

Civil & Stormwater Report

Tallawong Station Precinct South

State Significant Development Application (SSDA)

Civil & Stormwater Report

Tallawong Station Precinct South

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Executive Summary

The Tallawong Station Precinct South development site comprises around 7.8 ha of former government owned land within the Area 20 precinct in the North Western Growth Centre. Located between Cudgegong Road, Tallawong Road, Schofields Road and the Metro corridor.

A Civil and Stormwater Report has been prepared to support the State Significant Development Application (SSDA) for this precinct and covers the below items:

- Civil Engineering;
- Utilities Assessment;
- Stormwater Quantity Management;
- Stormwater Quality Management; and
- A Sydney Metro Corridor Protections Letter.

The Utilities Assessment section demonstrates that public infrastructure (including the supply of potable water, wastewater, electricity, gas and telecommunications) have been considered within the proposal and will be made available to adequately service the future precinct development;

The Stormwater Quantity Management section details the site drainage, the site drains in a south eastern direction to a degraded section of Second Ponds Creek. Station enabling works and existing roads include stormwater pipe drainage across Cudgegong Road in two locations. The proposed development will connect to this stormwater network. These drainage structures have been planned to accommodate future development including the proposed development;

As detailed in the Stormwater Quality Management section, water sensitive urban design (WSUD) elements are proposed as part of the treatment train that will provide an acceptable level of detention and treatment to achieve the prescribed stream stability metric and stormwater quality targets; and

The Sydney Metro Corridor Protections Letter confirms that due to the distance between the Tallawong Metro Station and the proposed development, the development is not located within the protection reserve of the metro nor does it cause design and construction related safety, engineering, maintenance and operational impact on the at grade and elevated Metro infrastructure.

1.0 Introduction

Tallawong is a key destination within the ever-growing North West Priority Growth Area. As the location for the final Norwest Metro line, Tallawong offers the immediate community direct connection to the city and surrounding key recreational, social and economic facilities.

The site is located:

- Directly adjacent to the Tallawong Metro Station; and
- Adjacent to Schofields Road and Cudgegong Road.

The Tallawong development will deliver residential, commercial and retail services consisting of 987 units. The Site 1 area is 16,240m² while the Site 2 area is 27,030m², the areas are shown Figure 1 below.

This document summarises the design approach, key assumptions, references and standards considered in developing the civil and stormwater design documentation for the Tallawong Station Precinct South development.

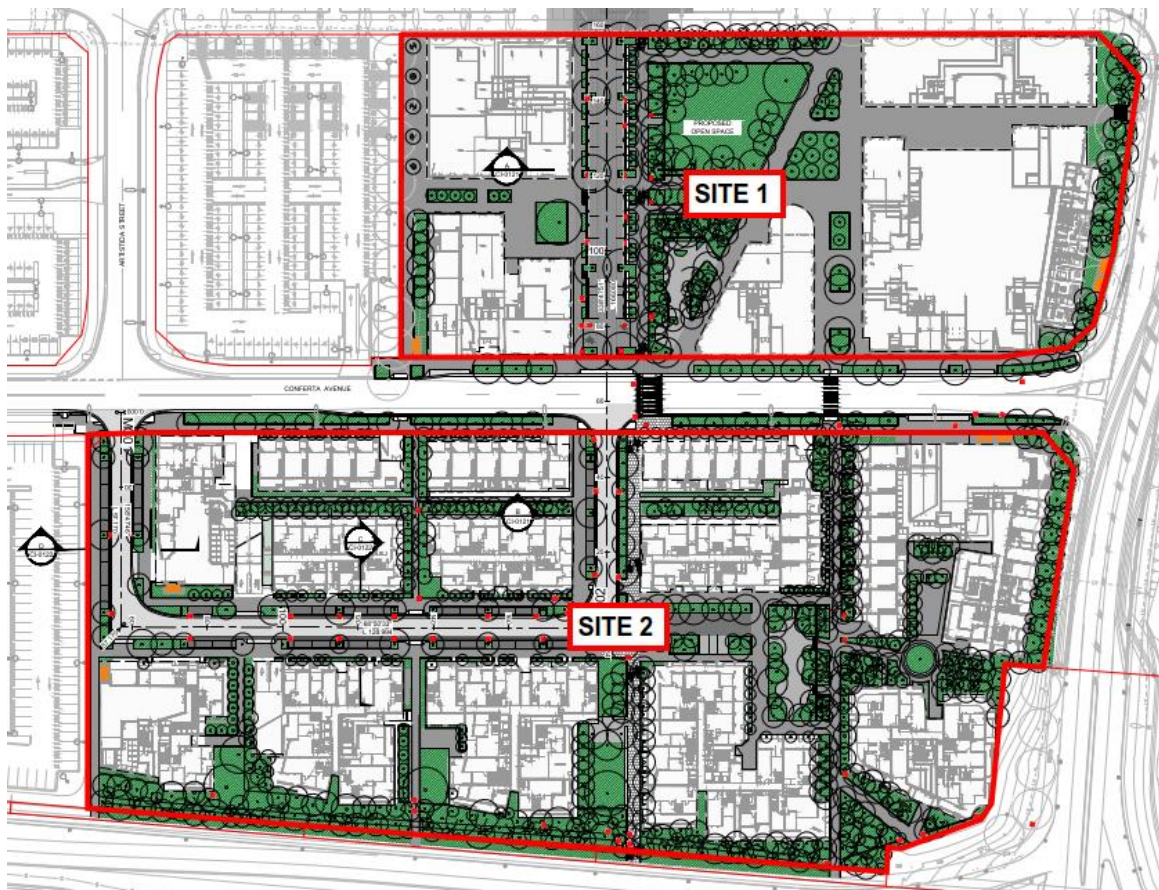


Figure 1 Site Plan

The civil scope of works for the design includes:

- Pedestrian paths – up to the kerb line at Conferta Avenue and Themeda Avenue;
- Proposed private and public internal roads;
- A shared path in site 2; and
- Residential, retail, commercial building entry points.

Further indicative dedications can be found in the *SSDA Civil Engineering Drawing Package* accompanying this report.

The concept proposal generally adheres to the State Environmental Planning Policy (SEPP) (Sydney Region Growth Centres, 2006) Indicative Layout Plan (ILP) and Development Control Plan (DCP) for Area 20.

1.1 Planning Requirements

Table 1 below provides a summary of the planning requirements that are addressed within this report, these are from:

- SSD-10425 Secretary's Environmental Assessment Requirements (SEARS);
- Additional recommendations from the Environment, Energy and Science Group (EES); and
- Blacktown City Council (BCC) review of SEARS.

Table 1 Response to SEARS

Item	Description	Action
SEARS	Utilities	<p>The EIS must:</p> <ul style="list-style-type: none"> • identify and address the existing capacity to service the development proposed and any augmentation requirements for utilities in consultation with relevant agencies; and • identify any potential impacts of the proposed construction and operation on the existing utility infrastructure and service provider assets, and demonstrate how these will be protected, or impacts mitigated.
SEARS	Plans and Documents	<p>The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedules 1 and 2 of the <i>Environmental Planning and Assessment Regulation 2000</i> including:</p> <ul style="list-style-type: none"> • Services and utilities impact assessment; and • Sydney Metro Underground Corridor Protection Guidelines or Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines report.
DPIE EE Comments 9.	Water and Soils	<p>The EIS must map the following features relevant to water and soils including:</p> <ul style="list-style-type: none"> • Rivers, streams, wetlands, estuaries (as described in s4.3 of the Biodiversity Assessment Method); and • Proposed intake and discharge locations.
DPIE EE Comments 10.	Water and Soils	<p>THE EIS must describe background conditions for any water resource likely to be affected by the development, including:</p> <ul style="list-style-type: none"> • Existing surface and groundwater; • Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations;

Item	Description	Action
		<ul style="list-style-type: none"> Water Quality Objectives (as endorsed by NSW Government) including groundwater as appropriate that represent the community's uses and values for the receiving waters.
BCC Review - 10-13.	Engineering	<p>Engineering:</p> <ul style="list-style-type: none"> All roads must comply with engineering standards set out in Council's Engineering Guide for Development. No basement parking permitted under a public road therefore the road must remain private with a public easement for access; Drainage overland flow path must be dedicated and in a public road (not a private easement); Overland drainage must be in public space and treated to meet CPTED requirements; and Splays are required on corners of overland flow paths and public roads.
BCC Review - 14-15.	Drainage	<p>Drainage:</p> <ul style="list-style-type: none"> Compliance with drainage requirements as outlined in meeting with Council's drainage section on 7th February 2020; and Compliance with water sensitive urban design requirements set out in Part J of the Blacktown Development Control Plan.

2.0 Civil Engineering Design

2.1 Design Overview

The key considerations incorporated throughout the design of the urban areas of the development include the following principles:

- A connected town centre;
- Street network hierarchy;
- Pedestrian and cycle network;
- Open space network;
- Urban block structure;
- Variations in height and scale;
- A range of housing typologies; and
- Mixed-uses and activation.

A summary of the design parameters considered for the concept proposal is outlined below in Table 2.

Table 2 Key Design Considerations

Area	Key Design Considerations
Proposed Roads	<ul style="list-style-type: none"> • Pedestrian crossing at the intersection with Conferta Avenue; • Trees and planting to improve the outdoor aesthetic and provide water quality treatment; • Utility services underneath footpath to service development lots; • Road design to support vehicular access to development lots; • Loading zone parking; • Lighting; and • Integration with the landscape design.
Private Park and Urban Plaza	<ul style="list-style-type: none"> • Flexible seating / event space adjacent; • Retaining walls allow a view of the park and surrounds; and • Integration with the landscape design to form an interconnected open space.
Pedestrian and Cycle Network	<ul style="list-style-type: none"> • Create a series of through site links that extend the pedestrian and cycle network connecting key elements such as the Metro station with landscaped spaces, major intersections and residential areas. • Seating along the walkway; • Trees and planting to improve the outdoor aesthetic and provide water quality treatment; • Coordination with the landscape of the existing traverse roads; • Crime prevention through environmental design (CPTED); and • Integration with the landscape design.

2.2 Design Documentation

The Design Documentation comprises of the following drawing list:

Table 3 Design Documentation

Drawing Number	Drawing Name	Other
GENERAL PLANS		
60558549-SHT-CI-0001	COVER SHEET	
60558549-SHT-CI-0003	GENERAL NOTES	
60558549-SHT-CI-0011	KEY PLAN	
60558549-SHT-CI-0021	GENERAL ARRANGEMENT	
PUBLIC DOMAIN PLANS		
60558549-SHT-CI-0101	PUBLIC DOMAIN - PLAN	SHEET 01
60558549-SHT-CI-0102	PUBLIC DOMAIN - PLAN	SHEET 02
60558549-SHT-CI-0103	PUBLIC DOMAIN - PLAN	SHEET 03
60558549-SHT-CI-0104	PUBLIC DOMAIN - PLAN	SHEET 04
TYPICAL SITE SECTIONS		
60558549-SHT-CI-0121	TYPICAL SITE SECTION	SHEET 01
60558549-SHT-CI-0122	TYPICAL SITE SECTION	SHEET 02
LONGITUDINAL SECTIONS		
60558549-SHT-CI-0161	PUBLIC DOMAIN LONGITUDINAL SECTIONS MC01	SHEET 01
60558549-SHT-CI-0162	PUBLIC DOMAIN LONGITUDINAL SECTIONS MC01	SHEET 02
60558549-SHT-CI-0163	PUBLIC DOMAIN LONGITUDINAL SECTIONS MC02	SHEET 03
60558549-SHT-CI-0164	PUBLIC DOMAIN LONGITUDINAL SECTIONS MC02	SHEET 04
EROSION AND SEDIMENTATION CONTROL PLANS		
60558549-SHT-CI-0201	EROSION AND SEDIMENT CONTROL PLAN	
60558549-SHT-CI-02221	EROSION AND SEIDMENT CONTROL DETAIL	
ISPACH PLANS		
60558549-SHT-CI-0220	ISOPACH – PLAN – SITE WIDE	
DRAINAGE PLANS		
60558549-SHT-CI-0300	DRAINAGE – PLAN – SITE WIDE	
60558549-SHT-CI-0301	DRAINAGE – PLAN	SHEET 01
60558549-SHT-CI-0302	DRAINAGE – PLAN	SHEET 02
60558549-SHT-CI-0303	DRAINAGE – PLAN	SHEET 03
60558549-SHT-CI-0304	DRAINAGE – PLAN	SHEET 04

DRAINAGE LONGITUDINAL SECTIONS		
60558549-SHT-CI-0401	DRAINAGE LONGITUDINAL SECTION	SHEET 01
60558549-SHT-CI-0402	DRAINAGE LONGITUDINAL SECTION	SHEET 02
60558549-SHT-CI-0403	DRAINAGE LONGITUDINAL SECTION	SHEET 03
60558549-SHT-CI-0404	DRAINAGE LONGITUDINAL SECTION	SHEET 04
60558549-SHT-CI-0405	DRAINAGE LONGITUDINAL SECTION	SHEET 05
60558549-SHT-CI-0406	DRAINAGE LONGITUDINAL SECTION	SHEET 06
60558549-SHT-CI-0407	DRAINAGE LONGITUDINAL SECTION	SHEET 07
60558549-SHT-CI-0408	DRAINAGE LONGITUDINAL SECTION	SHEET 08
60558549-SHT-CI-0409	DRAINAGE LONGITUDINAL SECTION	SHEET 09
60558549-SHT-CI-0421	DRAINAGE SWALE – CROSS SECTIONS	
SERVICE PLANS		
60558549-SHT-CI-0500	COMIBINED SERVICES – PLAN – SITE WIDE	SHEET 01
60558549-SHT-CI-0501	COMIBINED SERVICES – PLAN	SHEET 01
60558549-SHT-CI-0502	COMIBINED SERVICES – PLAN	SHEET 02
60558549-SHT-CI-0503	COMIBINED SERVICES – PLAN	SHEET 03
60558549-SHT-CI-0504	COMIBINED SERVICES – PLAN	SHEET 04
60558549-SHT-CI-0505	COMIBINED SERVICES – PLAN	SHEET 05

2.3 Consultation

The design documentation integrates comments and feedback received on preliminary documentation from both this SSDA and the previous Landcom design from the following authorities:

- Sydney Water;
- Endeavour Energy;
- Jemena Gas;
- Roads and Maritime Services;
- Sydney Metro;
- Telstra NSW;
- NBN Co; and
- Blacktown City Council.

2.4 Roadworks, Earthworks Level Design

Design criteria applied to the road and levels design are summarised in Table 4 below.

Table 4 Road Design Criteria

Item	Standard	Adopted	Comment
Horizontal Road Alignment			

Item	Standard	Adopted	Comment
Vehicle Design Speed	BCC DCP	50 km/h	Based on operational speed of 50 km/h
Turning Paths	BCC/TfNSW AS 2890.2 – 2002	<u>Design Vehicle:</u> BCC Refuse vehicle: <ul style="list-style-type: none"> Overall length = 11m Width = 2.5m Wall to wall turn radius = 10.5m Medium Rigid Vehicle (MRV) <ul style="list-style-type: none"> Overall Length = 8.8m Overall Width = 2.5m Kerb to kerb turn radius = 10m 	Access for BCC Garbage Truck and single Medium Rigid Vehicle (MRV) to proposed roads required. Refer to Traffic Engineers report for details of swept paths.
	Austrroads 2008	Emergency response vehicles and service vehicles	L = 19.0m
Road Reserve Width			
Lane Width	BCC Engineering Guideline	<u>Proposed Roads</u> <ul style="list-style-type: none"> Local Road = 16m Collector Road = 18m Pathways = 4.0 – 10m (depending of function) 	
Parking Lane	AS 2890.5 – 1993 On-Street Car Parking	Min Width = 2.1 m Length 1 space = 6.3m	Allows for kerbs and/or obstructions at either end of the parking spaces.
Footpath/Cycleway	BCC Engineering Guideline	Min Width = 4.0m Max Width = 10.0m	Depending on function (access/drainage/servicing)
Kerb Types			
Collector Road (Major and Minor)	BCC Engineering Guideline	150mm kerb & gutter	
Local Road/Street	BCC Engineering Guideline	Roll top kerb & gutter	
Vertical Road Alignment			
Maximum Longitudinal Grade	BCC Engineering Guideline	Residential Roads Desirable = 12% Maximum = 16%	
Maximum Longitudinal Grade at intersections	BCC Engineering Guideline	5 %	
Minimum Longitudinal Grade	BCC Engineering Guideline	Desirable = 1% Minimum = 0.7%	
% change in grade requiring a Vertical Curve	BCC Engineering Guideline	1%	
Min VC lengths	BCC Engineering Guideline	<u>Cul-de-sac, Access and Local Streets</u> Desirable = 25m Acceptable = 6m <u>Collector Streets</u> Desirable = 35m Acceptable = 12m	Lengths of VC given are for straight alignments; longer curves may be necessary where roads also have horizontal curvature.

Item	Standard	Adopted	Comment
Cross fall	BCC Engineering Guideline	Concrete = 2.0-3.0% Asphaltic Concrete = 3.0% Sprayed Seal = 3.0-4.0%	
Vertical Footpath Alignment			
Maximum Longitudinal Fall	BCC Engineering Guideline	8.3%	Grading of pathways shall not be steeper than 1 in 12
Minimum Footpath Cross Fall	BCC Engineering Guideline	2%	To accommodate existing vehicular crossing and other facilities.
Maximum Footpath Cross Fall	BCC Engineering Guideline	6%	With prior approval from Council
Cross fall	BCC Engineering Guideline	Roads 2.0 to 3.0% Footpaths 2.0 to 6.0%	For concrete road pavement

2.5 General Description

The following are the main features of the road and earthworks design for the project:

- Design of roads with 2-way cross-fall to suit stormwater management requirements;
- Kerb radii to suit the turn path of the design vehicle;
- Footpath cross fall designed to meet BCC standards; and
- Landscaping and earthworks to suit a public park.

The design of public roadways including footpaths, shared paths and private roadways within the Tallawong Station South Precinct comply with the Blacktown City Council Growth Centre Precincts DCP as outlined in Figure 3-14 of the DCP (refer Figure 2 below) however with indented parking.

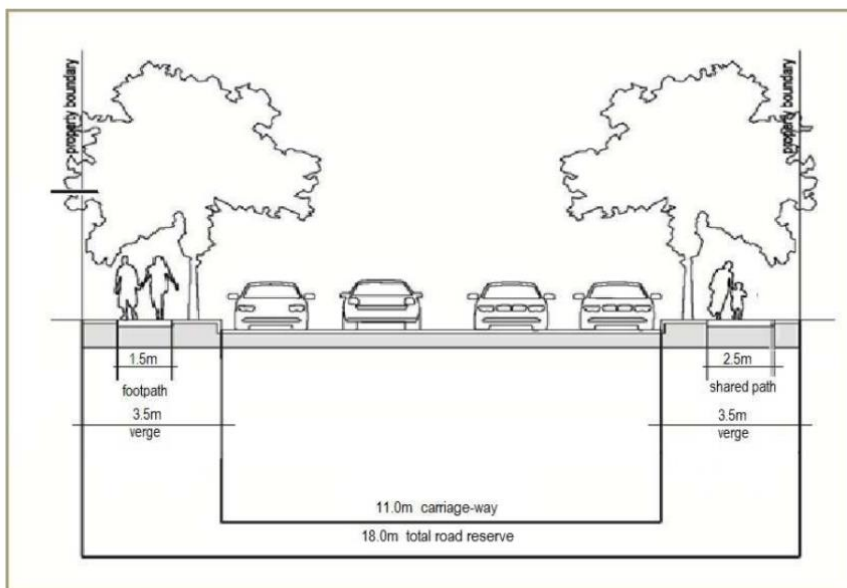


Figure 3-14 Medium-high density local road

Source: BCC Growth Centre Precincts DCP

Figure 2 BCC Growth Centre Precincts Road Widths

2.6 Lot Splays

Lot splays are currently provided at the edges of Cudgegong Road as per the previously approved Landcom SSDA submission, the site boundaries have been maintained as per the previously approved plans.

2.7 Conferta Avenue Parking

Conferta Avenue is an existing council public road, as a part of this development we would recommend Blacktown City Council install parking signage to allow parking on Conferta and slow passing vehicles.

There is 17 on-street parking spaces that can be made available while complying with Australian Standards and road rules as shown below in Figure 3.

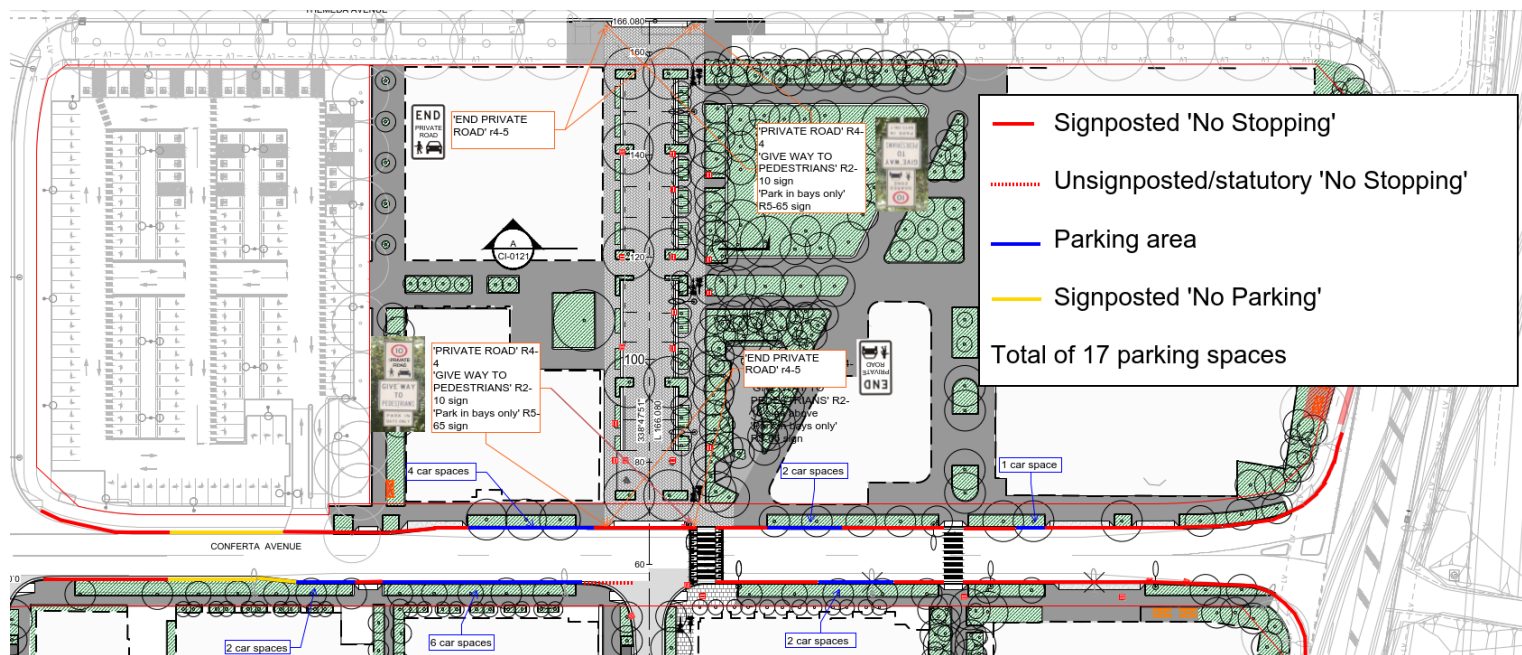


Figure 3: Recommended Conferta Parking

2.8 Pavement Design

Paved areas throughout the Tallawong Station Precinct South development include roads and footpaths along the Proposed Roads and along the pedestrian and cycle thoroughfares. This section summarises the structural design process for the pavements within the Tallawong Station Precinct South development. Pavements included in the design are summarised as follows:

- Pavement Type PT-CUD-01C - Flexible Road Pavement; and
- Pavement Type PT-CUD-15 – Concrete Footpath.

These pavement designs will tie into the existing pavement for the precinct constructed as part of the Northwest Rapid Transit (NRT) works. BCC Engineering guidelines indicate that pavements should be designed using the general principles of Austroads (2012) "Guide to Pavement Technology – Part 2 Pavement Structural Design". These pavement designs are subject to further detailed analysis and may change during design development.

2.8.1 Type PT-CUD-01C – Unbound Granular

Flexible pavement is presented along the road surface of the Proposed Roads (MC01 and MC02). The previous pavement along Precinct Streets C (Aristida) and D (Conferta) for the NRT design is shown below, adopting a Design Traffic Loading (ESA) 3.90×10^5 .

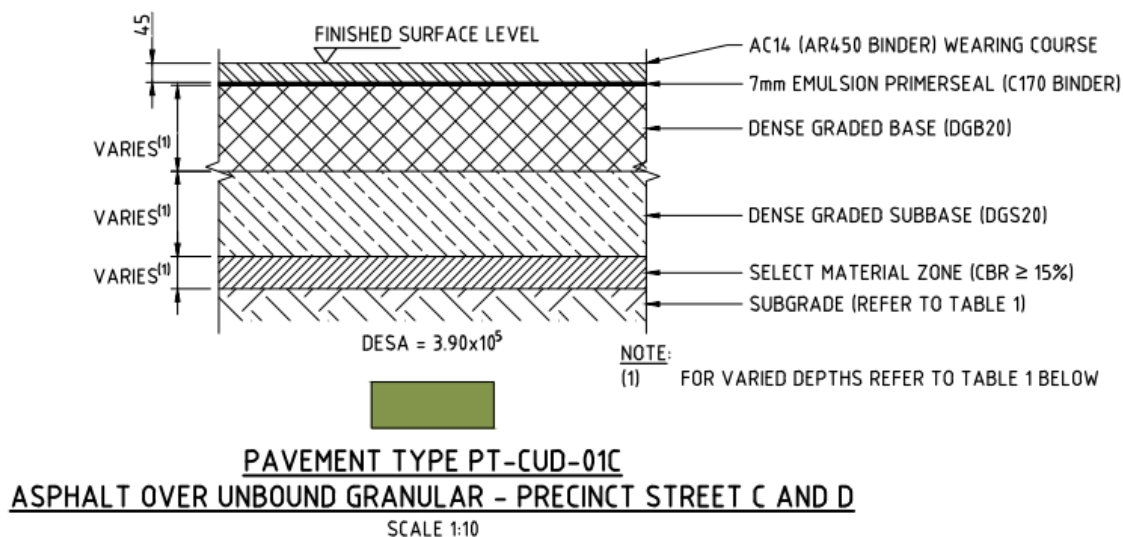


Figure 4 Type PT-CUD-01C Pavement (Proposed Roads MC01, MC02)

Pavement Tag	Pavement Type	Thickness (mm)	Subgrade CBR%
PT-CUD-01C	Unbound Granular	180 (DGB20)	3
		180 (DGB20)	
		150 (SMZ)	
PT-CUD-01C	Unbound Granular	150 (DGB20)	7
		150 (DGS20)	
PT-CUD-01C	Unbound Granular	150 (DGB20)	12
		150 (DGS20)	

2.8.2 Type PT-CUD-15 - Footpath Pavement

Footpath pavement will be used along to link the site from North to South. All new footpaths within the Tallawong Station Precinct South will implement the following footpath pavement design.

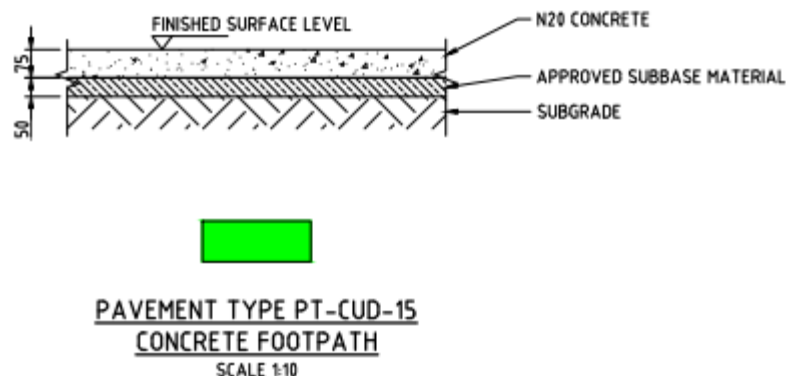


Figure 5 Footpath Pavement

New pavement calculations will be undertaken as part of detailed design, but the intent would be to match the existing NRT design wherever possible with the exception of different finishes for the indented car bays and the proposed new plaza.

2.9 Lighting Design

Street lighting will be installed along all proposed Roads, pedestrian footpaths and cycle ways. These will be provided in accordance with Blacktown City Council and Endeavour Energy requirements. The key methodology and assumptions to be applied to the street lighting design are outlined below:

- Council requires all new lighting levels are to be in accordance with AS/NZ 1158 in its various parts and to comply with all the requirements of Endeavour Energy's document "*Public Lighting Equipment – Luminaires, Lamps & Ancillary Equipment, Technical Specification (2014)*";
- The lighting of arterial and sub-arterial (Traffic Route Lighting) roads must comply with AS/NZS 1158. Part 1.1 – Vehicular Traffic (Category V) Lighting – Performance and Installation Design Requirements 1997, using the appropriate lighting categories;
- Lighting of residential roads and public places must comply with AS/NZS 1158 Residential Street Lighting Part 3.1: Pedestrian Area (category P) Lighting – Performance and Installation Design Requirements 1999, using the appropriate lighting categories;
- Luminaire Type (roads) = SHP250w ROADSTER;
- Column Height/Outreach = 8.5m / 3m (to be confirmed in lighting design); and
- Maintenance Factor = 0.7.

Luminaires to be supplied are to comply with AS/NZS 1158.6 specifications and Endeavour Energy's documents and shall be:

- With National Electrical Manufacturers Association (NEMA) photoelectric cell base;
- With integral control gear;
- Designed for clear tubular lamp;
- Single insulated;
- With radio and television interference suppression capacitors; and
- With a Metal Oxide Varistor (MOV) – minimum 320 Joules.

3.0 Utilities Assessment

A Dial Before You Dig request was submitted for the site area which identified a range of services present within the study area. These are summarised in Table 5.

Table 5 Summary of Existing Services

Authority Name	Phone	Utility Type
Optus and/or Uecomm, Nsw	1800505777	Data and Telecommunications
PIPE Networks, Nsw	1800201100	Data and Telecommunications
Telstra NSW, Central	1800653935	Data and Telecommunications
Endeavour Energy	0249510899	Electricity
Jemena Gas	1300880906	Gas
The Hills Shire Council	0292659819	Other
Roads and Maritime Services	0294227792	Other
Sydney Water	0132092	Potable and Recycled Water / Wastewater
Sydney Metro	0291119083	Road & Rail
NBN Co, NswAct	1800626762	Communications

The plans provided from the DBYD requests were considered as a part of the condition and capacity review.

3.1 Utilities Reports

A number of annual reports and master plans that have been prepared by stakeholders provide information relevant to the study area. A list of the reports used in the infrastructure strategy assessment is shown below:

- Northwest Rapid Transit Project Integrated Management System, 2015
- Area 20 Primary Utilities Report, Cardno 2015
- Blacktown City Council Growth Centre Precincts, Development Control Plan, NSW Government, 2016
- Cudgegong Road Station, (Area 20 Precinct) Finalisation Report, NSW Government, 2015
- North West Rail Link, Cudgegong Road Station Structure Plan, NSW Government, 2013
- Development Servicing Plan (Rouse Hill Recycled Water System), Sydney Water, 2016
- Draft Metropolitan Strategy for Sydney To 2031, NSW Government, 2014
- A Plan for Growing Sydney, NSW Government, 2014
- NSW Long Term Transport Master Plan, NSW Government, 2014
- Decentralised Water - Master Plan, City of Sydney, 2012
- Growth Servicing Plan July 2014 to June 2019, Sydney Water, 2014
- Wastewater Systems, Sydney Water, 2014
- Distribution Annual Planning Report, Endeavour Energy, 2016
- BASIX Water Savings Monitoring – Sydney Water, 2009
- BASIX Monitoring Report - Electricity Consumptions for 2007-2009, NSW Department of Planning, 2010

3.2 Combined Services Plan

A combined services plan has been developed for the Tallawong Station Precinct South site, presenting utility service routes throughout the precinct and considering the following:

- Connection to existing utility infrastructure;
- Potential development lot connection points;
- Coordination between services; and
- Provision of water, wastewater, electrical and gas supply.

All services are shown schematically and are subject to changes during further design stages and input from the relevant utility authorities. Schematic layouts for each utility service are presented in the individual sections within this report.

The Combined Services Plan sheets are shown in Figure 6.

ISO A1 594mm x 841mm
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Filename: \\AUSTRALIA\PROJECTS\TALLAWONG STATION\18532-SHT-00-0000-CI-0500.DWG

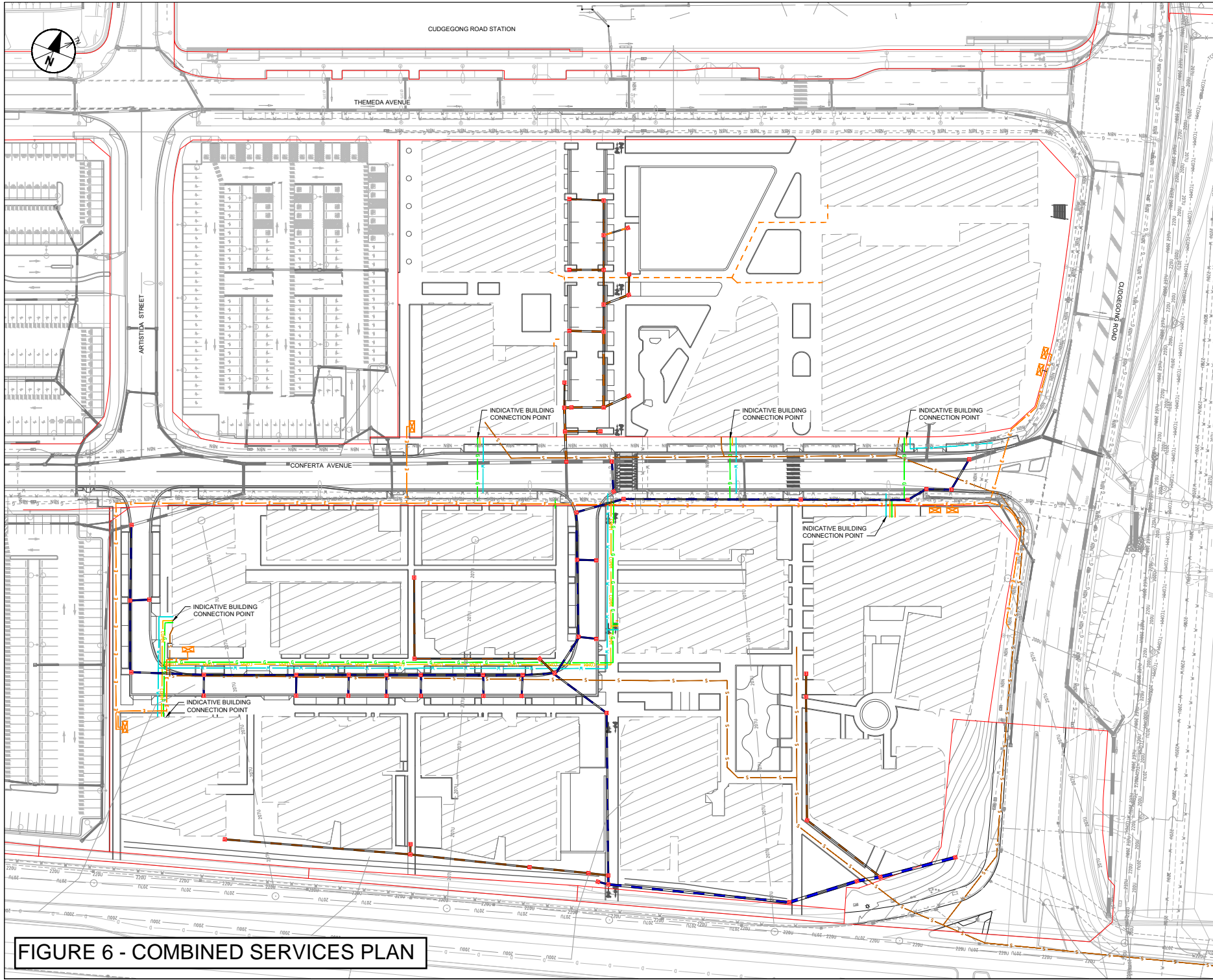


FIGURE 6 - COMBINED SERVICES PLAN

AECOM

PROJECT
**TALLAWONG STATION
PRECINCT SOUTH
CIVIL PACKAGE**

CLIENT



DEICORP PROJECTS
(TALLAWONG STATION) PTY LTD

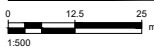
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LEGEND

- PROPOSED BUILDING OUTLINE
- DRAINAGE LINE
- DRAINAGE PITS
- CAP BUILDING CONNECTION POINT AT BOUNDARY
- EXISTING DRAINAGE LINE
- COMMUNICATIONS
- GAS (JEMENA)
- ELECTRICITY (AUSGRID)
- INDICATIVE FIRE WATER LINE
- SEWER (SYDNEY WATER)
- WATER (SYDNEY WATER)
- STREET LIGHTING (CITY OF SYDNEY)
- NEW SUBSTATION
- EXISTING COMMUNICATIONS
- EXISTING GAS
- EXISTING ELECTRICITY
- EXISTING SEWER
- EXISTING WATER
- EXISTING HIGH VOLTAGE

SCALE BAR



PRELIMINARY

PROJECT MANAGEMENT INITIALS

	N.MITCHELL	D.FETTEL
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

ISSUE/REVISION	DATE	DESCRIPTION
3	07.05.2020	ISSUE FOR SUBMISSION
2	16.04.2020	ISSUE FOR SUBMISSION
1	03.04.2020	ISSUE FOR REVIEW

KEY PLAN

PROJECT NUMBER

60618532

SHEET TITLE

COMBINED SERVICES
PLAN
SITE WIDE

SHEET NUMBER

60618532-SHT-00-0000-CI-0500

3.3 Potable Water

Sydney Water supplies potable water to the Tallawong Station Precinct from the prospect supply system as shown below in Figure 7.

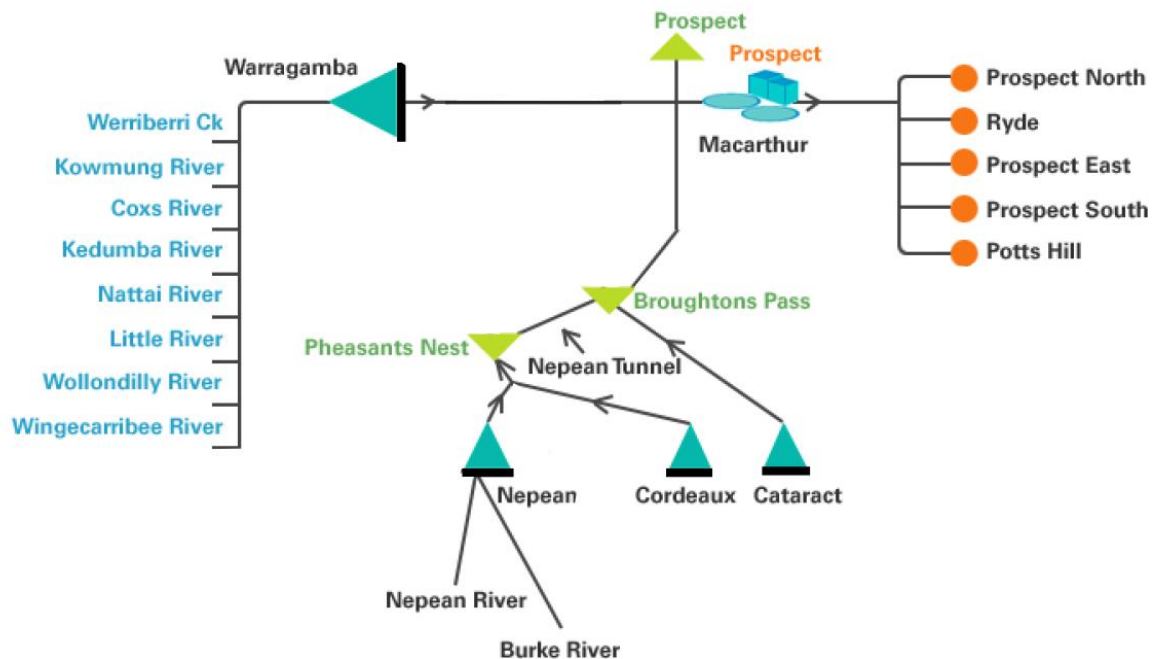


Figure 7 Potable Water Supply (Sydney Water Corporation, 2017)

The Rouse Hill Supply Area is supplied via the Potts Hill Trunk Delivery System and incorporates the Rouse Hill WWTP/WRP, Parklea North Reservoir, Kellyville Reservoir and Parklea Reservoir. There are also three potable water pumping stations within the system:

- Parklea North WP0308;
- Kellyville WP0307; and
- Parklea WP0309.

Existing On-Site Utility Infrastructure

The existing Sydney Water potable water network on the Tallawong Station Precinct South site has been identified based on Dial Before You Dig (DBYD) records. These records indicate the presence of numerous potable water mains within and adjacent to the precinct boundaries.

The existing potable network in the immediate surrounding vicinity consists of the following:

- External DN250 DICL main running along Schofields Road South of the site;
- External DN750 DICL main running along the eastern side of Cudgegong Road;
- External DN250 DICL main running along the western side of Cudgegong Road; and
- External DN450 DICL main running along Tallawong Road west of the site.

The depths and position of the existing reticulation mains are unknown, further investigation is required to determine the exact existing layout. Additionally, while Sydney Water have confirmed that the trunk mains should have sufficient capacity to service the projected demand, smaller reticulation mains may require amplification.

It should be noted that the above discussion only considers Sydney Water infrastructure, it is likely that private or other authority water infrastructure is present on the site (particularly on NRT land).

Potential On-Site Infrastructure Layouts

It is assumed that the proposed development would ultimately be supplied from the existing DN750 DICL or DN250 DICL external main along Cudgegong Road.

The proposed internal water reticulation layout assumes connections to the existing Sydney Water network to be made in two locations. A new potable water main is to extend from Cudgegong Road running westbound underneath Conferta Avenue to supply new buildings within the southern site. Connections will also be made to newly constructed water mains beneath the proposed new public road for buildings adjacent.

It has been assumed that one point of connection is required per lot, these points of connection have been located adjacent to the assumed driveway locations of each building and are proposed to be co-located with other services connections.

The potable water reticulation network will also likely require new hydrants within the streets however these will be confirmed during detailed design. It is noted that Sydney Water will generally not provide a lot connection until an application is made by that developer for a service and Sub-division of lots is required prior to submitting applications to Sydney Water.

The proposed potable water infrastructure may be influenced by staging of the development and requirements for connection to individual lots.

Coordination of Potable Water Infrastructure with Other Services

Coordination of the proposed potable water infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards.

Section 5.12.5.2 of the Water Services Association of Australia codes (WSA 03-2011-3.1, Sydney Water Edition – 2012) states that the clearance requirements for water mains from other service utility assets shall not be less than the minimum vertical and horizontal clearances as summarised in Figure 8.

Utility (Existing or proposed service)	Minimum horizontal clearance		Minimum vertical clearance ¹ mm
	mm		
	New main size		
	≤DN 200	>DN 200	
Water mains ² >DN 375	600	600	300
Water mains ≤DN 375	300 ³	600	150
Gas mains	300 ³	600	150
Telecommunication conduits and cables	300 ³	600	150
Electricity conduits and cables	500	1000	225 ⁷
Stormwater drains	300 ³	600	150 ⁴
Sewers – gravity	1000 ⁵ /600	1000 ⁵ /600	500 ⁴
Sewers – pressure and vacuum	600	600	300
Kerbs	150	600 ⁶	150 (where possible)
NOTES – see over			

NOTES:

- Vertical clearances apply where water mains cross one another and other utility services, except in the case of sewers where a vertical separation shall always be maintained, even when the main and sewer are parallel. *The main should always be located above the sewer to minimise the possibility of backflow contamination in the event of a main break.*
- Water mains includes mains supplying drinking water and non-drinking water.
- Clearances can be further reduced to 150 mm for distances up to 2 m where mains are to be laid past installations such as concrete bases for poles, pits and small structures, providing the structure will not be destabilised in the process. The clearance from timber poles should be at least 200 mm and preferably 300 mm..
- Water mains should always cross over sewers and stormwater drains. For cases where there is no alternative and the main must cross under the sewer, the design shall nominate an appropriate trenchless construction technique in accordance with Clause 5.5 or other water main construction and protection treatment, effectively joint-free in the vicinity of the sewer. Refer to Standard Drawings WAT-1211-V and WAT-1255-S.
- Where a parallel sewer is at the minimum vertical clearance lower than the water main (500 mm), maintain a minimum horizontal clearance of 1000 mm. *This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.*
- Clearance from kerbs shall be measured from the nearest point of the kerb. *For water mains ≤DN 375 clearances from kerbs can be progressively reduced until the minimum of 150 mm is reached for mains ≤DN 200.*
- An additional clearance from high voltage electrical installations should be maintained above the conduits or cables to allow for a protective barrier and marking to be provided.

Figure 8 Potable Water Clearances (WSA 03-2011-3.1, Sydney Water Edition – 2012)

3.4 Wastewater

Sydney Water currently services the Tallawong Station Precinct South site precinct through the Rouse Hill Water Recycling Plant. The facility is Australia's largest residential recycling scheme which treats wastewater to tertiary standards which then recycles back to customers for non-drinking purposes. It has a capacity of 20ML/day and services approximately 32,000 properties. Flow is transferred to treatment plants via a series of sewer pumping stations and any excess recycled water is released into wetlands in Second Ponds Creek.

AECOM's *Services and Infrastructure Strategic Investigation* (2014) for NWRL identified that the overall Tallawong Station Precinct (Area 20) is located within two wastewater catchments, with the adjacent Riverstone catchment requiring major amplifications to the trunk system. For the Rouse Hill catchment specifically, the need for system amplification is still under assessment for the period after 2016.

The sewer catchments for the development are shown below in Figure 9.

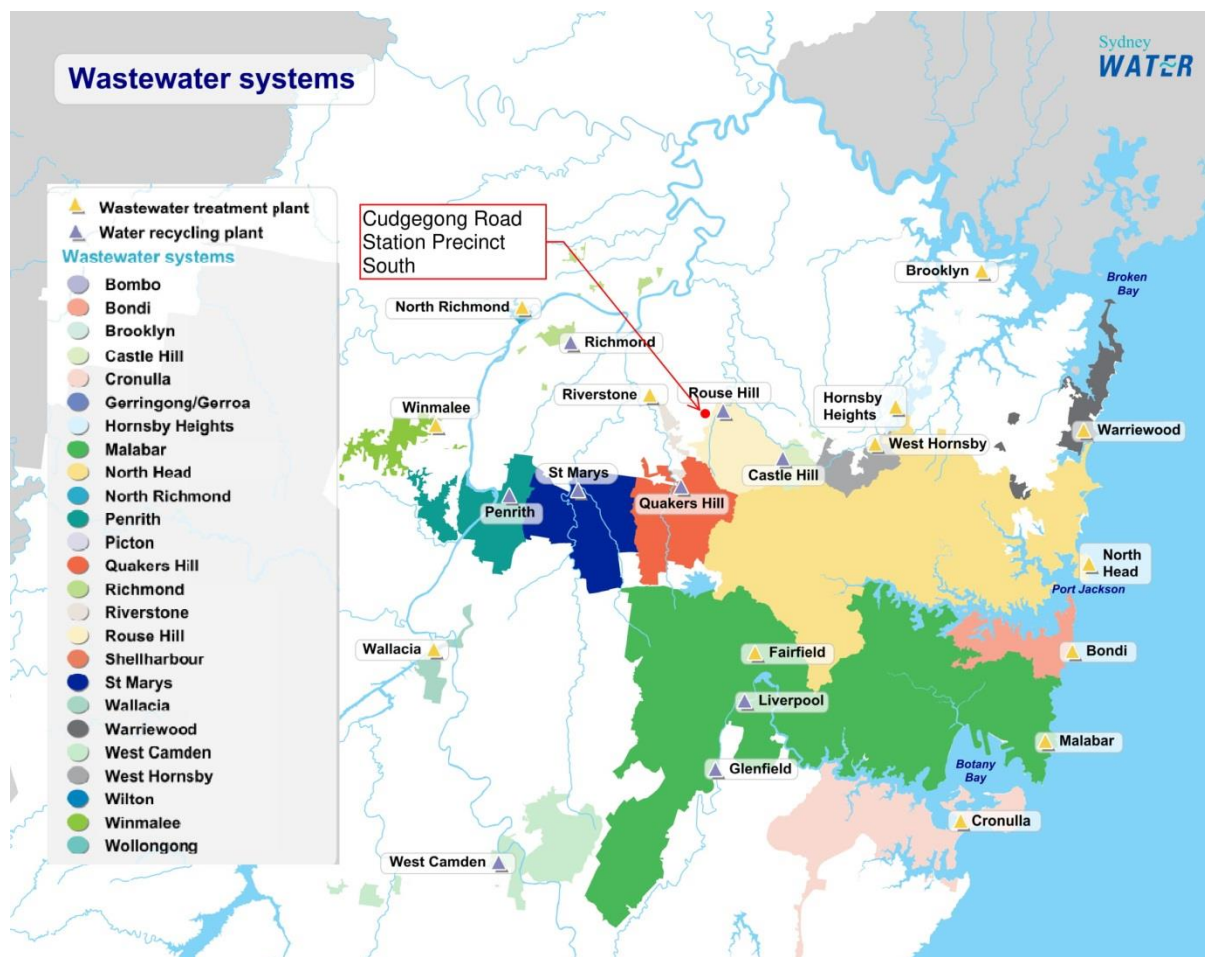


Figure 9 Sydney Water Wastewater Systems

Existing On-Site Utility Infrastructure

The existing Sydney Water wastewater network has been identified based on Dial Before You Dig (DBYD) records.

The Tallawong Station Precinct is located within the Rouse Hill wastewater system, with wastewater being treated at the Rouse Hill Recycling plant and transferred via a series of sewer pumping stations. Rouse Hill Recycling plant is located on Mile End Road, Rouse Hill approximately 3km from the site.

The existing wastewater network within the vicinity of the development primarily consists of the following:

- DN600 GRP pipe running through property east of the Precinct.

While this assessment only considers Sydney Water infrastructure, it should be noted that there may be existing wastewater lines adjacent to the site that have not been dedicated to Sydney Water.

Potential On-Site Infrastructure Layouts

The scope of external infrastructure upgrades are to be confirmed based on hydraulic modelling to be undertaken during detailed design. In advance of this detail, it is assumed that the proposed internal gravity reticulation network splits the site into two sub-catchments to generally complement the staging of the proposed development

- New DN300 main at 1% grade connecting the site to existing external DN600 GRP main parallel to Second Ponds Creek.

The proposed upgrades and building wastewater connection points are shown in the combined services plan. Each lot is required to be serviced with a single sewer connection with detailed requirements nominated in the Sydney Water Notice of Requirements. Sub-division of lots is required prior to submitting applications to Sydney Water.

Coordination of Wastewater Infrastructure with Other Services

Coordination of the proposed wastewater infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards.

Section 4.4.5.2 of Water Services Association of Australia codes (WSA 02-2002-2.2, Sydney Water Edition – Version 3) states the clearance requirements for sewers in Table 4.2, as summarised below in Figure 10.

Utility (Existing service)	Minimum horizontal clearance mm		Minimum vertical clearance ¹ mm
	New sewer size		
	≤DN 300	>DN 300	
Sewers ≤DN 300	300	600	150 ² /300
Sewers >DN 300	600	600	300
Gas mains	300 ³	600	150 ² /300
Telecommunication conduits and cables	300 ³	600	150 ² /300
Electricity conduits and cables	500	1000	225 ² /300
Drains ⁷	300 ³	600	150 ² and ⁴ /300 ⁴
Water mains	1000 ⁵ /600	1000 ⁵ /600	500 ⁴
Kerbs	150	600 ⁶	150 (where practicable)

NOTES:

- 1 Vertical clearances apply when sewers cross one another, except in the case of water mains when a vertical separation shall always be maintained, even when the sewer and main are parallel. *The sewer should always be located below the main to minimise the possibility of backflow contamination in the event of a main break.*
- 2 A minimum vertical clearance of 300 mm applies if the size of either the existing service or proposed sewer is >DN 300.
- 3 *Clearances can be further reduced to 150 mm for distances up to 2 m when passing installations such as poles, pits and small structures, providing the structure is not destabilised in the process.*
- 4 *Sewers should always cross under water mains and stormwater drains.* If this requirement cannot be met, consult Sydney Water in respect of alternatives such as adjusting the water main or stormwater drain. Where a sewer crosses a water main at or close to 90 degrees, the vertical clearance may be reduced to not less than 200 mm provided that the sewer is concrete encased and a 50 mm compressible material is placed over the encasement. The encasement shall not have any joints within 1000 mm either side of the water main and shall conform to Drawing SEW-1205-V.
- 5 When the sewer is at the minimum vertical clearance below the water main (500 mm) maintain a minimum horizontal clearance of 1000 mm. *This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance increases to 750 mm.*
- 6 Clearance from kerbs shall be measured from the nearest point of the kerb.
- 7 A sewer to be constructed under an existing or proposed stormwater pipe or channel \geq DN 375 shall be concrete encased. The concrete encasement shall extend at least one metre each side of the stormwater pipe or channel. Clearances between the sewer and other services shall be measured from the outer surface of the concrete encasement.

Figure 10 Sewer Clearances WSA 02-2002-2.2, Sydney Water Edition – V3)

3.5 Electrical

Endeavour energy is the main supplier of the study area as shown below in Figure 11.



Figure 11 Endeavour Energy Supply Network

Projections indicate that there will be a substantial increase in electrical demand from the Tallawong Station Precinct South. At this time, it is expected that there will be sufficient capacity within the local zone substation to supply the proposed demand for the site. However further consultation with Endeavour Energy is required during the time of application for connection given concurrent development activities may utilise some of the existing capacity.

AECOM's *Services and Infrastructure Strategic Investigation* (2014) for NWRL identified that within the overall Tallawong Station Precinct, while there is capacity to service initial development, major additional subtransmission capacity (zone substation or subtransmission lines) will be required to service ultimate development. The delivery of new transmission lines and new zone substations can take between 3 to 5 years of planning respectively.

The precinct is predominantly serviced via 22kV reticulation feeders from the Mungerie Park Zone Substation located 2km east of the site along Commercial Road.

Detailed lead-in infrastructure upgrades will need to be confirmed with Endeavour Energy as part of formal applications made as a part of detailed design. In addition, street lighting supply may comprise a separate Blacktown City Council network (with the supply taken from the local Endeavour Energy (LV) network). This will need to be confirmed with Blacktown City Council through detailed design, however if this is the case, a separate Blacktown City Council infrastructure study will also be required.

Existing On-Site Utility Infrastructure

The existing Endeavour Energy electrical infrastructure on the site has been identified based on Dial Before You Dig (DBYD) records.

There are existing underground electrical assets adjacent to the site boundary. These include electrical conduits running underneath Schofields Road and Cudgegong Road and while additional underground cables have been proposed to run along Tallawong Road.

The existing and proposed Endeavour Energy infrastructure are outlined below, it is noted that this section only considers Endeavour Energy infrastructure and does not include private electrical infrastructure which may be present within the site.

Potential On-Site Infrastructure Layouts

As noted previously the scope of external infrastructure upgrades and lead-in works will be confirmed when formal Endeavour Energy applications are made as part of detailed design.

Upgrades to the existing Endeavour Energy underground electrical network are proposed to service each lot. The proposed potential electrical layout consists of a single connection point to the existing service on Stores Street.

It has been assumed that internal road layouts will be dedicated to Blacktown City Council and that easements will not be required where the electrical assets pass through public land or roads.

As noted previously, ownership of the street lighting will need to be confirmed as part of detailed design. If Endeavour Energy assets within the precinct are to be fed by the local Endeavour Energy LV network it may require the proposed network to be expanded to ensure that all road network are covered.

Coordination of Electrical Infrastructure with Other Services

Coordination of the proposed electrical infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards.

Endeavour Energy's specification "MDI 0028 – Underground distribution network design" does not provide specific information on clearances from other services. If the electrical services are installed within the standard allocation, the separations given by the other services provider should apply for all crossings. Where a reduced allocation is proposed, separations should be determined in consultation with Endeavour Energy.

3.6 Gas

Gas servicing to the Tallawong Station Precinct South is provided by Jemena. Projections indicate that there will be an increase in the gas demand for the Tallawong Station development site. Whilst there is a substantial distribution network in the area, it is predominately comprised of small connections providing supply at a low pressure.

Jemena have not confirmed whether the existing infrastructure within the Tallawong Station Precinct has sufficient capacity. Confirmation of capacity and potential required upgrades will be received when formal connection applications are received.

Existing On-Site Utility Infrastructure

Existing Jemena gas infrastructure on site have been identified using Dial Before You Dig (DBYD) records. These records indicate the presence of a number of existing gas mains surrounding the proposed development site. These primarily consist of:

- External DN110 PE main underneath Schofields Road;
- External DN110 PE main underneath Cudgegong Road; and
- External DN50 NY main underneath Tallawong Road.

Plans of newly laid internal mains have also been provided by NRT. These include:

- DN50 NY main underneath Themeda Avenue;
- DN50 NY main underneath NRT Arstida Street; and
- DN50 NY main underneath Conferta Avenue.

The exact depths and positions of the existing reticulation mains have not been confirmed and further investigations will likely be required to determine the extent of diversions required.

Potential On-Site Infrastructure Layouts

New internal gas connections will be made between the proposed buildings and existing gas infrastructure. Their connection location will be designed to be adjacent to the assumed building driveways.

The natural gas infrastructure is to be installed by Jemena within a trench prepared as part of infrastructure facilitation works.

Coordination of Gas Infrastructure with Other Services

Coordination of the proposed gas infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards.

Jemena provide guidance on horizontal and vertical clearances, the minimum separations between electrical and natural gas mains are provided in Table 1.0 of "Natural Gas Requirements for Developer Provided Trench" as summarised in Table 6.

Table 6 Jemena Minimum Separation Between Utilities

Utility	Minimum Separation	
	Gas Mains up to 75mm diameter	Gas Mains of 110mm diameter or larger
Telecommunication cables and/or conduits	150 mm	300 mm
Protected ² Low Voltage electricity cables	150 mm	300 mm
Protected ² High Voltage electricity cables	300 mm	300 mm

1. Separations relate to distances between conduits/cables peripheries
2. "Protected" refers to mechanical protection of the cables, which usually takes the form of either polymeric strips (at least 3 mm thick) or clay brick
3. The above table is considered to provide desirable minimum separations. Consideration should be given for the need to access for future maintenance of services when determining the required separations

3.7 Telecommunications

A number of communication providers have assets around the Tallawong Station Precinct South. However, the only providers which have assets that border or intersect with the site are:

- Telstra;
- Ucomm; and
- NBN Co.

The exact provider of telecommunications services will be confirmed later in the development process however opportunities to connect to the National Broadband Network (NBN) have been assessed within this report.

Figure 12 below illustrates the current extents of the NBN rollout with reference to the investigation site area.

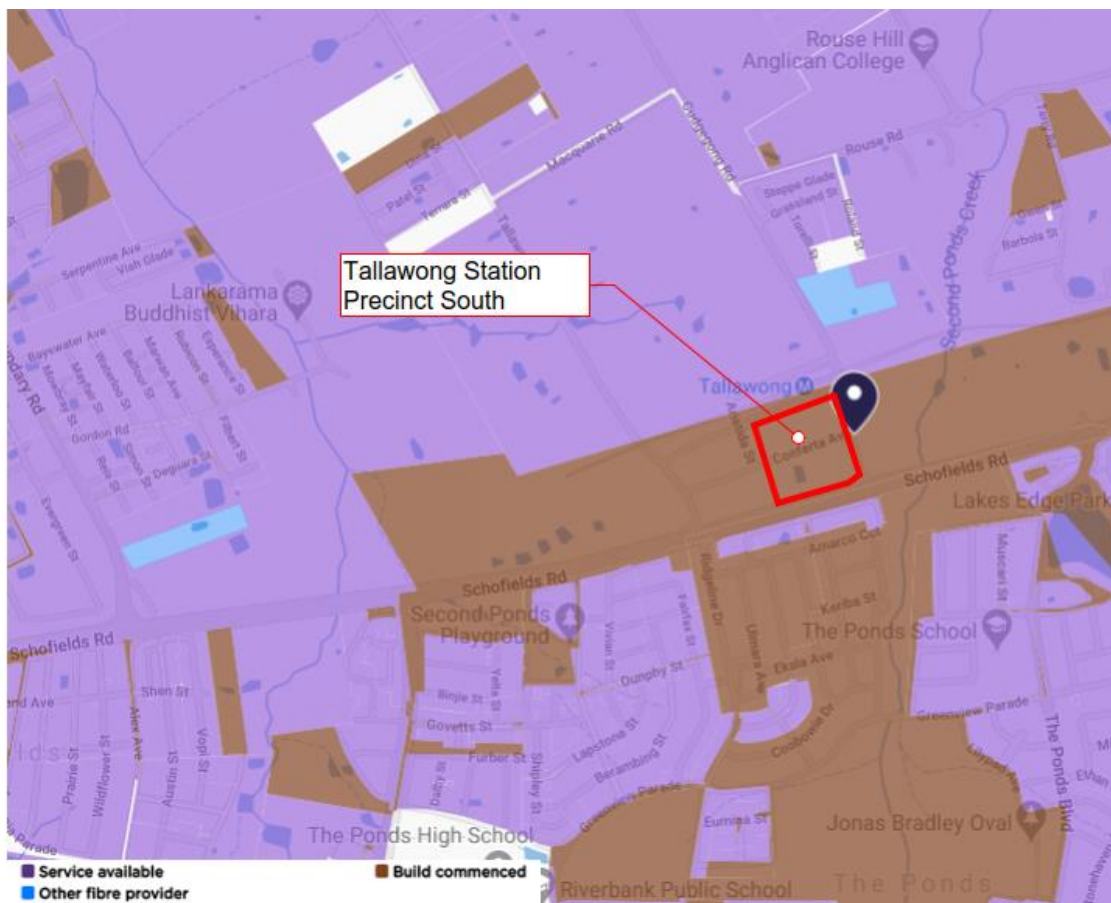


Figure 12 NBN Rollout (NBN Co. 2017)

Existing On-Site Utility Infrastructure

Telstra

Underground Telstra services have been identified underneath the streets surrounding the Tallawong Station Precinct South boundaries, namely underneath Tallawong, Schofields and Cudgong Roads. These are assumed to be servicing existing properties and buildings within the site. It has been assumed at this stage that the existing Telstra services are to be retained in order to continue servicing the site's existing buildings, and to provide connection points for the new reticulation required to service the proposed buildings within the Precinct. This will need to be confirmed as part of the detailed design.

Optus/Uecomm

DBYD records have identified a series of Optus pits and underground cables located along Cudgegong Road only. No existing connections to the proposed development site have been shown.

NBN Co.

DBYD records have identified NBN Co. assets being present within the project precinct and are in the process of being rolled out. NRT plans show NBN cables located underneath Themeda Avenue, Conferta Avenue and NRT Implexa Parade fed through Cudgegong and Tallawong Roads.

Coordination of Telecommunications Infrastructure with Other Services

Coordination of the proposed communications infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards.

The clearances for NBN services from other utilities is given in Section 5.2.13 of “New Development: Deployment of the NBN Co Conduit and Pit Network – Guidelines for Developers”, these requirements are presented in Figure 13.

Service Item		Minimum Radial Clearances* ¹
Gas Pipe	Over 110 mm	300 mm
	110 mm or Less	150 mm
Power	High Voltage	300 mm
	Low Voltage	100 mm* ²
Water Mains	High Pressure/Capacity	300 mm
	Local Reticulation	150 mm
Sewer	Main	300 mm
	Connection Pipe	150 mm
Other Telecommunications		100 mm* ¹
* 1 – Reduced separation is possible where all parties (including NBN Co) are consulted and agreement is reached. * 2 – Only where protection barriers are used, for example, conduit, bedding, marker tape and cover batten.		

Figure 13 NBN Clearances from Other Carriers and Underground Services

4.0 Stormwater Quantity

4.1 Existing Site Conditions

The Tallawong Station Precinct South site is located within the Blacktown City Council Local Government Area (LGA) and is approximately 2km west of Rouse Hill Town Centre and 45km northwest of the Sydney CBD.

The Precinct site is approximately 7.8ha in size, is bounded by Tallawong Road to the West, Cudgegong Road to the East, Schofields Road to the South and Tallawong Metro Station to the north. The current site can be characterised as having semi-rural lots to the north and low density residential to the south. The site context is shown in Figure 14 below.



Figure 14 Site Context

The development site is located adjacent Schofields Road and 90m west of the Second Ponds Creek channel. Both waterways drain into the Hawksbury River catchment which is located to the north.

4.2 Stormwater Management Strategy

The Tallawong Station Precinct South is within the area covered by the Rouse Hill Trunk Drainage Strategy, developed by GHD on behalf of the Rouse Hill Infrastructure Consortium during the late 1990's. Sydney Water is the authority for management of the trunk drainage infrastructure incorporated within the strategy.

Stormwater quantity management for the precinct is addressed through the provision of regional detention basins, located external to the site. As such, stormwater quantity management, relating to detention basins, does not require further consideration as part of this stormwater strategy.

In accordance with the previous approvals, streets within the development were constructed as part of the Sydney Metro Northwest works will be dedicated to Blacktown City Council.

4.3 Design Standard and Approach

The following sections detail the criteria and standards that have been used to guide the development of the stormwater quality and quantity management strategy.

Note that 'pre-development' refers to conditions prior to works undertaken by Northwest Rapid Transit on the precinct.

4.3.1 Area 20 Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design (2010, JWP)

The following approach, defined in the Area 20 Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design (2010, JWP) has been adopted in developing a water and stormwater management strategy for the site:

- The strategy should include water reuse and maximise potable water conservation;
- Stormwater management should be based on the objectives and principles of WSUD;
- Existing waterways and riparian zones should be conserved and enhanced where possible;
- Stormwater management strategies must consider and addresses potential salinity hazards;
- Stormwater management strategies should maximise efficient use of land and facilitate adequate allocation of land for stormwater management purposes;
- A treatment train approach should be used, incorporating structural stormwater treatment measures at the primary, secondary and tertiary levels as necessary to comply with the stormwater management targets;
- The design of stormwater management systems should be integrated with the planning of road layout and design, given the potential benefits of incorporating suitable WSUD elements into road corridors;
- Stormwater reuse, retention and detention strategies should be used to minimise changes to the hydrological (or flow) regime of receiving waterways;
- Management of stormwater should be considered on a sub catchment basis to employ source control techniques in preference to highly centralised 'end-of-pipe' treatment measures wherever practicable;
- Trunk drainage routes and dual carriageways should be aligned where possible, to allow use of centre medians for WSUD drainage systems; and
- WSUD drainage systems may be incorporated into other roads and streets, where practicable and compatible with other design issues, including safety requirements of the relevant Road Authority.

4.3.2 Blacktown City Council (BCC) Development Control Plan

The Blacktown City Council (BCC) Development Control Plan 2016 requires the proposed development to implement stormwater quantity controls to achieve the following:

- Manage the flow of stormwater from urban parts of the Precinct to replicate, as closely as possible pre-development flows;
- Define the flood constraints and standards applicable to urban development in the Precinct;
- Minimise the potential of flooding impacts on development;
- No residential allotments are to be located at a level lower than the 1% AEP flood level plus freeboard of 500mm;
- Pedestrian and cycle pathways and open space may extend within the 100-year ARI flood level, provided the safe access criteria contained in the NSW Floodplain Manual are met;
- Stormwater is to be managed primarily through the street network in accordance with Council's DCP;

- Roads on primary drainage lines shown on the Key elements of the water cycle management and ecology strategy figure, in the relevant Precinct Schedule, are to be constructed in the locations shown, and are to be designed in accordance with specifications of Council in relation to management of stormwater flows and quality;
- Roads are generally to be located above the 1% AEP level;
- Management of 'minor' flows using piped systems for the 20-year ARI (residential land use) and 10-year ARI (commercial land use) shall be in accordance with Blacktown Council's Engineering Guidelines for Subdivision and Development. Management measures shall be designed to:
 - prevent damage by stormwater to the built and natural environment;
 - reduce nuisance flows to a level which is acceptable to the community;
 - provide a stormwater system which can be economically maintained, and which uses open space in a compatible manner;
 - control flooding;
 - minimise urban water run-off pollutants to watercourses, and
 - meet the standards for a 100-year ARI flood level.
- Management of 'major' flows using dedicated overland flow paths such as open space areas, roads and riparian corridors for all flows in excess of the pipe drainage system capacity and above the 20-year ARI shall be in accordance with Blacktown Council's Engineering Guidelines for Subdivision and Development. Management measures shall be designed to:
 - prevent both short term and long-term inundation of habitable dwellings;
 - manage flooding to create lots above the designated flood level with flood free access to a public road located above the 100-year ARI flood level;
 - control flooding and enable access to lots, stabilise the landform and control erosion;
 - provide for the orderly and safe evacuation of people away from rising floodwaters;
 - stabilise the landform and control erosion; and
 - meet the standards for a 100-year ARI flood level.
- The trunk stormwater system is to be constructed and maintained by Council in accordance with the Riparian and Water Cycle Management Strategy, and to achieve water quality targets set by the Department of Environment, Climate Change and Water (DECCW); and
- Where development on land affected by local runoff or local overland flooding – major drainage is proposed, it must be designed in accordance with Council's *Engineering Guide for Development*.

4.3.3 Blacktown City Council (BCC) Design Standards

The BCC *Works Specification Civil and Engineering Guide for Development* provide detailed requirements addressing stormwater drainage and erosion and sediment control. BCC has also developed a design criteria memo for design of Council stormwater assets which has been referenced.

Design Standards

BCC design standards have generally been adopted for the Tallawong Station Precinct South development, as the stormwater infrastructure that is to be delivered external to the buildings will ultimately be dedicated to council. A summary of each of the standards, codes and other additional design documents used in the design of stormwater infrastructure for the development are presented in Table 7 below:

Table 7 Stormwater Drainage reference documents and standards

Reference Number	Title
SEPP 2006	State Environmental Planning Policy (Sydney Region Growth Centres) 2006. Growth Centres Development Code 2006
DCP	Blacktown City Council Growth Centre Precincts Development Control Plan, DPE 2016.
DCP Part J	Blacktown City Council Development Control Plan 2015 including Part J and associated handbooks and guidelines.
EGFD	Blacktown City Council Engineering Guide for Development.
RMS R11	RMS Specification R11.
Works Specification Civil	Blacktown City Council Works Specification Civil, 2005
NSW FDM	New South Wales Floodplain Development Manual
-	Precinct Planning Watercycle Management Strategy reports.
-	Dams Safety Act 1978 and Dams Safety Committee Policies and Guidelines.
CPA	Concrete Pipe Association's "Concrete Pipe Selection and Installation" Guide
AR&R Vol 1	Australian Rainfall and Runoff "A Guide to Flood Estimation" Volume 1, 1987.
AR&R Vol 2	Australian Rainfall and Runoff "A Guide to Flood Estimation" Volume 2, 1987.
AR&R – Project 10	Australian Rainfall and Runoff – Revision Projects "Appropriate Safety Criteria for People"
AR&R – Project 11	Australian Rainfall and Runoff – Revision projects "Blockage of Hydraulic Structures"
AS 3500.3	Australian Standard AS3500.3: Plumbing and Drainage Code – Stormwater Drainage (2003)
AS 3725	Australian Standards AS3725: Design for Installing of Buried Concrete Pipes
Section 79C	Environmental Planning and Assessment Act 1979

4.3.4 Design Criteria

Based on the planning commitments and the requirements of the various design standards, the stormwater drainage design criteria adopted for the development are summarised below in Table 8.

Table 8 Stormwater Drainage Design Criteria

Item	Standard	Adopted	Comment
Hydrology			
Hydrological Model	BCC Engineering Guide for Development, 2005	DRAINS model	Using the Time Area method – ILSAX
Time of concentration	BCC Engineering Guide for Development, 2005	Paved: 5 minutes Grassed: 6 minutes	Kinematic Wave Equation.
Minor Design Storm	BCC Engineering Guide for Development, 2005	20-year Average Recurrence Interval (5% AEP)	Commercial area with overflow to bypass to public road
Major Design Storm	BCC Engineering Guide for Development, 2005	100-year ARI (1% AEP)	Applied to calculating flood safety criteria in streets
Design Rainfall	BCC Engineering Guide for Development, 2005	As per table or BOM values	AR&R 1987 values have been adopted
Rural Rainfall Losses		Pervious IL = 15mm Pervious CL = 2.5mm/h Imperv. IL = 1.5 mm Imperv. CL = 0 mm/h	Applied in flood modelling
Urban Rainfall Losses		Pervious IL = 5mm Pervious CL = 2.5mm/h Imperv. IL = 1.0 mm Imperv. CL = 0.0 mm/h	Applied in flood modelling
Hydraulics			
Pipe size	BCC Engineering Guide for Development, 2005	Min. 150mm diameter Min. 375mm diameter	150mm pipe diameter is the absolute minimum for pipes located in private property. 375mm pipe diameter is the minimum for pipes owned by Blacktown City Council.
Retardance Coefficient	BCC Engineering Guide for Development, 2005	Road/Paved Areas Only = 0.01 Medium Density Residential = 0.06 Parkland = 0.15 Open Space (Natural Bushland) = 0.3	
Pit spacing	BCC Engineering Guide for Development, 2005	Max. 80m	Maximum spacing increases with increasing pipe sizes
Pit losses	BCC Engineering Guide for Development, 2005	Missouri Charts, (Sangster et al, 1958)	
Pit blockage factors	BCC Engineering Guide for Development, 2005	Minor system (5% AEP): Sag Pit = 0 On Grade Pit = 0 Major system (1% AEP): Sag Pit = 0.5 On Grade Pit = 0.2	Applied to proposed infrastructure

Item	Standard	Adopted	Comment
Pit blockage factors for overland flow calculations	BCC design memo	Small pipes - 30% Large pipes – 50%	Applied when calculating floor levels or overland flow path capacity
Flood and Overland Flow			
Appropriate Safety Criteria for People	AR&R – Project 10	Max. Depth x Velocity = $0.4\text{m}^2\text{s}^{-1}$	
Stormwater Quality Targets			
Pollution reductions targets	Blacktown City Council Growth Centre Precinct Development Control Plan	Gross Pollutants – 90% TSS – 85% TP – 65% TN – 45%	
Stream Erosion Metrics	Growth Centres DCP and BCC DCP	Stream Erosion Index no greater than 3.5	

4.4 Catchment Description

The project site is located within a semi-rural to low-density residential external catchment which drains towards the Second Ponds Creek low point extending from the high point north-west of the site. Stormwater from this external catchment is conveyed via overland flow paths and Blacktown City Council pipe drainage network which are currently present underneath Schofields Road to the south.

4.5 Existing Minor Stormwater Network

An existing stormwater network has been delivered to service Tallawong Station, access roads and car parks. The network consists of pit and pipe drainage networks and informal flow paths controlled by BCC and NRT.

Drainage assets owned by Council have been identified underneath Schofields Road and Cudgegong Road, which generally service the overall site catchment area and outlet towards Second Ponds Creek in the East. This includes an existing biofiltration basin to manage stormwater from Council owned roads.

A new drainage network has been constructed by NRT servicing the rail corridor and carparks located adjacent to the designated Tallawong Station Precinct. Collected stormwater here converges to a DN900mm pipe underneath Conferta Avenue and outlets across Cudgegong Road through the raingarden basin immediately east of the site.

The Roads and Maritime Services (RMS) also currently owns the drainage assets underneath the newly upgraded Schofields Road and parts of Cudgegong Road. The development site's low point in the South East corner of the site is serviced by a series of pits and pipes specifically a Median Gully Pit Quadruple Grate (M.G.Q.G) and two DN825 which grade towards Second Ponds Creek underneath Schofields Road.

4.5.1 Recent Infrastructure Upgrades

NRT has been provided stormwater drainage infrastructure as part of the precinct enabling and augmentation works as agreed in the North West Rail Link OTS Project Deed – Scope and Performance Requirements Appendix 96 – Precinct Utility Services Revision C.

RMS currently owns a network of pits and pipes underneath Schofields and Cudgegong Road which were constructed during the widening Schofields Road completed in June 2014.

4.6 Proposed Stormwater Drainage Strategy

The proposed stormwater drainage system for the Tallawong Station Precinct South will comply with the design requirements identified above.

The stormwater drainage strategy has been split into three different areas:

- Public stormwater drainage;
- Site 1 private stormwater;
- Site 2 private stormwater; and
- An overflow path easement.

Public Stormwater Drainage

- There is no public stormwater proposed for Site 1 as the entirety of this lot is proposed to be private;
- Public stormwater drainage for site 2 is proposed to run through the proposed new streets and features a bifurcation pit which separates early flows into the existing bio-retention basin while later flows are directed to the south of site and ultimately connect to twin DN825mm pipes under Cudgegong Rd.

Site 1 Private Drainage

- Site 1 drainage including the proposed park drainage are to connect to the existing stormwater pipe network in Conferta Avenue which drains to a DN900mm pipe that runs perpendicular underneath Cudgegong road and discharges into a bio swale filter to the east of Cudgegong Rd.

Site 2 Private Drainage

- Site 2 private drainage is split into three areas:
 - The area north of the proposed new public road, this area connects to the new public drainage downstream of the bifurcation pit;
 - The area south of the proposed new public road, this area has new pipework adjacent to the southern swale which connects to the new council drainage within the new shared path; and
 - The area east of the proposed new public road, this area has a new stormwater line that connects into the new council drainage that runs on the southern portion of the site.

Overflow Path Easement:

- There is an existing overflow from the NRT carpark to the west of site 2, this has been incorporated into the design via a vegetated swale with an associated drainage easement.

All of these elements are shown within the Civil Engineering Drawings submitted along with this report and also in Figure 15.

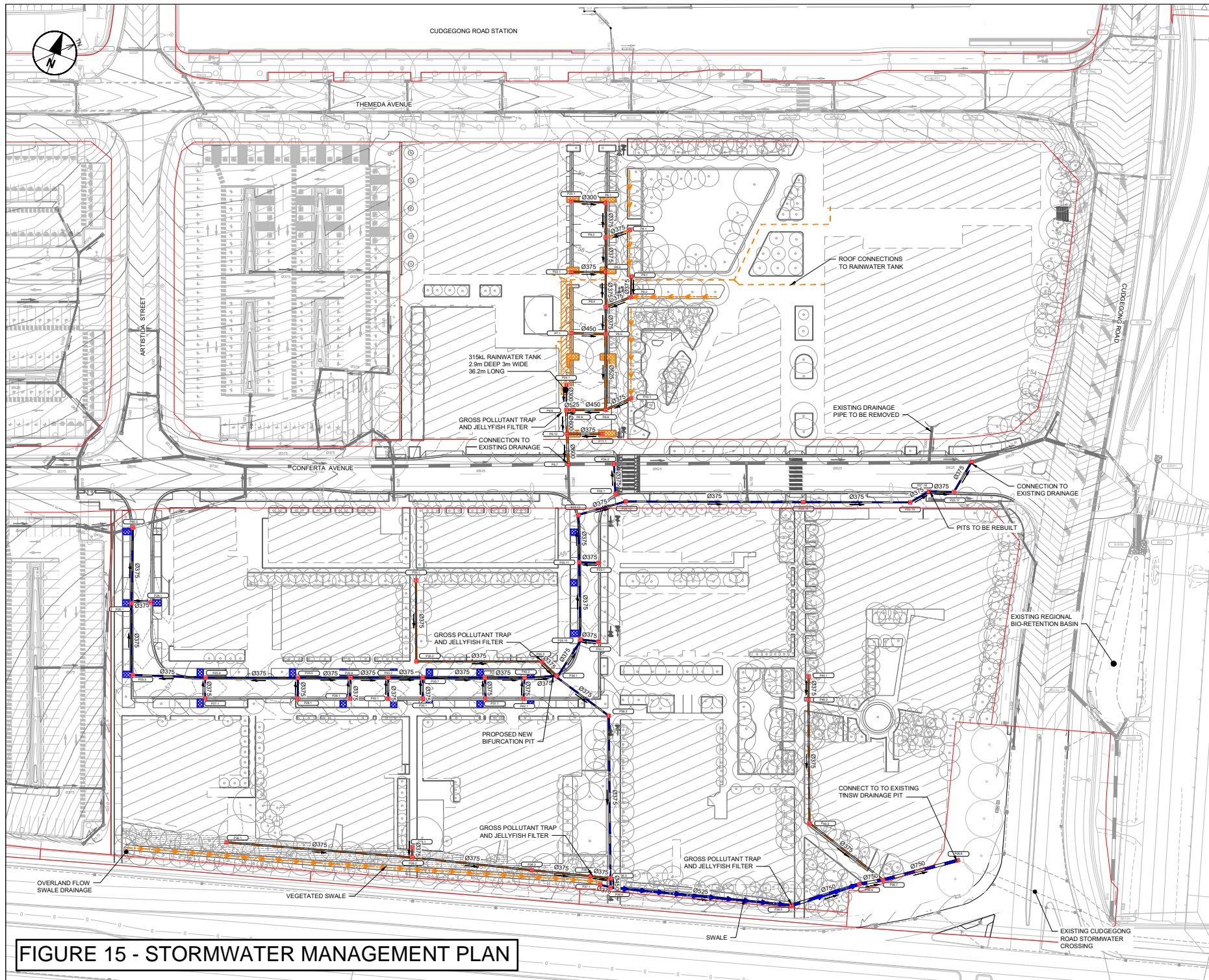
It is noted that the overall stormwater quantity strategy is in line with the previously approved Landcom SSDA package.

4.6.1 Demonstration of Compliance (DRAINS Modelling)

A notional pipe design has been developed using DRAINS hydraulic modelling software. The model demonstrates that the proposed site can be developed and achieve the requirements of BCC's minor and major drainage networks. The proposed network and notional pipe diameters are provided in

Screenshots of the DRAINS model compiled for both minor and major storm events is presented in Figure 16 and Figure 17 below.

ISO A1 594mm x 841mm
Last saved by: REVES/20200305/07 Last Plotter: 2020.05.07
Filename: \\AUSTYD\FP001\PROJECT\561626\60655649\5 CAD\0A-SHEET\60618532-SHT-00-0000-CI-0300.DWG



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PROJECT
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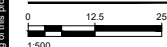
CONSULTANT

AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com

LEGEND

- 66-5 MAJOR COUNTOURS
- 0525 DRAINAGE SIZE AND FLOW DIRECTION
- 0525 DRAINAGE PIT TAG
- PUBLIC DRAINAGE
- PRIVATE DRAINAGE
- PUBLIC SWALE
- PRIVATE SWALE
- DRAINAGE PITS (REFER DRAINAGE DRAWINGS FOR DETAILS)
- EXISTING DRAINAGE LINE
- EXISTING RMS DRAINAGE

SCALE BAR



PRELIMINARY

PROJECT MANAGEMENT INITIALS

A.TOH	N.MITCHELL	D.FETTELL
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

NO	DATE	DESCRIPTION
4	07.05.2020	ISSUE FOR SUBMISSION
2	16.04.2020	ISSUE FOR SUBMISSION
1	03.04.2020	ISSUE FOR REVIEW

KEY PLAN

PROJECT NUMBER

60618532

SHEET TITLE

DRAINAGE
PLAN
SITE WIDE

SHEET NUMBER

60618532-SHT-00-0000-CI-0300

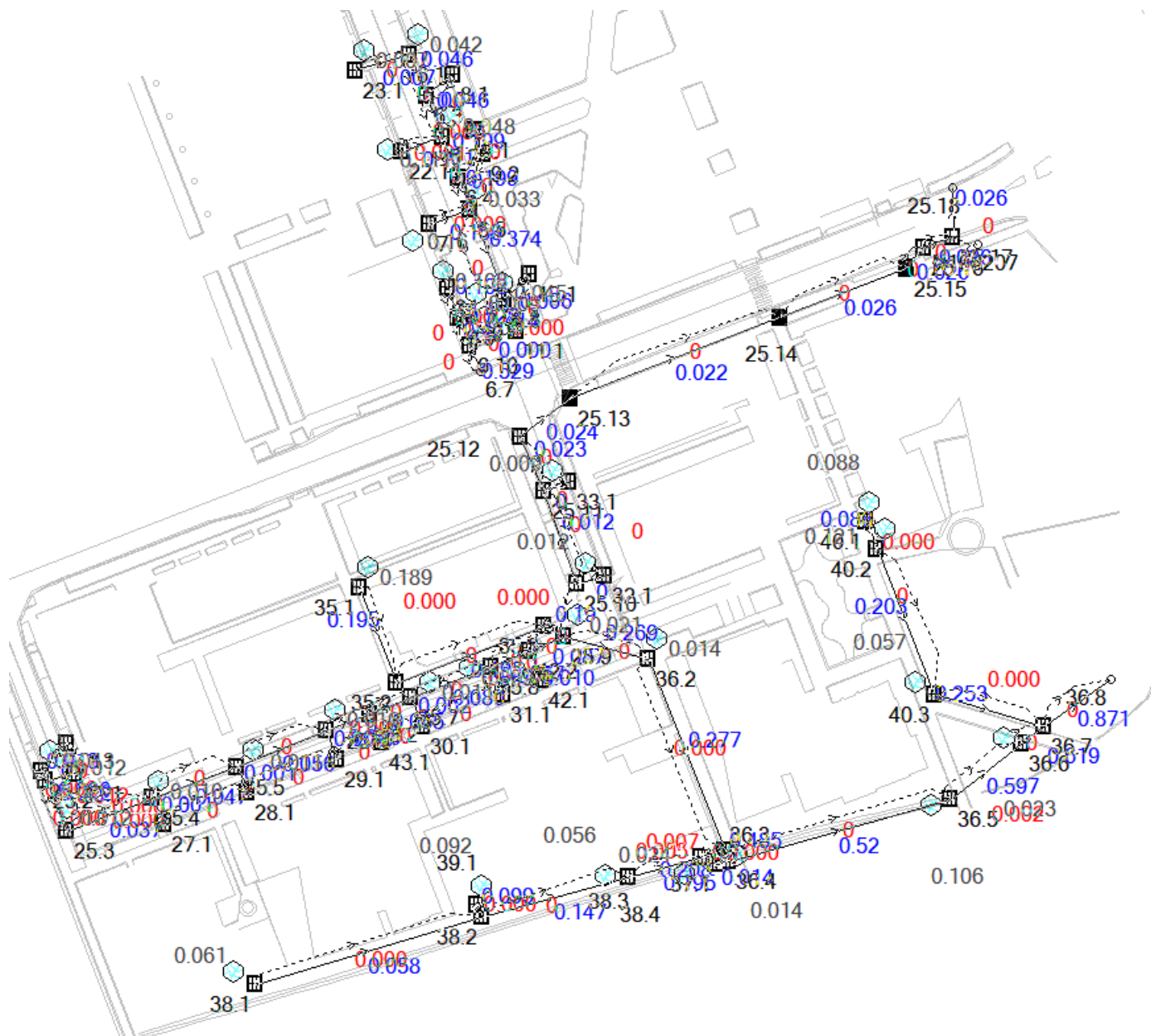


Figure 16 Minor Storm Flow

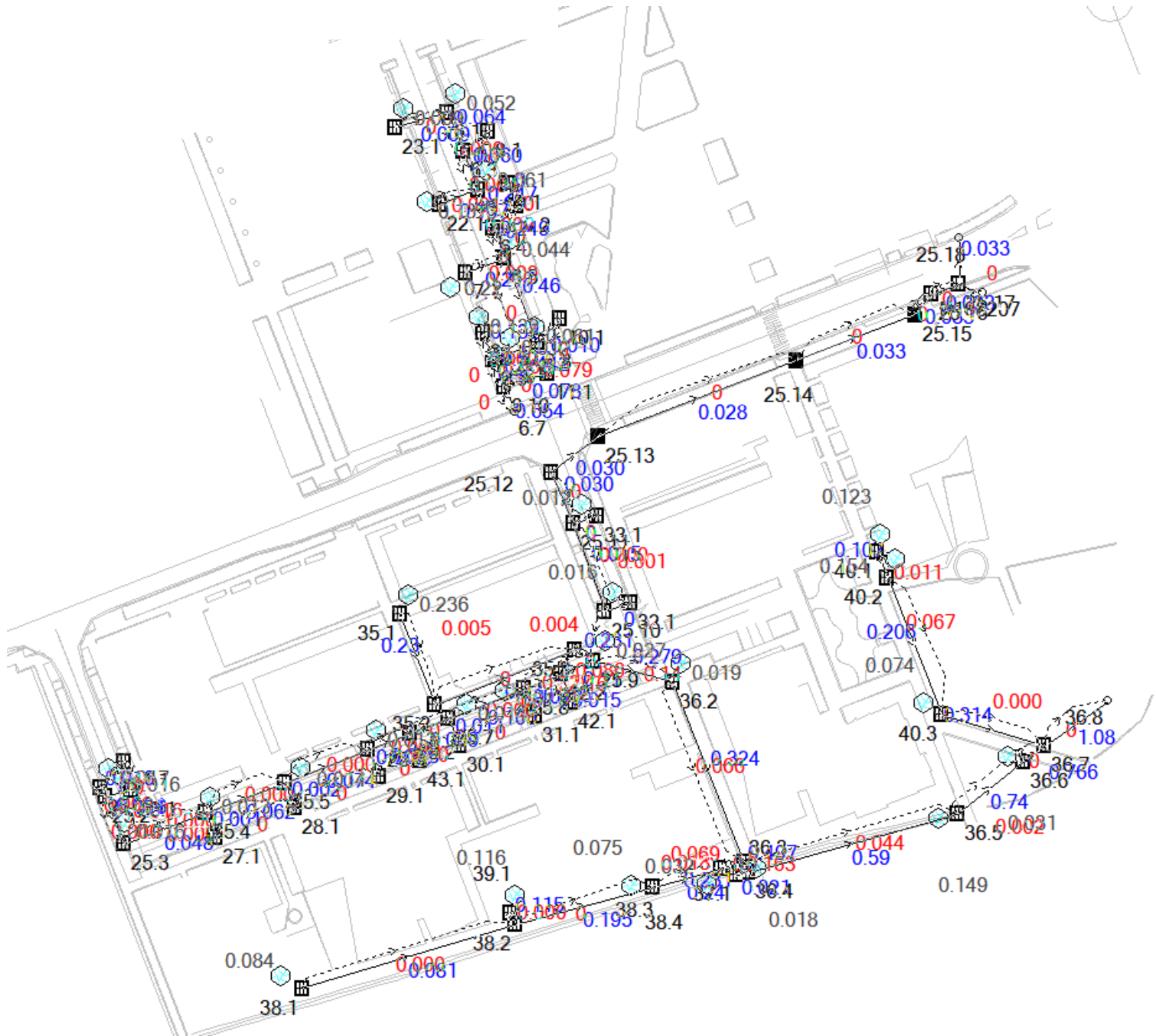


Figure 17 Major Storm Flow

5.0 Stormwater Quality

The stormwater quality management approach incorporates Water Sensitive Urban Design (WSUD) principles and treatment train to ensure water quality targets prescribed in the Area 20 DCP. The water quality targets are measured as 'mean annual pollutant load' discharged from a development site and the minimum percentage reductions are specified in Table 8 above.

It is intended that individual development lots will meet water quality requirements through at-source controls on the lot as documented in this section. A rainwater tank is proposed to capture runoff from the building rooves north of Conferta Avenue and provide water for irrigation throughout the precinct.

Stormwater quality management for runoff from Council roads and public open space is to be provided via the existing regional stormwater management basin which is located on the eastern side of the Cudgegong Road. It is proposed that some stormwater quality management is also provided via biofiltration street trees in new streets located within Site 1 and Site 2.

5.1 WSUD Implementation

WSUD measures including on lot filtration, gross pollutant traps, passive irrigation and bioretention have been considered for the development as well as a large rainwater tank in Site 1.

General layouts have been adopted for the current design, and further details including subsoil drainage and exact infrastructure layouts will be further developed in detailed design.

5.2 On Lot Filtration

At-source stormwater pollution control devices provide flexibility to achieve stormwater treatment targets without an associated land take at ground level. Stormwater filtration of this type is suited to densely populated sites where public open space is limited.

These treatment strategies are typically deployed to achieve stormwater pollution reduction targets prior to discharge from a super lot. These are placed in tanks beneath podium courtyards and within the upper levels of underground car parks. To remain free from tail-water impacts caused by downstream stormwater networks, tanks will be elevated at or above street level.

5.3 Regional Bioretention Systems

5.3.1 Existing Biofiltration Basin

An existing biofiltration basin has been provided east of the intersection of Rd Precinct Road and Cudgegong Road. It is assumed that the existing regional bioretention system was constructed in accordance with best practice design and therefore achieves existing water quality requirements. This basin achieves the stormwater management targets for Council's roads and the proposed public open space.

It is proposed that the new public road drainage in Site 2 is directed to this existing biofiltration basin and involves the use of the existing GPT installed as part of the NRT works.

There will be a small increase in flow rates to the biofiltration basin of 0.03 m³/s from the road associated with Site 2 (south of Conferta Avenue). This flow rate is small and will increase the rate of GPT bypass by 0.4% which is a marginal and small amount. The shortfall in treatment will be compensated by increasing the biofiltration basin surface area. The best opportunity to do this would provide an additional 40 square m of biofiltration. There should be adequate space for 102sq.m of biofiltration.

A plan and section of these proposed upgrade works are detailed below in Figure 18 and Figure 19.

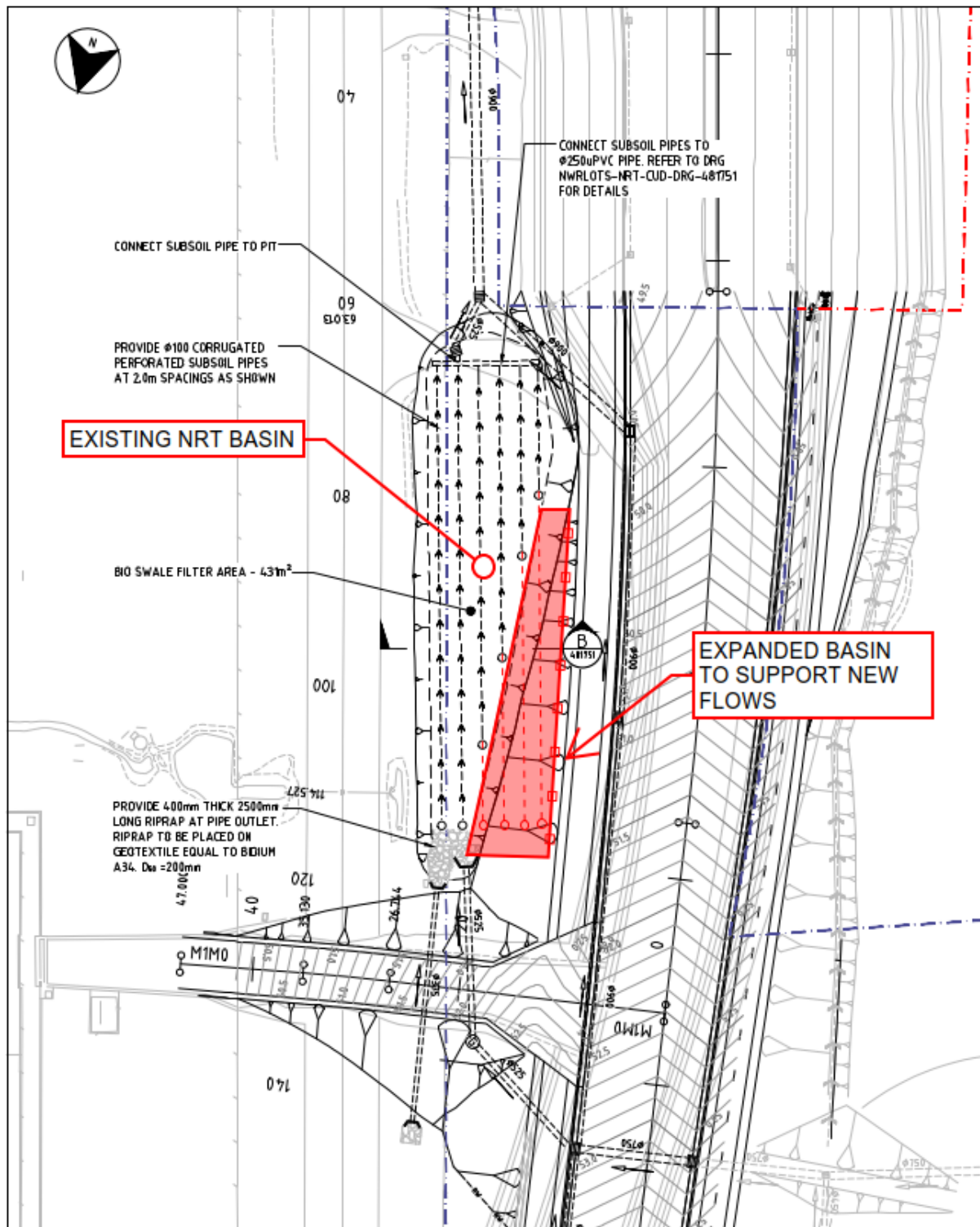


Figure 18 Proposed Basin Expansion (Plan)

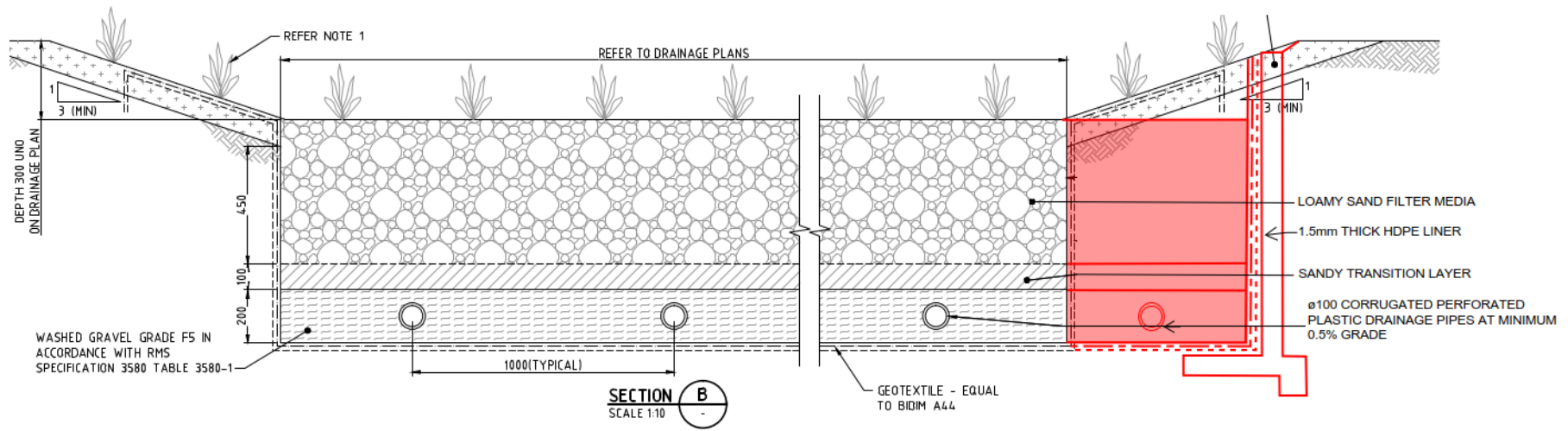


Figure 19 Proposed Basin Expansion (Section)

5.3.2 Proposed Rainwater Tank

A 315kL rainwater tank is proposed for Site 1, all roofed areas are directed into this rainwater tank, the rainwater tank has been sized to irrigate all of the greenspace located within the precinct however will feature a potable water backup to account for prolonged periods without rainfall. Opportunities for having a recycled water backup for irrigation will also be investigated as a part of the detailed design of the irrigation system post DA.

All downpipes from the roofed areas connected to the rainwater tank will be fitted with a first flush pipe to allow for the first flush of debris and rain from the roof to be collected prior to the rainwater tank.

The estimated irrigation demand is summarised below:

- Available volume: 315kL
- Annual Irrigation Demand: 2715kL/year.

The tank has been sized to allow for future rainwater re-use, for example wash down areas or ground floor retail uses. Details of the proposed rainwater tank are shown below in Figure 20 and Figure 21.



Figure 20 Proposed Rainwater Tank

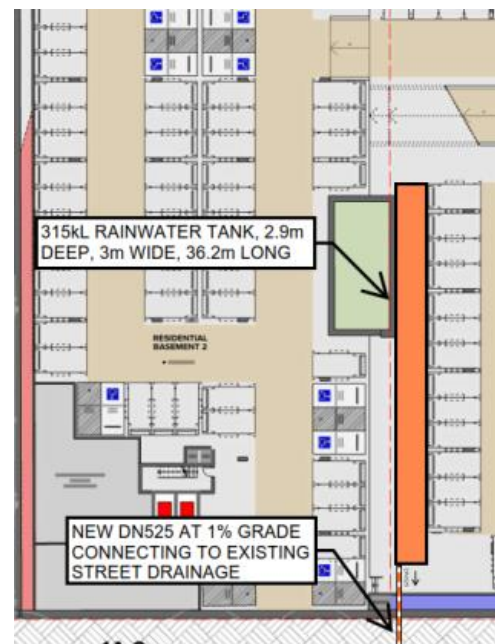


Figure 21 Rainwater Tank Location in Basement

5.3.3 Biofiltration Street Trees

Consultation with Blacktown Council indicates that street tree biofiltration is not supported where it would reduce on street parking. Biofiltration street trees are not proposed along existing Themeda and Conferta Avenues but are proposed along new Council road in Site 2 and the new private road in Site 1 as shown below in Figure 22.

The strategy is reliant on these trees to provide additional stormwater quality reductions as the regional biofiltration basins discussed above cannot get any larger due to site constraints.

The subject streets are graded at 3 to 4% which will not be associated with adverse level changes or trip hazards. Each street tree is designated to have 100mm of ponding over a 2.5 m² area above the tree pit. TUFLOW modelling indicates flood velocities from along the proposed roads will vary between 0.7 and 1.2 m/s in a 1% AEP event which suggests some erosion control measures may be required, but overall velocities are not unsuitable.

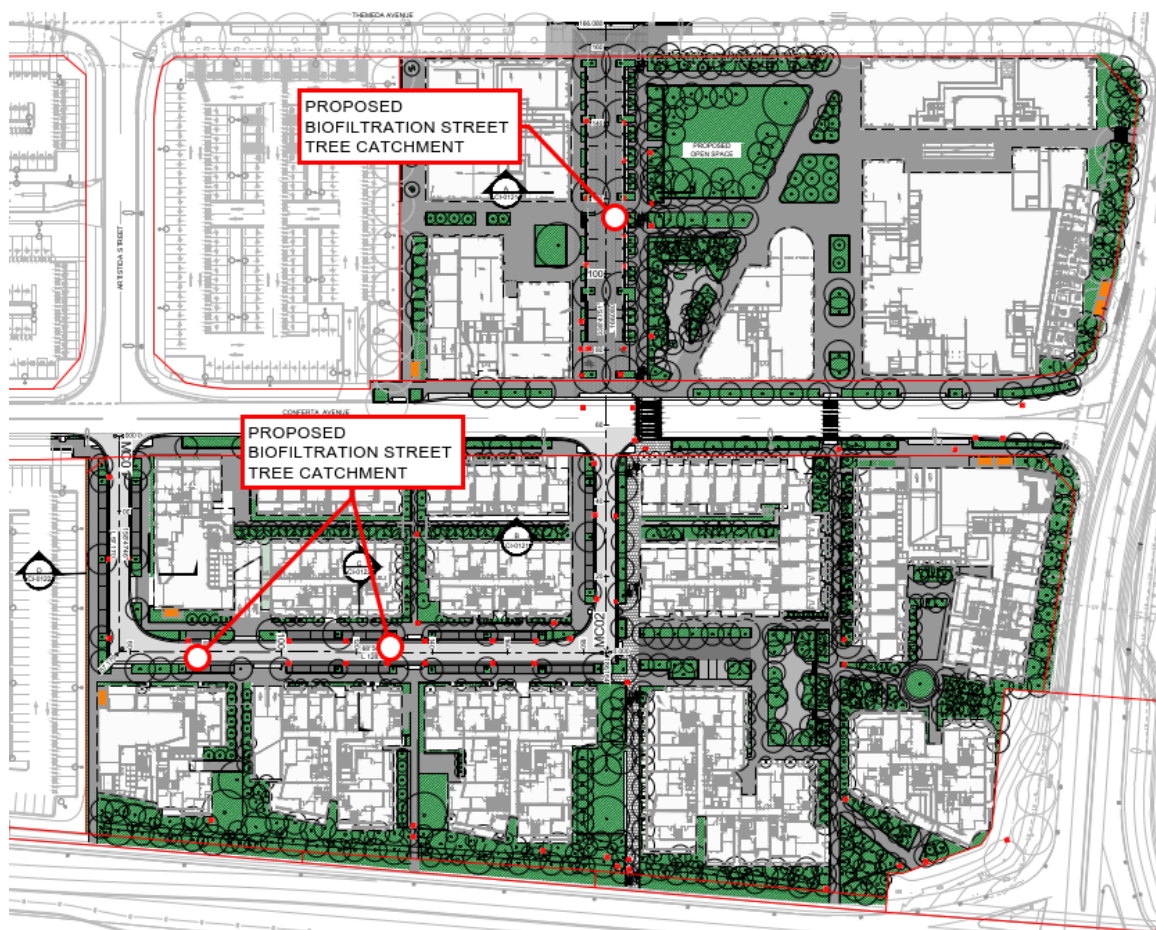


Figure 22 Proposed biofiltration street trees

This proposed bio-retention street detail is shown below in Figure 23.

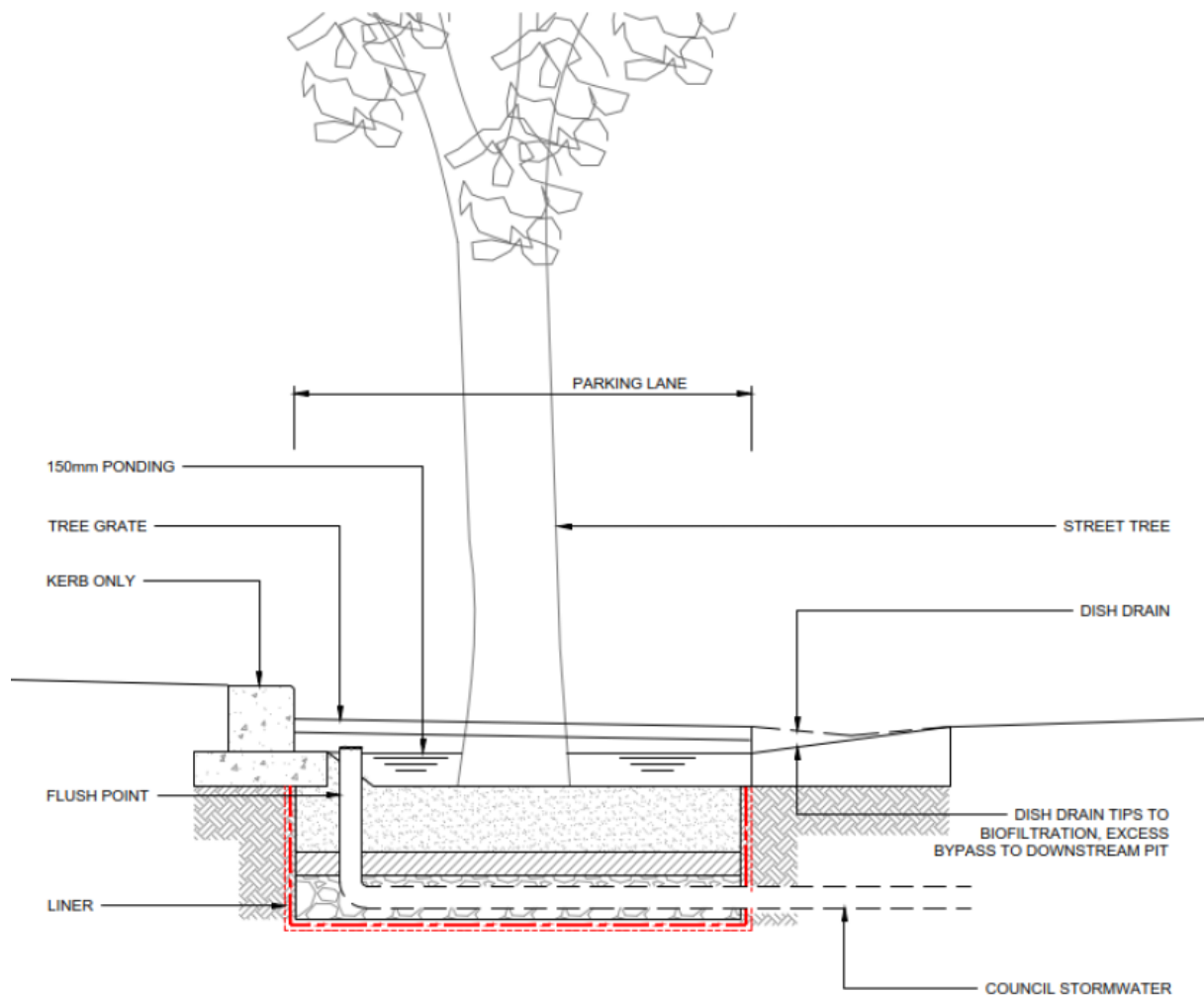


Figure 23 Bio-retention street tree detail

5.4 Demonstration of Compliance (MUSIC Modelling)

MUSIC modelling is being undertaken to assess the quality of stormwater runoff discharged from the proposed development site to ensure water quality requirements are met. MUSIC modelling results for the entire Area 20 zone demonstrate that integrating proposed WSUD techniques allow the pollutant reduction targets to be met.

A land use schedule is presented in Table 9.

Table 9 Land Use Schedule

Future Development (currently car parks and not part of this proposal)	Area (Ha)
Roof areas	2.16
Courtyards/ ground floor lands within super lots	1.03
Private Roads* (& public easement or drainage easement)	0.19
Council Open Space	-
Council Roads - To be dedicated	-
Council Roads - Existing	-
Tallawong Station South Development Site	Area (Ha)
Roof areas	2.22
Green Courtyards/Gardens	0.52
Paved Areas	1.43
Private Roads* (& public easement or drainage easement)	0.14
Council Open Space	0.60
Council Roads - To be dedicated	0.24
Council Roads - Existing	4.62

Results of the MUSIC modelling are provided in Table 10.

Table 10 MUSIC Modelling

Pollutants	Sources (kg/yr)	Residual Load (kg/yr)	% Reduction	Compliance
Total Suspended Solids	17,900	2,290	87%	Yes
Total Phosphorus	33.5	11.7	65%	Yes
Total Nitrogen	212	103	51%	Yes
Gross Pollutants	2,420	12.7	99%	Yes

The stream erosion index was calculated for the reach of creek immediately to the east of Site 1 and Site 2. The critical flow rate was adopted as 25% of the 50% AEP flow rate from a rural catchment with 0% imperviousness. This was determined from DRAINS modelling using a kinematic wave calculation to determine the time of concentration for three sub catchments. This method produced a flow estimate that is similar to the prescribed method in BCC's MUSIC modelling guideline.

The stream erosion index for the proposed stormwater strategy is 1.6 and therefore complies with BCC's target (less than 3.5).

The proposed WSUD strategy will meet the water quality targets prescribed by BCC for stream health and stability. The proposed development will therefore have an acceptable impact on Second Ponds Creek.

Additionally, the WSUD strategy does not reduce existing stream flow rates within the recharge zones of the regional aquifer, and the development will therefore have no impact on groundwater dependent ecosystems.

It is noted that the overall stormwater quality strategy is in line with the previously approved Landcom SSDA package expect with the addition of rainwater harvesting in Site 1.

6.0 Conclusion

Responses to design standards and approaches taken to fulfil the requirements are summarised below.

Growth Centres Development Code (Growth Centres Commission 2006)

The Civil and Stormwater Report for the Tallawong Station Precinct South project adopts a WSUD approach to water management and is consistent with the Growth Centres Development Code in:

- Reuse of rainwater;
- Achieving the stormwater quality targets stipulated by BCC, and on this basis will not worsen flood;
- Achieving the target stream erosion index criteria, and on this basis will not worsen erosion in Second Ponds Creek;
- Avoiding potential salinity hazards by prescribing stormwater filtration basins that do not interact with groundwater;
- Utilising a treatment train approach through use of GPTs, on-lot filtration and regional stormwater filtration basins;
- Integrating passive irrigation and street tree biofiltration amongst parking bays for improved amenity, street tree health and canopy cover;
- Managed low flows through bioretention to achieve the target stream erosion index;
- Proposing a mix of on-lot, street scape and 'end-of-pipe' treatment measures in a practical way;
- Aligning trunk drainage routes with local roads and drainage easements overland flow paths where possible; and
- Avoiding safety issues associated with biofiltration street trees in collector roads.

Adherence to Blacktown City Council Engineering Guidelines for Development (2005)

The civil and stormwater strategy demonstrates that minor and major drainage can be provided without risk of property damage or public safety. The concept stormwater drainage design demonstrates that the appropriate freeboard between hydraulic grade lines and street levels and habitable floor levels in design minor and major storm events respectively.

Summary of Responses to SEARS

Table 11 provides a summary of how each of the project SEARS requirements (SSD9063) are addressed in this management plan.

Table 11 Response to SEARS

Item	Action	Response
SEARS	The EIS must:	Please see responses below:
Utilities	<ul style="list-style-type: none"> • identify and address the existing capacity to service the development proposed and any augmentation requirements for utilities in consultation with relevant agencies; and • identify any potential impacts of the proposed construction and operation on the existing utility infrastructure and service provider assets, and demonstrate how these will be protected, or impacts mitigated. 	<ul style="list-style-type: none"> • Existing capacity and potential connection points are shown within Section 3.0 of this report.

Item	Action	Response
SEARS Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedules 1 and 2 of the <i>Environmental Planning and Assessment Regulation 2000</i> including: <ul style="list-style-type: none"> • services and utilities impact assessment; and • Sydney Metro Underground Corridor Protection Guidelines or Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines report. 	Please see responses below: <ul style="list-style-type: none"> • A services and utilities impact assessment has been carried, refer Section 3.0; and • The Sydney Metro Underground Protection guidelines requirements are contained within Appendix A.
DPIE EE Comments 9. Water and Soils	THE EIS must map the following features relevant to water and soils including: <ul style="list-style-type: none"> • Rivers, streams, wetlands, estuaries (as described in s4.3 of the Biodiversity Assessment Method); and • Proposed intake and discharge locations. 	Please see responses below: <ul style="list-style-type: none"> • There are no wetlands or estuaries within the proposed development boundary or impacts, for more information on groundwater please refer to the Geotechnical Investigation Report; and • There is no proposed groundwater intake for this site, stormwater discharge locations are shown within Section 4.0 and 5.0.
DPIE EE Comments 10. Water and Soils	THE EIS must describe background conditions for any water resource likely to be affected by the development, including: <ul style="list-style-type: none"> • Existing surface and groundwater; • Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations; • Water Quality Objectives (as endorsed by NSW Government) including groundwater as appropriate that represent the community's uses and values for the receiving waters. 	Please see responses below: <ul style="list-style-type: none"> • Existing surface water impacts are shown in Section 4.0 and 5.0, for groundwater refer to the Geotechnical Investigation Report; • Hydrology and discharge information is contained within Section 4.0 and 5.0; and • Water Quality Objectives are shown in Section 4.0.
BCC Review - 10-13. Engineering	Engineering: <ul style="list-style-type: none"> • All roads must comply with engineering standards set out in Council's Engineering Guide for Development. No basement parking permitted under a public road therefore the road must remain private with a public easement for access; • Drainage overland flow path must be dedicated and in a public road (not a private easement); • Overland drainage must be in public space and treated to meet CPTED requirements; and 	Please see responses below: <ul style="list-style-type: none"> • All public roads comply with the Council's Engineering Guide for Development, Refer to Section 2.0; • Drainage overland flow is contained within Section 4.0, the only overland flow in private land is an existing discharge from the NRT car parks;

Item	Action	Response
	<ul style="list-style-type: none"> Splays are required on corners of overland flow paths and public roads. 	<ul style="list-style-type: none"> Details of CPTED treatments are contained within the CPTED report; and Splays are described in Section 2.0.
BCC Review - 14-15. Drainage	Drainage: <ul style="list-style-type: none"> Compliance with drainage requirements as outlined in meeting with Council's drainage section on 7th February 2020; and Compliance with water sensitive urban design requirements set out in Part J of the Blacktown Development Control Plan. 	Please see responses below: <ul style="list-style-type: none"> The drainage strategy in Section 4.0 is consistent with the requirements discussed with the council's drainage section on the 7th February 2020; and Compliance with water sensitive urban design requirements is contained within Section 5.0 of the report.

Appendix A – Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines Letter

13th March 2020

Marvin Huang
Development Manager
Deicorp Pty Ltd
Level 3/161 Redfern Street,
Redfern NSW 2016

Dear Marvin

Tallawong Station Precinct Development RE: Development Near Rail Corridor

Summary

The Protection Zone around rail corridors is divided into two classifications: "First Reserve" and "Second Reserve". Demolition and construction works are generally not possible within the First Reserve, while works within the Second Reserve are normally possible, subject to a detailed engineering assessment.

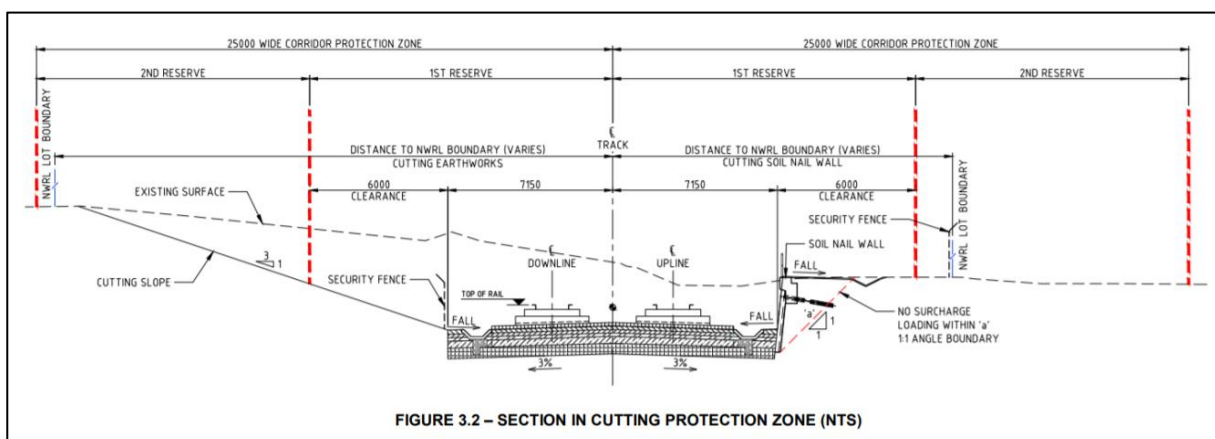
The principle elements for this assessment are to confirm the proposed ground loadings and ensure that the at-grade rail asset is not adversely affected by the proposed development works. Assessment also entails demonstrating that the presence of the rail will not adversely affect the proposed development (noise, vibration etc.). Other requirements are subject to further assessment.

The relevant guidelines for works around the Sydney Metro rail corridor is the *Sydney Metro At Grade and Elevated Sections corridor Protection Guidelines (2018)*. These stipulate the specific requirements and provides technical and procedural guidelines to be followed for new developments near existing and future Sydney Metro rail at grade and elevated infrastructure during development planning, designing, construction and operating stages.

The guidelines define the Rail Corridor Protection Zone as elements as follows;

- Elevated viaduct - 25m from the centre line of the dual track structure.*
- At Grade embankments and cuttings within a fenced or walled boundary - 25m from the centre line of the dual track structure.*
- For other infrastructure the protection zone shall be assessed based on the adjacent proposed development.*

Figure 3.2 (see below) from Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines defines the zones that forms the First Reserve and Second Reserve around Metro infrastructure. The Corridor Protection Zone that encompasses both reserves measure 25 metres either side from the centreline of track.



Proposed Development

The proposed Tallawong Station Precinct South Development has a frontage to Themeda Avenue which is adjacent to the southern side of Tallawong Station. Tallawong station is in cut.

The proposed development comprises commercial and residential buildings up to eight stories high and with up to three basement levels. The deepest basement on the Themeda Avenue boundary has a proposed finished surface level of RL46 AHD, about 10m below existing ground level.

The distance between the boundary of the proposed Tallawong Station Precinct Development and the dual track centreline is approximately 50 metres, well clear of the 25-metre Corridor Protection Zone. It should also be noted that the Themeda Avenue road reserve is over 15m wide and a 45 degree zone of influence extending up from the basement excavation will not extend past the road reserve Tallawong station.

A visual representation of the relationship between the proposed development and the station is shown below in Figure 1.



Figure 1: Distance of proposed development from track centreline

Due to the distance between the Metro and the proposed development, it is clear that the Tallawong Station Precinct South Development:

- Is not located within the protection reserve; and
- Does not have the potential to cause design and construction related safety, engineering, maintenance and operational impact on the at grade and elevated Metro infrastructure.

The development of this future precinct was considered as a part of the Tallawong Station design and the adjacent roads and frontages are already completed, with new works limited to the south of the recently constructed road.

It is recommended that construction access to the proposed development is limited to Conferta Avenue (the street frontage away from the station).

If you require any further information, please don't hesitate to contact me on the details below.

Yours faithfully



Daniel Fettell

Principal Engineer

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