Addendum Integrated Water Management Plan

May 2024

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Document Number: SMWSTEDS-SMD-PTA-SN600-WA-RPT-044003

REVISION	DATE	SUITABILITY CODE	TEAMBINDER DOCUMENT NUMBER	TB REVISION
A	21/05/24	S4		A

Approval Record

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Amendment Record

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Mott MacDonald Australia Pty Ltd

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Contents

List of Figures

List of Tables

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.
ARI	Average Recurrence Interval - The 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 AEP, which is the industry standard terminology for definition of design flood events.
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
CoA	Conditions of Approval
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
DCP	Development Control Plan
DOSD	Drainage On-Site Detention
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*
GFA	Gross floor area
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.
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

Term	Definition
OSD	Over Station Development
RFI	Request For Information
SEARs	Secretary's Environmental Assessment Requirements
SSDA	State Significant Development Application
SSI	State Significant Infrastructure
Stage 2 CSSI Approval	SSI-19238057, approved 24 August 2022, including major civil construction works between The Bays and Sydney CBD including station excavation and tunnelling, associated with the Sydney Metro West railway line
Stage 3 CSSI Approval	SSI-22765520, approved 25 January 2023, including rail infrastructure, stations, precincts and operation of the Sydney Metro West line
SMW	Sydney Metro West: Construction and operation of a metro rail line and associated stations between Westmead and the Sydney CBD
TP	Total Phosphorous
TSS	Total Suspended Solids
WSUD	Water Sensitive Urban Design

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 and Environment (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 over station development (OSD) and adjacent station development (ASD). The Concept State Significant Development Application (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.

This addendum report addresses concerns around drainage on-site detention system and water quality modelling raised in advice from the City of Parramatta Council (CoPC).

The size of stormwater detention tanks has been updated using the Upper Parramatta River Catchment Trust (UPRCT) Fourth Edition calculation sheets. Water sensitive urban design elements are proposed as part of the treatment train that will provide an adequate level of detention and treatment to achieve the stormwater quality targets.

The report evaluates the adoption of an integrated water cycle management approach at the proposed development which includes rainwater harvesting, reuse and recycled water to achieve the best possible outcomes for a Green Star accreditation.

1 Introduction

1.1 Purpose and Scope

This addendum to the Integrated Water Management Plan and Quality Assessment (IWMP) report supports a Concept State Significant Development Application (Concept SSDA) submitted to the Department of Planning and Environment, now Department of Planning and Environment (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).

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Advice from NSW Government agencies have been received in response to the Concept SSDA EIS. This addendum report addresses stormwater system related issues raised in an agency submission from the City of Parramatta Council (CoPC).

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 public authorities and Sydney Metro's response to the issues raised.
- Chapter 3 – provides updated assessments to support the responses outlined in Chapter 2 and the design refinements that have occurred for the Development.
- 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 W - Integrated Water Management Plan (Sydney Metro, 2022) which details the methodology and the applicable industry guidelines.

2 Response to submissions

During public exhibition, agency advice was received from CoPC on the Concept SSDA. The issues raised and proposed responses outlined in this chapter.

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 this Concept SSDA but are an important consideration in the requirements for on-site detention within buildings.

2.1 CoPC advice

2.1.1 Separation of private and public stormwater

CoPC Comment

CoPC commented that it is not clear from the EIS documents whether the public stormwater and private stormwater discharge are separate or combined. Stormwater discharge from public domain should be separately connected to council stormwater infrastructure after appropriate water quality treatment. Water Quality treatment elements should also be separate to private stormwater quality treatment elements. Council do not recommend proprietary water quality treatment for public domain except GPTs rather prefers standard raingarden and other natural devices. Similarly, council does not prefer tree pits as water quality treatment unit due to maintenance issues rather prefers standard raingarden and other natural devices.

Response

This comment has been addressed during design development that has taken place. Public and private stormwater discharge are separate and clearly demarcated. Stormwater discharge in public domain would be connected to council stormwater infrastructure, while private developers are responsible for water treatment and maintenance of buildings only.

The only distinction is that during initial operation of the Sydney Meto West line, runoff from station buildings will be directed to public domain system for treatment first, as detention tanks and the associated water quality chambers have yet to be built. Sufficient treatment devices have been provided within the public domain to meet both construction state and end state water quality targets.

Having only natural devices without proprietary products are unfeasible due to the scale and footprint of the additional footprint of the buildings.

Section 3.2 of this addendum report provides the supporting assessment for this response.

2.1.2 Stormwater quantity

CoPC Comment

CoPC commented that a detailed DRAINS model for stormwater drainage design and a detailed MUSIC model for water quality treatment needs to be developed and need to be submitted to council for review along with detailed report.

Response

Detailed DRAINS and MUSIC models have been included within the submission package to CoPC.

Chapter 3 of this Addendum Report provides the supporting assessment for this response.

CoPC Comment

CoPC commented that stormwater from the subject site is proposed to be connected ultimately to existing Smith Street stormwater drainage system which is under capacity. Due to several constraints Smith Street drainage system upgrade is also limited. The proposed civic link may provide a good opportunity to incorporate additional drainage line to cater stormwater as per current standard. This will also provide better conveyance from sag location at Macquarie St. The current CoPC standard for stormwater system design is to be adequate for up to 5% AEP inclusive of climate change with 50% blockage in sag pit and 20% blockage in on-grade pit with safe 1%AEP (inclusive of climate change) overland flow. This needs to be demonstrated by DRAINS model and made available to CoPC for review.

Response

Additional drainage systems have been provided within Civic Link to capture most of the runoff. Public domain catchments draining to Smith Street have also been reduced significantly with the proposed grading. Building C which drains to Smith Street also has massively reduced flow due to the inclusion of a detention system. Post development results within DRAINS show great improvement in this aspect.

Section 3.1 of this addendum report provides the supporting assessment for this response.

2.1.3 Drainage capacity and flows

CoPC Comment

CoPC commented that the proposed drainage arrangement must be updated to include surface grading (surface levels with suitable contour spacing) to provide a clearer view of on the direction of flows. The existing capacity of Council's drainage system must be assessed, it must be ensured there is no increased flows connecting to the system and there is adequate capacity. Detailed drainage plans to be submitted for CoPC review, the diameter of any pipe and longitudinal grades must be shown on the submitted plans. The minimum permissible gradients are shown in City of Parramatta Design Guidelines (2018). The long section of pipes should also be shown on the drainage plans.

Response

Surface gradings and contours have been provided on drainage arrangement plans to show the direction of flow. The existing capacity of the drainage systems has been assessed, with the results showing decreased post development flows in all directions even with the inclusion of climate change factor. Pipe diameter and longitudinal grades have been included within the drainage package and are designed in accordance with CoPC Design Guidelines.

Section 3.1 of this Addendum Report provides the supporting assessment for this response.

2.1.4 Consideration of tailwater

CoPC Comment

CoPC commented that tailwater levels needs to be considered when designing the internal site drainage.

Response

Tailwater conditions have been set according to CoPC Engineering Design requirements at kerb level.

Section 3.1 of this addendum report provides the supporting assessment for this response.

2.1.5 Drainage on-site detention

CoPC Comment

CoPC commented that a maintenance schedule is to be prepared to ensure the required maintenance and frequency for each component to allow the system to function effectively.

Response

A maintenance schedule has been included within Appendix A of this Addendum Report.

CoPC Comment

CoPC commented that OSD (On Site Stormwater Detention) calculations should be undertaken using the Upper Parramatta River Catchment Trust OSD Handbook Fourth Edition (December, 2005) for integration of rainwater storage and OSD.

Response

The fourth edition of UPRCT OSD Handbook has been utilised for detention storage calculation.

Appendix B of this Addendum Report provides the supporting assessment for this response.

CoPC Comment

CoPC commented that the OSD system shall function during all storm events up to and including the 1% AEP plus climate change. When assessing the tailwater levels 1% AEP plus climate change scenario must also be considered. The design should consider relevant safety provisions and provide adequate freeboard when the OSD system malfunctions or overflows in the event of a 1% AEP (inc. climate change) storm event.

Response

All storm event events up to 1% AEP have been considered for the storage volume. Climate change factors have been included within the building outflows and tailwater levels have minimal effect in this instance. Void space and freeboard have been provided above the top water level, along with provision for overflow.

Section 3.1 of this Addendum Report provides the supporting assessment for this response.

CoPC Comment

CoPC comment that it must be ensured that the OSD tank can be readily inspected and can be maintained at all times.

Response

Clearance has been provided above and around the detention tanks to enable proper access.

Section 3.1 of this Addendum Report provides the supporting assessment for this response.

CoPC Comment

CoPC commented that the 1% AEP flood levels on Macquarie Street and surroundings may impact OSD design. Current calculations assume a free discharge outlet, however relevant tailwater conditions may apply and drowned outlet conditions will need to be assessed which may result in increases in OSD volumes.

Response

Tailwater conditions have been added to Macquarie Street discharge point and post development flows with the proposed Drainage On-Site Detention (DOSD) DOSD volumes are still shown as sufficient within DRAINS model.

Section 3.1 of this Addendum Report provides the supporting assessment for this response.

CoPC Comment

CoPC commented that if the OSD has a completely drowned outlet it should be designed accordingly, refer to section 6.4 Drowned Outlets for the OSD Handbook. The SSR should be increased as per the recommendation of the guideline which will result in a significantly larger OSD size.

Response

None of the DOSD systems have drowned outlets as they are all located at high level within building plant rooms.

Section 3.1 of this Addendum Report provides the supporting assessment for this response.

2.1.6 Water quality

CoPC Comment

CoPC commented that an electronic copy of MUSIC Model must be provided to Council for assessment and review. Council recommends using PARRAMATTA NORTH MASONS DR (66124) RAINFALL STATION 6 minutes data from 1988 to 1998 (10 years). It is also available in MUSIC-Link for MUSIC_X.

Response

The MUSIC model has been updated with Parramatta North rainfall data as requested.

Section 3.2 of this Addendum Report provides the supporting assessment for this response.

3 Stormwater assessment

The scope of this report is to summarise the major differences from previous IWMP report (dated Nov 2022) after further design refinements of the scheme.

3.1 Stormwater quantity

3.1.1 Pre-development Scenario

In response to CoPC comments regarding stormwater discharge to drainage networks surrounding the Sydney Metro site, an assessment of the peak flow rates from the existing catchments was undertaken using the ILSAX hydrologic model in the DRAINS software model. A summary of the calculated existing peak flow rates for the 5% and 1% AEP is provided in Table 1. Previous studies undertaken to identify appropriate climate change projections identified a +21.3% increase in rainfall intensities by the year 2090 for the RCP 8.5 global warming scenario. The model includes allowance for climate change. The total peak flows are a combination of pipe and overland flow within the catchment area. The existing catchment area is shown in Figure 1.

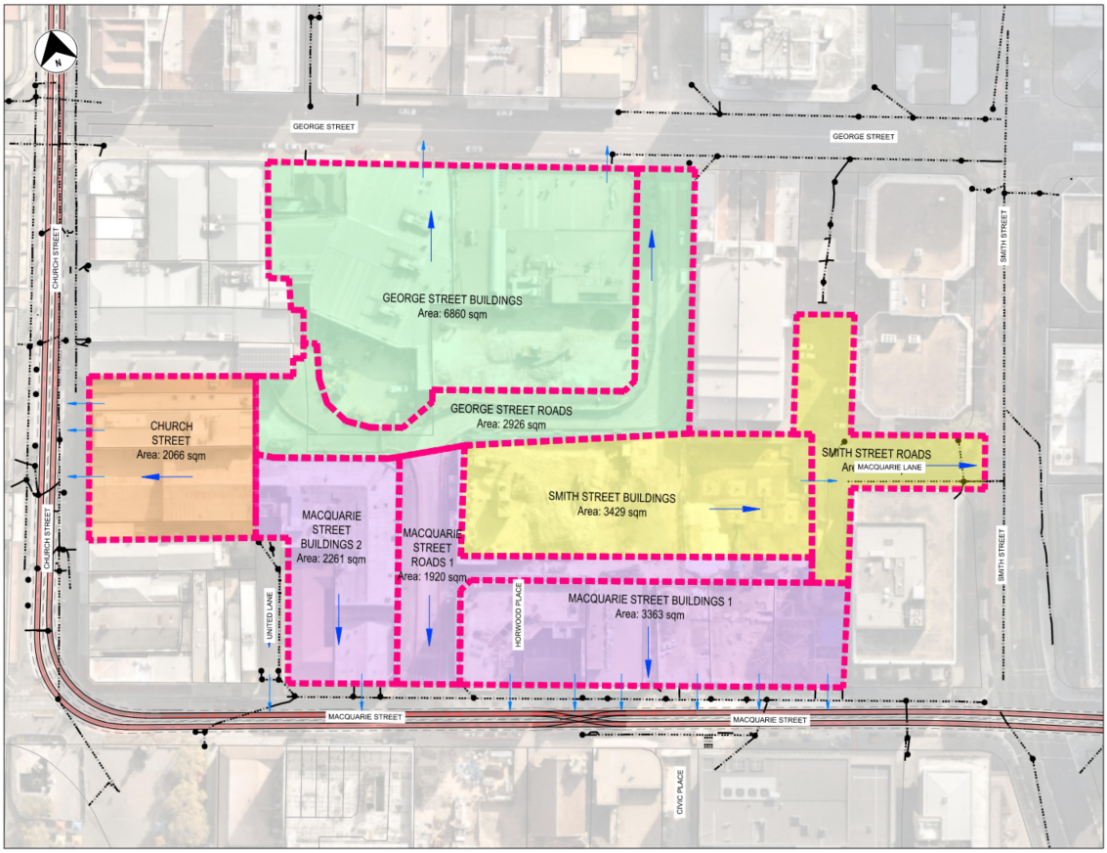

Figure 1 Existing catchment area for subject site

Table 1 Calculated existing peak flow rates

Catchment[1]	5% AEP Peak Flow Rate + 21.3% Climate Change (L/s)[2]	1% AEP Peak Flow Rate + 21.3% Climate Change (L/s)[2]
George Street	513	666
Macquarie Street	396	513
Smith Street	263	341
Church Street	108	141

1. Catchment identified by street, which comprises both building and road portions of catchment

2. The above values do not necessarily represent the true peak flow values at the identified locations. They are values calculated based on catchment areas which lie within or near the project area and as such may not contain the entire catchments contributing to the discharge locations. The values are calculated to provide a benchmark for the post-development scenario.

The model created for the analysis has assumed that the existing private properties, internal roads and parking networks are not draining into a drainage on-site detention system.

3.1.2 Post Development Scenario

For the post development scenario, the catchment areas have been split up into buildings and public domain. For the purposes of design of the public domain areas, the design rainfall intensities in the vicinity of the study area have been generated using the Bureau of Meteorology Design Rainfall Data System (2016). While hydrology for the building catchments has been accounted for in the UPRCT calculation sheet.

Areas external to the roofs include public domain spaces and through-site links. The areas are a mixed of paved and landscaped area including mature trees. The surface profiles will be graded away around all building perimeters. The public domain has been designed using surface trench drains and sag pits to capture runoff. The grading of the public domain is illustrated in Figure 2.

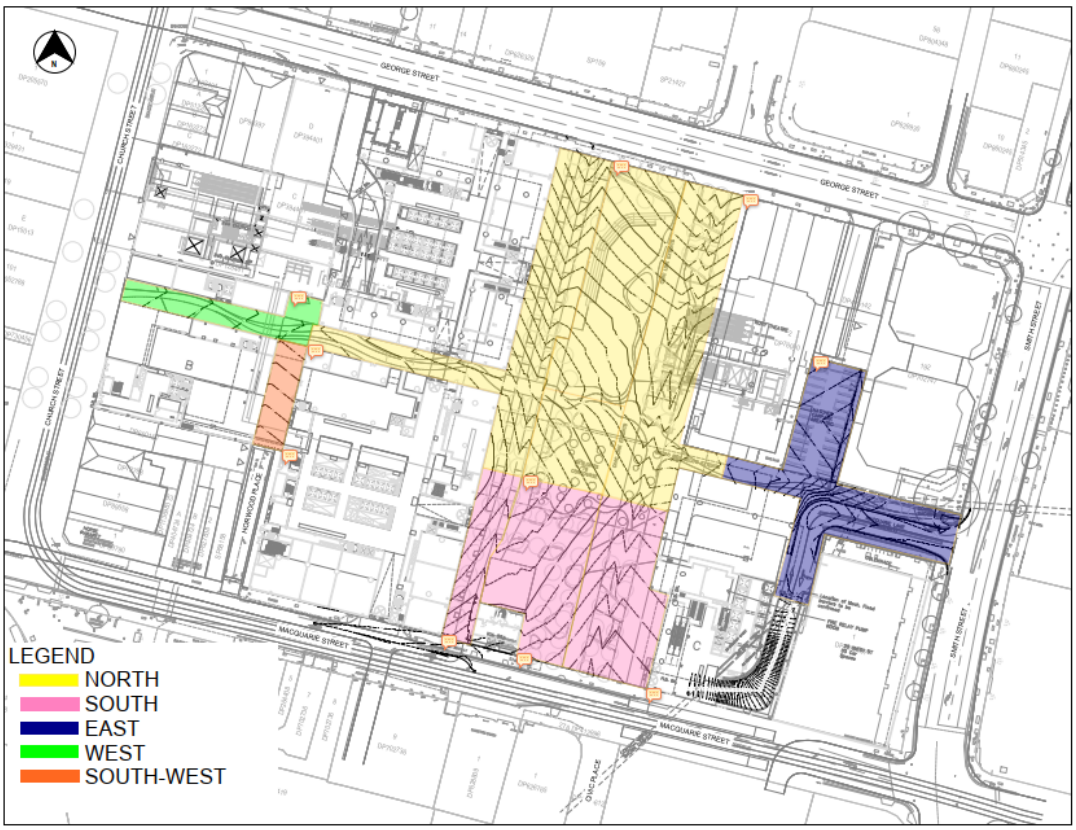

Figure 2 Public Domain Grading

An assessment of the peak flow rates from the proposed development catchments was undertaken using the ILSAX hydrologic model in the DRAINS software model. A summary of the calculated peak flow rates for the 5% AEP and 1% AEP is provided in Table 2. The model includes allowance for climate change. The total flows will be a combination of pipe and overland flow within the catchment area.

Table 2 Post Development Catchment Runoff

Catchment	5% AEP Peak Flow Rate + 21.3% Climate Change (L/s)	1% AEP Peak Flow Rate + 21.3% Climate Change (L/s)
George Street	428	537
Macquarie Street	286	354
Smith Street	151	183
Church Street	85	104

1. Catchments are identified by their connection point to the Council drainage network. I.e. 'George Street' catchment comprises all runoff areas that drain to George Street.

The current drainage design within the site does not worsen the conditions of the existing CoPC drainage network as the post development flow is less than the pre-development flow. Therefore, the proposed works at the development site does not necessitate any drainage upgrade works at north of George Street and along Smith Street.

3.1.3 Drainage On-Site Detention

In accordance with the UPRCT OSD Handbook 4th Edition, UPRCT Calculation Sheet and the CoPC Development Control Plan (DCP) 2011, the following storage and discharge capacities, shall be incorporated into the design for the buildings:

- Site Storage Requirements (SSR):
  - Extended Detention Storage: 300 m³/ha
  - Total Detention Storage: 455 m³/ha (520 m³/ha if non-HED outlet installed)
- Site Reference Discharge (SRD):
  - Primary Outlet: 40L/s/ha
  - Secondary Outlet: 150 L/s/ha
- The goals of the SSR and SRD requirements are to:
  - Limit peak flows throughout the catchment, in a 1 in 100 year ARI event, to estimated peak flows under 1999 condition; and
  - Reduce post development peak flows, through the catchment, in the 1 in 1.5yr ARI event to be as close to natural flow rates as possible.

The design approach for the collection and disposal of stormwater is different between the private buildings (roof catchments) and public domain (external ground level catchment). Hydrology for the building catchments has been accounted for in the UPRCT calculation sheet. The criteria for the external ground level catchments (public domain) does not require storage. The design proposes not to worsen the downstream drainage system.

The design approach for the collection and disposal of stormwater from the buildings is described below. Roof catchments have been deemed to demarcate the catchments for on-site detention. All non-roofed areas have been included within the public domain catchment. The following section describes these approaches in detail.

The roof areas are summarised in Table 3 and schematically presented in Figure 3-3**.**

Table 3 Proposed development building roof catchments

Development	Roof Catchment Area (m²)
Building A	3446
Building B	1419
Building C	2573
Building D	4150

Roof catchment storage and disposal

The runoff collected from the roof structures will be discharged from the site by:

- An orifice plate fixed to the Drainage On-Site Detention outlet pipe which controls the discharge equivalent to the site reference discharge. A primary and secondary orifice plate will be provided.
- All connections to the CoPC underground pipe network will be made in accordance with the Section 3.2 of CoPCs Engineering Design Guidelines.

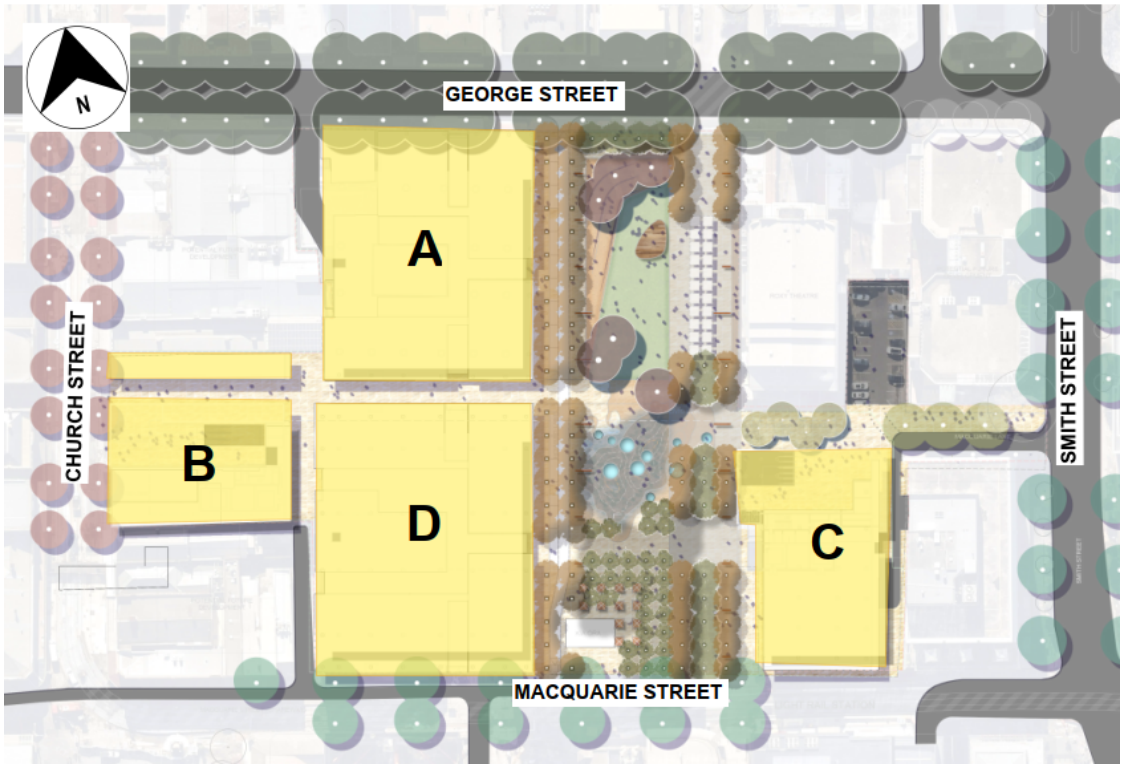

Figure 3-3 Proposed development precinct building catchments

Detention System

Drainage on-site detention systems are proposed to cater for all the building catchments areas. The Drainage On-Site Detention storage capacities have been designed in accordance with the UPRCT On-site Stormwater Detention Handbook 4th Edition, UPRCT Calculation Sheet and CoPCs DCP.

The drainage on-site detention system receives discharge from the building roof catchment areas. The Drainage On-Site Detention system treats the water with water filtration cartridges and then discharges via the Drainage On-Site Detention orifice plates into the discharge chamber. This discharge chamber then connects to the various council stormwater pipe networks that drains toward George Street, Smith Street, Macquarie Street and Church Street.

All Drainage On-Site Detention storage are located above the 1% AEP flood levels so the outlet is not submerged and can maintain a free discharge condition. Refer to Table 4 for sizing of the Drainage On-Site Detention tanks and orifice.

Table 4 Parramatta metro station Drainage On-Site Detention and orifice sizing

Building	DOSD Storage Volume (m^3)	DOSD External Size (LxWxH)	Orifice Diameter (mm)		Outlet Discharge Rate (L/s)	
			Primary	Secondary	Primary	Secondary
Building A	185	8m x 8m x 3.5m	73	189	11.01	33.20
Building B Roof	60	5m x 4m x 3.5m	40	106	3.40	10.41
Building B Podium	25	4m x 4m x 2.5m	24	65	1.24	3.95

Building	DOSD Storage Volume (m^3)	DOSD External Size (LxWxH)	Orifice Diameter (mm)		Outlet Discharge Rate (L/s)	
			Primary	Secondary	Primary	Secondary
Building C	135	7m x 7m x 3.5m	67	187	9.40	32.65
Building D	220	9m x 9m x 3.5m	82	223	14.20	46.23

Notes:

1 - The total On-Site Detention volume is the combine volume of the extended storage and the flood storage

2 - The primary orifice controls the extended storage volume and limits the discharge from the site in 'normal' conditions to the natural levels 1 in 1.5-year 5 minute storm event (40L/s/ha, UPRCT OSD Handbook)

3 - The secondary orifice controls the flood storage volume in large storm events up to the 1% AEP (150L/s/ha, UPRCT OSD Handbook)

The layout of the Drainage On-Site Detention system is shown in Figure 4.

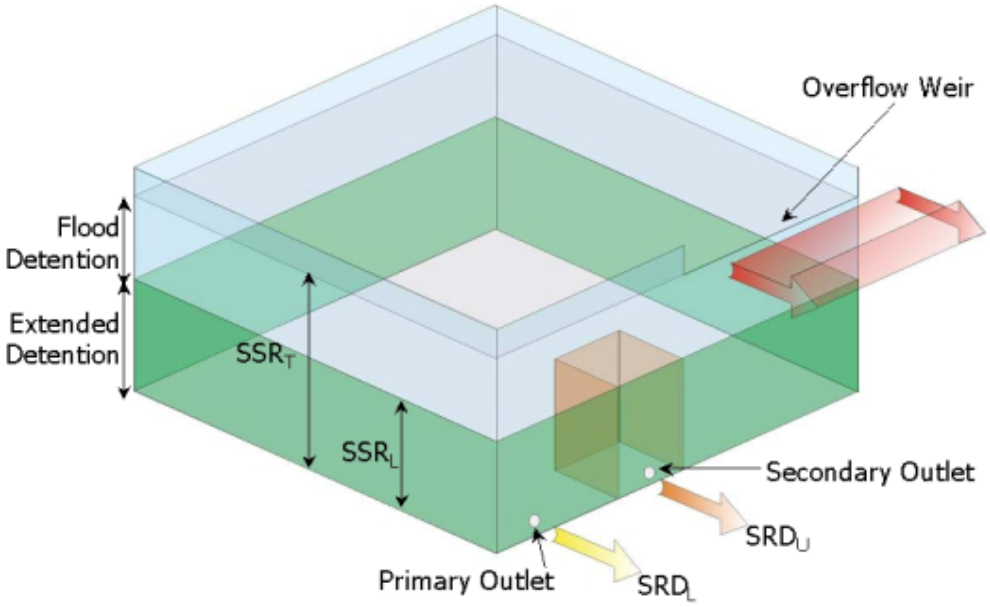

Figure 4 Parramatta metro station on-site detention arrangement. Source: UPRCT OSD Handbook, 4th Edition.

The Drainage On-Site Detention systems are located well above the 1% AEP level to prevent inundation during high rainfall events. This also necessitates that each building will contain a separate Drainage On-Site Detention system as the 1% AEP levels in the surrounding streets mean that a combined buried or below ground tank is not feasible.

Drainage On-site Detention bypass

Based on the current location of the stormwater storage tanks, certain terraces and balconies of Buildings A, B, C and D will bypass the drainage on-site detention storage tanks. The approximate size of the bypass catchments is summarised in Table 5.

Table 5 Bypass Catchment Summary

Building	DOSD Capture Area (m^2)	DOSD Bypass Area (m^2)	% of Area Bypassing DOSD
Building A	2522	924	26.8%
Building B Roof	783	266	25.3%
Building B Podium	290	80	21.6%
Building C	2276	297	11.5%
Building D	3349	801	19.3%

Based on the guidance in the UPRCT it is understood that the SRD should be adjusted in accordance with tabulated values where areas bypass the drainage on-site detention systems. The indicative location of the DOSD tanks for each building are outlined in Figure 5 to Figure 9. The SRD adjustment is presented in Table 6.

Table 6 Extract from UPRTC 4.2.9

Residual lot capture (%)	Primary outlet SRD_L (L/s/ha)	Extended Detention Storage SSR_L (m^3/ha)	Secondary outlet SRD_U (L/s/ha)	Overall detention storage SSR_T (m3/ha)
100	40.0	300	150	455
95	38.5	300	140	455
90	37.0	300	130	455
85	35.5	300	120	455
80	34.0	300	110	455
75	32.5	300	100	455
70	31.0	300	90	455

Note: 100% of roof area assumed to be directed to the OSD storage

Figure 5 Building A DOSD Tank Location

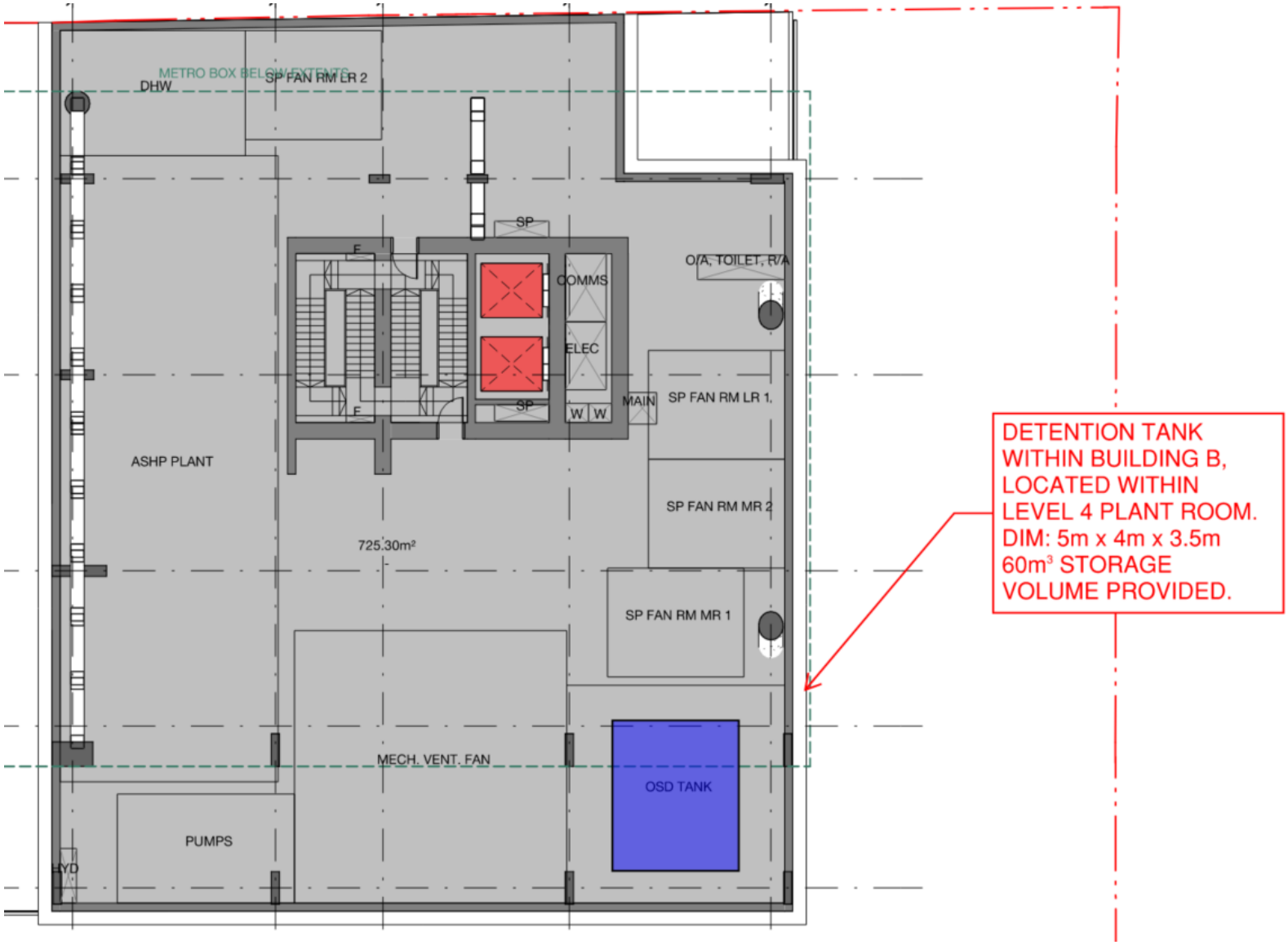

Figure 6 Building B DOSD Tank Location

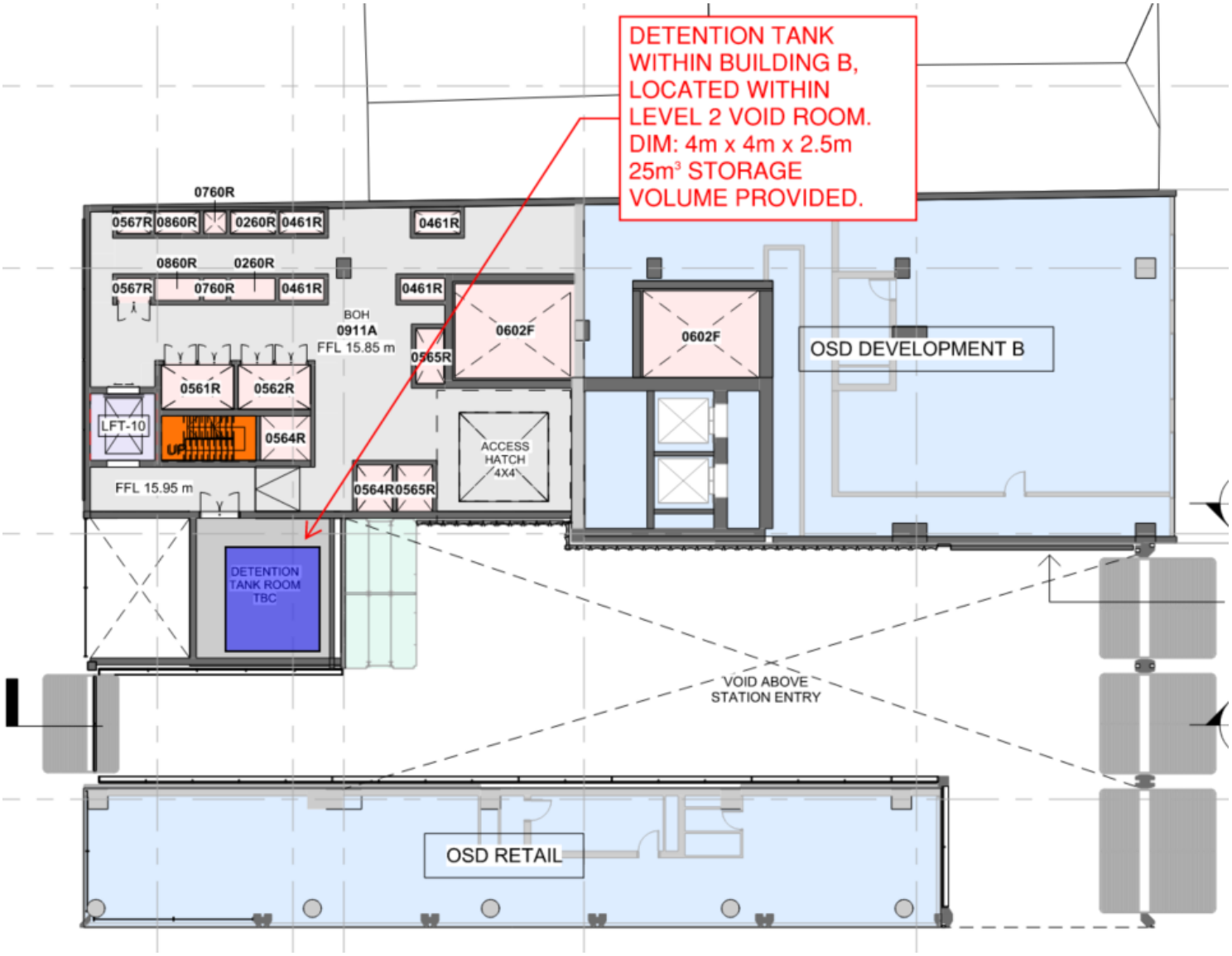

Figure 7 Building B (STATION) DOSD Tank Location

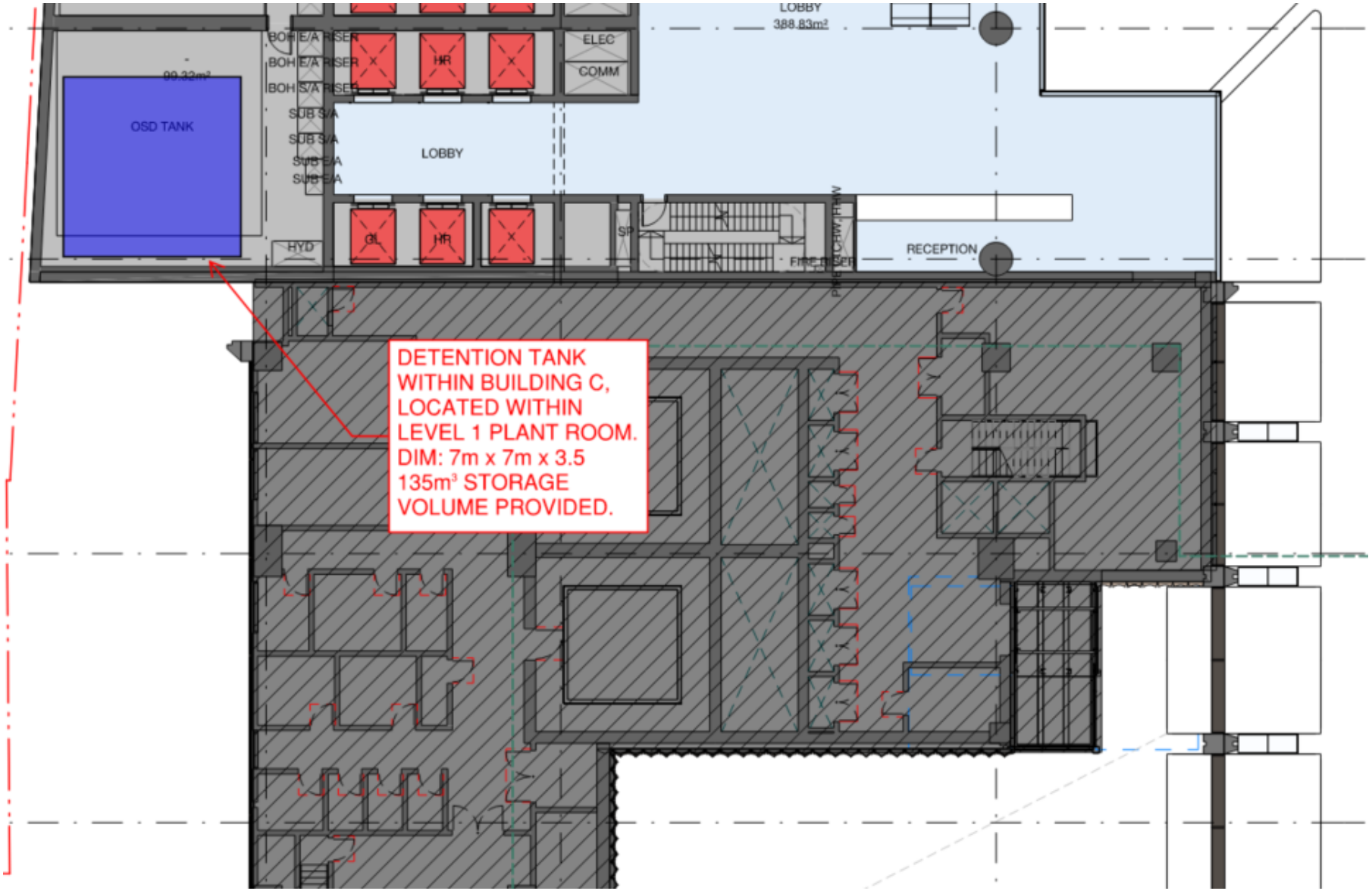

Figure 8 Building C DOSD Tank Location

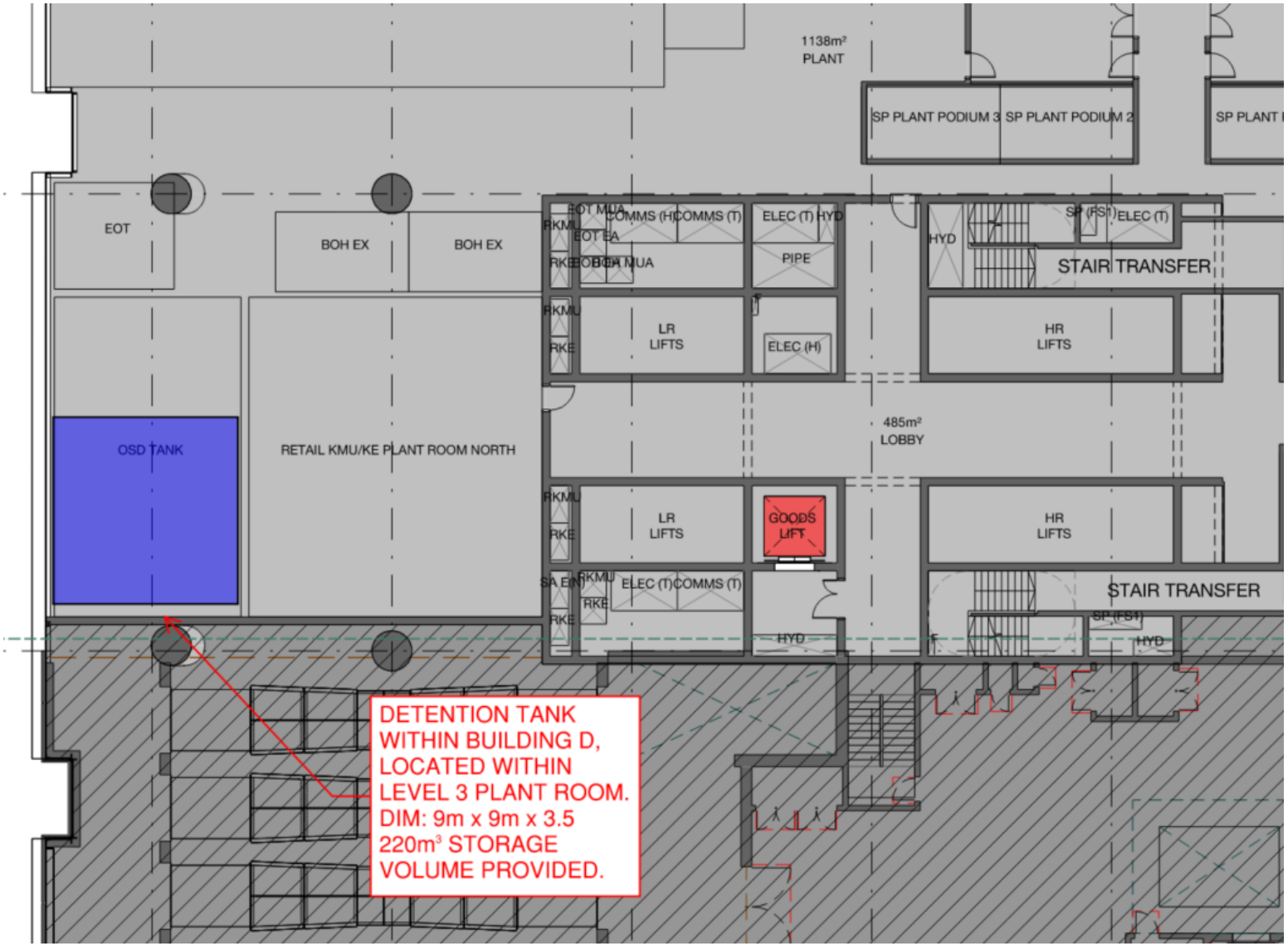

Figure 9 Building D DOSD Tank Location

3.2 Stormwater quality

3.2.1 Input Data

The urban runoff data and evapotranspiration data has been reviewed and updated to be in accordance with the CoPC Guidelines. The water quality data adopted in the updated MUSIC modelling is based on the current CoPC water quality data which consists of 6-minute data ranging from 1988 to 1998 taken from the Parramatta North Dr (66124) rainfall station.

3.2.2 Stormwater quality requirements

The design has looked to promote Water Sensitive Urban Design (WSUD) and comply with CoPC Development Control Plan and Greenstar 5+ rating. This document details the water quality treatment required for developments and are listed in Table 7.

Table 7 Council DCP Stormwater Quality Reduction targets for developments

Water Quality Parameter	Council DCP Target	Greenstar 5+ Target
Total Suspended Solids (TSS)	85	85
Total Phosphorous (TP)	60	65
Total Nitrogen	45	45
Gross Pollutants	90	90

Further detail on the preferred WSUD arrangements for the Civic Link have been provided in the draft Civic Link Design brief. The design has been developed to enable these strategies to be implemented. It is noted that the current brief identifies water storage in certain areas of the Civic Link, however none of these are within the development site project site and therefore no water storage has been provided.

3.2.3 Precinct wide strategy

A WSUD treatment train has been identified using the current landscape and architectural models. The following treatments are proposed to be implemented within the project area:

- Gross Pollutant Traps
- Treatment Channels with filter media within
- Filter cartridges within the Drainage On-Site Detention tanks.

Based on the MUSIC model, proposed treatment system for proposed catchments is providing stormwater quality compatible with Greenstar development principles.

During end state, roof runoff is directed to a treatment chamber within the detention tank, while bypass from the lower roof and podium levels will be directed to treatment channels before discharging to council's system. While during construction, these will be directed towards the public domain treatment.

The public domain utilises a separate drainage network and will be treated by a combination of gross pollutant traps and treatment channels. Due to spatial issues

related to raingardens, as well as the fact that sufficient treatment devices need to be provided for the public domain to meet both during construction and end state water quality targets. Natural devices therefore are not feasible as the main system for treatment.

The treatment diagram for Parramatta is shown in Figure 10, with the MUSIC model results in Table 8.

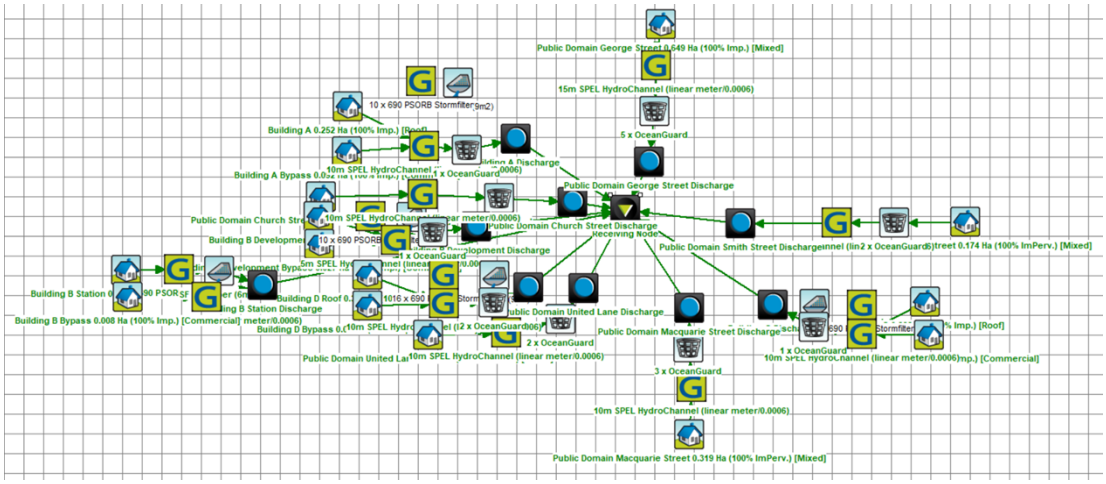

Figure 10 MUSIC Model for Parramatta metro station

Table 8 MUSIC Model Results

Water Quality Parameter	Sources	Residual Load	Reduction (%)	Reduction Target (%)
Total Suspended Solids (TSS)	2770	200	92.8	85
Total Phosphorous (TP)	6.36	1.54	75.8	65
Total Nitrogen	54	19.6	63.7	45
Gross Pollutants	567	0.249	100	90

4 Conclusion

This Addendum to the Integrated Water Management Plan has been written to support a Concept SSDA and to respond to agency comments received to the Concept SSDA EIS. Chapter 2 provides an overview of the responses to agency advice regarding the IWMP.

In response to feedback from CoPC, the stormwater quantity design has been updated in accordance with the CoPC DCP and UPRCT Fourth Edition guidelines, providing storage within the building developments and connection to public domain and the CoPC network.

The stormwater quality design has been developed in accordance with the CoPC DCP and proposed WSUD measures have achieved the required water quality reduction targets, with suitable treatment systems taking into consideration of site constraint and future use of land.

Further design refinement at future stages of the proposal would ensure that all stormwater management system is comprehensively assessed and adequately satisfied.

Appendix A Maintenance Schedule

Table 9 Maintenance Schedule

Maintenance Action	Frequency	Responsibility	Procedure
DOSD Tank			
Inspect & remove orifice blockages	Every 6 Months	Maintenance Contractor /Owner	Remove grate & screen to inspect orifice
Check orifice plate attachment to wall of pit (ensure no gaps exist)	Annually	Maintenance Contractor /Owner	Remove grate and screen. Ensure orifice plate is mounted securely – tighten fittings if required and seal any gaps which are present
Check orifice diameter correct and retain sharp edge	Every 5 years	Maintenance Contractor /Owner	Compare diameter to approved design (see Work as Executed Drawing) and ensure edge is not pitted or damaged. If so, replace
Inspect trash screen and clean	Every 6 Months	Maintenance Contractor /Owner	Remove grate and trash screen if cleaning is required
Check attachment of trash screen to pit wall	Annually	Maintenance Contractor /Owner	Remove grate and screen. Ensure screen fittings are secure. Tighten fittings if required
Check trash screen for corrosion	Annually	Maintenance Contractor /Owner	Remove grate and examine trash screen for rust or corrosion, especially at corner or weld points
Inspect flap valve and remove any blockages	Every 6 Months	Maintenance Contractor /Owner	Remove grate. Remove any debris to allow the flap to move freely.
Check attachment of flap valve to pit & hinges move freely	Annually	Maintenance Contractor /Owner	Remove grate. Ensure fittings of valves are secure and hinges move freely.
Check flap valve seals against wall of pit	Annually	Maintenance Contractor /Owner	Remove grate. Fill tank with water and check that flap seals against wall of pit with minimal leakage.
Check any hinges on the flap valve to ensure flap moves freely	Every 6 Months	Maintenance Contractor /Owner	Remove grate. Test valve hinge by moving flap to full extent and allowing it to drop back into normal position. Flap should freely swing at hinge.

Maintenance Action	Frequency	Responsibility	Procedure
Inspect overflow weir & remove any blockages	Every 6 Months	Maintenance Contractor /Owner	Remove grate and open cover to ventilate underground storage if present. Ensure weir clear of blockages.
Inspect sump & remove any sediment/sludge	Every 6 Months	Maintenance Contractor /Owner	Remove grate and screen. Remove sediment build up and check orifice and flap valve are clear.
Inspect grate for damage or blockage	Every 6 Months	Maintenance Contractor /Owner	Check both sides of grate for corrosion, damage, or blockage.
Inspect outlet pipe and remove any blockage	Every 6 months	Maintenance Contractor /Owner	Remove grate and screen. Ventilate underground storage if present. Check orifice and remove any blockages in outlet pipe. Flush outlet pipe to confirm it drains freely.
Check step irons for corrosion	Annually	Maintenance Contractor /Owner	Remove grate. Examine step irons and repair any corrosion or damage
Check fixing of step irons is secure	Every 6 Months	Maintenance Contractor /Owner	Remove grate and ensure steps are secure – before loading.
Inspect walls (internal & external) for cracks or spalling	Annually	Maintenance Contractor /Owner	Remove grate to inspect internal walls. Repair as required.
Inspect holding tank & remove any sediment/sludge/debris/litter	Every 6 Months	Maintenance Contractor /Owner	Remove grate and screen. Remove any sediment/sludge/debris/litter build-up.
Compare storage volume to volume approved (rectify if 5% difference)	Annually	Maintenance Contractor /Owner	Compare actual storage available with Work As Executed Drawing. If volume loss is >5%, arrange to provide additional volume.
Inspect storages for subsidence near pits	Annually	Maintenance Contractor /Owner	Check along drainage lines and at pits for subsidence
Inspect OSD Plaque and Confined Spaces sign	Annually	Maintenance Contractor /Owner	Check signs and ensure that they are fixed securely to wall, not faded, deteriorated, or missing and is clearly visible. Replace as necessary

Drainage Devices

Maintenance Action	Frequency	Responsibility	Procedure
Inspect pits and trench drains on site and remove debris/litter/sludge	Every month or following Rain Period	Maintenance Contractor /Council	The general inspection involves visual inspection inside pits, removal, and disposal of larger gross pollutants within pits in accordance with waste disposal regulations to prevent blockages, and minimal rectification works as required.
Inspect site for litter and floatable debris and remove	Fortnightly	Maintenance Contractor /Council	Remove litter from site and sweep all paths to remove leaves or sediments that may enter the drainage system
Water Quality Devices			
Filtration Inserts within pits	Every 3 Months	Maintenance Contractor /Council	This involves inspection and evaluation of the filter bad and its condition, removal of captured pollutants, and the appropriate disposal of captured material in accordance with waste disposal regulations. The minor service is designed to return the ocean guard back to optimal operating performance. An inspection of the condition is to be particularly undertaken following major storm events to check for damage and higher than normal sediment accumulation. Refer to manufacturer's maintenance procedures for details of safely undertaking hand maintenance or vacuum maintenance
Filtration cartridges within DOSD tanks	Every 6 Months	Maintenance Contractor /Owner	The general inspection involves visual inspection of cartridges and chamber, removal and disposal of larger gross pollutants from the device in accordance with waste disposal regulations to prevent blockages, and minimal rectification works as required. Cartridges are also to be checked to ensure they are all firmly connected to the connectors.

Appendix B UPRCT Calculations Sheet

On-Site Detention Calculation Sheet for Upper Parramatta River Catchment
Non-HED Secondary Outlet
(Due to Elevated Downstream 100 yr ARI Flood Level)

Project:	**UPRCT Handbook Demonstration Example**
Site Address	**Building A**
Job No:	
Designer:	
Telephone:	

Site Data

OSD Area:	**Upper Parramatta River Catchment**					
L.G.A	**Parramatta City Council**					
Site Area	**0.3446**	ha	**3,446**	m^2		
Total Roof Area	**0.0001**	ha	**1**	m^2		
Area of Site draining to OSD Storage	**0.2522**	ha	**2,522**	m^2	**Satisfactory**	
Residual Site Area (Lot Area - Roof Area)	**0.345**	ha				
Area Bypassing Storage	**0.0924**	ha				
Area Bypassing / Residual Site Area	**26.8%**				**Satisfactory**	**30% Max**
No. of Dwellings on Site	**1**				**Satisfactory**	
Site Area per Dwelling	**0.345**	ha				
Roof Area per Dwelling	**0.000**	ha				

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**520**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**73%**				
Adjusted SRDs	**32**	L/s/ha		**96**	L/s/ha

OSD Calculations

		Extended Detention			Detention	
Basic SSR Volume	Ext Detention Storage	**103.38**	m^3	Total Storage	**179.19**	m^3
Total Rainwater Tank Credits		**0.02**	m^3		**0.04**	m^3
Storage Volume				Total	**179.15**	m^3
Storage Volume	Ext Detention Storage	**103.36**	m^3	Flood Detention Storage	**75.79**	m^3
OSD Discharges	Primary Outlet	**11.01**	L/s	Secondary Outlet	**33.20**	L/s
RL of Top Water Level of Storage		**10.100**	m		**10.300**	m
RL of Orifice Centre-line		**9.100**	m		**10.100**	m
Number of Orifices		**1**			**1**	
Estimated Downstream Flood Level		**8.90**	1.5 yr ARI		**10.05**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.20**	**Satisfactory**	**Satisfactory**	**-0.05**	
Design Head to Orifice Centre		**1.000**	m	TWL Detn Storage - RL Orifice	**0.200**	m
Calculated Orifice Diameter		**73**	mm	**Satisfactory** **Satisfactory**	**189**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**10.600**	m
RL of Minimum Garage Floor Level		**10.500**	m
Length of Overflow Weir		**2.00**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.75**	
Storm Intensity (5 min 100 yr ARI)		**206**	mm/h
Peak Flow over Weir		**108.2**	L/s
Depth of Flow over Weir		**103**	mm
Freeboard to Habitable Floor	**Unacceptable - Min Freeboard = 200 mm**	**197**	mm
Freeboard to Garage Floor	**Unacceptable - Min Freeboard = 100 mm**	**97**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	80.0%		Increase	6625.7%	100%
Total Rainwater Tank Volume	5.00	kL	Tank Volume OK		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	5.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	5.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0.657	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	5.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	27577.31	kL		32195.51	kL
Combined Rainwater Tank Credit	27577.31	kL		32195.51	kL
Maximum Rainwater Tank Credit	0.02	kL		0.04	kL
Rainwater Tank Credit per Dwelling	0.02	kL		0.04	kL
Rainwater Tank Credit for the Site	0.02	m^3		0.04	m^3

Signature: _____ **Date:** _____

On-Site Detention Calculation Sheet for Upper Parramatta River Catchment
Non-HED Secondary Outlet
(Due to Elevated Downstream 100 yr ARI Flood Level)

Project:	**UPRCT Handbook Demonstration Example**
Site Address	**Building B**
Job No:	
Designer:	
Telephone:	

Site Data

OSD Area:	**Upper Parramatta River Catchment**						
L.G.A	**Parramatta City Council**						
Site Area	**0.1049**	ha	**1,049**	m^2			
Total Roof Area	**0.0001**	ha	**1**	m^2			
Area of Site draining to OSD Storage	**0.0783**	ha	**783**	m^2	**Satisfactory**		
Residual Site Area (Lot Area - Roof Area)	**0.105**	ha					
Area Bypassing Storage	**0.0266**	ha					
Area Bypassing / Residual Site Area	**25.4%**				**Satisfactory**	**30% Max**	
No. of Dwellings on Site	**1**				**Satisfactory**		
Site Area per Dwelling	**0.105**	ha					
Roof Area per Dwelling	**0.000**	ha					

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**520**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**75%**				
Adjusted SRDs	**32**	L/s/ha		**99**	L/s/ha

OSD Calculations

		Extended Detention				Detention	
Basic SSR Volume	Ext Detention Storage	**31.47**	m^3		Total Storage	**54.55**	m^3
Total Rainwater Tank Credits		**0.02**	m^3			**0.04**	m^3
Storage Volume					Total	**54.51**	m^3
Storage Volume	Ext Detention Storage	**31.45**	m^3		Flood Detention Storage	**23.06**	m^3
OSD Discharges	Primary Outlet	**3.40**	L/s		Secondary Outlet	**10.41**	L/s
RL of Top Water Level of Storage		**10.100**	m			**10.300**	m
RL of Orifice Centre-line		**9.100**	m			**10.100**	m
Number of Orifices		**1**				**1**	
Estimated Downstream Flood Level		**8.90**	1.5 yr ARI			**10.05**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.20**	**Satisfactory**		**Satisfactory**	**-0.05**	
Design Head to Orifice Centre		**1.000**	m		TWL Detn Storage - RL Orifice	**0.200**	m
Calculated Orifice Diameter		**40**	mm	**Satisfactory**	**Satisfactory**	**106**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**10.600**	m
RL of Minimum Garage Floor Level		**10.500**	m
Length of Overflow Weir		**2.00**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.75**	
Storm Intensity (5 min 100 yr ARI)		**206**	mm/h
Peak Flow over Weir		**33.6**	L/s
Depth of Flow over Weir		**47**	mm
Freeboard to Habitable Floor	**Satisfactory**	**253**	mm
Freeboard to Garage Floor	**Satisfactory**	**153**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	80.0%		Increase	6625.7%	100%
Total Rainwater Tank Volume	5.00	kL	Tank Volume OK		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	5.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	5.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0.657	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	5.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	8394.83	kL		9800.66	kL
Combined Rainwater Tank Credit	8394.83	kL		9800.66	kL
Maximum Rainwater Tank Credit	0.02	kL		0.04	kL
Rainwater Tank Credit per Dwelling	0.02	kL		0.04	kL
Rainwater Tank Credit for the Site	0.02	m^3		0.04	m^3

Signature: _____ **Date:** _____

On-Site Detention Calculation Sheet for Upper Parramatta River Catchment
Non-HED Secondary Outlet
(Due to Elevated Downstream 100 yr ARI Flood Level)

Project:	**UPRCT Handbook Demonstration Example**
Site Address	**Building B - Podium**
Job No:	
Designer:	
Telephone:	

Site Data

OSD Area:	**Upper Parramatta River Catchment**					
L.G.A	**Parramatta City Council**					
Site Area	**0.037**	ha	**370**	m^2		
Total Roof Area	**0.0001**	ha	**1**	m^2		
Area of Site draining to OSD Storage	**0.029**	ha	**290**	m^2	**Satisfactory**	
Residual Site Area (Lot Area - Roof Area)	**0.037**	ha				
Area Bypassing Storage	**0.008**	ha				
Area Bypassing / Residual Site Area	**21.7%**				**Satisfactory**	**30% Max**
No. of Dwellings on Site	**1**				**Satisfactory**	
Site Area per Dwelling	**0.037**	ha				
Roof Area per Dwelling	**0.000**	ha				

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**520**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**78%**				
Adjusted SRDs	**33**	L/s/ha		**107**	L/s/ha

OSD Calculations

		Extended Detention			Detention	
Basic SSR Volume	Ext Detention Storage	**11.10**	m^3	Total Storage	**19.24**	m^3
Total Rainwater Tank Credits		**0.02**	m^3		**0.04**	m^3
Storage Volume				Total	**19.20**	m^3
Storage Volume	Ext Detention Storage	**11.08**	m^3	Flood Detention Storage	**8.12**	m^3
OSD Discharges	Primary Outlet	**1.24**	L/s	Secondary Outlet	**3.95**	L/s
RL of Top Water Level of Storage		**10.100**	m		**10.300**	m
RL of Orifice Centre-line		**9.100**	m		**10.100**	m
Number of Orifices		**1**			**1**	
Estimated Downstream Flood Level		**8.90**	1.5 yr ARI		**10.05**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.20**	**Satisfactory**	**Satisfactory**	**-0.05**	
Design Head to Orifice Centre		**1.000**	m	TWL Detn Storage - RL Orifice	**0.200**	m
Calculated Orifice Diameter		**24**	mm	**Satisfactory**	**Min Diam 25 mm**	**65**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**10.600**	m
RL of Minimum Garage Floor Level		**10.500**	m
Length of Overflow Weir		**2.00**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.75**	
Storm Intensity (5 min 100 yr ARI)		**206**	mm/h
Peak Flow over Weir		**12.4**	L/s
Depth of Flow over Weir		**24**	mm
Freeboard to Habitable Floor	**Satisfactory**	**276**	mm
Freeboard to Garage Floor	**Satisfactory**	**176**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	80.0%		Increase	6625.7%	100%
Total Rainwater Tank Volume	5.00	kL	Tank Volume OK		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	5.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	5.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0.657	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	5.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	2961.00	kL		3456.86	kL
Combined Rainwater Tank Credit	2961.00	kL		3456.86	kL
Maximum Rainwater Tank Credit	0.02	kL		0.04	kL
Rainwater Tank Credit per Dwelling	0.02	kL		0.04	kL
Rainwater Tank Credit for the Site	0.02	m^3		0.04	m^3

Signature: _____ **Date:** _____

On-Site Detention Calculation Sheet for Upper Parramatta River Catchment
Non-HED Secondary Outlet
(Due to Elevated Downstream 100 yr ARI Flood Level)

Project:	**UPRCT Handbook Demonstration Example**
Site Address	**Building C**
Job No:	
Designer:	
Telephone:	

Site Data

OSD Area:	**Upper Parramatta River Catchment**					
L.G.A	**Parramatta City Council**					
Site Area	**0.2573**	ha	**2,573**	m^2		
Total Roof Area	**0.0001**	ha	**1**	m^2		
Area of Site draining to OSD Storage	**0.2276**	ha	**2,276**	m^2	**Satisfactory**	
Residual Site Area (Lot Area - Roof Area)	**0.257**	ha				
Area Bypassing Storage	**0.0297**	ha				
Area Bypassing / Residual Site Area	**11.5%**				**Satisfactory**	**30% Max**
No. of Dwellings on Site	**1**				**Satisfactory**	
Site Area per Dwelling	**0.257**	ha				
Roof Area per Dwelling	**0.000**	ha				

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**520**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**88%**				
Adjusted SRDs	**37**	L/s/ha		**127**	L/s/ha

OSD Calculations

		Extended Detention			Detention	
Basic SSR Volume	Ext Detention Storage	**77.19**	m^3	Total Storage	**133.80**	m^3
Total Rainwater Tank Credits		**0.02**	m^3		**0.04**	m^3
Storage Volume				Total	**133.75**	m^3
Storage Volume	Ext Detention Storage	**77.17**	m^3	Flood Detention Storage	**56.59**	m^3
OSD Discharges	Primary Outlet	**9.40**	L/s	Secondary Outlet	**32.65**	L/s
RL of Top Water Level of Storage		**10.100**	m		**10.300**	m
RL of Orifice Centre-line		**9.100**	m		**10.100**	m
Number of Orifices		**1**			**1**	
Estimated Downstream Flood Level		**8.90**	1.5 yr ARI		**10.05**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.20**	**Satisfactory**	**Satisfactory**	**-0.05**	
Design Head to Orifice Centre		**1.000**	m	TWL Detn Storage - RL Orifice	**0.200**	m
Calculated Orifice Diameter		**67**	mm	**Satisfactory** **Satisfactory**	**187**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**10.600**	m
RL of Minimum Garage Floor Level		**10.500**	m
Length of Overflow Weir		**2.00**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.75**	
Storm Intensity (5 min 100 yr ARI)		**206**	mm/h
Peak Flow over Weir		**97.7**	L/s
Depth of Flow over Weir		**96**	mm
Freeboard to Habitable Floor	**Satisfactory**	**204**	mm
Freeboard to Garage Floor	**Satisfactory**	**104**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	80.0%		Increase	6625.7%	100%
Total Rainwater Tank Volume	5.00	kL	Tank Volume OK		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	5.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	5.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0.657	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	5.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	20590.95	kL		24039.19	kL
Combined Rainwater Tank Credit	20590.95	kL		24039.19	kL
Maximum Rainwater Tank Credit	0.02	kL		0.04	kL
Rainwater Tank Credit per Dwelling	0.02	kL		0.04	kL
Rainwater Tank Credit for the Site	0.02	m^3		0.04	m^3

Signature: _____ **Date:** _____

On-Site Detention Calculation Sheet for Upper Parramatta River Catchment
Non-HED Secondary Outlet
(Due to Elevated Downstream 100 yr ARI Flood Level)

Project:	**UPRCT Handbook Demonstration Example**
Site Address	**Building D**
Job No:	
Designer:	
Telephone:	

Site Data

OSD Area:	**Upper Parramatta River Catchment**						
L.G.A	**Parramatta City Council**						
Site Area	**0.415**	ha	**4,150**	m^2			
Total Roof Area	**0.0001**	ha	**1**	m^2			
Area of Site draining to OSD Storage	**0.3349**	ha	**3,349**	m^2	**Satisfactory**		
Residual Site Area (Lot Area - Roof Area)	**0.415**	ha					
Area Bypassing Storage	**0.0801**	ha					
Area Bypassing / Residual Site Area	**19.3%**				**Satisfactory**	**30% Max**	
No. of Dwellings on Site	**1**				**Satisfactory**		
Site Area per Dwelling	**0.415**	ha					
Roof Area per Dwelling	**0.000**	ha					

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**520**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**81%**				
Adjusted SRDs	**34**	L/s/ha		**111**	L/s/ha

OSD Calculations

		Extended Detention			Detention	
Basic SSR Volume	Ext Detention Storage	**124.50**	m^3	Total Storage	**215.80**	m^3
Total Rainwater Tank Credits		**0.02**	m^3		**0.04**	m^3
Storage Volume				Total	**215.76**	m^3
Storage Volume	Ext Detention Storage	**124.48**	m^3	Flood Detention Storage	**91.28**	m^3
OSD Discharges	Primary Outlet	**14.20**	L/s	Secondary Outlet	**46.23**	L/s
RL of Top Water Level of Storage		**10.100**	m		**10.300**	m
RL of Orifice Centre-line		**9.100**	m		**10.100**	m
Number of Orifices		**1**			**1**	
Estimated Downstream Flood Level		**8.90**	1.5 yr ARI		**10.05**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.20**	**Satisfactory**	**Satisfactory**	**-0.05**	
Design Head to Orifice Centre		**1.000**	m	TWL Detn Storage - RL Orifice	**0.200**	m
Calculated Orifice Diameter		**82**	mm	**Satisfactory** **Satisfactory**	**223**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**10.600**	m
RL of Minimum Garage Floor Level		**10.500**	m
Length of Overflow Weir		**2.00**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.75**	
Storm Intensity (5 min 100 yr ARI)		**206**	mm/h
Peak Flow over Weir		**143.7**	L/s
Depth of Flow over Weir		**124**	mm
Freeboard to Habitable Floor	**Unacceptable - Min Freeboard = 200 mm**	**176**	mm
Freeboard to Garage Floor	**Unacceptable - Min Freeboard = 100 mm**	**76**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	80.0%		Increase	6625.7%	100%
Total Rainwater Tank Volume	5.00	kL	Tank Volume OK		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	5.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	5.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0.657	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	5.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	33211.21	kL		38772.88	kL
Combined Rainwater Tank Credit	33211.21	kL		38772.88	kL
Maximum Rainwater Tank Credit	0.02	kL		0.04	kL
Rainwater Tank Credit per Dwelling	0.02	kL		0.04	kL
Rainwater Tank Credit for the Site	0.02	m^3		0.04	m^3

Signature: _____ **Date:** _____