormwater condition can be achieved on the site and surrounding properties resulting from an increase in development density on the site.

The SDCP 2012 details planning and design guidelines to support the planning controls throughout the City of Sydney local government area (LGA) which include the management of stormwater. The DCP requirements are outlined in section 3.7 of the SDCP 2012.

Specific key requirements in the DCP which relate to stormwater include:

- A site-specific flood study should be prepared to support the development of the site
- The connection to the existing stormwater network is not to reduce the capacity of that infrastructure by more than 10%
- Post development run-off from impermeable surfaces is to be managed by stormwater source measures that: contain frequent low-magnitude flows; maintain the natural balance between run-off and infiltration; remove some pollutants prior to discharge into receiving waters; prevent nuisance flows from affecting adjacent properties; and enable appropriate use of rainwater and stormwater.
- The stormwater quality management approach will involve integrating Water Sensitive Urban Design (WSUD) techniques in the proposed stormwater drainage system. The water quality requirements are summarised below, and are in line with Green Star 5+ rating:

- reduce the baseline and annual pollutant load for litter and vegetation larger than 5mm by 90%
- o reduce the baseline annual pollutant load for total suspended solids by 85%
- reduce the baseline annual pollutant load for phosphorous by 65%
- o reduce the baseline annual pollutant load for total nitrogen by 45%.

## 4 Assessment

## 4.1 Baseline investigations

## 4.1.1 Existing drainage network

The drainage network around the site consists of road kerb and gutter system, local piped drainage and a trunk drainage system (the Tank Stream and Bennelong sewer) which discharge to Sydney Harbour to the north. The trunk drainage system is owned by the Sydney Water Corporation.

The existing drainage network within the existing site at Hunter Street West is unknown. It is assumed that the stormwater runoff is collected and discharged to the nearby kerb inlet pits and kerb and gutter channels.

The existing stormwater networks are presented in drawings in Appendix A.

## 4.1.2 Catchment and topography

The site is located in the city area catchment within the City of Sydney LGA. The existing site at Hunter Street West is fully developed. The surrounding sites are comprised of paved public spaces and high rise buildings which provides minimal water infiltration due to the high level of impervious areas.

The catchments for the site consists of the roof and bypass areas. The roofs are all draining towards the detention tank as shown in Table 4-1 and Figure 4-1.

Catchment area (ha)	Catchment area – % impervious	Detention tank catchment area (ha)	Detention tank bypass area (ha)
0.3758	100	0.3035	0.0723

#### **Table 4-1 Hunter Street West catchment areas**



Figure 4-1 Catchment area

## 4.1.3 Existing stormwater performance

A hydrological model of the catchment was formulated using the DRAINS software package and was analysed to assess the performance of the site stormwater network. The DRAINS program typically performs design and analysis calculations for urban stormwater systems behaviour on both rural and urban catchments. The DRAINS model prepared for this site is shown in Figure 4-2 and results are summarised in section 4.1.3. The DRAINS Model shown below includes the predevelopment and post-development catchment for the West station site. The on-site detention tanks are also modelled to be connected to the council pits.



## Figure 4-2 DRAINS model

The existing stormwater network surrounding the station site was also modelled in TUFLOW to produce flood maps to assess the flood depths and existing conditions. flood depths around the sites are outlined below:

• Flood depths up to 0.35 metres occur in the 1% AEP Climate Change flood event at the north eastern portion of the site between the northern site boundary and Hunter Street. However, the 5% AEP Climate Change flood event has much shallower depths up to 0.04m. Outside of the northern boundary, there are flood depths up to 0.2 metres between the western boundary and George Street in the 1% AEP Climate Change flood event. A similar trend is seen in the PMF flood event with the worst-case flooding occurring at the northern boundary with depths up to one metre. The western boundary is inundated up to 0.4 metres in the PMF flood event.

Preliminary flood depth mapping and flood hazard mapping are presented in the Preliminary Flood Report (Appendix Y to the EIS). The flood hazards for the site is outlined below:

 In the 5% AEP Climate Change flood event all roads surrounding the site are within a low H1 hazard category. In the 1% AEP Climate Change flood event the northern portion of the site along Hunter Street has a H5 hazard along with a small section of George Street. The remainder of the site surrounds appears to be within the low H1 hazard category (generally safe for vehicles, people and buildings) and as expected, the PMF flood event produces higher hazard categories of H5 and H6 with only pockets of the streets falling within the low hazard (H1).

In order to model the tail water influence at the discharge or existing connection pit in the DRAINS model, the tail water level is estimated using the flood depths at the connection point from the flood maps. The tail water can impact the stormwater modelling and design as it creates downstream condition that impacts the size and location of any stormwater storage and discharge system.

Table 4-2 summarises the tail water levels for the west building drainage connection points (part of the station structure) to the nearest council stormwater pits.

#### Table 4-2 Tail water levels of the site

Location of	5% AEP	5% AEP tail	1% AEP	1% AEP tail
connection	flood depth	water level	flood depth	water level
point	(m)	(mAHD)	(m)	(mAHD)
Hunter Street kerb inlet pit	0.05	9.65	0.10	9.70

## 4.2 Stormwater quantity

## 4.2.1 Stormwater strategy

The proposed stormwater drainage and runoff system for the site will comply with the design requirements as identified in section 3.4 with the main design considerations summarised below:

- post development stormwater runoff connections into existing drainage infrastructure will match predevelopment case where feasible. (i.e. building connection to Hunter St)
- compliance with Sydney Water total Permissible Site Discharge (PSD) requirements of 138L/s (assuming 3,735 m<sup>2</sup> area) and On-Site Detention of 59m<sup>3</sup>
- On-Site Detention is to be situated above the 100 year ARI (Average Recurrence Interval) flood levels to facilitate discharge into potentially fully charged stormwater pipes
- management of water quantity to ensure no increase in stormwater discharge rate from the sites for the 20 and 100 year ARI storms.

A DRAINS model was developed to assess the existing hydrological and hydraulic conditions for the site and revised to estimate the stormwater discharge from the site under the proposed future conditions.

#### 4.2.2 Proposed stormwater design

The proposed stormwater strategy is to provide an on-site detention system for the proposed development as outlined in section 4.2.1. That on-site detention volume requirement, of 59m<sup>3</sup>, was modelled in DRAINS to analyse the stormwater flows post development. As per the City of Sydney DCP 2012, post development flows are to be managed and stormwater management design is to ensure flows are less than pre-development conditions.

The impervious area of the site in the post-development scenario is the same as the pre-development because the existing site condition is the same as a built-up commercial building with 100% impervious area. The detention tank will be located within the plant room, as such not all of the hardstand areas can be captured and directed towards the tank. The storage volume therefore have been increased to accommodate for the bypass while still meeting the PSD requirements of the site.

The proposed drainage system is to be sized to convey the 5% AEP storm event, with climate change in accordance with Australian Rainfall & Runoff and council requirements as outlined in section 3.4. The catchment flow results for the 5% AEP and 1% AEP storm events are summarised in Table 4-4 below. A HED chamber is also utilised within the detention tank to optimise the dimension and reduce tank size. As such outflow from the tank will be similar during both storm events.

The post development flows accounting for climate change will result in adverse impacts on the local stormwater drainage system due to the 21.3% volume increase of rainfall required as part of that assessment. The City of Sydney A4 drainage

manual requires stormwater connections to have no adverse impacts on the private property due to the development. As such, an on-site detention system has been designed using DRAINS to control the flows.

A summary of the concept on-site detention design is provided in Table 4-3.

Table 4-3 On-site detention summary	
-------------------------------------	--

Volume (m³)	Orifice Diameter (mm)	Outlet Pipe Diameter (mm)
90	140	300

Table 4-4 On-site detention catchment flow rates

5% AEP Pre Flow (m³/s)	5% AEP Tank Flow (m³/s)	5% AEP Bypass Flow (m³/s)	1% AEP Pre Flow (m³/s)	1% AEP Tank Flow (m³/s)	1% AEP Bypass Flow (m³/s)
0.197	0.072	0.046	0.261	0.073	0.061

An initial hydraulic analysis of the on-site detention based on Sydney Water storage requirement of 59m<sup>3</sup> showed that the tank would have insufficient capacity to meet the Sydney Water PSD in the 1% AEP post development flow including climate change storm event and bypass. Further modelling of the on-site detention tank indicates that the volume will be 90m<sup>3</sup> to meet the requirement of 0.138 m<sup>3</sup>/s PSD. As shown in Table 4-4, the on-site detention flow rates are compliant in controlling post development flows to the required PSD.

The provision of an on-site detention system also provides opportunity to implement stormwater quality control devices as discussed further in section 4.3.2.

Due to the elevated tailwater levels in the council stormwater network, detailed in section 4.1.3, it is unlikely that a detention system can be buried at ground level as it will become inundated in high storm events, along with impacts to basement and station structures.

#### 4.2.3 **Proposed stormwater works**

A summary of the proposed stormwater works on-site are summarised below.

For the proposed development contract:

 construction of stormwater pipe network and associated storage and rainwater tanks within the OSD.

## 4.3 Stormwater quality

#### 4.3.1 Existing stormwater quality measures

There is no known stormwater quality treatment measures on the existing development sites.

The site is located to the east of Darling Harbour catchment, a sub-catchment of Sydney harbour catchment. The Darling Harbour catchment, comprising of Haymarket, Surry Hills, Pyrmont and Sydney CBD, is a receiving environment of both Pyrmont Station and Hunter Street Station sites. The harbour and its surrounding environment are fully developed with urban and commercial usage giving water very little opportunity to infiltrate due to large amounts of impervious areas. As a result, the harbour is characterised by elevated nutrient, heavy metal concentrations and high turbidity. The total catchment covers approximately 307 hectares which drains to Sydney Harbour at various locations (RPS Australia East, 2014).

Prior works includes the installation of a temporary construction water treatment plant at the site which will discharge treated water to Circular Quay via the local stormwater network. The water treatment plant would be configured so that treated water is compliant with the ANZECC/ANZG (2018) guideline values.

A review of available data indicates the watercourses relevant to this proposal are generally in poor condition and are representative of a heavily urbanised system (Jacobs, 2020). The watercourses which discharged water will be released to from the Hunter Street Station temporary water treatment plant has been assessed against the ANZECC/ANZG guidelines as part of Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) is provided in Table 4-5.

#### Table 4-5 Existing water quality conditions of watercourses relevant to the site

Watercourse	Water quality characteristic relevant to ANZECC/ARMCANZ (2000) Indicators
Circular Quay	1. elevated nutrient concentrations
	2. elevated heavy metal concentrations
	3. high turbidity

## 4.3.2 Proposed stormwater quality strategy

The stormwater quality strategy has been developed in accordance with the requirements of Green Star and City of Sydney's stormwater quality reduction targets as well as the Local Planning for Healthy Waterways using NSW Water Quality Objectives (June 2006) and Managing Urban Stormwater – Harvesting and Reuse Guidelines (December 2006).

Modelling of the proposed works was undertaken using Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software. The software was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales.

MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

The council and green star 5+ water quality targets are as follows:

- 90% reduction in post-development loads for Gross Pollutants (GP)
- 85% reduction in post-development loads for Total Suspended Solids (TSS)
- 65% reduction in post-development loads for Total Phosphorus (TP)
- 45% reduction in post-development loads for Total Nitrogen (TN).

The following methodology and parameters were incorporated into the MUSIC modelling for the proposed site.

## 4.3.3 Rainfall data and model parameters

- Rainfall pluviograph and catchment data was implemented using the City of Sydney Council MUSIC-link within the model.
- The pollutant concentration parameters used within the model were based on the recommended model defaults for different land use categories as specified in City of Sydney Council's MUSIC-link data. The catchments utilised within the model were classified as summarised in Table 4-7 below.
- Sandy loam soil properties were adopted as the site conditions at Hunter Street development were classified as Gymea according to City of Sydney WSUD Technical Guidelines (2014).

## 4.3.4 Proposed treatment train

The proposed treatment train is to treat stormwater runoff mostly through Filter Cartridges for the roof catchment area. A water quality treatment room will exist within the on-site detention tank, with inlet pipes directed towards this chamber first before discharging through the building's drainage reticulation system.

Treatment channels will be located on the ground level to take in the bypass flows, along with protecting entrances from overland flows. Gross Pollutant Traps will also be installed within gully pits to capture pollutants, before discharging to council's stormwater systems. The proposed water quality treatment process is summarised in Table 4-6.

### Table 4-6 Proposed treatment train

Catchment	Treatment train
The site	<ol> <li>3 x OceanGuard (Gross Pollutant Traps) within above ground pits</li> <li>10m SPEL HydroChannel (Treatment Channel)</li> <li>16 x 690mm PSORB Stormfilter (Filter Cartridges) within a 10.8m<sup>2</sup> chamber inside the on-site detention tank</li> </ol>

The water quality treatment train has been modelled in MUSIC as shown in Figure 4-3 below.



#### Figure 4-3 MUSIC model treatment train

The current design assumed that the catchment area will be 100% impervious, due to the lack of deep soil within the site. The catchment source nodes used in MUSIC has been summarised in Table 4-7. As the design further develops, the MUSIC model and catchment classifications will be updated.

#### Table 4-7 Water quality catchment areas of the site

Bypass catchment area (ha)	% Impervious	Roof catchment area (ha)	% Impervious
0.0723	100	0.3035	100

The resulting percentage reduction for each of the catchments for total suspended solids, phosphorus, nitrogen and gross pollutants are as summarised in Table 4-8 below.

The overall total percentage reduction for the proposed treatment train meets the targets as set by City of Sydney and Green Star, therefore meeting the water quality requirements.

## Table 4-8 MUSIC results for the site

Pollutant	City of Sydney/Green Star reduction targets (%)	Overall % reduction	WQ target achieved
Total Suspended Solids (kg/yr)	85	85.1	Yes
Total Phosphorus (kg/yr)	65	71.6	Yes
Total Nitrogen (kg/yr)	45	50.9	Yes
Gross Pollutants (kg/yr)	90	100	Yes

## 4.4 Authority consultation

As a part of this assessment process, consultation was undertaken with Sydney Water. Comments include the detention storage and permissible discharge requirement from the proposed development.

## 5 Conclusion

As outlined through this report, subject to detailed design development prepared in accordance with the standard industry practice, a suitable stormwater condition can be achieved on the site as a result of increased rainfall due to climate change and the high impervious area of the proposed site within the Concept SSDA. This Integrated Water Management Plan summarises the stormwater quantity and quality analysis process, results, and design.

The stormwater quantity design has been developed in accordance with City of Sydney and Sydney Water guidelines, providing both a temporary and permanent tank within the building developments and connection to the existing council buried pipe network. The required on-site detention tank size is 90m<sup>3</sup> with 140mm orifice with further details in section 4.2.2.

The stormwater quality design has been developed in accordance with CoS DCP and Green Star. The proposed WSUD measures have achieved the required mitigation targets. The recommended water quality treatment train is summarised below with further details in section 4.3.4:

• 16 x 690 mm Filter Cartridges within a 10.8 m<sup>2</sup> chamber inside the on-site detention tank, followed by 3 x Gross Pollutant Traps within pits and 10m Treatment Channel.

Future work that is required to finalise the stormwater and water quality design, will be part of the Detailed SSDA design process. This will include the following:

- design of connection to existing council drainage system
- final on-site detention requirements based on the finalised architectural scheme
- further authority coordination as required.

## Appendix A Existing stormwater network



Hunter Street West Over Station Development Integrated Water Management Plan | November 2022