Pendle Hill High School Expansion

Stormwater Management Plan

SINSW

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1 INTRODUCTION

1.1 PROJECT INFORMATION

Pendle Hill High School (PHHS) is located in Lot 11 on DP1141329 on Cornock Avenue, Toongabbie. This project is centred around constructing new buildings to expand the existing campus. The project includes;

- Construction of a new three-storey courtyard building on Binalong Road comprising two (2) three-storey wings under a connected roof which will accommodate a library, staff unit, lecture theatre, multimedia and senior learning spaces, administration unit and student amenities;
- External transport infrastructure upgrade works;
- New covered walkways and upgraded landscaping; and
- New hard stand areas for bicycle parking.

Aurecon have been commissioned to investigate and report on the civil engineering, servicing and stormwater requirements pertaining to expansion of Pendle Hill High School in Toongabbie, NSW. The proposed layout plan is shown on the Fulton Trotter Architects Building Plan in Appendix A.

1.2 PURPOSE

The purpose of this report is to outline the stormwater drainage network for the proposed building site and the subsequent effects on the existing system. The document reports on the existing and proposed civil works and infrastructure proposed as part of the development. This document also reports on the stormwater quantity and quality management investigation relating to the proposed development. This report outlines the requirements stated in Secretary's Environmental Assessment Requirements (SEARs). The primary sections addressed in SEARs is in relation to guidelines 15, 16 and 17.

Table 1 References to SEARs Policies

Guideline	Reference in Report	Application in project
15 – Stormwater Drainage	4.3	- Adequate on-site detention is designed. - Downstream properties are not adversely impacted. - Adheres to Parramatta Council guidelines.
16 - Flooding	3.4	- Site is not located in flood zone.
17 – Erosion and Sediment Control	4.2.3	- Addresses International Erosion Control Association (IECA) compliance. - Requirements for this guideline are being detailed by different consultants.

The engineering requirements for this proposal shall be in accordance with the Parramatta Council's Stormwater Disposal Policy (2015), Parramatta Council's Development Design Guidelines (2015), Upper Parramatta River Catchment Trust On-Site Detention Handbook (UPRCT OSD Handbook) with reference to the Queensland Urban Drainage Manual (QUDM). This report outlines preliminary design methodology and calculations in support of a development application and should be read in conjunction with other documents issued by the consultant team.

2 CIVIL SERVICES SCOPE

Under the PHHS development project, civil engineering services shall incorporate:

- Stormwater drainage (in-ground)
  - Stormwater Quantity/flow mitigation, Detention

- Stormwater Quality Improvement
- External connection works

- Bulk earthworks and site levels
- Erosion and Sediment Control SSDA plans

2.1 GENERAL SERVICE REQUIREMENTS

2.1.1 References

The design of civil engineering services shall comply with the following legislation, regulations, codes, and standards:

Table 2 Reference Documents

Standards/Guidelines	
UPRCT OSD Handbook	Upper Parramatta River Catchment Trust Onsite Detention Handbook
QUDM	The Queensland Urban Drainage Manual
DEDG	Development Engineering Design Guidelines (City of Parramatta)
DCP	Development Control Plan (City of Parramatta)
SDP	Stormwater Disposal Policy (City of Parramatta)
IECA	International Erosion Control Association
WBD - MUSIC	Water by Design – MUSIC Modelling Guidelines
SEARs	Secretary's Environmental Assessment Requirements

2.1.2 Sustainability

The design of civil services will be undertaken to drive sustainable project outcomes. Civil engineering initiatives to achieve Greenstar objectives include:

- Improving quality of stormwater discharge from the developed site to meet and exceed state objectives where practical.
- Collection, treatment, and reuse of rainwater from building roofs where practical.
- Minimising stormwater discharge flow rates and volumes from site by promoting onsite retention and reuse of stormwater as well as detention storage to reduce site discharge to council specified rates.
- Selection of best practice sustainable materials.

2.2 KEY ASSUMPTIONS

The following key assumptions have been made as part of the SSDA civil engineering designs and allowances:

- The existing site has been considered 0% impervious as it is completely grass.
- The development site will require onsite stormwater detention to comply with Parramatta City Council Development Engineering Design Guidelines and Upper Parramatta River Catchment Trust Onsite Detention Handbook (UPRCT) OSD Handbook development policies.
- Stormwater Quality modelling to comply with Water Sensitive Urban Design (WSUD) manual.

3 SITE LOCALITY AND TOPOGRAPHY

3.1 SITE LOCATION

The development site is located to the East of Cornock Avenue and along Binalong Road. The site is bound by the existing school site to the West and residential properties to the north and south. Refer to Figure 1 below for locality details.

Street Address: Cornock Avenue, Toongabbie NSW 2146

DP Description: Lot 11 on DP1141329

Figure 1 Development Locality Plan (Source: ArcGIS)

3.2 SITE DESCRIPTION

The existing development site is completely grass. The proposed development site has an area of 0.514ha and a 60m frontage to the existing PHHS Building D and Building E. The development site is an expansion of the existing school and includes a portion of redevelopment around the existing school buildings which are to remain. This area has also been considered under this report as part of the development in accordance with Parramatta City Council policies. It will be located along Binalong Road, behind the existing school. It will be connected to the site entrance to Binalong Road. It will consist of two triple-storey, concrete buildings covered by a single roof. There will be a void in the centre of the structure to allow for landscaped learning space.

Figure 2 Site Aerial Photo (Source: Google Maps)

3.3 EXISTING TOPOGRAPHY AND SITE DRAINAGE

The existing school buildings are all located towards the southern side of the grounds which is also the natural high point. There are multiple catchments discharging in all directions, outwards from the buildings:

- Approximately 1ha of the school grounds drains east, discharging to Binalong Road as overland flow. This catchment is where the works are located and is the subject of this report.
- Less than 0.8ha discharges to the southwest into private residential properties and Cornock Avenue
- The remainder of the school grounds discharge to the north via an existing pedestrian access easement to Favell Street via a piped connection and overland flow.
- There are also a number of smaller uncontrolled catchments discharging directly into the surrounding residential properties as overland flow. None of these areas include hardstands or roofs etc. and are not considered problematic.

The proposed site will be built on top of an embankment that runs along the northern and eastern side of the proposed development. Captured water will fall down the embankment and into the road channel on Binalong Road before draining into the council pit to the north-east corner of the site (Refer to Appendix A). The stormwater drainage system will take advantage of the natural embankment to aid the catchment and channelling of overland flow.

The existing levels in the northwest corner are approximately RL 59.5m AHD and falling to RL 57.97m at the northeast corner, before the stairs leading to Binalong Road access gate. There is a nominal drop from RL 59.71m AHD in the southwest corner to RL 59.1m in the southeast corner. The grade of the land is an average of 1.46% under the proposed building site, while the embankment has a grade of 15.57% (1 in 9). The building will be constructed on level pads to account for this slope.

3.4 FLOODING

Several flood studies have been undertaken by the Council on the two proximity creeks (Pendle Creek and Toongabbie Creek) as well as on the Parramatta River. From the City of Parramatta maps the school site is not located in flood warning area and is not in a flood risk area. Refer to Aurecon's Site Analysis Report for detail.

Two waterways are in proximity to the school site. To the east is Pendle Creek and to the north Toongabbie Creek which forms part of the Upper Parramatta River catchment and discharges to the Parramatta River.

Several flood studies have been undertaken on the two creeks as well as on the Parramatta River. From the City of Parramatta maps the school site is not located in flood warning area and is not in a flood risk area. Only localised flooding directly on or around the property is prevalent.

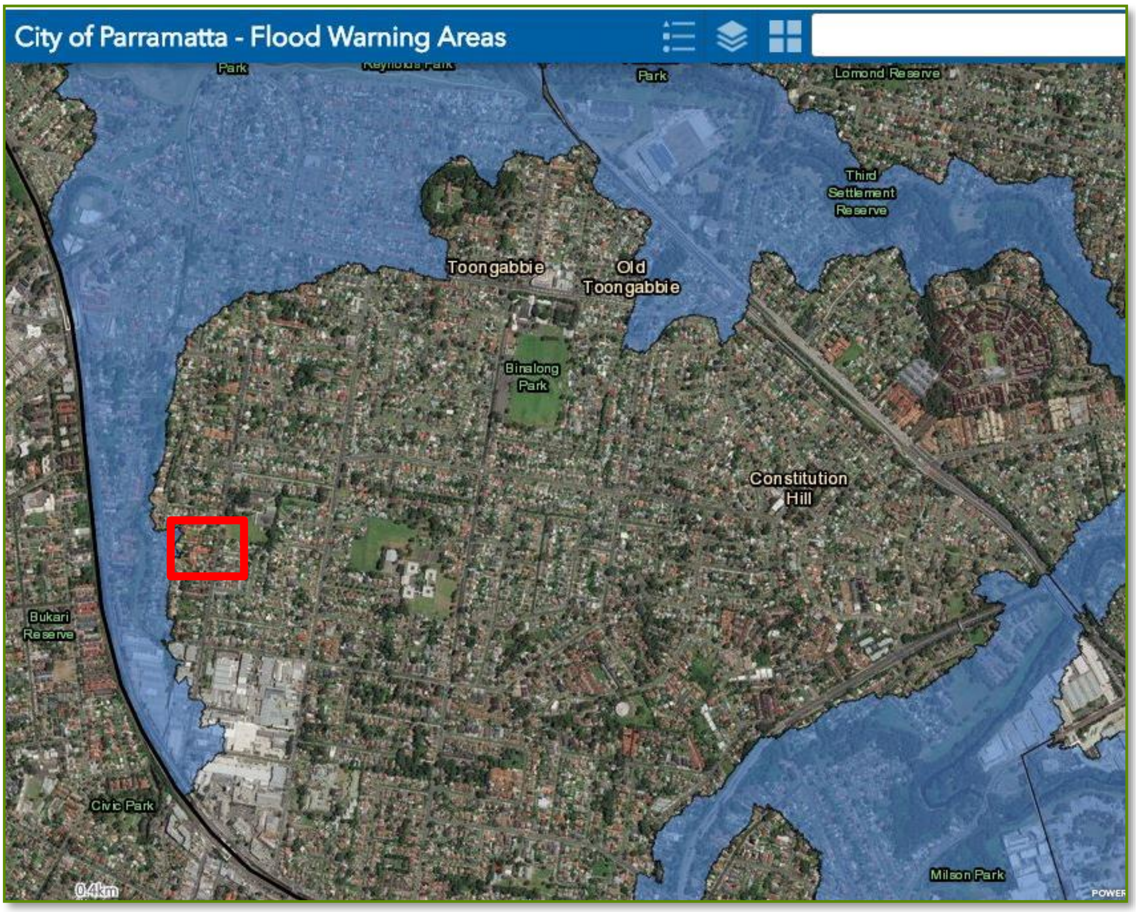


Figure 3 100 – year ARI Flood Extend

For any new development, the minimum floor levels must be above the Flood Planning Levels which is defined as the 100-year ARI (1%AEP) flood level plus 500mm freeboard as required by LEP and DCP. In this instance the site levels are approximately 5.0m above the nearest flood level and will not be inundated during any conceivable flood event. The flood conditions will not be impacted by climate change.

4 STORMWATER MANAGEMENT PLAN

4.1 STORMWATER OBJECTIVES

Under the Parramatta City Council requirements, several design elements were identified in relation to stormwater management issues. Using the principles of Development Engineering Design Guidelines (DEDG), Parramatta City Council must be satisfied that:

- The proposed development can be drained.
- The stormwater management system can follow the features and functions of the natural drainage system.
- Prevent increases in downstream flooding that could result in the damage of surrounding structures.
- Suitable provision is made in the design layout to accommodate for major drainage (i.e. designed for 1% AEP storms).
- Surcharges from existing drainage systems are minimised.
- The quantity of stormwater runoff is minimised through adequately sized detention tank (OSD).

All stormwater related infrastructure will be designed and installed in accordance with WSUD principles and Parramatta City Council guidelines. Captured stormwater from structures, landscape and overflows will be treated in accordance with the relevant standards, and discharge to the existing infrastructure located on Binalong Road.

4.2 WATER RETICULATION

4.2.1 Proposed Infrastructure

As part of the proposed works a new stormwater drainage system will be designed to connect to the Parramatta Council drainage network on Binalong Road. As the existing site is undeveloped, a new drainage system will be designed in accordance with City of Parramatta's standards.

During major storms, overflow from the new piped system will drain as overland flow down the embankment and into the road channel along Binalong Road. This overland flow path is required to prevent ponding around the new and existing buildings and is similar to the existing stormwater drainage discharge scenario.

The proposed civil stormwater will also incorporate the following assets prior to discharge into the municipal drainage network downstream:

- Stormwater quality improvement devices (SQIDs) including:
  - A gross pollutant trap (GPT) - "Ocean Guard 200µm"
  - A tertiary or polishing treatment system - "690mm PSorb Cartridge Storm filters"
- New 243,000 L (243m^3) detention system

  Detention system will be a double layer ecoAID system comprising of 4 rows and 27 arches per row. This detention storage cannot be incorporated into rainwater harvesting storage volumes as it must remain empty in anticipation of large storm events.

These devices will work in conjunction to reduce the overall pollutants in captured rainwater and control the outlet flow rate into the council system. All new stormwater drainage will be designed and constructed in accordance with Parramatta City Council Requirements.

4.2.2 Proposed External Infrastructure

The proposed site drainage will be connected to the existing council pit on Binalong Road located to the north-east of the site (Refer to Appendix A). All new infrastructure built within the road reserves will be council asset. This includes the new pit on Binalong Road and the connecting pipe to the existing pit will be council assets. All other infrastructure will be the responsibility of the NSW Department of Education.

4.2.3 Earthworks

The existing school grounds have been developed on flat pads. The proposed buildings will be constructed in the same manner. Considering the grade of the proposed site is only 1.46%, the extent of necessary bulk earthworks is minimal. The soil on the high point of the site can be cut and moved to fill the low point of site to create a flat foundation.

4.2.4 Erosion & Sediment Control

Onsite earthworks will expose the natural soils creating the potential for erosion. Construction phase erosion and sediment control measures are to be designed in accordance with the International Erosion Control Association (IECA) Guidelines as part of the detailed design phase for implementation during the construction phase should the project proceed. A preliminary erosion and sediment control plan has been developed for the site and is included in Appendix E for reference. An updated plan is to be devised during the detailed design phase of the project.

4.3 STORMWATER QUANTITY

4.3.1 Lawful Point of Discharge

Under existing conditions, stormwater runoff within the development site drains as overland flow, down the embankment and to the concrete channel into the council pit. Given that it is a new establishment, any increase of stormwater runoff has the potential to adversely impact the carriageway. Therefore, the development will include a detention tank to control the flow into the City of Parramatta's drainage network.

4.3.2 Stormwater Drainage Methodology

Modelling of stormwater runoff quantity from the property to be developed (Pendle Hill High School), that flows into Binalong Road stormwater pit has been setup to compare the existing case and proposed developed case. Modelling of the stormwater and drainage characteristics for each scenario has adopted industry standard techniques as specified in QUDM and the Parramatta City Council's Development Engineering Design Guidelines. The drainage modelling software package DRAINS has been used in this assessment to give a simple representation stormwater flows both within drainage infrastructure and in overland flow paths.

The modelling included an analysis of the peak discharges from the developed site to assess the potential for the proposed development to adversely impact the capacity of downstream drainage flow paths and infrastructure. The peak outlet flow of interest is in Pipe 11 (outlet of detention tank) so that the council drainage system is not flooded.

The assessment has been completed by isolating the property to be developed and estimating a likely increase in peak discharge using a preliminary calculation method rational method. These results were then used in conjunction with and compared to the DRAINS modelling of the property. Details of these assessments are covered in section 4.4.

4.3.3 Preliminary Peak Flow Calculations

The Rational Method, as outlined in QUDM is an industry standard technique, and was used to determine preliminary peak flow rates corresponding to the minor and major storm events for the existing and development site as an initial flow capacity review. Parramatta City Council's Design Control Plan were used to identify the design storm events for this development as:

Minor	- 10% AEP	(1 in 10-year ARI)
Major (overland flow)	- 1% AEP	(1 in 100-year ARI)

The fraction impervious for the property to be developed in the existing case condition was estimated to be 0% (as the existing condition was all grass) and was increased to 99% for the developed case which is a conservative (upper limit) given that there will be landscaped space within the development footprint. As determined from the Bureau of Meteorology Intensity-Frequency-Duration (IFD) data, the 1hr rainfall intensity (${}^{1}I_{10}$) for the 10% AEP at the development locality was adopted to be 51mm/hr. The fraction impervious values were then converted to C_{10} values.

Table 3 Existing Case vs Development Case Peak Flow Calculations

	Parameter	Existing Catchment	Developed Catchment	Difference
Catchment Details	Area (Ha)	0.3954	0.3954	0
	Fraction Impervious (f_i)	0%	99%	99%
	Coefficient of Runoff (C_{10})	0.7	0.9	0.2
	Time of Concentration (min)	7	5	-2
	10% AEP Rainfall Intensity (mm/hr)	132	149	17
Peak Flow	39% AEP Discharge (m^3/s)	0.06	0.087	0.027
	10% AEP Discharge (m^3/s)	0.101	0.147	0.046
	5% AEP Discharge (m^3/s)	0.122	0.177	0.055
	2% AEP Discharge (m^3/s)	0.155	0.218	0.063
	1% AEP Discharge (m^3/s)	0.179	0.242	0.063

4.3.4 Preliminary Analysis of Potential for Adverse Impacts

As indicated within Table 1 above, the estimated peak discharges for the proposed developed case exceed those of the existing case conditions by an average of 20%. This is because the proposed development site has a significantly higher fraction of impervious than the existing site.

4.4 DRAINS Modelling

To gain a more comprehensive insight into the increased downstream flow conditions, a DRAINS model has been developed for two case scenarios:

- Existing case (representing Pendle Hill High School in its current state without changes).
- Developed case (representing a proposed development of Pendle Hill High School's East Catchment).

The existing case and developed cases have been setup to isolate and compare the influence of the changes to the East Catchment and the potential for impacts in the receiving road flow path.

The developed case scenario is also intended to test the flow rate in the proposed drainage system in comparison to the existing layout. It is intended to provide context around the risks associated with small increases in discharges associated with developing Pendle Hill High School.

4.4.1 Model Setup

The model adopted estimated parameters to reflect contributing sub-catchments, open channels and drainage features based on available digital information including, reports, drawings, and a survey data. An ILSAX hydrological model is built into the 2019 version of the software for processing design rainfall information and generating flows. Design rainfall information for the Parramatta area was downloaded from the Bureau of Meteorology (BOM) data hub and rainfall intensities, depths and temporal patterns were put into the model.

The model was structured to be able to estimate peak discharges at key locations including:

- From each of the sub-catchment areas that contribute flow, Catchments 2, 4, 6, 7 and 9, refer to Figure 4.
- At the outlet/discharge point from the property to be developed from Pipe 11 (leading out of the detention tank).

The model input parameters adopted for sub-catchments and a detailed schematic of model setup is given in sections 4.4.2.

After establishing catchment areas upstream and downstream from the site, a flow path to the Binalong Road channel and out to council pit was determined. Refer to **Error! Reference source not found.**3 for m odel layout.

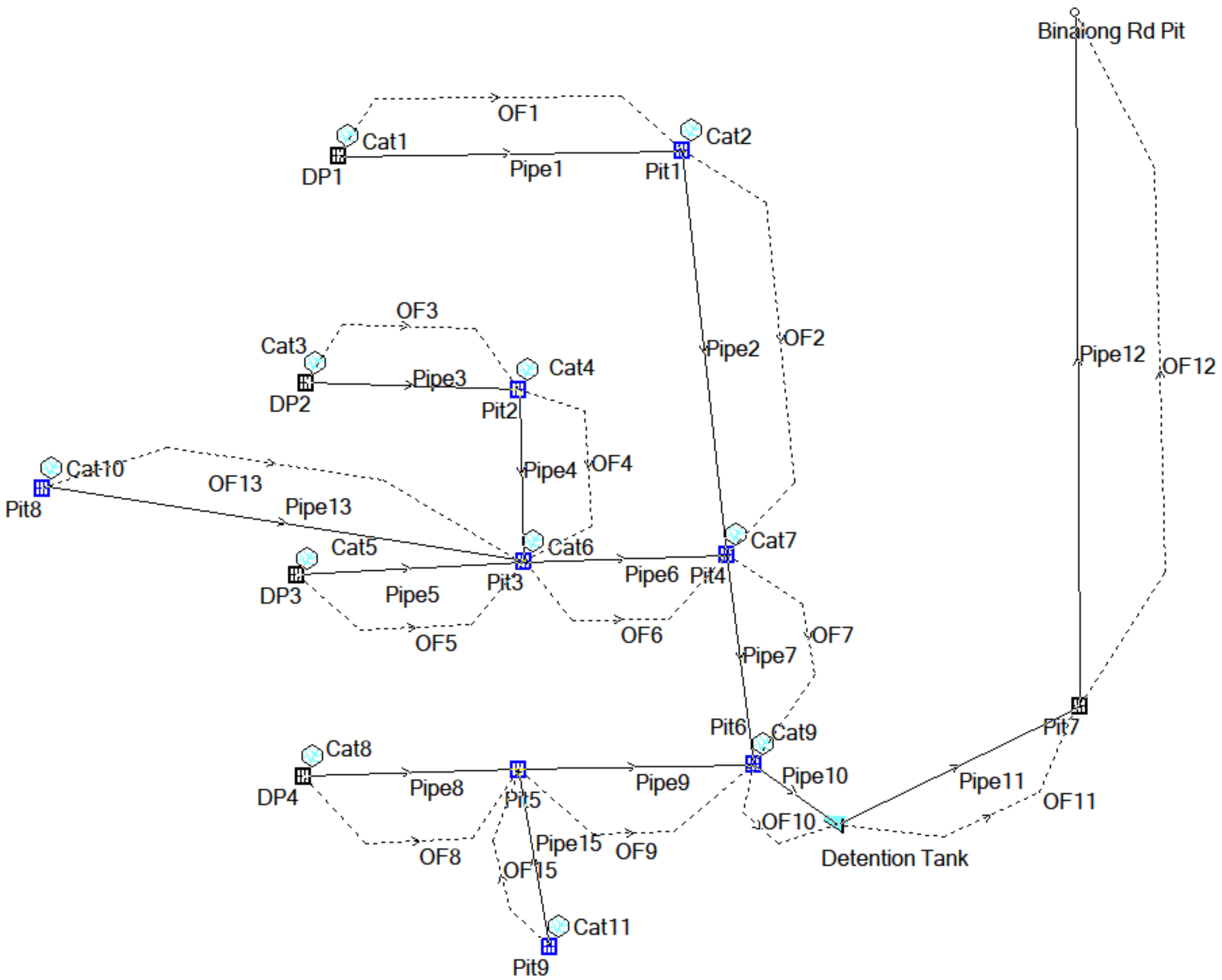


Figure 4 Model Layout Used for Analysis

4.4.2 Model Input Parameters

Using preliminary design drawings, catchment areas were determined. See Table 4 for catchment details contributing to the relevant infrastructure and flow paths. Refer to Figure 4 for catchment locations.

Table 4 Drains Catchment area summary

CATCHMENT	CATCHMENT AREA (ha)
Cat 1	0.0275
Cat 2	0.0472
Cat 3	0.0383
Cat 4	0.0084
Cat 5	0.0479
Cat 6	0.0084
Cat 7	0.0114
Cat 8	0.0601
Cat 9	0.0437
Cat 10	0.0981
Cat 11	0.0206

4.4.3 Modelled Peak Discharges

The developed case model was established to assess the peak discharge in the outlet pipe. The primary differences in model inputs were the breakdown of sub-catchments in the design scenario and the fraction imperviousness for the developed site catchment areas. Comparison of results from these scenario models were analysed for a range of storm events and durations.

The peak discharge for the downstream open channel was determined to be a 1-hour burst (storm 1) during a 1% AEP event. For consistency in the modelling results the 1-hour burst (storm 1) storm events were adopted for all AEP in the developed scenario. Peak discharges are shown for all sub-catchments in Table 55. Note these are un-mitigated, prior to onsite detention measures.

Table 5 Catchments Peak Discharge Summary

CATCHMENT	PEAK FLOW (m^3/s)				
	20%	**10%**	**5%**	**2%**	**1%**
Existing	**0.084**	**0.074**	**0.086**	**0.167**	**0.189**
1	0.007	0.005	0.006	0.011	0.012
2	0.012	0.009	0.01	0.018	0.02
3	0.01	0.007	0.008	0.015	0.017
4	0.002	0.002	0.002	0.003	0.004
5	0.012	0.009	0.011	0.019	0.021
6	0.002	0.002	0.0002	0.003	0.004
7	0.029	0.022	0.025	0.044	0.049
8	0.016	0.012	0.013	0.023	0.026
9	0.011	0.009	0.01	0.017	0.019
10	0.018	0.015	0.017	0.033	0.038
11	0.003	0.003	0.003	0.007	0.008
Total Design	**0.115**	**0.09**	**0.0992**	**0.182**	**0.206**

4.4.4 Existing Case vs Developed Case Modelling Results

The results show that the flow rate has been drastically reduced. The flow depth and ponding depths were analysed only for the developed case, as the existing site does not have pipelines.

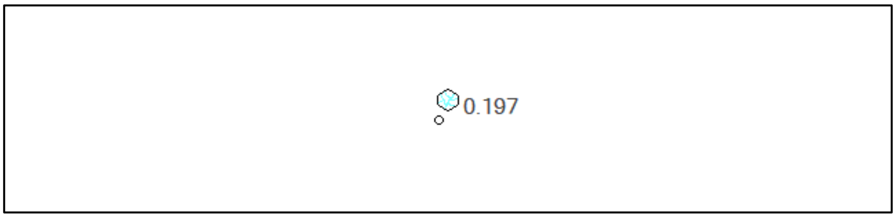


Figure 5 Existing case catchment & peak discharges

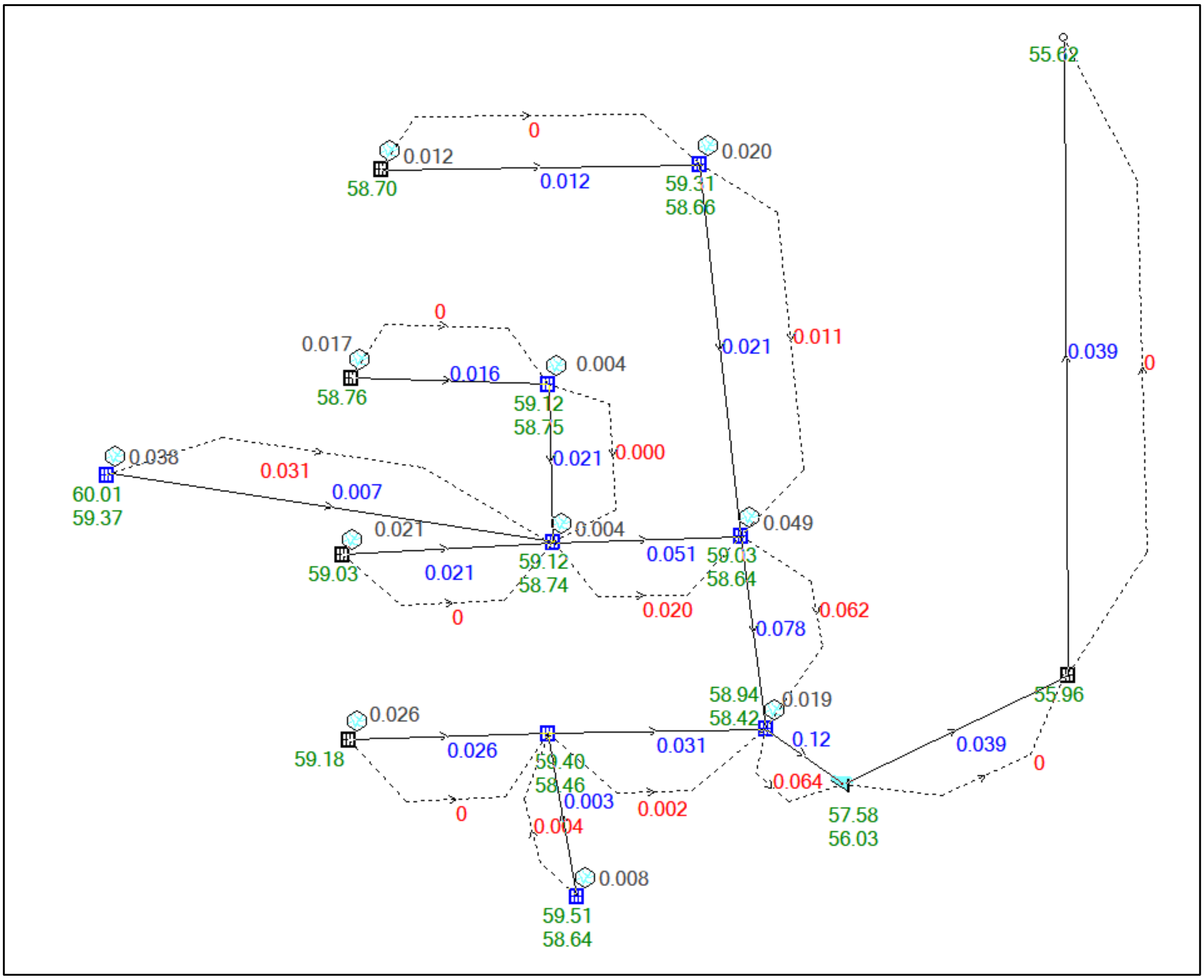


Figure 6 Developed case maximum water levels & peak discharges

Note: The green values are the peak water levels at each node, blue represents the peak flow rates in each conduit and the red values represent overflows exceeding the capacity of the primary conduit (i.e. overland flow)

The above figures indicate that during the developed case scenario, peak discharges are drastically reduced when compared to the existing case scenario. This is expected, as UPRCT OSD Handbook specifies that the outlet flowrate must not exceed 80L/s/ha area developed.

4.4.5 On-site Detention

City of Parramatta has a specified a target outlet flowrate of 80L/s/ha area developed. To control the outlet flowrate to be compliant with the standards, a detention node with an orifice plate has been added to the development site. The detention system initial sizing was adopted from UPRCT OSD Handbook to require 470m^3/ha area developed. That would result in a 243m^3 tank.

According to the UPRCT OSD Handbook, the maximum flowrate into council system must not exceed 80L/s/ha area developed. This value was calculated to be a maximum of 41L/s for this development.

Table 6 Drains Detention Model catchment area summary

Properties:	Existing Catchment	Developed Catchment
Catchment Area (ha)	0.514	0.514
Fraction Impervious (f_i)	0	99%
Time of Concentration – Pervious (t_c) (mins)	7	-
Time of Concentration – Impervious (t_c) (mins)	-	5

Detention Sizing and Materials

Parramatta City Council standards requires detention sizing of 470m^3/ha developed land. As a result, the tank must detain a minimum of 243m^3 of water. The proposed design for the underground detention tank is a double layer “ecoAID” modular arch system. EcoAID is an Australian made detention system that is made from 100% recycled materials. This is proposed over the usual concrete detention tank because it is safer to install as each unit only weighs 15kg. It is also easy and quick to fit as units are simply placed so they overlap the previous unit until the row is completed. This would mean there are reduced labour costs.

The system also integrates a “Catch-All-Row” to act as an internal GPT. It provides both primary and secondary treatment of stormwater and could potentially be used in the treatment train. It could be used instead of Ocean Guard and Stormfilter to reduce costs, however this would require more frequent maintenance as there would be gross pollutants in the OSD. On this basis it has not been considered as part of the treatment train or modelling within this report.

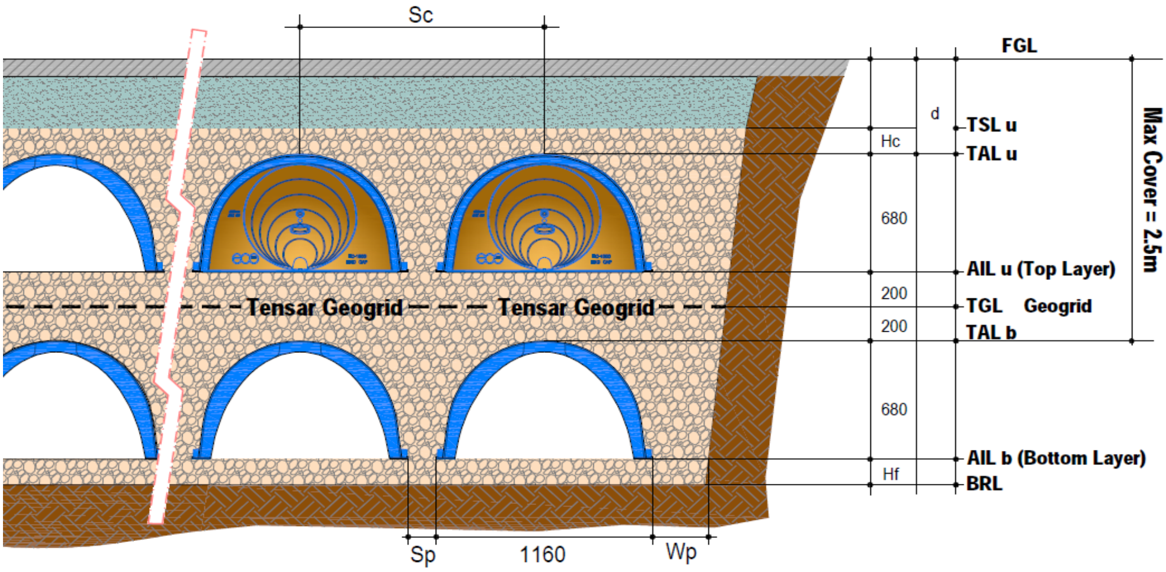


Figure 7 Double-layer ecoAID Cross-section (Source: ecoAID Design Suggestion Tool)

Figure 7 depicts a diagram of the double-layer ecoAID detention system. First a geofabric is laid out in the excavated pit. Then, a layer of cleaned gravel (usually scoria) is placed over the geofabric. The arches are placed down over the gravel, each unit overlaps over the previous one to create a single row. Another layer of gravel covers the bottom layer of arches. This process is repeated for the top layer.

This system will require maintenance every 6 months involving a vacuum truck to remove pollutant and sediment build up in the catch-all-row arches. As the only current access point for large vehicles is via Cornock Road and through the school, it is proposed that there will be a new gate added on Binalong Road for easier maintenance access. The storage capacity is modelled as follows:

Table 7 Detention Stage Storage

Elevation (m)	Surface Area (m^2)
55.57	78.4
55.72	78.4
55.89	148.624
56.06	143.8752
56.23	66.2528
56.4	78.848
57.77	78.4
57.94	148.624
58.11	143.8752
58.28	66.2528
58.45	78.848
58.6	78.4
58.61	0.81
58.9	0.81

The surface areas at each level were calculated by adding the surface area of the gravel and the surface area of the arch at that elevation. Figure 8 shows the cross section of the double-layer ecoAID detention tank. The solid black lines represent the surface area of gravel at each elevation and the dashed red line represents the surface are of the arch at each interval.

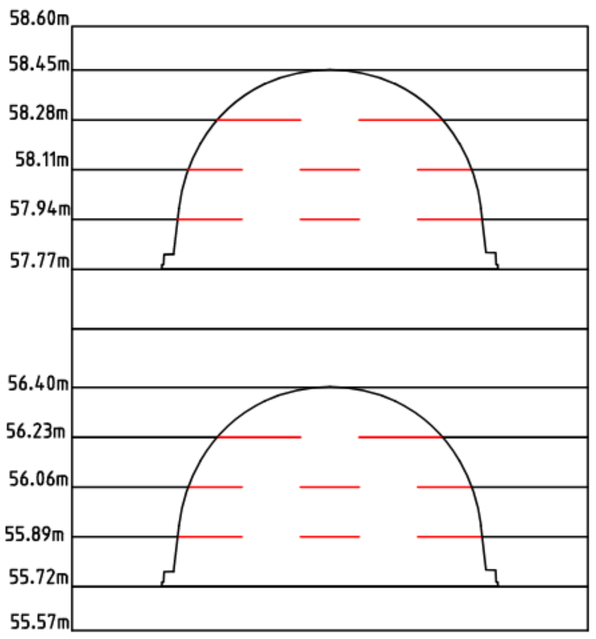


Figure 8 Cross-sectional diagram of detention tank

Detention Outlet Arrangement

The inlet pipe would be 300mm in diameter at an elevation of 57.8m AHD. The outlet route modelled included a single 300mm diameter outlet pipe at the invert of the tank. In order to control the flow rate to be compliant with Parramatta Council Stormwater Design Standards, a 121mm diameter orifice plate is fixed to the outlet pipe. Parramatta City Council requires a Permissible Site Discharge (PSD) flow rate of 80L/s/ha so that it does not overload the broader council drainage network.

Peak Flow Mitigation

The resulting discharge flow rates from the system for the assessed storm events are as follows:

Table 8 Pre Vs Post Development Discharge

STORM EVENT (AEP)	39%	20%	10%	5%	2%	1%
Existing Scenario (L/s)	54.6	64	57	66	128	145
Developed Scenario (L/s)	54.6	18	21	23	26	27
Flow Difference (L/s)	0	-46	-36	-43	-102	-118

As shown in Table 8, the addition of the detention system into the development proposal effectively mitigates the peak discharges for all storm events as required. The maximum water level within the tank, as shown in DRAINS, was determined to be 2.49m deep. Based on the above results the proposed detention system is considered appropriate to meet the requirements listed within the UPRCT OSD Handbook.

4.5 STORMWATER QUALITY

4.5.1 Existing Infrastructure

On site, there is currently a single rainwater tank attached to Building C. The captured water is used for irrigation. There are no other treatment systems on the current site. Parramatta Council requires stormwater quality treatment systems for proposed developments. The stormwater treatment train was modelled using a software called “Model for Stormwater Urban Improvement Conceptualisation” (MUSIC).

4.5.2 MUSIC Modelling

All references to water quality designs and requirements have been made to Water Sensitive Urban Design Manual (WSUD) and UPRCT OSD Handbook.

The aim of stormwater quality treatment is to reduce the pollutants in runoff water before it enters the detention system and ultimately the municipal drainage network. The target reduction numbers specified in the Parramatta DCP manual are:

- Gross Pollutants: 90%
- Total Suspended Solids (TSS): 85%
- Total Phosphorus (TP): 65%
- Total Nitrogen (TN): 45%

To evaluate the percentage reduction in pollutants, a MUSIC model was created based on rainfall data for Parramatta. The initial input parameters were used based on the Water by Design “MUSIC Modelling Guidelines”. The initial model included Humeceptor as a gross pollutant trap (GPT) and a ZPG Storm Filter as a tertiary treatment system, with each cartridge treating 3L/s of captured water. The model was tested by

Ocean Protect to assess the efficiency of the treatment train. Ocean Protect have adjusted the MUSIC model with source nodes specific to the City of Parramatta. They have also altered the treatment nodes to design a more efficient and cost-effective system.

Treatment Nodes

The treatment devices used to reduce the percentage of pollutants are all created by Ocean Protect. They include a GPT called "Ocean Guard 200" and a tertiary treatment system called "PSorb Cartridge Storm Filter". The Humeceptor has been replaced by Ocean Guard because pit insert systems are easier to design and do not require a large hydraulic drop. It is proposed that 7 x Ocean Guard 200µm will be implemented in the East Catchment for the with 200-micron mesh bags in each pit insert. The ZPG StormFilter was removed as it is only used in Blacktown City Council. Instead, 4 x (690mm) PSorb Cartridge StormFilters with a $6m^3$ chamber were proposed. These cartridges have a flow rate of 0.9L/s. This design will require a 910mm weir with a minimum internal height of 1300mm. The treatment train is shown in Figure 8.

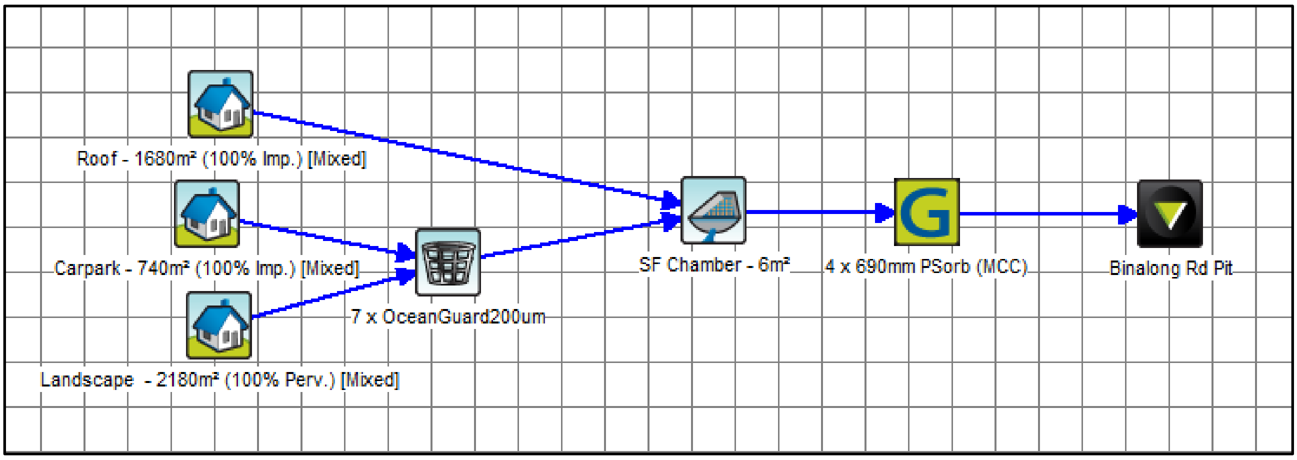


Figure 9 MUSIC Treatment Train

Table 9 Treatment Train Effectiveness

Pollutants of Concern	Residual Pollutants (Developed Case) (kg/yr)	% Reduction (Developed Case)	% Reduction Targets
Gross Pollutants (GP)	83.4	100	90
Total Suspended Solids (TSS)	466	90.2	85
Total Phosphorus (TP)	0.906	66.9	60
Total Nitrogen (TN)	6.93	45.2	45

The results in Table 9 indicate that the proposed treatment train is effective and meets the target reduction in pollutants as stated in WSUD manual. This is a viable stormwater treatment system.

5 ASSUMPTIONS AND LIMITATIONS

- This assessment represents an approximation of risk relating to the potential for adverse impacts associated with development creating additional stormwater runoff. Modelling of drainage paths and infrastructure is approximate in nature and does not represent a detailed analysis of the hydraulic characteristics.
- All presented results are subject to the assumptions and limitations of the software used, which can be subject to change over time as modelling software is updated and best practice methods change.

6 CONCLUSIONS

From the investigations conducted, it has been shown that the proposed buildings for PHHS has been developed in accordance with the Upper Parramatta River Catchment Trust Onsite Detention Handbook, Parramatta Development Engineering Design Guidelines, and the Queensland Urban Drainage Manual.

The following points summarise the findings and recommendations:

- Stormwater quality treatment is required as specified in the Parramatta City Council Development Guidelines. A gross pollutant trap and stormfilter (manufactured by Ocean Protect) or an equivalent system will be installed. The detention tank's catch-all-row will act as a sediment trap in addition to the Ocean Protect products.
- A detention tank of volume 243m^3 is required to reduce the outlet flow rate to 41L/s. The tank will be a double layer ecoAID modular stormwater system.

It is important to recognise that these findings are compliant with SEARs Section 4.12 of the Environmental Planning and Assessment Act 1979. Particularly policies 15, 16 and 17 as they are critical to stormwater drainage design. The design incorporates adequate stormwater treatment devices, detention sizing and site drainage to mitigate contamination and flooding to downstream properties. As Pendle Hill High School is not located in a flood zone, the proposed design is adequate for the development. There will be further design completed for erosion and sediment control during the detailed design phase.

This modelling undertaken and stormwater management proposals outlined within this report have demonstrated that the proposed development for the expansion of Pendle Hill High School can be completed in accordance with the Parramatta City Council City Plan, planning scheme policies, stormwater management and modelling guidelines and best management practices.

Appendix A

Stormwater Drainage Design

aurecon
www.aurecongroup.com

CLIENT

Pendle Hill High School
Responsibilities Respect Rights Learning

REV	DATE	REVISION DETAILS	APPROVAL
A	02.04.21	ISSUED FOR INFORMATION	T.MUSPRATT
B	30.03.21	ISSUED FOR INFORMATION	T.MUSPRATT
C	30.04.21	ISSUED FOR SCHEMATIC DESIGN	T.MUSPRATT

SCALE	SIZE
1:250	A1

DRAWN: H.NGUYEN
DESIGNED: T.MUSPRATT
CHECKED: T.MUSPRATT

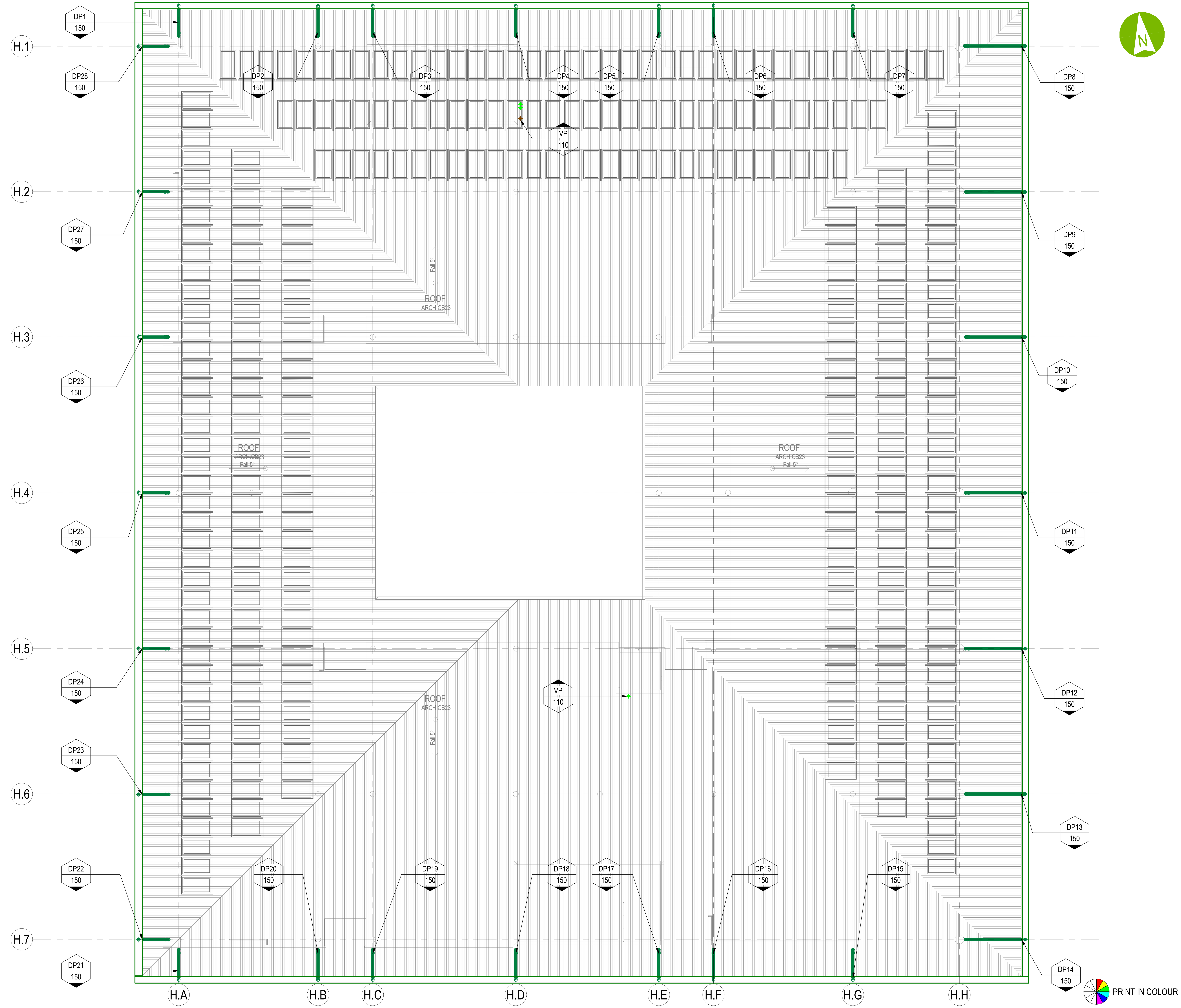
SCHEMATIC DESIGN
NOT FOR CONSTRUCTION

APPROVED
DATE

PROJECT: PENDLE HILL HIGH SCHOOL
Cornock Avenue, Toongabbie NSW

TITLE: CIVIL SERVICES
BUILDING H
STORMWATER DRAINAGE PLAN

DRAWING No.	PROJECT No	WBS	TYPE	DISC - NUMBER	REV
	507914	0001	DRG	CC-1006	C



GENERAL NOTES

- THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS, SPECIFICATIONS AND INSTRUCTIONS FOR THIS PROJECT.
- REFER TO HY-0001 FOR GENERAL NOTES AND LEGEND
- REFER TO THE PROJECT ARCHITECTURAL DRAWINGS & SPECIFICATION FOR THE MAKE/MODEL & SET OUT DIMENSIONS OF FIXTURES, APPLIANCES & TAPWARE.
- THE ROUTE OF THE HYDRAULIC SERVICES PIPEWORK SHOWN IN THE DRAWING IS INDICATIVE. FINAL POSITIONING OF PIPEWORK IS TO BE DETERMINED ONSITE AND CO-ORDINATED WITH THE STRUCTURE, MECHANICAL SERVICES DUCTS, PIPES, CABLES ETC.
- THE SANITARY PLUMBING SYSTEM HAS BEEN DESIGNED AND IS TO BE INSTALLED TO COMPLY WITH THE FOLLOWING CODES;
  - AS/NZS 3500.PART 2
  - BUILDING CODE OF AUSTRALIA
- LOCATION OF EXISTING SANITARY SERVICES INDICATIVE ONLY. CONTRACTOR TO VERIFY LOCATION ON SITE.
- THE DOMESTIC COLD, HOT AND WARM WATER SYSTEM HAS BEEN DESIGNED AND IS TO BE INSTALLED TO COMPLY WITH THE FOLLOWING CODES:
  - AS/NZS 3500.PART 1 AND 4
  - AS/NZS 3498
  - BUILDING CODE OF AUSTRALIA
- LOCATION OF EXISTING WATER SERVICES INDICATIVE ONLY. CONTRACTOR TO VERIFY LOCATION ON SITE.
- ALL DAMAGE TO BE MADE GOOD TO THE SPECIFICATION OF THE ARCHITECT.

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CLIENT

Pendle Hill High School
Responsibilities Respect Rights Learning

REV	DATE	REVISION DETAILS	APPROVED
A	23.04.21	ISSUED FOR SCHEMATIC DESIGN	P.DO

SCALE	SIZE
1 : 100	A1

SCHEMATIC DESIGN
NOT FOR CONSTRUCTION

DRAWN: J.NAPPER
DESIGNED: J.NAPPER
CHECKED: T.GIERSZ

APPROVED
DATE 23.04.21

PROJECT
PENDLE HILL HIGH SCHOOL
Cornock Avenue, Toongabbie NSW

TITLE
HYDRAULIC SERVICES
BUILDING H

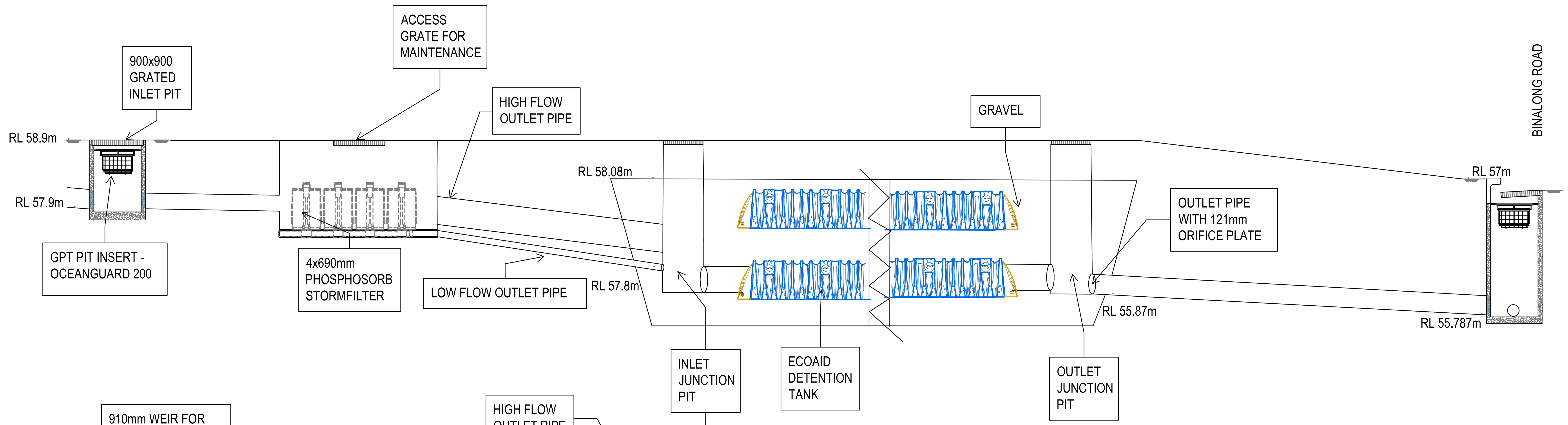
ROOF LAYOUT

PRINT IN COLOUR

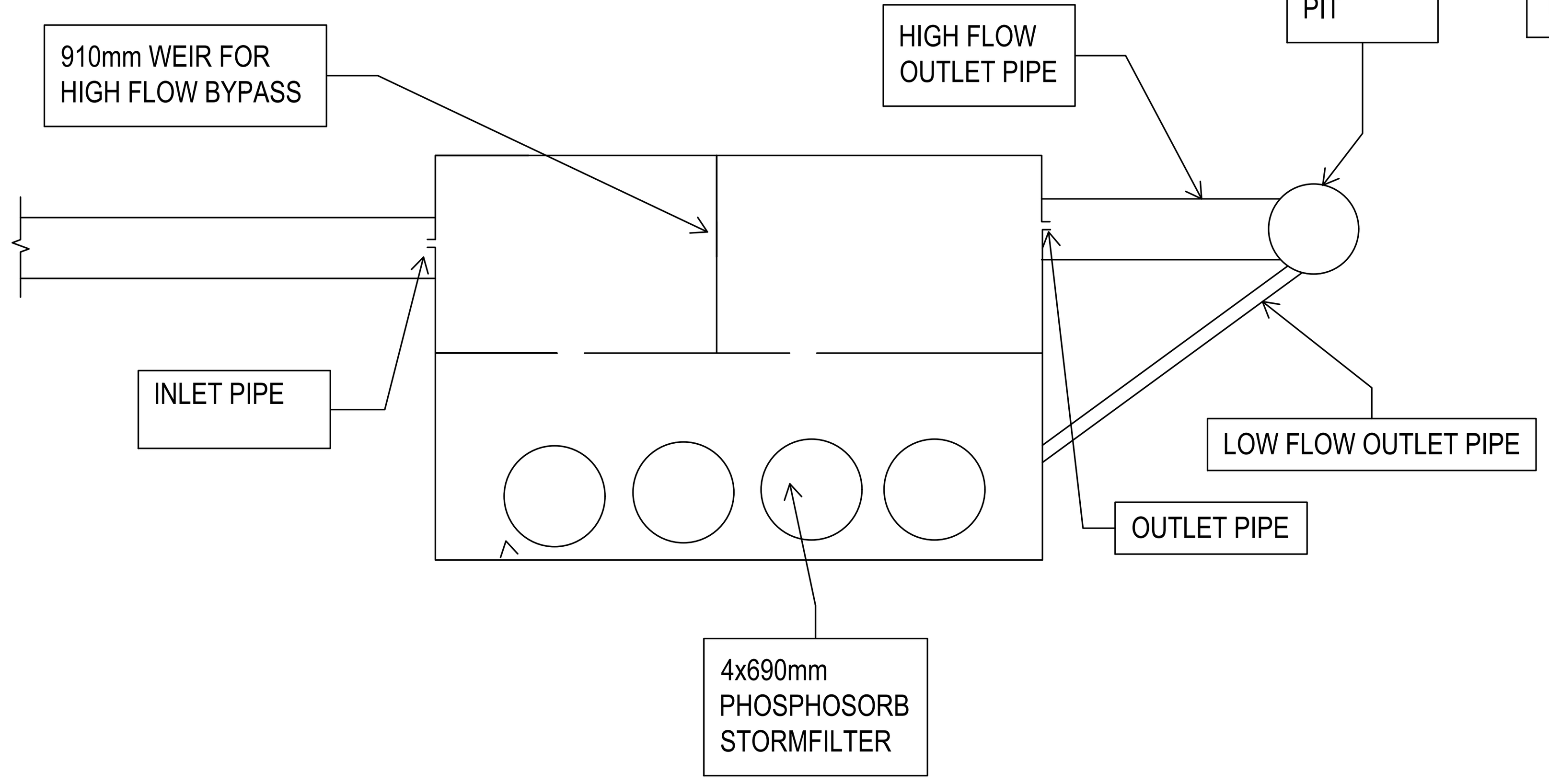
DRAWING NUMBER

PROJECT No	WBS	TYPE	DISC - NUMBER	REV
507914 -	0001 -	DRG -	HY-4304 -	A

Plot Date: 4/23/2021 2:58:04 PM Office: Filename: BIM 360://507914 - Pendle Hill High School/507914_Pendle Hill HS_AUR_CS_R20.rvt



LONG SECTION OF WATER QUALITY AND OSD



PLAN VIEW PSORB STORMFILTER

NOTES:
1. LEVELS (RL/IL's) SHOWN ARE INDICATIVE BASED ON AVAILABLE SURVEY DATA.
TO BE CONFIRMED WITH 3D MODELLING.

PRINT IN COLOUR

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www.aurecongroup.com

CLIENT
Pendle Hill High School
Responsibilities Respect Rights Learning

REV	DATE	REVISION DETAILS	APPROVAL
A	02.04.21	ISSUED FOR INFORMATION	T.MUSPRATT
B	23.04.21	ISSUED FOR SCHEMATIC DESIGN	T.MUSPRATT

SCALE: NTS
SIZE: A1
DRAWN: H.NGUYEN
DESIGNED: T.MUSPRATT
CHECKED: T.MUSPRATT

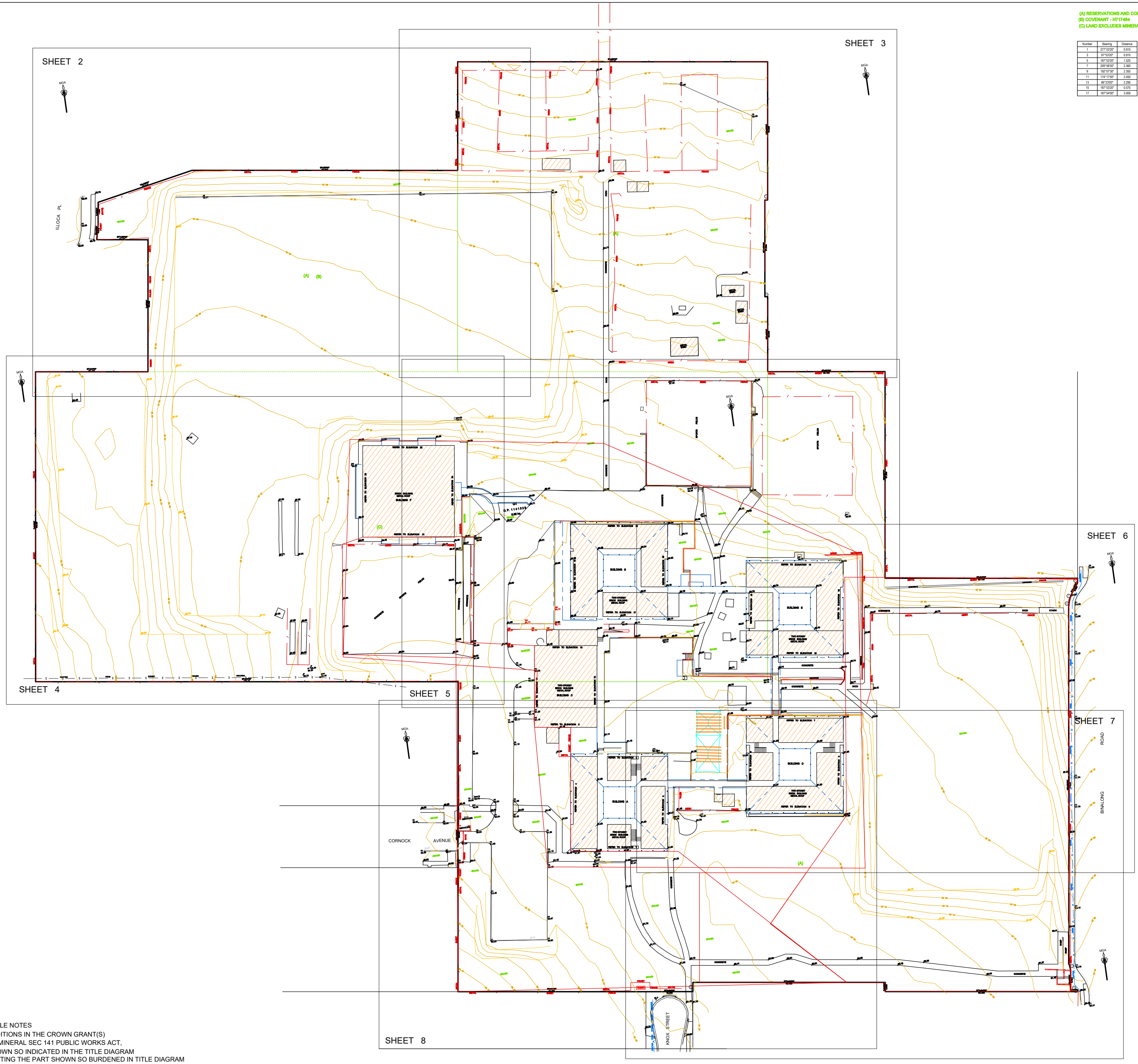
SCHEMATIC DESIGN
NOT FOR CONSTRUCTION
APPROVED
DATE

PROJECT: PENDLE HILL HIGH SCHOOL
Cornock Avenue, Toongabbie NSW
TITLE: CIVIL SERVICES
OSD AND WATER TREATMENT DIAGRAM

DRAWING No.	PROJECT No	WBS	TYPE	DISC - NUMBER	REV
	507914	0001	DRG	CC-1007	B

Appendix B

Detailed Survey Drawing



(A) RESERVATIONS AND CONDITIONS - SEE CROWN GRANT
(B) COVENANT - H717484
(C) LAND EXCLUDES MINERALS

Number	Bearing	Distance
1	277°53'20"	0.915
3	97°53'20"	0.915
5	187°53'20"	1.525
7	209°56'50"	2.360
9	192°07'30"	2.350
11	174°17'50"	2.450
13	96°23'00"	2.290
15	187°53'20"	0.575
17	187°54'00"	3.000

* THE LOT 101 DP 1141329 TITLE NOTES
1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. H263919 LAND EXCLUDES MINERAL SEC 141 PUBLIC WORKS ACT, 1912 WITHIN THE PART SHOWN SO INDICATED IN THE TITLE DIAGRAM
3. H717484 COVENANT AFFECTING THE PART SHOWN SO BURDENED IN TITLE DIAGRAM

NOTES :

- * BOUNDARIES HAVE NOT BEEN DEFINED BY SURVEY AND ARE DIAGRAMMATIC ONLY
- * LAND DIMENSIONS AND AREAS HAVE BEEN COMPILED FROM PLANS OBTAINED FROM LPMA
- * BEARINGS RELATE TO MGA NORTH ORIGINATING SCIMS MARKS
- * LEVEL DATUM IS AHD ORIGINATING FROM SSM166014 RL 46.4 .
- * VISIBLE, ACCESSIBLE SERVICES ONLY HAVE BEEN LOCATED. THIS PLAN DOES NOT PURPORT TO SHOW UNDERGROUND SERVICES.
- * THE EXISTENCE OF UNDERGROUND SERVICES HAS NOT BEEN ESTABLISHED.
- * EXISTENCE OF SERVICES MUST BE VERIFIED BY CONTACTING DIAL BEFORE YOU DIG (DBYD) 1100.COM.AU CRITICAL SERVICES MUST BE EXPOSED AND LOCATED.
- * NEIGHBOURING HOUSES , WINDOWS AND ROOF POSITIONS ARE APPROXIMATELY ONLY.
- * FLOOR LEVELS GENERALLY SURVEYED AT DOOR THRESHOLDS. INTERNAL ROOMS NOT SURVEYED.
- * CONTOURS SHOWN ARE INDICATIVE OF LAND FORM. SPOT LEVELS SHOULD TAKE PRECEDENCE.
- * REFER TO FACE OF PLAN FOR SUBJECT TITLE NOTATIONS.
- * THIS TITLEBLOCK IS AN INTEGRAL PART OF THIS DRAWING AND SHOULD NOT BE REMOVED.

LEGEND

ELP - ELECTRIC LIGHT POLE
HYD - HYDRANT
TW - TOP WALL
TK - TOP KERB
TG - TOP GUTTER
PP - POWER POLE
SMH - SEWER MANHOLE
SP - SIGN POST
SV - STOP VALVE
TEL - TELSTRA PIT
VC - VEHICLE CROSSING
WM - WATER METER

REV	AMENDMENTS	DATE
A	BUILDING NAMES AMENDED	19.02.2020

SCALE 1:600
0 10 20 30 40 50

SHEET 1 OF 9 - DETAIL SURVEY

CLIENT : NSW Department of Education

SURVEYOR :	BG
DATUM :	AUSTRALIAN HEIGHT DATUM
ORIGIN :	SSM 166014 RL 46.4
JOB REF. :	B04636
DRAWING No.	B04636
CHECKED :	SD
DATE OF SURVEY:	NOV 2019
REDUCTION RATIO :	1:600

PLAN OF: PENDLE HILL HIGH SCHOOL PENDLE HILL
BEING: LOT 101 IN DP 1141329
SHOWING: GENERAL DETAIL AND SITE LEVELS
PURPOSE: ARCHITECTURAL DESIGN COUNCIL SUBMISSION

BELLA VISTA
ABN 20 068 433 974
PO Box 7419 BAULKHAM HILLS NSW 2153
SUITE 405, LEVEL 4 14 LEXINGTON DRIVE, BELLA VISTA NSW 2153
PHONE : 9056 1900
email: office@projectsurveyors.com.au
www.projectsurveyors.com.au
PROJECT SURVEYORS
Professional Innovative... Results.

A1

Appendix C

Dial Before You Dig

Asset Information

Legend

Sewer

- Sewer Main (with flow arrow & size type text) — 225 PVC
- Disused Main
- Rising Main
- Maintenance Hole (with upstream depth to invert) — 1.7
- Sub-surface chamber
- Maintenance Hole with Overflow chamber
- Ventshalft EDUCT — VSE
- Ventshaft INDUCT — VSI
- Property Connection Point (with chainage to downstream MH) — 10.6
- Concrete Encased Section — Concrete Encased
- Terminal Maintenance Shaft — TMS
- Maintenance Shaft — MS
- Rodding Point — RP
- Lamphole
- Vertical — VERT
- Pumping Station — SP0882
- Sewer Rehabilitation

Pressure Sewer

- Pressure Sewer Main
- Pump Unit (Alarm, Electrical Cable, Pump Unit) — A
- Property Valve Boundary Assembly
- Stop Valve
- Reducer / Taper
- Flushing Point — FP

Vacuum Sewer

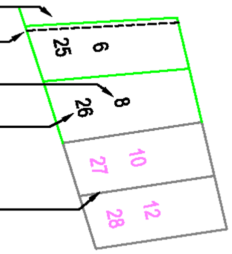
- Pressure Sewer Main
- Division Valve
- Vacuum Chamber
- Clean Out Point

Stormwater

- Stormwater Pipe
- Stormwater Channel
- Stormwater Gully
- Stormwater Maintenance Hole

Property Details

- Boundary Line
- Easement Line
- House Number
- Lot Number
- Proposed Land



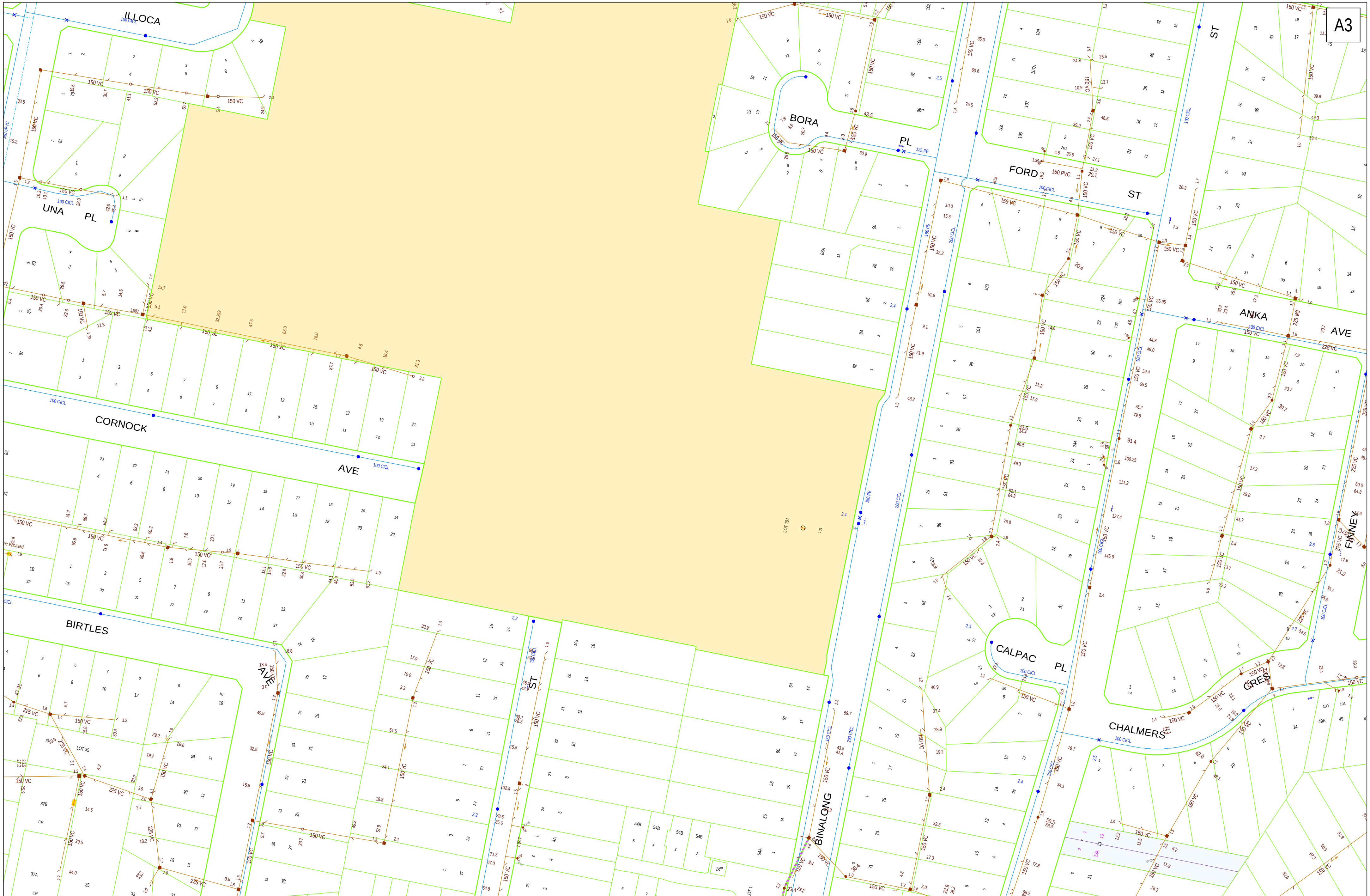
- Sydney Water Heritage Site (please call **132 092** and ask for the **Heritage Unit**)

Water

- WaterMain - Potable (with size type text) — 200 PVC
- Disconnected Main - Potable
- Proposed Main - Potable
- Water Main - Recycled
- Special Supply Conditions - Potable
- Special Supply Conditions - Recycled
- Restrained Joints - Potable
- Restrained Joints - Recycled
- Hydrant
- Maintenance Hole
- Stop Valve
- Stop Vale with By-pass
- Stop Valve with Tapers
- Closed Stop Valve
- Air Valve
- Valve
- Scour
- Reducer / Taper
- Vertical Bends
- Reservoir
- Recycled Water is shown as per Potable above. Colour as indicated

Private Mains

- Potable Water Main
- Recycled Water Main
- Sewer Main
- Symbols for Private Mains shown grey



DBYD Address:
n/a Cornock Avenue
Toongabbie NSW 2146

DBYD Job No: 21020817

DBYD Sequence No: 106242056

Scale: 1:1500

Date of Production: 05/02/2021

Plan 1 of 1

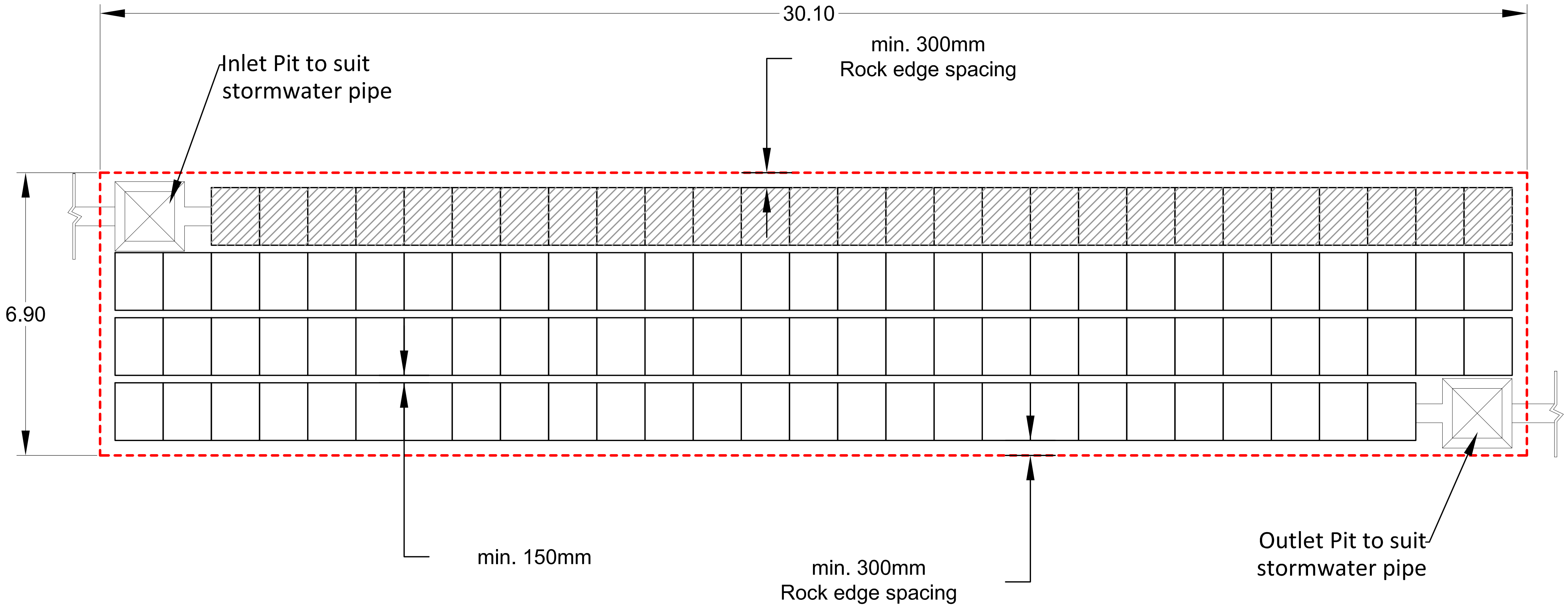
N

0m 9m 18m 27m 36m

Appendix D

Preliminary OSD Tank Design

EcoAid technical drawings



DESIGN SUGGESTION LAYOUT

It is opportune to emphasize that we have provided an ecoAID design suggestion for installation purposes only. It is not to be considered a full design as we are not consulting engineers, and are not privy to all the information pertaining to this matter and have no control over the project. No warranty is implied or granted in any drawing or design suggestion or assistance we may give.

KEY

Catch-All-Row (Inlet Row on bottom layer only)

bidim A44 geotextile cushion both sides of a 1.14mm Coolpro Reinforced Polypropylene (RPP) Liner.

NOTES

1. All pipe & manhole sizes to be specified by the Design Engineer . The dimensions indicated in this drawing are indicative only and must be checked on site.
2. Exact location of ecoAID tank to be determined on site by Design Engineer.
3. Exact location of manhole pits and pipes to be determined on site by Design Engineer.
4. All levels to be determined on site by Engineer .
5. Finished Ground Levels to be determined by Design Engineer.
6. All dimensions shown on this drawing are in meters unless noted otherwise.
7. Do not scale from this drawing.
8. EcoAID system to be installed in accordance with manufacturers installation guidelines.

TOTAL STORAGE VOLUME CALCULATION TANK 1

Total Storage Volume = 243m3

Number of Arches required = 232 units
Number of End Caps required = 16 units
Combined length of 'Catch All Rows' = 30m
Volume of rock required = 308m3 or 462 Tonnes approx.

GEOFABRICS®
Smarter Infrastructure

Rev:	Issue / Revision:	Date:

Designed:	Date:
BL	18/02/2021
Drawn:	Date:
GM	18/02/2021
Approved:	Date:
BL	18/02/2021

Project Title: Pendle High School

Drawing Tile: ecoAID Stormwater Chamber System - Plan View

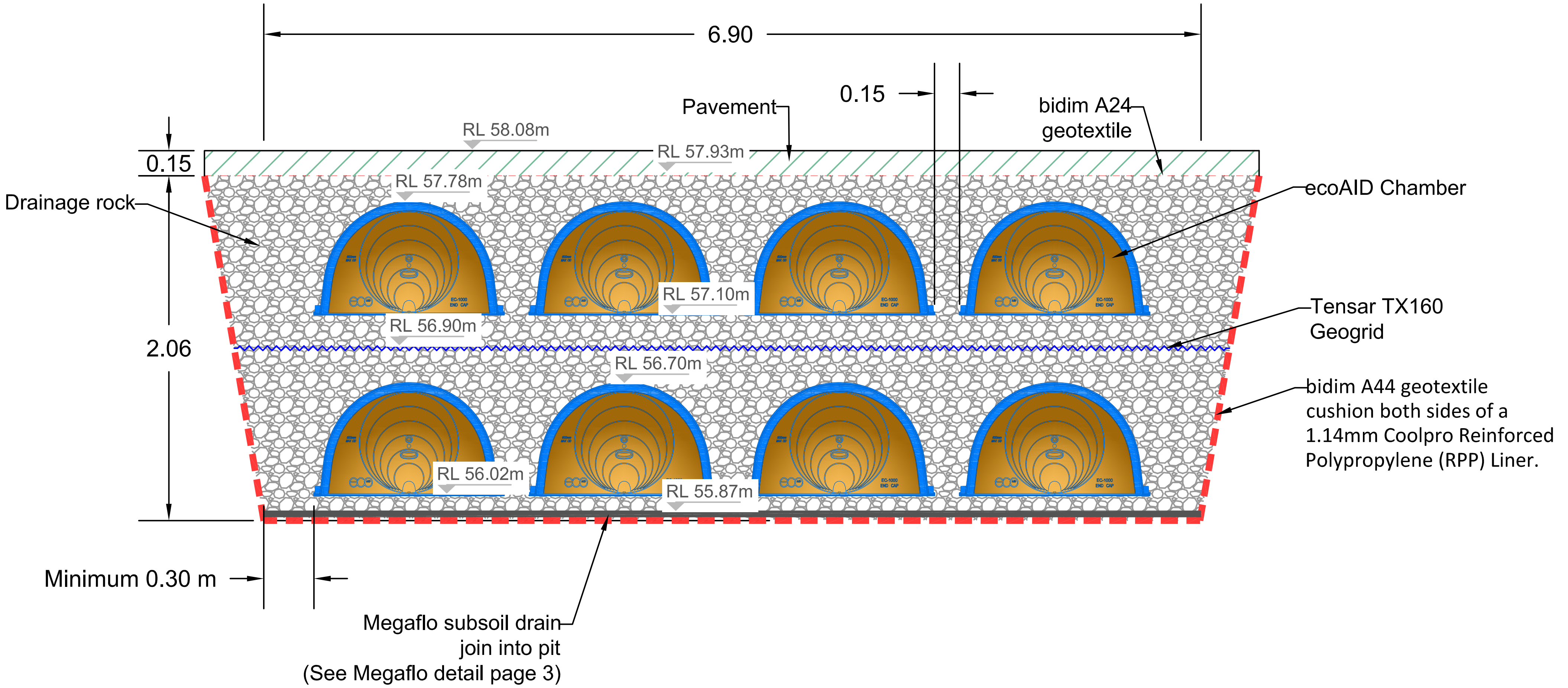
Client: AURECON DESIGN

N.T.S

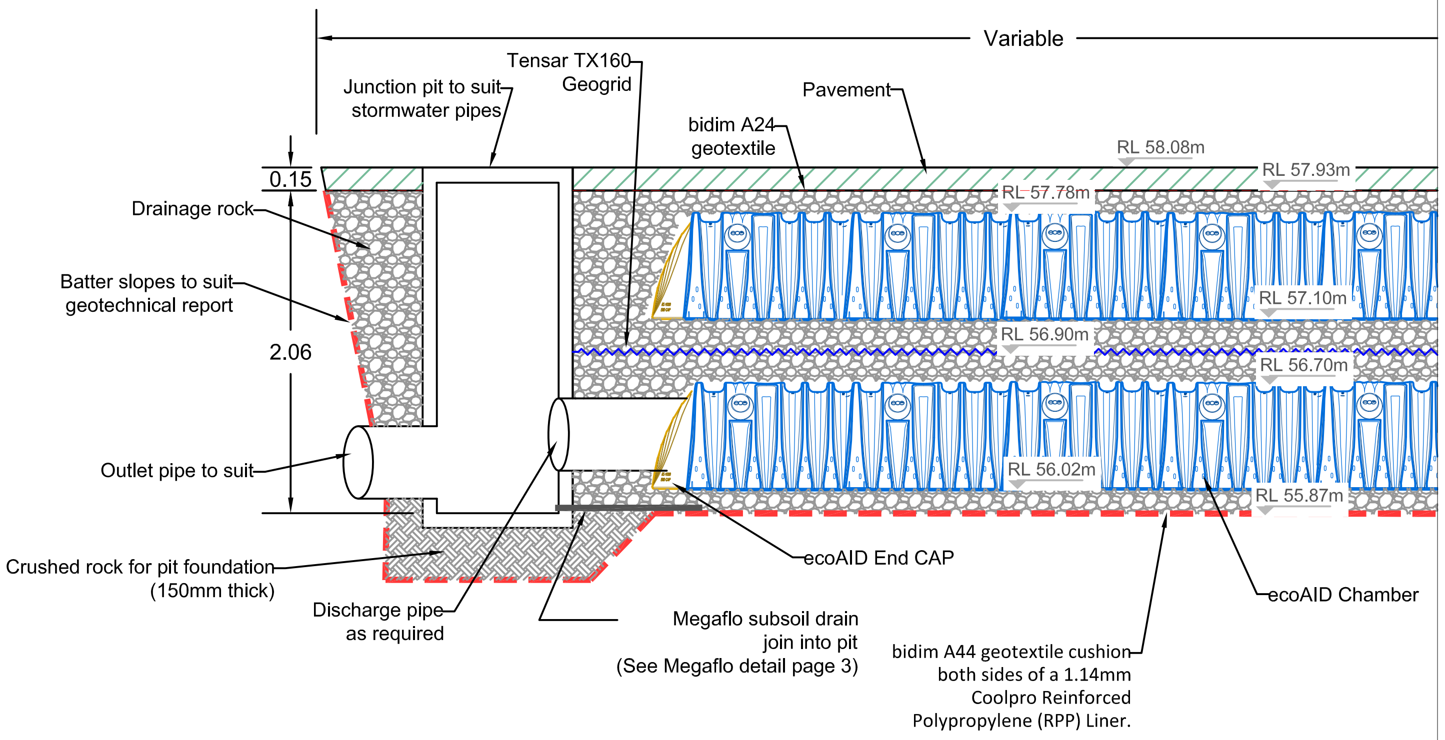
Project No:

1/4

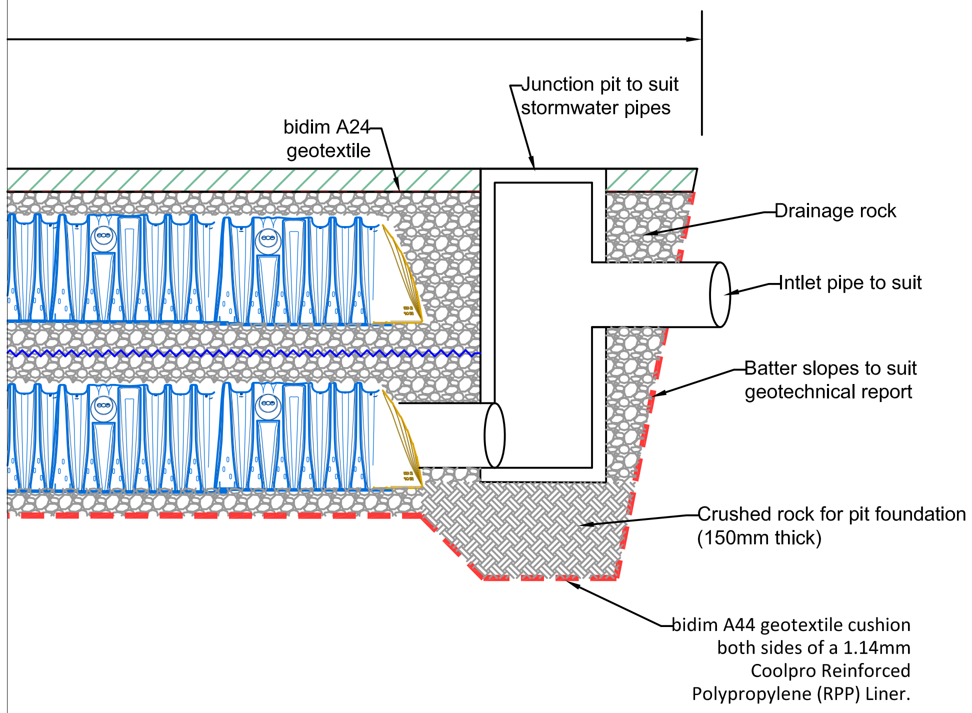
Rev: 0



Outlet Pit Detail



Inlet Pit Detail



DESIGN SUGGESTION LAYOUT

It is opportune to emphasize that we have provided an ecoAID design suggestion for installation purposes only. It is not to be considered a full design as we are not consulting engineers, and are not privy to all the information pertaining to this matter and have no control over the project. No warranty is implied or granted in any drawing or design suggestion or assistance we may give.

KEY

The chamber system bedding, embedment and cover must be clean, washed, angular rock with a particle size grading between 20mm and 50mm. Total fines content must be less than 2% fines by weight and be free from dust, clay, dirt and other deleterious material. Please see EC-1000 System Specification for further details.

bidim A44 geotextile cushion both sides of a 1.14mm Coolpro Reinforced Polypropylene (RPP) Liner.

bidim A24 geotextile

Tensar TX160 Geogrid

NOTES

1. All pipe & manhole sizes to be specified by the Design Engineer . The dimensions indicated in this drawing are indicative only and must be checked on site.
2. Exact location of ecoAID tank to be determined on site by Design Engineer.
3. Exact location of manhole pits and pipes to be determined on site by Design Engineer.
4. All levels to be determined on site by Engineer .
5. Finished Ground Levels to be determined by Design Engineer.
6. All dimensions shown on this drawing are in meters unless noted otherwise.
7. Do not scale from this drawing.
8. EcoAID system to be installed in accordance with manufacturers installation guidelines.

TOTAL STORAGE VOLUME CALCULATION TANK 1

Total Storage Volume = 243m3

Number of Arches required = 232 units
Number of End Caps required = 16 units
Combined length of 'Catch All Rows' = 30m
Volume of rock required = 308m3 or 462 Tonnes approx.

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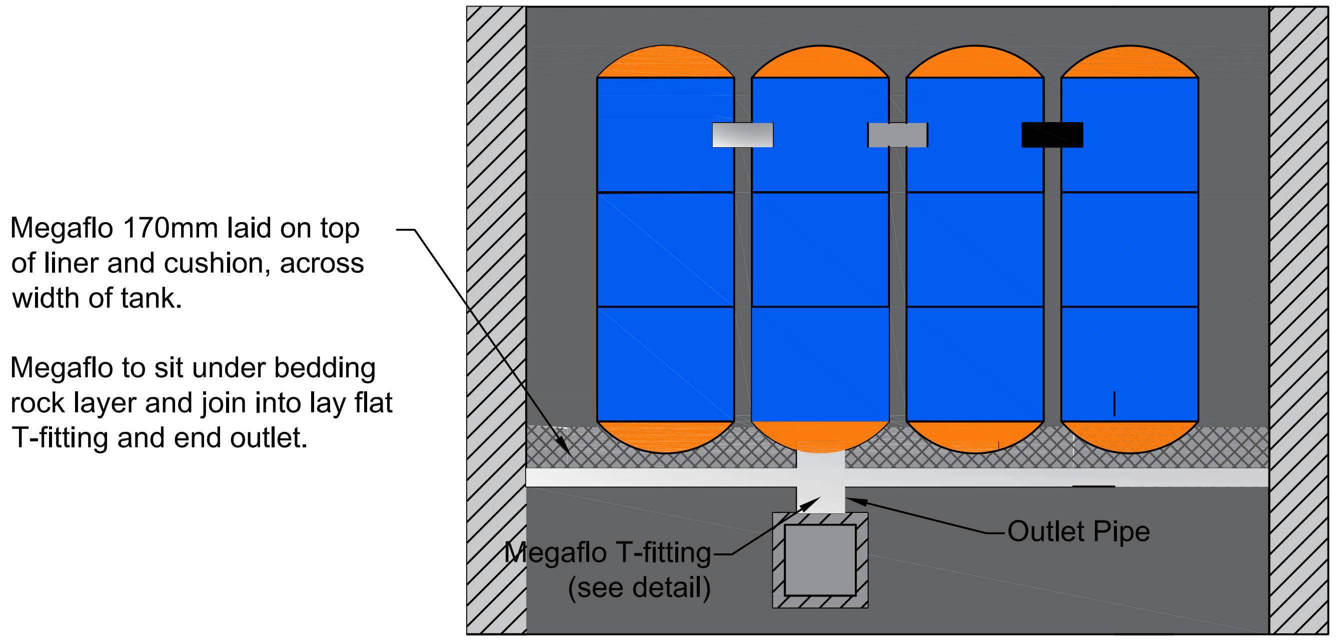
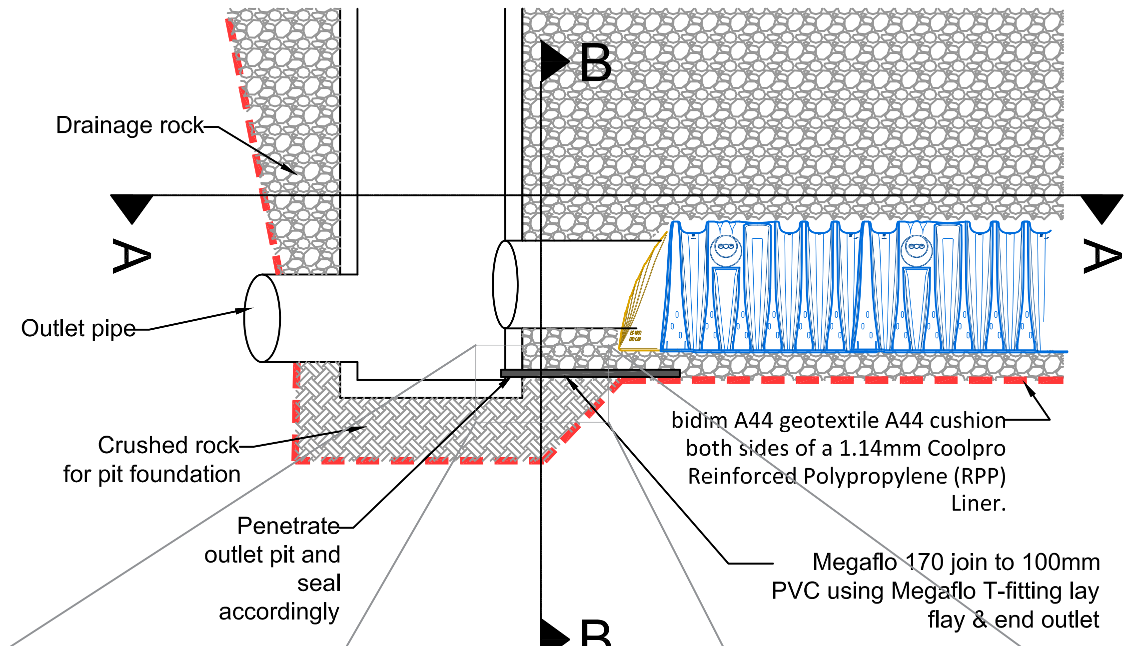
Smarter Infrastructure

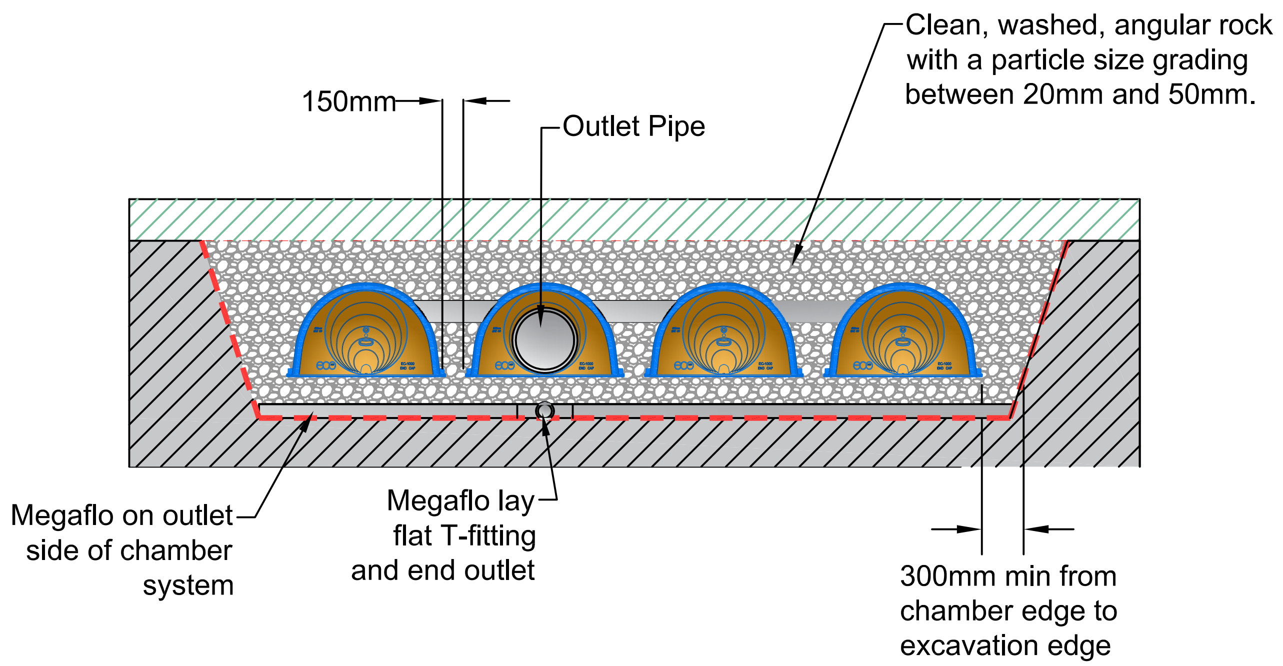
Designed:	Date:	Project Title:	Client:
BL	18/02/2021	Pendle High School	AURECON DESIGN
Drawn: GM	Date: 18/02/2021	Drawing Tile: ecoAID Stormwater Chamber System - Section Details	N.T.S / Project No:
Approved: BL	Date: 18/02/2021		2/4 / Rev: 0



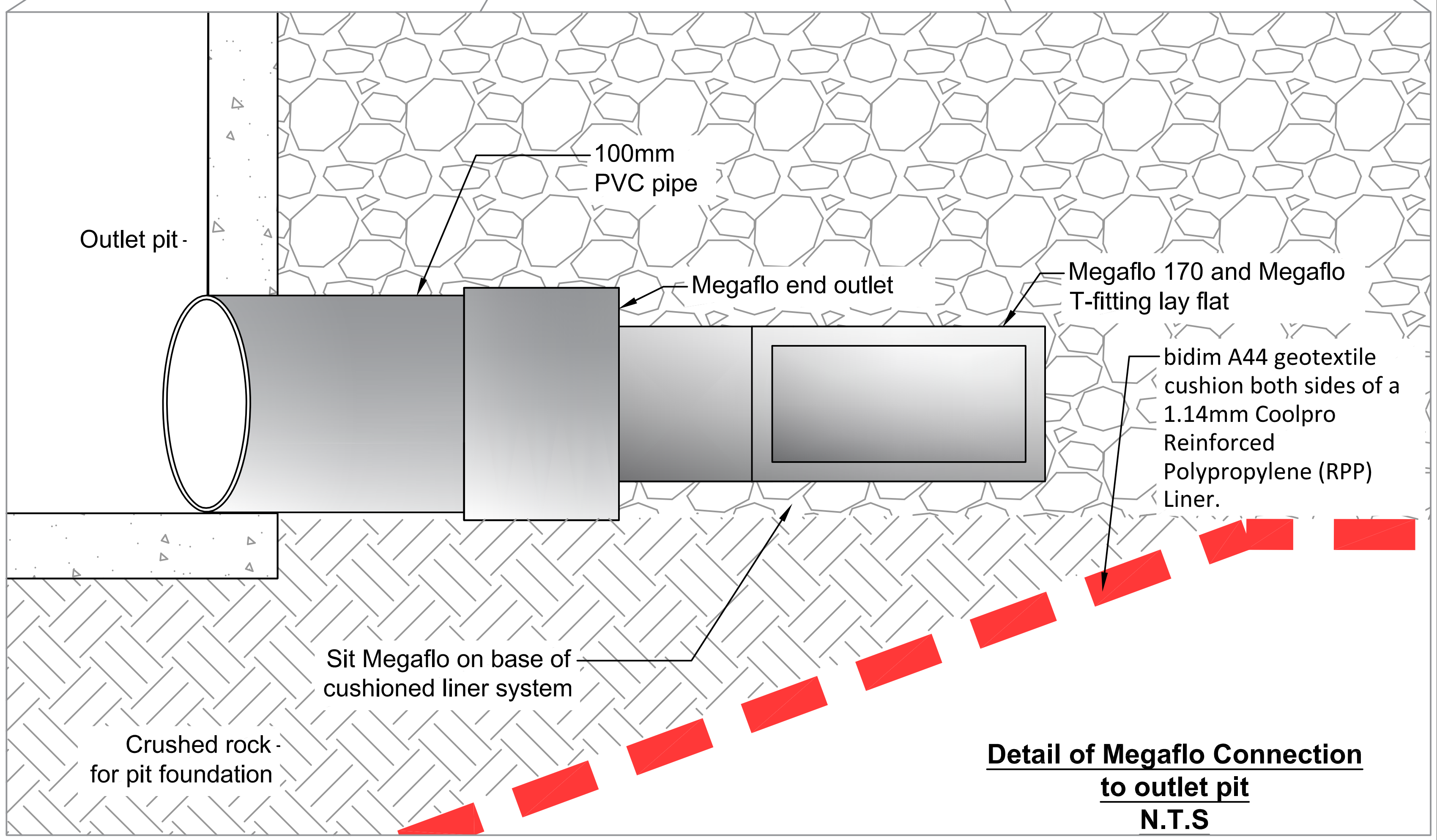
PLAN VIEW
(A-A)
N.T.S



BASE SIDE VIEW
N.T.S



SECTION VIEW
(B-B)
N.T.S



Detail of Megaflo Connection to outlet pit
N.T.S

GEOFABRICS
Smarter Infrastructure

Issue / Revision:	Date:	Designed: BL	Date: 18/02/2021	Project Title: Pendle High School
		Drawn: GM	Date: 18/02/2021	Drawing Tile: Megaflo Drainage Detail - Fully Empty Tank
		Approved: BL	Date: 18/02/2021	

Client:	AURECON DESIGN
N.T.S	Project No:
3/4	Rev: 0

1. GENERAL

The buried arched chamber system will be comprised of the following components:-

a. a corrugated Arch with adequate stiffness in service conditions against global deformation and localised buckling.
b. a reinforced End Cap to start and finish each row of arches that prevents embedment aggregate ingress into the chambers created by arches and end caps,
c. embedment media, that provides stiffness and load support to the spaced rows of arched chambers, typically comprising 20-50mm diameter angular aggregate, or approved crushed recycled construction materials. The media is wrapped or fully encapsulated by a nonwoven geotextile to prevent fines migration into the embedment media, and
d. optional; geotextiles, geomembranes, and geogrids - for filtration, separation, reinforcement or barrier functions, depending on the application and the site conditions.

The Arch and End Cap components will be injection moulded from uniform, high quality, virgin Polypropylene (PP) copolymer with high impact and creep resistance, and UV-stabilised masterbatch, providing long-term structural performance in service conditions.

2. SYSTEM COMPONENT REQUIREMENTS

2.1 Corrugated Arch

a. The Arch shall be corrugated and have a continuously arch-shaped cross-sectional profile, with an overlapping corrugation joint system that allows the creation of rows or chambers of varying length.
b. The Arch will have a Minimum Average wall thickness greater than 4.6mm (Minimum Average – make at least two sets of readings along the longitudinal axis of the arch. Each set shall include at minimum of 8 readings, evenly spaced around the circumference of the arch along a slice taken at 90 degrees to the longitudinal axis).
c. The Rise of the Arch (Rise - the vertical distance from the arch base to the inside of an arch wall valley element at the arch crown – ref. ASTM F2418-09) will be no more than 140 times the minimum wall thickness.
d. The Span of the Arch (Span - the horizontal distance from the interior of one sidewall valley element to the interior of the opposite sidewall valley element) will be no more than 210 times the minimum wall thickness.
e. The Span of the Arch must be less than < 75% of the centerline spacing between rows (ie Arch Span divided by minimum centerline spacing of rows = < 0.75), ensuring soil arching and load bearing contribution by the embedment aggregate.
f. The deviation from straightness of any one arch is not to exceed 12mm, as measured when the Arch is placed on a flat level surface and subjected to no loads in excess of self-weight. Measure the maximum vertical deviation from any arch corrugation crown to a straight line between the highest (or lowest) corrugation crowns points, or the maximum lateral deviation of the feet from a straight longitudinal line, along the Arch length.
g. The Arch must have an initial Compressive Stiffness, as calculated in accordance with AS 3572.10 - 2002, greater than 30,000 Newtons/metre per metre length.
h. Creep Modulus – the arch material as fabricated must have a 50 year tensile creep modulus at 23 °C not less than 225 MPa (32,632 psi) when tested at 500 psi applied stress. (ASTM D6992 - Step Isothermal (SIM) Method).
i. The Arch will have integral load-dispersing footings (or feet) a minimum of 100mm wide running longitudinally the full length of the arch. The external edge of the feet will be raised and thickened by and additional 6mm creating a key (or finger) to lock the feet of the arch into position after the placement of embedment aggregate.
j. The Arch must have dedicated, reinforced vertical and horizontal (lateral) ports with cut-out guides to accommodate up to a nominal Ø150mm PVC stormwater pipe for optional inspection risers and lateral overflow into adjacent chambers.
k. The nominal storage volume inside each installed Arch shall be 516 litres, with 822 litres of storage being provided per installed unit length after utilising the storage capacity of the minimum required embedment aggregate (see section 2.3), based on aggregate porosity of p=0.40.
l. The Arch shall be open-bottomed, with thirty-six slots (when installed and overlapped by one corrugation) penetrating the sidewall 12mm wide by 32mm long, providing 0.0127 m^2 (± 10%) total slot area per lineal metre of chamber row to allow for lateral flow distribution of water between chamber rows.
m. The Arch will have open ends that allow unimpeded; flow through the chambers, visual inspection along the length of the chamber via inspection ports or manifolds, and access for cleaning.
n. The Arch will have at least one orifice near the arch crest to allow for air and water equalisation externally and internally to the chamber.

2.2 End Caps

a. End Caps must be designed to fit underneath the first and last corrugation of the Arch and ensure embedment aggregate does not enter the void created by the Arches. The base of all End Caps must sit horizontal and be fully supported by the aggregate bedding layer after insertion under the Arch end corrugation.
b. End Caps must not be integral to the Arch or chamber, ie they must be a separate component in the chamber system allowing configuration changes if required or approved by the Design Engineer to accommodate unexpected site constraints such as in-situ rock or services.
c. The End Caps must have a minimum wall thickness of 4.6mm, and have adequate number and spacing of reinforcing ribs to prevent buckling under long-term service loads.
d. The primary surface of the End Cap must be domed outward from the chambers being created to provide resistance to in-situ service loads.
e. The End Caps must have circular cut-out guides to accommodate various size manifolds or inlet pipes with outside diameters up to 600mm. Cutouts for pipes with nominal diameters greater than 150mm must be reinforced with a circular rib no greater than 75mm from the edge of any hole or cut made for pipe insertion, that remains unaffected by cutting for inlet pipe insertion.

2.3 Embedment Aggregate / Rock Backfill

a. The chamber system bedding (150mm minimum), embedment and cover (surrounding and to a cover 150mm above chambers) must be clean, angular rock with a particle size grading between 20mm and 50mm (20mm < d < 50mm). Total fines content must be less than 2% by weight for detention and infiltration applications. For harvesting / re-use applications, rock or aggregate should be free from dust, clay, dirt and other deleterious material.
b. Rock used shall be fresh to slightly weathered and of very high to extremely high strength, as defined in AS 1726. Rock that is laminated, fractured, physically weak, or prone to weathering actions of air and water is unacceptable. Flat slab-like rock pieces, with the breadth or thickness less than one third its length, should be avoided due to poor interlocking, although up to 30% by weight is acceptable.
c. Sub-rounded or rounded rock or aggregate is not acceptable.
d. The Wet/Dry Strength Variation (AS 1141.22) of the embedment material must be less than 35%.
e. If recycled crushed concrete (RCC) or brick is used, the foreign materials content must be less than 5% (less than 2% for Foreign Material Types II and III) according to RTA test method T276. RCC should not be used in applications under pavements/roads unless the strength and suitability has been confirmed by the design engineer.

2.4 System Separation / Filter Geotextiles

a. The chamber system (including embedment aggregate) shall be completely encapsulated by a nonwoven geotextile to prevent fines ingress into the storage volume and to separate the porous rock media from in-situ subgrade and trench soils.
b. The nonwoven separation geotextile shall meet RTA R63 / QLD Main Roads MRS11.27 / TNZ F/7:2003 Geotextile Strength Class B, and Filtration Class 1.

3. SYSTEM INSTALLATION REQUIREMENTS

Installation of the chamber system shall be in accordance with the manufacturer's latest installation guidelines document or instructions. The following critical requirements are highlighted:-

a. subgrade soil minimum bearing capacity, which may vary depending on the application and allowable global settlement,
b. bedding layer minimum thickness, which may vary depending on the application and in-situ subgrade strength,
c. row or chamber minimum spacing,
d. chamber cover minimum thickness for both embedment material (rock) and additional fill / sub-base soil,
e. chamber maximum total soil surcharge height, which may vary depending on the application and allowable global settlement.
f. inlet pipe scour prevention measures to ensure inlet flow velocity does not cause bedding rock movement.
g. the inlet rows or chambers must have adequate air venting to the surface to allow air to escape as stormwater enters the system during a rainfall event.

4. ADDITIONAL REQUIREMENTS FOR HARVESTING AND RE-USE APPLICATIONS

a. Arched chamber systems used for stormwater harvesting and water re-use require an impermeable Engineered Lining system to prevent infiltration losses into surrounding soil. The Engineered Lining system used must meet the chamber system manufacturer's Engineered Liner Specification. This includes the specification of a geotextile cushion layer to protect the engineered liner from stone indentation and damage during installation and service.
b. Subgrade preparation and condition immediately prior to placement of the Engineered Liner must be in accordance to the Engineered Liner manufacturer's instructions.

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Rev:	Issue / Revision:	Date:

Designed:	Date:	Drawn:	Date:	Approved:	Date:
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Project Title: Pendle High School

Drawing Tile: ecoAID Stormwater Chamber System Specification detail

Client: AURECON DESIGN

N.T.S

Project No:

4/4

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Appendix E
Erosion and Sediment Control Plan

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CLIENT

Pendle Hill High School
Responsibilities Respect Rights Learning

REV	DATE	REVISION DETAILS	APPROVAL
A	29.03.21	ISSUED FOR INFORMATION	T.MUSPRATT
B	30.03.21	ISSUED FOR INFORMATION	T.MUSPRATT
B	23.04.21	ISSUED FOR SCHEMATIC DESIGN	T.MUSPRATT
C	30.04.21	ISSUED FOR SCHEMATIC DESIGN	T.MUSPRATT

SCALE: 1:250 | SIZE: A1
DRAWN: H.NGUYEN
DESIGNED: T.MUSPRATT
CHECKED: T.MUSPRATT

SCHEMATIC DESIGN
NOT FOR CONSTRUCTION
APPROVED
DATE

PROJECT: PENDLE HILL HIGH SCHOOL
Cornock Avenue, Toongabbie NSW

TITLE: CIVIL SERVICES
BUILDING H
EROSION AND SEDIMENT CONTROL PLAN

DRAWING No.: PROJECT No 507914 - WBS 0001 - TYPE DRG - DISC - NUMBER CC-1005 - REV C

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