STORMWATER MANAGEMENT STRATEGY

NEWCASTLE GRAMMAR SCHOOL – PARK CAMPUS STAGE 1

Client: Newcastle Grammar School C/- APP Corporation Pty Limited
Project: Newcastle Grammar School Park Campus – Stage 1
Project No: 00016194
Report: 16194-LD-RP-C-0002

Member of: CONSULT AUSTRALIA

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Disclaimer

Document Location: Z:\00016194\Engineering\Reports\Civil SSD Design Report\16194-LD-RP-C-0002_C.docx

REV	DATE	DESCRIPTION	AUTHOR	REVIEWER	APPROVER
A	05/08/2021	For Approval	L.Kleyn	N.Lane	N.Lane
B	13/10/2021	Re-Issued for Approval	L.Kleyn	N.Lane	N.Lane
C	30/03/2022	Re-Issued for Approval	N.Lane	N.Lane	N.Lane

Contents

1 Scope and Introduction

1.1 Report Scope

This report is intended to accompany the civil design documentation for the site and has been prepared for the purpose of supporting the SSD and DA processes (as required) to gain concept approval for the proposed development. The report comments directly on outcomes of Stage 1 of the Redevelopment Masterplan by SHAC Architects and will provide methodology and results relevant to civil design aspects of the project for review and acceptance by the relevant assessing authorities.

The background and context to the design assumptions and modelling methodologies employed are discussed and addressed within this Report to detail how each has guided the Civil Engineering design of the site as depicted on the LDCE Civil Engineering Design Drawings, Ref: 16194-LD-DR-C-0020. Additionally, this report should be read in conjunction with the following documentation:

- Geotechnical Assessment Report by Coffey Geotechnics, Ref: 754-NTLGE282007-AD dated 19 February 2021.
- Mine Subsidence Desktop Assessment Report by Tetra Tech Coffey Geotechnics, Ref: 754-NTLGE282007-AB dated 2 February 2021.
- Mine Subsidence Investigation and Assessment Report by Tetra Tech Coffey Geotechnics, Ref: 754-NTLGE282007-01-AI dated 30 July 2021.
- Detailed Site Survey by Delfs Lacelles Consulting Surveyors, Ref: 19586_1_Rev A dated 15 October 2019.
- Architectural drawings by SHAC Architects, Ref: 4293.
- Landscape Architectural drawings by Gallagher Studios, Ref: 202008_NG_DA-20210813_RevE dated 12 October 2021.
- Newcastle Grammar School Flood Impact Assessment by Torrent Consulting, Ref: R.T2030.001.01 dated May 2021.

1.2 Background and Context

The Subject Site currently features an existing pre-School and houses grades K-4 through six main buildings. The School has recently approved a masterplan prepared SHAC Architects to support the continued development of the School.

This report is intended to provide context and supporting design calculations for the Stage 1 works. A copy of the original Masterplan document provided during the RFT phase is provide in Appendix A for reference. The Stage 1 works include the following:

- Demolition or part-demolition of existing Admin Building.
- Construction of a new internal drop off roadway on the north-eastern boundary.

- Stormwater upgrades across the School site.
- Refurbishment of Block B to accommodate a new central Administration and relocation of other School functions.
- Construction of a new 3-storey building which will feature the following components:
    - Ground floor open air space acting as a COLA and extension of adjacent play area.
    - Levels 1 and 2 to house 16 learning spaces.
    - Roof top terrace/outdoor play area.
    - Lift access.
    - Associated landscaping, services and School amenity.

The Stage 1 works will be delivered by a team of consultants engaged by NGS with the coordination of APP as the Project Manager. The Architectural Masterplan was endorsed by the NGS Board in late 2019 and forms the basis for the Stage 1 project.

As part of the Masterplan process NGS have sought an options analysis for authority approval pathways from local town planning consultants KDC. Following consideration of each option, NGS have decided to pursue a State Significant Development (SSD) for a staged masterplan of the Park Campus.

1.3 Existing and Proposed Site Description

Newcastle Grammar School's (NGS) Park Campus is located at 127 Union Street, Cooks Hill, 2300 (the Subject Site). The site is bound by Union Street (north-west), Parkway Avenue (south-west), Corlette Street (south-east) and a residential unit complex (north-east).

The residential development features a retaining wall along its shared boundary with NGS, which required consideration during design. This wall is retaining the neighbouring property, therefore any cut proposed along this boundary may pose issues to this wall.

The site generally falls from south to north at grades ranging from 1.0-3.5% approximately. The site is impacted by the adjacent Cottage Creek Channel which runs between the separated legs of Parkway Avenue. This section of Cottage Creek features multiple hydraulic structures that constrain flow and demonstrate blockage risk within the channel. A summary of the flooding constraints and considerations for the site is outlined in Section 2 below and the Flood Impact Assessment Report (Torrent, 2021) is attached in Appendix B.

Current features of the site include a mixture of attached and detached structures, some of which are proposed to be demolished as part of the Stage 1 works. Figure 1 below shows the School's current layout and location (image taken from Nearmap, imagery dated 14th April 2021).

Figure 1 – Locality Plan

2 Flood Modelling Summary

2.1 Background and Study Catchment

A Flood Impact Assessment Report has been prepared for this development by Torrent Consulting Pty Ltd, including a detailed flood model of the surrounding catchment, focusing on the open concrete drain that is located to the south of the Subject Site. The findings of the Report, particularly relating to the flooding constraints and considerations for the site, have been summarized in this section of the LDCE Design Report.

The Subject Site is located within the Cottage Creek catchment, a total area of 7.6 km^2, around half of which is upstream, refer to Figure 2.

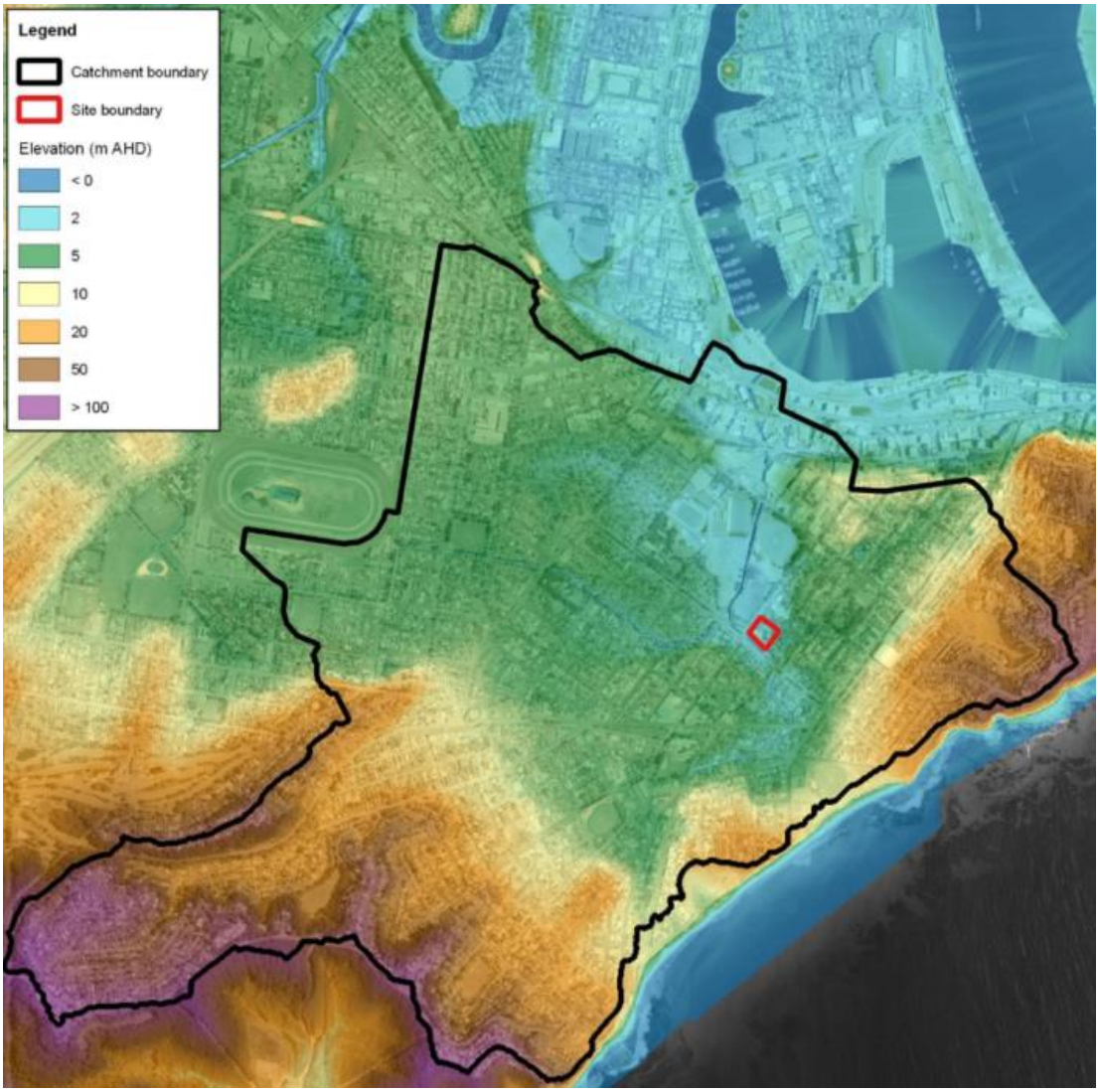


Figure 2 – Cottage Creek Catchment Topography (Torrent Consulting, 2021)

The School campus is situated at the edge of the Lower Cottage Creek floodplain and is subject to flooding from Cottage Creek and overland flow from upstream catchments. Cottage Creek drains a largely urbanised area immediately west of the Newcastle coastal ridge, including Merewether to the south and The Hill to the north. The drainage system has also been highly urbanised into multiple concrete lined channels and enclosed drains. The main branch runs from its mouth in Newcastle Harbour to Watkins Street, approximately 2.3kms. Major tributaries include the Broadmeadow Racecourse, Merewether Street, Mitchell Street, Frederick Street and Bruce Street branches.

2.2 Flood Impact Assessment

2.2.1 Model Results

The modelled flood conditions show that the Subject Site is not flood affected at the 20% Annual Exceedance Probability (AEP) or 10% AEP storm events. Flooding was shown to occur at the Subject Site for all storms above the 5% AEP storm event. During the 5% AEP design storm event, the capacity of Cottage Creek along Parkway Avenue is exceeded, resulting in overbank inundation along Parkway Avenue encroaching the Subject Site.

The trunk drainage capacity along Bruce Street to the east of the Subject Site is also exceeded during the 5% AEP storm event, which results in overland flow westwards through to Corlette Street and then through the Subject Site along the northern boundary, where the new driveway is proposed as part of the development works. Through the Subject Site the flood levels reduce from 3.4m AHD to 2.3m AHD, which is equal to the backwater flood level in National Park. Refer to Appendix B for flood mapping and other model outputs from the Flood Impact Assessment Report.

Peak flood velocities within the Subject Site during the 5% AEP storm event are around 0.1m/s within the Cottage Creek floodplain along Parkway Avenue and Union Street. Along the overland flow path from Corlette Street along the northern boundary of the Subject Site the modelled peak velocities are higher, at around 0.2m/s to 0.4m/s.

The flood behaviour at the 5% AEP storm event at the Subject Site is exhibited for all rarer design flood events, albeit with typically increased flood levels, depths and velocities. The peak flood level conditions are summarised in Table 1 below. Peak flood levels are provided for four locations, as follows:

- Adjacent the north-east corner of the Subject Site in Corlette Street.
- Adjacent the south-east corner of the Subject Site at the corner of Corlette Street & Parkway Avenue.
- Adjacent the south-west corner of the Subject Site at the corner of Parkway Avenue & Union Street.
- Adjacent the north-west corner of the Subject Site in Union Street, i.e., the National Park backwater.

Table 1 – Peak flood levels at the Subject Site (m AHD, Torrent Consulting, 2021).

Design Event (AEP)	NE Corner	SE Corner	SW Corner	NW Corner
20%	N/A	N/A	N/A	N/A
10%	N/A	N/A	N/A	2
5%	3.4	2.8	2.7	2.3
2%	3.5	2.9	2.8	2.6
1%	3.5	3	2.9	2.8
0.50%	3.5	3.2	3.1	3
0.20%	3.5	3.4	3.3	3.2
Probable Maximum Flood (PMF)	4.8	4.8	4.8	4.8

2.2.2 Flood Hazard

Flood hazards have been determined by Torrent Consulting (2021) in accordance with Guideline 7-3 of the Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR, 2017). This produces a six-tier hazard classification, based on modelled flood depths, velocities and velocity-depth product. The hazard classes relate directly to the potential risk posed to people, vehicles and buildings. Refer to Torrent Consulting's Flood Impact Assessment Report (2021) for mapping of the modelled peak flood hazard for each of the simulated design flood events.

At the 5% AEP storm event, the Subject Site is only impacted by a low hazard H1 flood environment, which presents a low risk to people, vehicles and buildings. At the 2% AEP storm event the increased flood depth creates some low hazard H2 flood conditions along Parkway Avenue in the north-west corner of the Site, which presents a potential risk for small vehicles.

During the 1% AEP design storm event the Subject Site is exposed to some medium hazard H3 flooding in the north-west corner, which presents a potential risk for all vehicles, children, and the elderly. There is no risk to buildings presented by the modelled flood hazards except at the PMF event when most of the Site is impacted by a high hazard H5 flood environment. This hazard level is unsafe for all vehicles and people, and presents a risk to less robust building structures, the heavy building constructions within the Subject Site would not be expected to suffer significant damage.

2.3 Management of Flood Impacts

2.3.1 Controls

The principal consideration of good practice floodplain risk management is to ensure compatibility of the proposed development with the flood hazard of the land, including the risk to life and risk to property. The City of Newcastle (CN) DCP 4.01 Flood Management identifies four controls for the management of flood risk:

- Floodways.
- Flood storage areas.

- Management of risk to property.
- Management of risk to life.

Torrent Consulting's Flood Impact Assessment (2021) states that no parts of the Subject Site are identified as being a floodway. Additionally, the proposed development does not include filling of the flood storage area. Hence, the requirements for development within floodways and flood storage areas from CN's DCP 4.01 are readily satisfied.

2.3.2 Risk to Property

Relevant risk to property controls from CN's DCP 4.01 include:

- Floor levels of all occupiable rooms are not set lower than the flood planning level (FPL), which is typically the 1% AEP flood level plus a 500 mm freeboard
- Garage levels are to be no lower than the 1% AEP flood level
- Electrical fixtures such as power points, light fittings and switches are located above the FPL unless they are on a separate circuit (with earth leakage protection) to the rest of the building
- Where parts of the building are proposed below the FPL, they are constructed of water-resistant materials
- Areas where light vehicles are parked are not located in areas subject to a property hazard of P2 or higher, with parking for heavy vehicles not located in areas subject to a property hazard of P3 or higher
- Buildings of a light construction are generally unsuitable within areas subject to a property hazard of P4 or higher. Heavier building constructions may be suitable, but require certification by a Structural Engineer
- All building constructions are generally unsuitable within areas subject to a property hazard of P5 or higher. Where building in a P5 area is necessary, certification by a Structural Engineer is required.

The 1% AEP flood level at the Site is around 2.8 m AHD where the Stage 1 building construction is proposed and so the standard FPL requirement is that finished floor levels (FFLs) of occupiable rooms be set at or above a level of 3.3 m AHD. However, as the Cottage Creek catchment is susceptible to impacts of potential structure blockage, a higher FPL has been considered. Torrent Consulting has determined an FPL of 3.55m AHD based on simulated blockages in the drainage system and consideration of the CN adopted FPL for the Honeysuckle Redevelopment Area (inclusive of structure blockages, plus a 400mm freeboard). The ground floor level of the proposed Stage 1 building is 2.57 m AHD. The principal use for the ground floor is as an open play space and so is not subject to application of an FPL. The occupiable rooms are located on the first floor and above, all of which have FFLs over 3m above the FPL.

The ground floor toilets are to be fit out using flood-compatible materials below the FPL of 3.55 m AHD. Electrical circuitry throughout the ground floor level should also be located above the FPL (or be on a separate circuit). Access to the lift can be raised to the FPL and ramp

access provided if flood proofing measures cannot be achieved. Storage areas are to include shelving where possible to enable any high-value equipment to be stored at or above the FPL. These measures would minimise potential damages in the event of a flood inundating the ground floor level of the building.

The CN DCP considers a P1-P5 risk to property classification, which directly correlates to CN H1-H5 hydraulic hazard categories at the 1% AEP event. Whilst the hydraulic hazard categories are not identical to the current best practice AIDR guidelines (adopted in Torrent Consulting's modelling), there are some similarities. Figure 3 is a reproduction of the AIDR classifications with the CN risk to property classes superimposed.

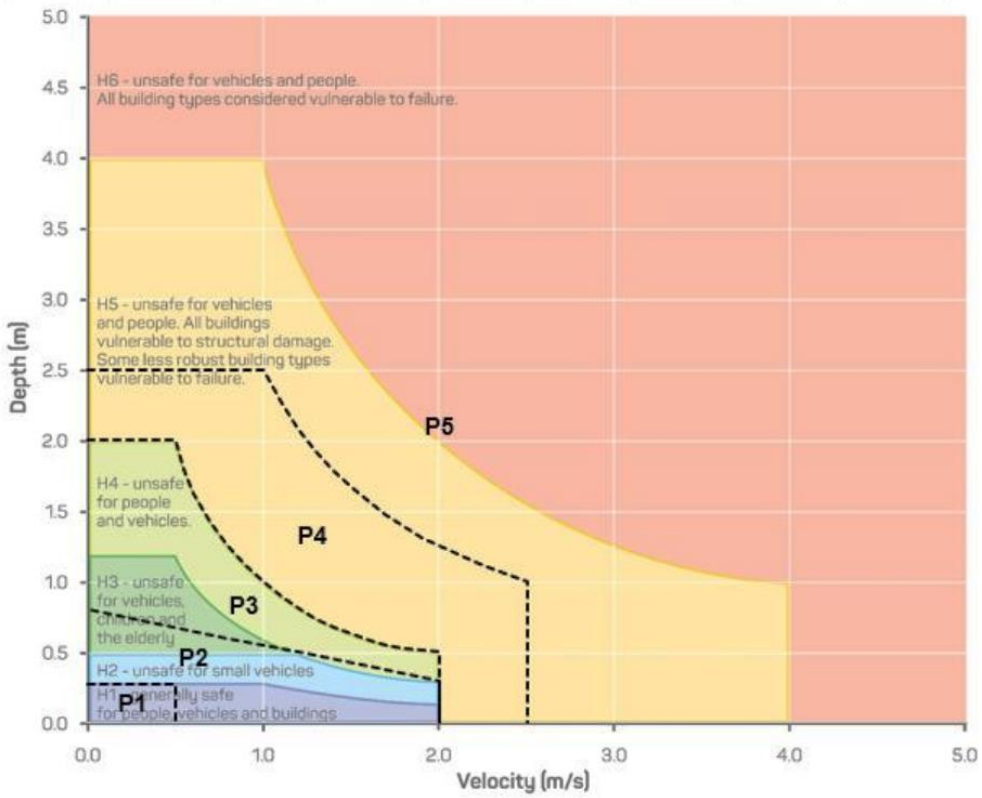


Figure 3 - CN risk to property classification correlation to hydraulic hazards classifications from AIDR (2017)

The parking bays along the access driveway are in an area of H2 to H3 hazard at the 1% AEP event and so do not satisfy the relevant requirements of the CN DCP relating to vehicle parking. However, these parking bays are for a student drop off zone which will only be used around School opening or closing times, with vehicles being momentarily stopped rather than parked. Therefore, the overall intent of the management of risk to property is satisfied.

The Union Street building is only subject to a H3 hazard (P3 CN risk to property) at the 1% AEP storm event and so readily satisfies the requirements relating to building construction. Only hazards above H4 (P3 CN risk to property) are considered to expose buildings to risk of damage.

2.3.3 Risk to Life

The CN DCP 4.01's management of risk to life controls seek to ensure that the full potential risk to life can be managed up to and including the PMF event. This is guided by a risk to life classification of L1-L5 and is based on the CN H1-H5 hydraulic hazard categories at the PMF event. For the PMF event the entire Site is classified as H3 to H5 on the AIDR hazard classification, which becomes an L4 or L5 CN risk to life classification. Based on the peak flood depth, velocity and velocity depth product, Torrent Consulting determined the Union Street building to be classified as an L4 risk to life hazard.

In accordance with CN DCP 4.01, the proposed development is required to provide on-site flood-free refuge given it's located within a flash flood environment and further than 40m from flood-free land above the PMF. The DCP requires the on-site refuge to comply with the following minimum standards:

- *"The minimum on-site refuge level is the level of the PMF. On-site refuges are designed to cater for the number of people reasonably expected on the development site and are provided with emergency lighting."* i.e., a minimum finished floor level of 4.8m AHD.
- *"On-site refuges are of a construction type able to withstand the effects of flooding. Design certification by a practising structural engineer that the building is able to withstand the hydraulic loading due to flooding (at the PMF)."*

Because the upper levels of the Stage 1 building (including the first floor) are all located above the PMF level, it inherently provides suitable flood-free refuge for the occupants.

To satisfy the management of risk to life requirements the Stage 1 building needs certification by a Structural Engineer to withstand the hydraulic forces of the PMF conditions, i.e., a flood depth of 2.2 m, flood velocity of 1.8 m/s and velocity-depth product of 1.4.

3 Erosion and Sedimentation Control

Sediment and erosion control design has been undertaken in accordance with Landcom's "Managing Urban Stormwater: Soils and Construction" (2004), more commonly known the "Blue Book".

The proposed development will disturb > 2500m^2 of land, requiring a soil and water management plan (SWMP) to be prepared. The SWMP is to include a calculation to determine the need for a sediment basin for the capture and storage of sediments generated from the construction works. The sediment basin calculation estimates soil loss using the Revised Universal Soil Loss Equation (RUSLE) Method. It was determined that the annual soil loss is expected to be less than 150 m^3/years, therefore the construction of a sediment basin can be considered unnecessary (in accordance with section 6.3.2(d)). RUSLE method calculations have been provided in the Lindsay Dynan Consulting Engineers (LDCE) civil drawing set.

Impacts of land disturbance shall be mitigated with standard sediment and erosion control measures as detailed in the LDCE civil drawing set. LDCE considers the adopted measures to be adequate to reduce pollution of downstream areas and reduce degradation of land, in accordance with the objectives of the Blue Book.

4 Stormwater Quantity Management

4.1 Existing Stormwater Management

Majority of the existing site drains as sheet flow from southeast to northwest, eventually discharging to the Union Street Council drainage infrastructure or infiltrating through the pervious playground area. Some drainage pits and grated drains are scattered throughout the playground areas however these are considered to capture little runoff in proportion to the runoff generated from these areas.

Roof drainage from existing Block A and B are connected to four above ground rainwater tanks, adjacent to Parkway Avenue. The size of the rainwater tanks is unknown however, it is considered their volume is approximately 2 x 15kL and 2 x 20kL (70kL total). Overflow from the tanks is connected to an adjacent drainage network that discharges to a Council kerb inlet pit in Parkway Avenue.

4.2 Proposed Stormwater Management

All new roof area will be directed to a 25kL above ground rainwater harvesting tank located at the northwest corner of the proposed Union Street building. The tank has been sized according to the water quality requirement calculations provided in Section 5. It is intended that runoff from majority of the landscape areas will be directed by grass lined swales to a 5m^2 bioretention garden before discharging from the site. Runoff from the driveway will sheet flow onto the adjacent landscape strip and before being collected by drainage pits. Discharge from the site will connect to the Council stormwater drainage pit on Union St, near the northwest corner of the site.

On-site detention (OSD) has been excluded from the design as the site is flood affected by storms greater than the 20% AEP event. It is anticipated that an OSD system will have negligible effect due to the impact of flood waters. The rainwater re-use tank will provide peak flow reduction from the Stage 1 new building being constructed as part of the development, in the order of 45% per the MUSIC model prepared.

LDCE considers the adopted drainage design will improve site drainage and nuisance water ponding in low lying areas of the site.

5 Stormwater Quality Management

5.1 Existing Stormwater Quality Management

The existing water quality treatment train consists of four rainwater tanks connected to the roofs of Block A and B, as described in Section 4. Sheet flow from footpath pavements onto landscaped areas is considered to provide some treatment of pollutants. No other treatment infrastructure exists at the Subject Site.

5.2 Proposed Stormwater Quality Management

In accordance with CN's DCP 7.06, a MUSIC model was developed to determine the efficiency of the proposed water quality treatment train. The treatment train comprises:

- Grass lined swales to capture runoff from landscape areas and direct it to a bioretention garden.
- Bioretention garden, water will be directed through the filter media before discharging through the outlet pipe.
- Proposed surface inlet pits in driveway to have ocean protect 'OceanGuard' inserts (2 total).
- Rainwater tanks sized to meet at least 80% of non-potable demand including outdoor use and toilets.

A summary of the water quality reduction targets and MUSIC model results are shown in Table 2.

Table 2 - Water quality targets and MUSIC model results

	Sources	Residual Load	% Reduction	Target Reduction %*
Flow (ML/y)	6.24	4.04	35.3	-
Total Suspended Solids (kg/y)	772	92.1	88.1	85
Total Phosphorus (kg/y)	1.84	0.636	65.4	65
Total Nitrogen (kg/y)	15.4	6.98	54.6	45
Gross Pollutants (kg/y)	166	14.9	91	90

*Target reductions are based on Table 4 of the CN DCP Section 7.06.

6 Rainwater Harvesting and Reuse

6.1 City of Newcastle Requirements

The CN DCP 7.07 Water Efficiency provides general controls for all developments to improve the efficiency of water usage and to reduce the long-term water consumption through best practice water use. Controls include:

1. *Where plumbing fixtures and water appliances are proposed to be installed, such are to be of the following types:*
    a. *a minimum WELS 3 Star Water Rating*
    b. *maximum 6L dual flush toilet cisterns where they are not supplied by a roof water tank.*
2. *Where washing appliances are installed, they are WELS 3 Star (or better) Water Rated where they are not supplied by a roof water tank.*
3. *Where installed, garden water hoses are fitted with trigger nozzles in order to maximise the efficiency of garden watering.*
4. *A rainwater tank is installed for the dual purposes of mains water demand management and reducing the volume of stormwater discharge from sites. The rainwater tank must be connected to roof areas and not be connected to possible contaminating water sources. All rainwater tanks must be fitted with a first flush device to prevent contaminates fouling water and to prolong the life of the tank. Rainwater tanks should be designed to cater for maintenance and cleaning.*

    Where rainwater tanks are provided, the volume of the tank can be used to offset any additional discharge control storage that is required. Rainwater tanks are to supply water for toilets, watering systems and other reuse devices and be designed and installed in accordance with Council's Stormwater and Water Efficiency for Development Technical Manual.
5. *Toilets and watering systems for landscaping are connected to rainwater supply.*

6.2 Proposed Rainwater Reuse Methodology

The proposed Union St building shall be connected to a 25kL rainwater tank at the northwest corner of the building. Sizing of the rainwater tank has been undertaken using MUSIC modelling software, to meet 70% of reuse demand. The rainwater tank shall include a first flush device and be connected to toilets and for outdoor use.

To maximise the efficiency of water reuse, installed toilets shall be a minimum WELS 3 Star Water Rated. Trigger nozzles shall be provided for any garden hoses connected to rainwater tanks, including the existing tanks adjacent Parkway Avenue.

No provision has been made for discharge control storage within the rainwater tanks given the site is flood affected in storm events greater than the 10% AEP, as discussed in Section 4.

7 Operation and Maintenance Plan

The stormwater drainage system and treatment devices will need to be maintained at regular intervals to ensure they continue operate as designed. LDCE recommends monitoring and recording the performance of the stormwater system and treatment devices in accordance with the inspection and maintenance schedule provided in Table 1. Maintenance shall typically occur as required and not necessarily at every inspection interval, the person conducting the inspection should use their discretion. It is recommended that inspections of all new stormwater systems also be completed after large rainfall events.

The MUSIC program documentation estimates that bioretention gardens can have a life cycle greater than 25 years if well maintained. If the basin stores water longer than one week after rainfall, the sub-soil drainage and filter media should be replaced. It should be noted that bioretention gardens are particularly susceptible to clogging during the establishment period before plant roots have grown down through the filter media. Additional maintenance information for bioretention gardens can be found in Melbourne Water's "WSUD maintenance guidelines: A guide for asset managers".

Table 3 - Operation and Maintenance Intervals and Procedures

Item	Inspection/ Maintenance Interval	Responsibility	Task/Procedure
Pits And Pipes Network	Quarterly	Owner	Remove and dispose of debris from item
Litter Baskets (OceanGuard)	Quarterly	Ocean Protect	Remove and dispose of debris from item
Bio-Retention Filter and Outlet	Yearly	Owner	Remove and dispose of debris from item Replace filter medium as required (25 years max)
Rainwater Re-Use Tank	Yearly	Maintenance contractor	Remove and dispose of debris from item, clean inside of tank (5 years maximum)

8 Conclusion

LDCE has prepared this report to provide background and context to the design assumptions and modelling methodologies employed that have guided the design of the site as depicted in the civil drawings package. The civil design documentation for the Newcastle Grammar School Park Campus has been prepared to support the SSD and DA processes (as required) to gain concept approval for the proposed development.

The Flood Impact Assessment undertaken by Torrent Consulting determined that the site is flood affected in storm events greater than the 10% AEP. During the 1% AEP event, the site is affected by medium hazard H3 flooding (AIDR classification) in the northwest corner which presents a potential risk for all vehicles, children, and the elderly. The Subject Site is affected by a high hazard H5 flood environment in the PMF event, presenting a risk to less robust structures. The heavy building constructions within the Subject Site would not be expected to suffer significant damage. Measures shall be adopted in accordance with CN's DCP 4.01 to mitigate flood impacts causing risk to property and risk to life. Measures include the provision of flood free refuge above the PMF flood level, floor levels above the FPL (3.55m AHD), structural design to withstand the PMF flood conditions and flood proofing measures for materials and electrical circuits below the FPL.

In accordance with the Blue Book, a SWMP has been prepared to mitigate sediment and erosion impacts on the site. RUSLE method calculations for Subject Site's annual soil loss were less than 150 m^3/year, indicating a sediment basin is not required.

All new roof area will be directed to an above ground rainwater harvesting tank and runoff from majority of the landscape areas will be treated by a bioretention garden. It is proposed that OSD has been excluded from the civil documentation as it is anticipated to have negligible effect due to the impact of flood waters. LDCE considers the adopted drainage design will improve site drainage and nuisance water ponding in low lying areas of the site.

References

Australian Rainfall and Runoff ***"Guide to Flood Estimation"***, 2019.

City of Newcastle, ***"Development Control Plan: Section 4.01 Flood Management"***, 2012.

City of Newcastle, ***"Development Control Plan: Section 7.06 Stormwater"***, 2012.

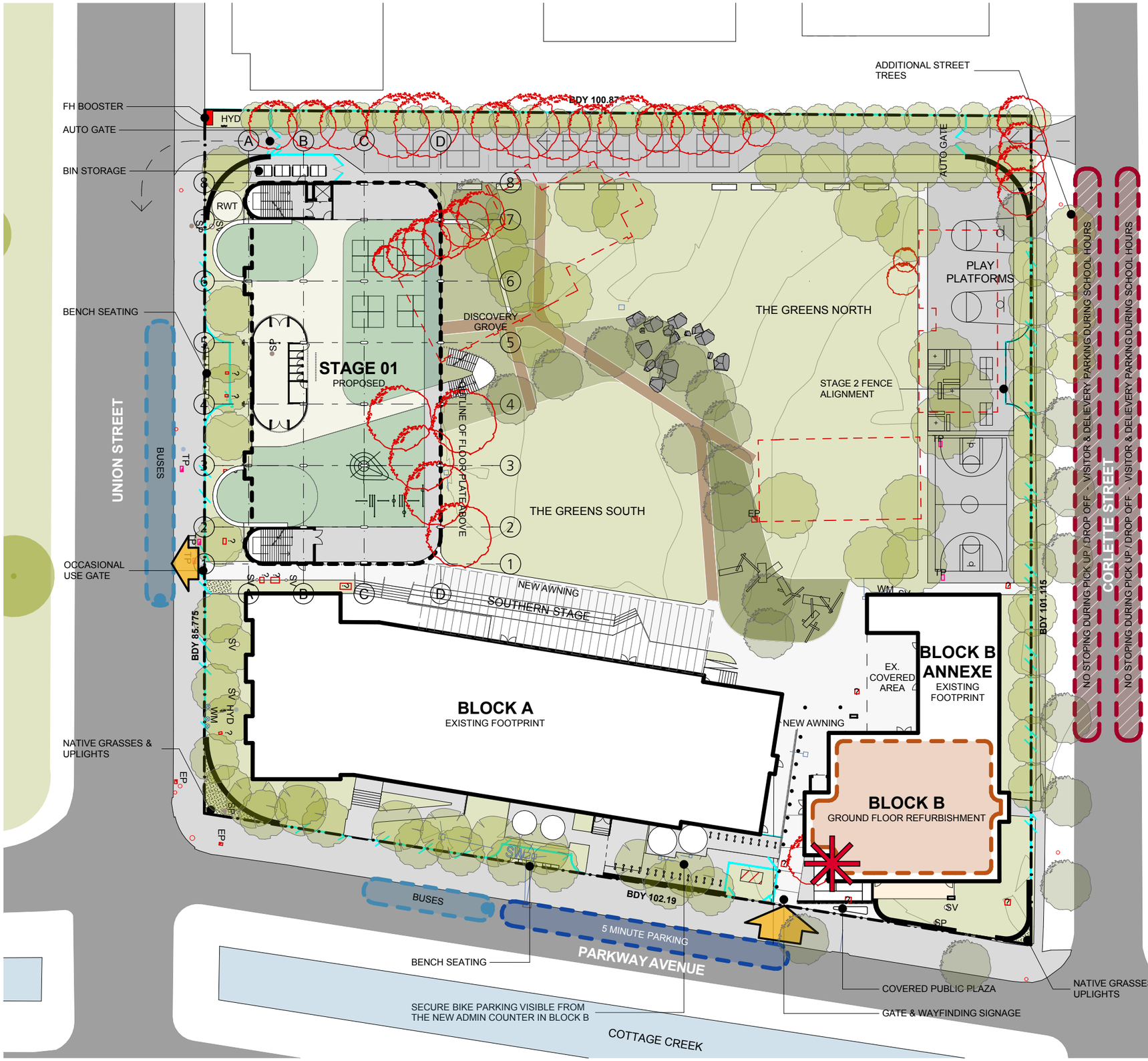
City of Newcastle, ***"Development Control Plan: Section 7.07 Water Efficiency"***, 2012.

City of Newcastle, ***"Stormwater and Water Efficiency for Development Technical Manual"***, April 2019.

Melbourne Water, ***"WSUD maintenance guidelines: A guide for asset managers"***, 2013.

Torrent Consulting, ***"Newcastle Grammar School Flood Impact Assessment"***, R.T2030.001.03, March 2022, Revised Draft Report.

Appendix A – Architectural Masterplan



Newcastle Grammar SCHOOL

SSD APPLICATION

1. Dimensions are in millimeters unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

LEGEND

- EXISTING PERMANENT BUILDINGS
- EXISTING BUILDINGS TO BE DEMOLISHED
- PALISADE FENCE
- SANDSTONE WALL 2400mm HIGH - HONED FINISH LIGHTING & MAIN SIGNAGE
- SANDSTONE WALL 2400mm HIGH - HONED FINISH
- REFURBISHMENT OF EXISTING BUILDING
- ROAD
- NO STANDING DURING PICK UP/DROP OFF, VISITOR PARKING DURING SCHOOL HOURS
- BUS ZONE
- EXISTING SITE TREES
- EXISTING SITE TREES TO BE REMOVED
- ADMINISTRATION / VISITOR ENTRY POINT
- SCHOOL ENTRY POINTS

GROSS FLOOR AREA

FUNCTION	AREA
COVERED DECK	496
COVERED PLAY	1,812
INTERNAL	1,978
	4,286 m²

4293
2.01
RevJ 27.09.21

Site Plan

Newcastle Grammar School - Park Campus Stage 1

Parkway Avenue, Cooks Hill NSW

0m 5 10 15 20 25 1:500 @A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

Appendix B – MUSICLink Report

THE CITY OF NEWCASTLE

MUSIC-*link* Report

Project Details		Company Details	
Project:	NGS Primary	**Company:**	
Report Export Date:	2/07/2021	**Contact:**	
Catchment Name:	2021 07 01 - Stage 2 SSD Model	**Address:**	
Catchment Area:	0.837ha	**Phone:**	
Impervious Area*:	62.37%	**Email:**	
Rainfall Station:	61078 WILLIAMTOWN		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1995 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
Evapotranspiration:	1735mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.33		
Study Area:	Newcastle		
Scenario:	Newcastle		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	35.3%	Rain Water Tank Node	2	Urban Source Node	8
TSS	88.1%	Buffer Node	4		
TP	65.4%	Bio Retention Node	1		
TN	54.6%	Swale Node	2		
GP	91%	GPT Node	1		

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	1
GPT	2 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	None	0.04
Rain	Ex. Rainwater Tanks	% Reuse Demand Met	70	None	80.93
Rain	Rainwater Tank	% Reuse Demand Met	70	None	80.29
Receiving	Receiving Node	% Load Reduction	None	None	35.3
Receiving	Receiving Node	GP % Load Reduction	90	None	91
Receiving	Receiving Node	TN % Load Reduction	45	None	54.6
Receiving	Receiving Node	TP % Load Reduction	65	None	65.4
Receiving	Receiving Node	TSS % Load Reduction	85	None	88.1
Swale	Swale	Bed slope	0.01	0.04	0.01
Swale	Swale	Bed slope	0.01	0.04	0.01
Urban	Block B	Area Impervious (ha)	None	None	0.016
Urban	Block B	Area Pervious (ha)	None	None	0.004
Urban	Block B	Total Area (ha)	None	None	0.021
Urban	Bypass	Area Impervious (ha)	None	None	0.013
Urban	Bypass	Area Pervious (ha)	None	None	0.030
Urban	Bypass	Total Area (ha)	None	None	0.044
Urban	Driveway	Area Impervious (ha)	None	None	0.061
Urban	Driveway	Area Pervious (ha)	None	None	0.007
Urban	Driveway	Total Area (ha)	None	None	0.069
Urban	Existing Roof	Area Impervious (ha)	None	None	0.183
Urban	Existing Roof	Area Pervious (ha)	None	None	0
Urban	Existing Roof	Total Area (ha)	None	None	0.183
Urban	North Landscape	Area Impervious (ha)	None	None	0.084
Urban	North Landscape	Area Pervious (ha)	None	None	0.199
Urban	North Landscape	Total Area (ha)	None	None	0.284
Urban	Proposed Roof	Area Impervious (ha)	None	None	0.089
Urban	Proposed Roof	Area Pervious (ha)	None	None	0
Urban	Proposed Roof	Total Area (ha)	None	None	0.089
Urban	South Hardstand	Area Impervious (ha)	None	None	0.067
Urban	South Hardstand	Area Pervious (ha)	None	None	0.017
Urban	South Hardstand	Total Area (ha)	None	None	0.085
Urban	South Landscape	Area Impervious (ha)	None	None	0.005
Urban	South Landscape	Area Pervious (ha)	None	None	0.056
Urban	South Landscape	Total Area (ha)	None	None	0.062

Only certain parameters are reported when they pass validation

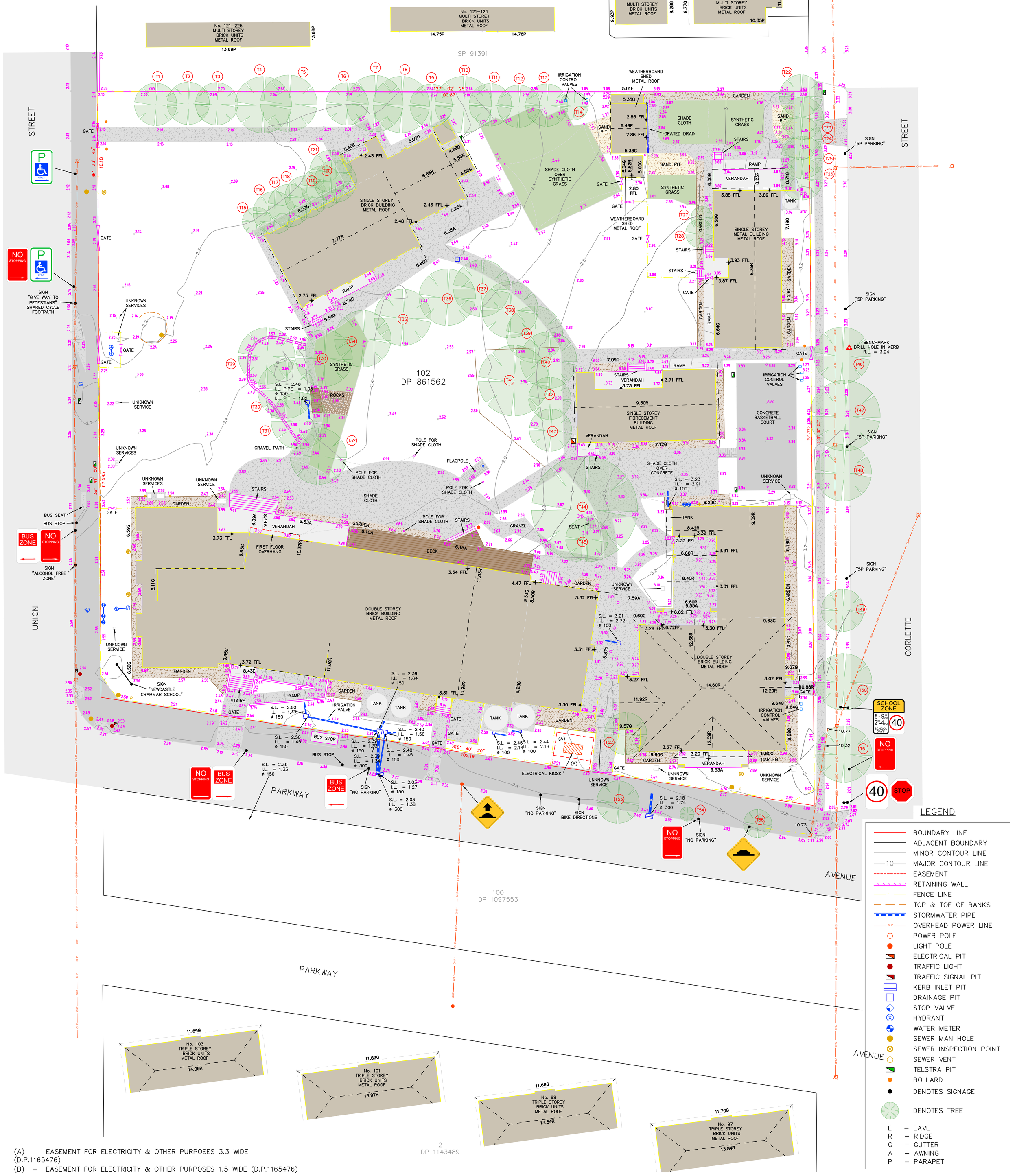
Appendix C – Detailed Site Survey

TREE TABLE

TREE NO.	SPREAD	TRUNK	HEIGHT	TREE NO.	SPREAD	TRUNK	HEIGHT	TREE NO.	SPREAD	TRUNK	HEIGHT	TREE NO.	SPREAD	TRUNK	HEIGHT
T1	6	0.4	4	T15	4	0.1	4	T29	8	0.4	4	T43	6	0.5	5
T2	6	0.4	4	T16	6	0.3	4	T30	8	0.4	4	T44	15	1.0	5
T3	6	0.3	4	T17	6	0.2	4	T31	8	0.4	4	T45	6	0.4	5
T4	8	0.5	4	T18	6	0.2	4	T32	8	0.4	4	T46	8	0.6	4
T5	8	0.5	4	T19	6	0.2	4	T33	8	0.4	4	T47	10	1.0	4
T6	6	0.3	4	T20	6	0.2	4	T34	8	0.4	4	T48	8	0.5	4
T7	8	0.4	4	T21	6	0.2	4	T35	8	0.4	5	T49	6	0.3	3
T8	8	0.4	4	T22	6	0.4	0.4	T36	8	0.4	5	T50	8	0.3	3
T9	6	0.4	4	T23	6	0.4	0.4	T37	8	0.4	5	T51	8	0.3	4
T10	8	0.5	4	T24	6	0.4	0.4	T38	8	0.4	5	T52	6	0.6	3
T11	6	0.4	4	T25	6	0.4	0.4	T39	8	0.4	5	T53	6	0.3	3
T12	6	0.4	4	T26	6	0.4	0.4	T40	8	0.5	5	T54	2	0.1	3
T13	6	0.4	4	T27	3	0.1	3	T41	10	1.0	5	T55	4	0.3	3
T14	4	0.3	3	T28	4	0.2	3	T42	6	0.4	5				

NOTES:

1. FEATURES SHOWN TO SCALE ACCURACY.
2. THIS PLAN IS SUITABLE FOR DETAILED PLANNING AND DESIGN AT THE SCALE/S STATED. THE PLAN MAY NOT BE SUITABLE FOR ANY OTHER PURPOSE OR FOR USE AT ANY OTHER SCALE/S.
3. SERVICES LOCATED ONLY WHERE VISIBLE.
4. THE LOCATION OF ALL UNDERGROUND SERVICES WHETHER SHOWN ON THE PLAN OR NOT, SHOULD BE PRECISELY DETERMINED BEFORE ANY CONSTRUCTION WORK COMMENCES AND MEASURES TAKEN TO PROTECT THESE SERVICES FROM DAMAGE.
5. CONTOUR INTERVAL – 0.2m
6. THE BOUNDARIES SHOWN ARE APPROXIMATE ONLY. THE BOUNDARIES SHOWN HAVE BEEN COMPILED FROM THE RELEVANT DEPOSITED PLANS. FURTHER SURVEY WILL BE REQUIRED IF CONSTRUCTION IS TO TAKE PLACE ON OR ADJACENT TO THE BOUNDARIES.



(A) – EASEMENT FOR ELECTRICITY & OTHER PURPOSES 3.3 WIDE (D.P.1165476)
(B) – EASEMENT FOR ELECTRICITY & OTHER PURPOSES 1.5 WIDE (D.P.1165476)

LEGEND

- BOUNDARY LINE
- ADJACENT BOUNDARY
- MINOR CONTOUR LINE
- 10 MAJOR CONTOUR LINE
- EASEMENT
- RETAINING WALL
- FENCE LINE
- TOP & TOE OF BANKS
- STORMWATER PIPE
- OHP OVERHEAD POWER LINE
- POWER POLE
- LIGHT POLE
- ELECTRICAL PIT
- TRAFFIC LIGHT
- TRAFFIC SIGNAL PIT
- KERB INLET PIT
- DRAINAGE PIT
- STOP VALVE
- HYDRANT
- WATER METER
- SEWER MAN HOLE
- SEWER INSPECTION POINT
- SEWER VENT
- TELSTRA PIT
- BOLLARD
- DENOTES SIGNAGE
- DENOTES TREE

E – EAVE
R – RIDGE
G – GUTTER
A – AWNING
P – PARAPET

REV.	DATE	AMENDMENT(S)	SUR	DFT	CHK
A	15.10.19	ORIGINAL ISSUE	PM	JD	MW

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260 MAITLAND ROAD, T: (02) 4964 4886
MAYFIELD NSW 2304 E: admin@delacs.com.au
ABN: 28 164 260 102 delacs.com.au

CAD REF: 19586 – DET

DETAIL SURVEY OF NEWCASTLE GRAMMAR SCHOOL – PARK CMPUS LOT 102 DP 861562

SITE ADDRESS:
127 UNION STREET
COOKS HILL

CLIENT:
KDC

POSITION DATUM:	PM 8488
ORIENTATION:	MGA (GROUND)
EASTING:	384 330.537
NORTHING	6 355 148.452
CLASS: B	ORDER: 2
HEIGHT DATUM:	PM 8488
CLASS: LB	ORDER: L2
RL: 2.637 (AHD)	DATE: 24.09.19

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SURVEYED	DRAFTED	CHECKED
PM	JD	MW

SCALE	PAGE SIZE	DATE
1:250	A1	15.10.19

SHEET	REV.	PROJECT No.
1	A	19586