Suite 2, Level 1
33 Herbert Street
ST LEONARDS NSW 2065

PO Box 292
ST LEONARDS NSW 1590

T 02 9438 5098
F 02 9438 5398

www.acor.com.au

ENGINEERS

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SSD – 10371

Trinity Grammar School, Summer Hill Campus - The Renewal Project

Stormwater Management and WSUD Report

ACOR Project No.: SY180898

Revision No: 02

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REVISIONS

Revision	Date	Purpose	Prepared By	Approved By
01	11.12.2019	Progress Issue for SEARs	M.B.	M.G.
02	04.02.2020	SEARs Submission	M.B.	M.G.

Review Panel	
Division/Office	**Name**
St Leonards	Matt Godwin

Unless otherwise advised, the parties who have undertaken the Review and Endorsement confirm that the information contained in this document adequately describes the conditions of the site located at "[Insert Client Site]"

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Appendices

1 Introduction

ACOR Consultants Pty Ltd has been commissioned by Trinity Grammar School (TGS) to prepare civil and stormwater design documentation to inform a State Significant Development Application (SSDA) for the proposed TGS Renewal Project.

This report documents the methodology involved in determining the design of the proposed stormwater drainage system for the project, including how proposed stormwater drainage elements will be integrated into the wider campus stormwater drainage system.

1.1 Scope of Report

The objective of this Stormwater Management and WSUD report is to identify the design criteria and controls for the proposed stormwater drainage system and the underlying design methodology for the design.

For the purpose of this report, the stormwater drainage system encompasses the following elements:

- Minor (piped) stormwater drainage system;
- Major (overland flow) stormwater drainage system;
- On-site Detention (OSD) system;
- On-Site Retention (OSR) and reuse system, including water balance;
- Water Sensitive Urban Design (WSUD);
- Flooding;
- Soil Erosion and Sediment Control during construction;

This report must be read in conjunction with the following documentation:

- ACOR Concept Civil design drawings;
- Architectural plans prepared by PMDL; and
- Site topographic survey prepared by Rygate Surveyors.

1.2 Reference Documents

The stormwater system has been designed to comply with the following standards and local authority requirements:

a) Bureau of Meteorology IFD data – sourced from http://www.bom.gov.au

b) Australian Rainfall and Runoff (2019)

c) Landcom Managing Urban Stormwater: Soils and Construction Volume 1 (2004)

d) Ashfield DCP 2016

e) Marrickville DCP 2011 Part 2 – General Provisions, being the following:

   i) 2.17 Water Sensitive Urban Design

   ii) 2.22 Flood Management

   iii) 2.25 Stormwater Management

f) Former Marrickville Council Area – Stormwater and On-Site Detention Code

g) Former Marrickville Council Area – Water Sensitive Urban Design Reference Guideline

h) AS/NZS 3500.3-2018

1.3 Aims and Objectives

The following objectives have been identified as forming the basis of the proposed development of the existing educational establishment:

- Create an education precinct to create a high-quality teaching and learning environment for staff and students;
- Establish additional floor space to increase availability and efficiency of teaching functions for Trinity Grammar School Summer Hill Campus;
- Improve site access, car parking and surrounding traffic functions in the precinct;
- Strengthen pedestrian linkages throughout the campus;
- Enhance the overall campus aesthetic, upgrade the public domain to create visually interesting transitions through the campus, and promote the heritage elements of the campus;
- Ensure minimal environmental impact;
- Maintain the significant green fields assets and provide opportunities for new outdoor environments;
- Ensure development is compatible with surrounding development and the local context; and
- Create a safe environment to support and nurture the boy's growth.

The site and proposed design are considered to meet the objectives of the project as it allows for development on land that has been previously used for educational purposes.

2 Site Description

2.1 Existing Site Characteristics

The Trinity Grammar School (TGS) site consists of an existing developed education campus containing sports fields, on-grade and underground carparks, circulation roadways and driveways, external landscaped and hardstand areas and various buildings used for education, administration and operations purposes.

The existing TGS site is shown in Figure 1 below:

Figure 1 TGS Site – Aerial Image and Locality Summary

The TGS site is bounded to the north by Seaview Street, to the east by Prospect Road, to the south by Yeo Park and to the west by Victoria Street.

The total existing site area of the TGS campus is calculated as approximately 65,500m^2 by topographic survey, including the residential properties at No. 46 to 52 Seaview Street which have been acquired by TGS but are yet to be re-developed and incorporated into the campus.

Due to the developed nature of the existing TGS campus, various portions of the TGS campus have been levelled and benched to accommodate building footprints, sports fields and carparks. As such, retaining walls are present along the southern boundary to Yeo Park (fill) and the western boundary to Victoria Street (cut).

2.2 Proposed Site Description

Further to Section 1.3 of this Report, the re-development of the TGS campus under this SSDA 10371 application will involve the following elements:

- New five (5) storey “Teaching & Learning” building at the heart of the Campus;
- Renewal and refurbishment of existing teaching and learning facilities (generally internal reconfigurations of existing buildings);
- Increasing the footprint of an existing carpark under the south-western sports field (Oval 3) and connection to the existing underground carpark under the north-western sports field (Oval 2) to improve traffic flow and safety;

- New multipurpose pavilion between Ovals 1 and 3;
- Demolition of school-owned residences at 46, 48, 50 and 52 Seaview Street and provision of maintenance and delivery facilities;
- Improvement and extension to Junior School outdoor teaching, assembly and recreational area; and
- Other general refurbishments / improvements to pedestrian links across the school grounds and between levels, including more accessible connections between the Junior School, ovals and car park.

The above extent of re-development works is further summarised in Figure 2 below. This extent of redevelopment works plan forms the basis in determining the required stormwater detention controls, detailed in subsequent sections of this report.

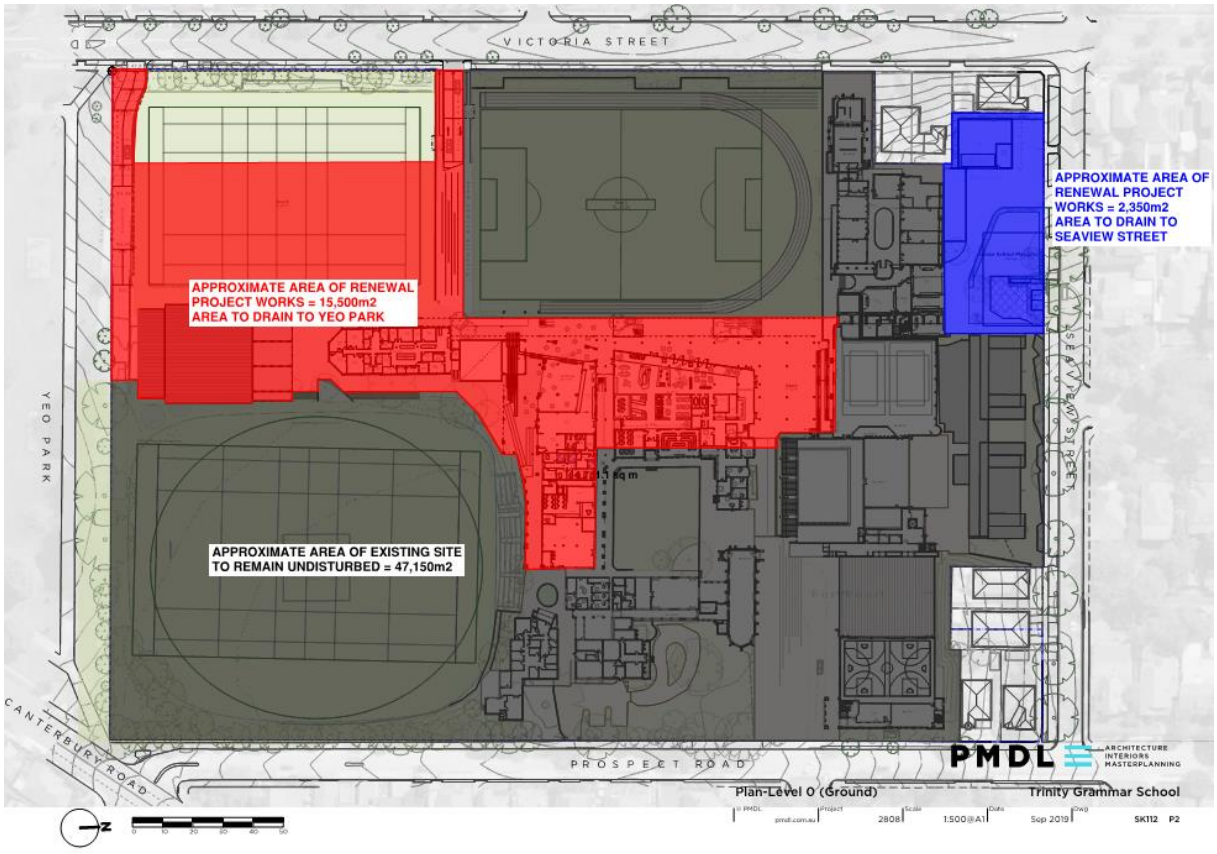


Figure 2 Extent of Re-Development Works Plan

We note that Figure 2 above shows areas involving full demolition of existing structures and site features and construction of new facilities.

3 Stormwater Management

3.1 Existing Stormwater Drainage

3.1.1 Drainage Catchments

The TGS campus is located towards the top of a low ridge that traverses in an east-to-west direction. As such, the topography of the campus means that it is divided into three distinct sub-catchments, being the following:

1. Southern Catchment (Red Catchment) – Draining to Yeo Park via an existing drainage easement pipeline;
2. Northern Catchment (Blue Catchment) – Draining to Seaview Street via existing piped connections to the Council stormwater network; and
3. Eastern Catchment (Green Catchment) – Draining to Prospect Road via overland surface flows.

An existing site drainage catchment map is shown in Figure 3 below:

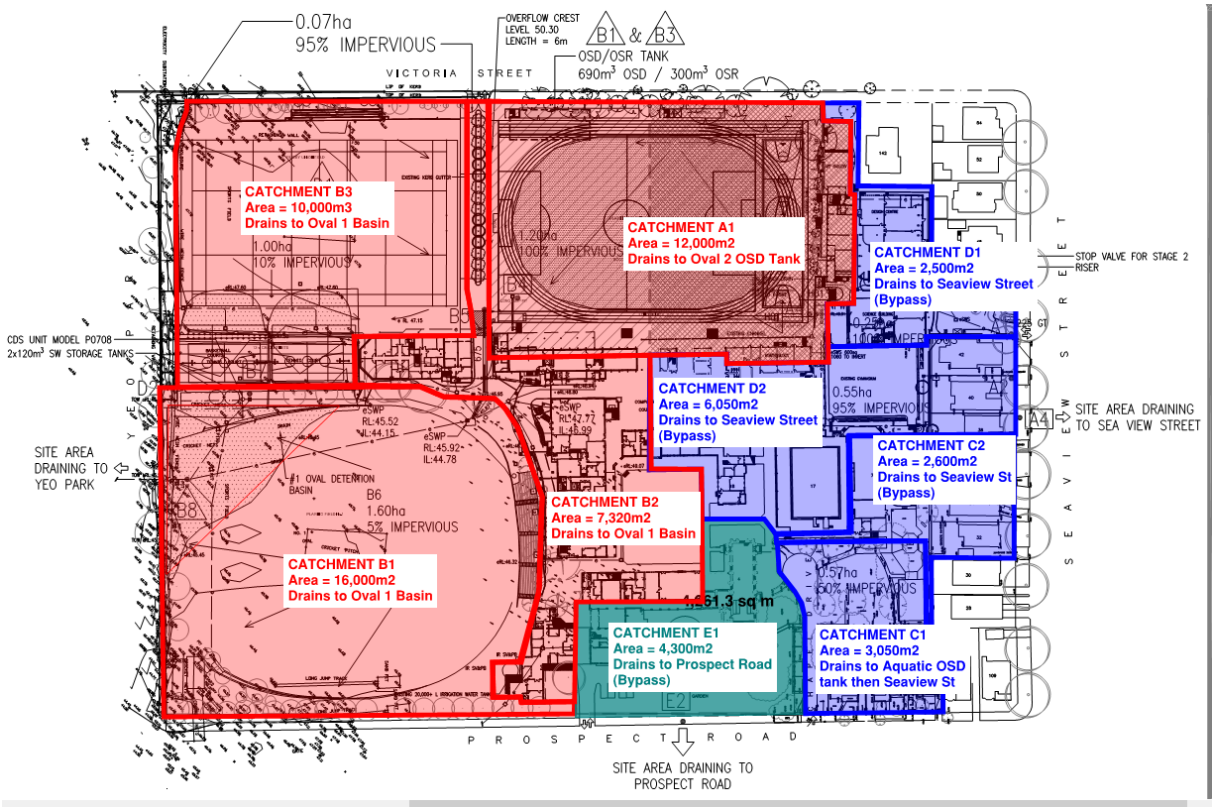


Figure 3 Existing Site Drainage Catchment Map

Characteristics of the existing drainage catchments, where remaining undeveloped, have been reviewed and incorporated into this stormwater and WSUD assessments where necessary. This is described in further detail in subsequent sections of this report.

3.1.2 On-Site Detention (OSD) Facilities

The three existing catchments within the TGS campus, combined with the staged development of the TGS campus in previous years, has led to several OSD facilities being constructed to attenuate stormwater flows discharging from the site prior to entering the receiving Council stormwater systems.

The existing OSD facilities that are currently in operation on the TGS campus and that will be retained as part of the re-development are summarised in Table 1 below:

Table 1 TGS Campus Existing OSD Facilities

Catchment Number	Type	Receiving System	Location	OSD Storage (m^3)	Orifice Plate Diameter (mm)
A1	Tank	Yeo Park	Carpark under Oval 2	421.5	245
B1	Basin	Yeo Park	Oval 1 surface storage	256.1	300
C1	Tank	Seaview Street	Adjacent to Aquatic Centre	130.2	144

Reconfiguration of the existing Catchment A1 OSD tank is proposed to utilise void space in the tank for additional on-site retention (OSR). This is described in further detail in Section 3.2.5 of this report.

Existing site OSD facilities that will be decommissioned as part of the TGS Renewal Project works have not been included in the above summary or subsequent modelling.

3.1.3 Stormwater Drainage Infrastructure

The existing stormwater drainage infrastructure for the TGS campus generally utilises an in-ground pit and pipe network for minor flows (up to the 5% AEP event) and overland flow paths for major flows (between the 5% AEP event and 1% AEP event).

The in-ground stormwater drainage network for the Yeo Park and Seaview Street catchments generally collects roof and surface water, before being directed to the receiving Council stormwater system.

An existing piped stormwater drainage connection appears to be present from the Oval 1 outlet pipeline (Catchment B1) to the Yeo Park stormwater pit within the footpath, shown in the Council stormwater drainage map in Figure 4 below, as well as on Dial Before You Dig Survey.

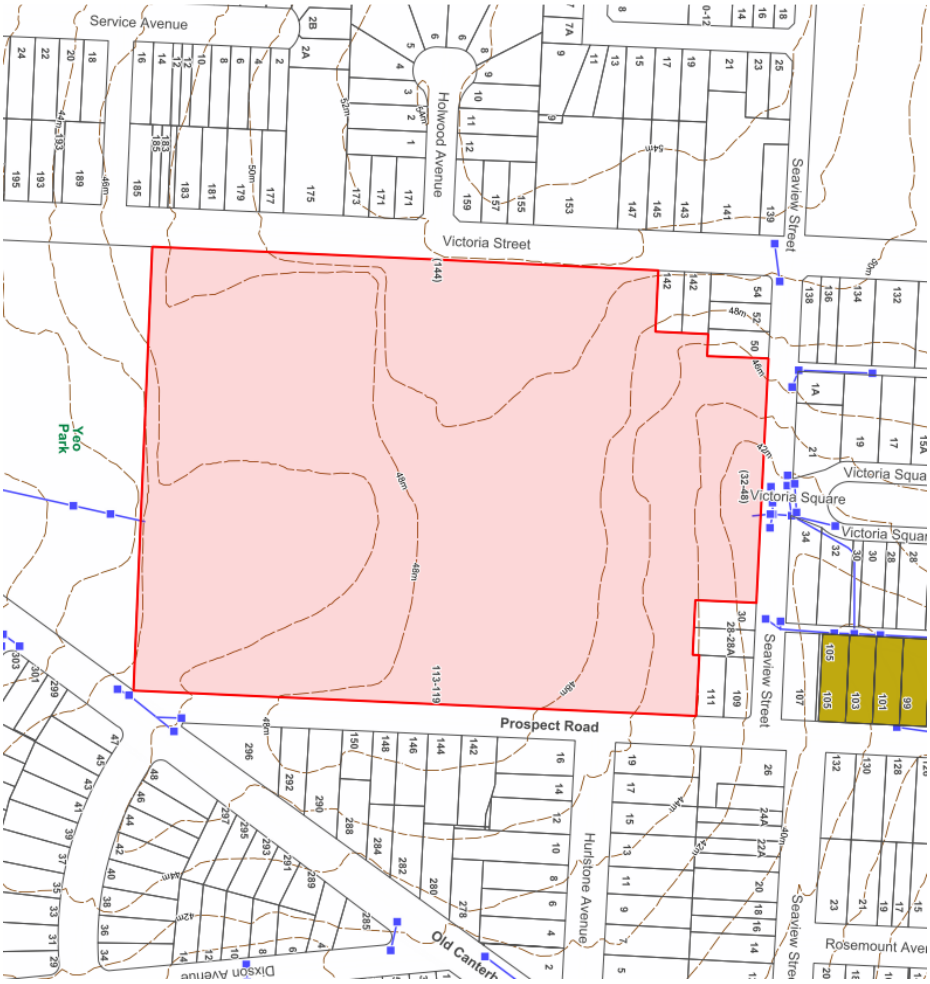


Figure 4 Council Stormwater Drainage Map. Source: Inner West Council (2019)

It is not proposed to adjust or relocate the existing drainage easement to Yeo Park as part of the TGS Renewal Project.

The Prospect Road catchment directs surface runoff from the existing carpark and landscaped areas to the road carriageway kerb and gutter. Similarly, it is not proposed to re-develop the Prospect Road catchment and thus the existing drainage scenario would remain.

3.2 Proposed Stormwater Drainage

3.2.1 Inner West Council Stormwater Controls and Requirements

The stormwater drainage infrastructure for the TGS Renewal Project is designed to comply with the following Council Policies:

- Marrickville DCP (2011) Part 2.25 Stormwater Management
- Former Marrickville Council Area – Stormwater and On-Site Detention Code

An institutional land use has been selected, with the corresponding Stormwater Controls applied in accordance with *Marrickville DCP Part 2.25.2*

3.2.2 Catchments and Areas

Existing catchment characteristics will generally be maintained in accordance with Figure 3 above, to ensure that peak flows entering the receiving Council system will not exceed pre-development flow rates.

Notwithstanding the above, the construction of the Teaching & Learning building will require deviation of a portion of existing Catchment D2 draining to Seaview Street to be diverted to the Yeo Park Council stormwater system. This provides the following benefits:

1. Connection to an OSD facility to attenuate peak flows leaving the site
2. Reducing the contributing catchment to Seaview Street and thus having net positive benefits in reducing piped flows and overland flows to the Seaview Street catchment

A post-development catchment plan for the TGS campus has been developed, shown in Figure 5 below:

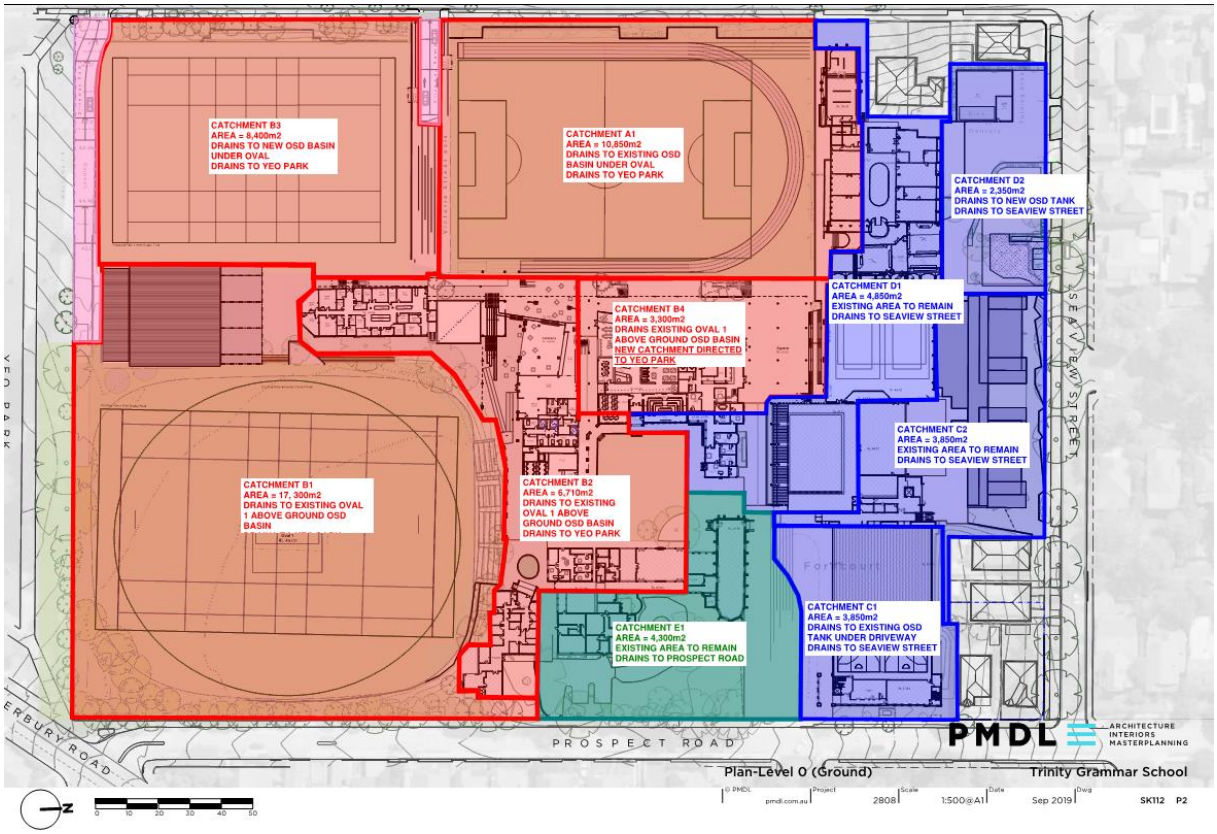


Figure 5 Post-Development Catchment Plan. Source: ACOR Consultants (2019)

A summary of the proposed catchment areas is shown in Table 2 below.

Table 2 Post-Development Catchment Areas

Catchment Name	Pre-Development Catchment Area (m^2)	Post-Development Catchment Area (m^2)	Catchment Area Difference (m^2)
Yeo Park (Red Catchment)	45,320	46,560	1,240
Seaview Street (Blue Catchment)	14,200	14,900	700
Prospect Road (Green Catchment)	4,300	4,300	0

The increase in total catchment area in the post-development scenario is due to the acquisition of the residential properties at 46-52 Seaview Street.

3.2.3 Hydrology

The following hydrological inputs and parameters have been used in the stormwater drainage design for the TGS Renewal Project works:

- Rainfall patterns have been derived from Intensity-Frequency-Duration (IFD) data sourced from the Bureau of Meteorology (BoM) for the Summer Hill locality, in accordance with AR&R (2019) guidelines
- Aerial temporal and temporal patterns for the TGS campus have been sourced directly from the AR&R data hub for use in ILSAX hydrological modelling (DRAINS)
- Time of concentration for each sub-catchment has been determined from site-specific information and calculated using the kinematic wave equation. Specifically:
  - Pre-development time of concentrations for the extent of work areas that will require attenuation of peak flows have been considered as a fully pervious (greenfield) sub-catchment. A retardance coefficient of 0.1 has been adopted for these greenfield sub-catchments.
  - Post-development time of concentrations have been calculated based on the pervious / impervious percentages and approximated average slopes for each sub-catchment
- Peak flows at each catchment's receiving system (Yeo Park, Seaview Street and Prospect Road) have been calculated based on the combined peak flow rate for the median storm in the corresponding critical storm event ensemble.
- The hydrological design philosophy for the post-development analysis is to ensure the following:
  - Peak flows for storm events ranging from the 20% AEP (4.48-year ARI) event up to and including the 1% AEP event will not exceed pre-development (greenfield) peak flows for the equivalent storm events
  - The entire Yeo Park catchment has been considered as a fully greenfield catchment, as the extent of works for the TGS Renewal Project is mostly confined to this catchment.
  - Existing OSD facilities within Yeo Park sub-catchments have been modelled and calibrated using available As-Constructed design documentation and site observations.

- Catchment D2, which represents the area to be re-developed for new Junior School maintenance / delivery facilities and the Junior School playground, has been considered as a greenfield site area in the pre-development scenario.
- Post-developed peak flows from Catchment D2 will be attenuated to these pre-development peak flow rates, to ensure no increase in total site flows to Seaview Street.
- Catchments C1, D1, D2 and E1 will all remain in their current, pre-development scenarios (i.e. pre-development will equal post-development), and thus these results have not been tabulated in the below summary.

3.2.4 Hydraulics

The following hydraulic design parameters have been used in the stormwater drainage design for the TGS Renewal Project works:

- The in-ground stormwater system has been designed to accommodate at least the 5% AEP storm event, where surface flow paths are available
- Surface flow paths, where available, have been designed to accommodate the 1% AEP storm event, assuming blockage of the in-ground system
- Where surface flow paths are not available, the in-ground stormwater system has been designed to the following parameters:
  - 50% blockage factor applied to sag inlet structures
  - 80% blockage factor applied to on-grade inlet structures
  - 50% blockage factor applied to in-ground pipelines. An equivalent diameter pipeline has been derived based on 50% cross-sectional area of the proposed pipeline, for design and modelling purposes
  - A hydraulic grade line (HGL) analysis of the in-ground system has been undertaken to ensure a minimum freeboard of 300mm to adjacent building floor levels, crests or other sensitive areas
  - Ponding above sag inlet structures has been designed to ensure a minimum freeboard of 100mm to adjacent building floor levels, crests or other sensitive areas
- Proposed and existing OSD facilities have been designed and modelled in DRAINS software using stage vs discharge relationships for the design storm events
- A minimum pipe grade of 0.5% has been adopted for all drainage pipelines greater than 225mm diameter
- Tailwater effects to the receiving Council stormwater system have been included in the design as follows:
  - Minor storm events (up to and including the 5% AEP) = top of grate / pit level
  - Major storm events (1% AEP) = top of kerb level / 150mm above the receiving pit's surface level
- Pit loss coefficients have been considered in the design, in accordance with the relevant Missouri Charts

3.2.5 On-Site Detention

Further to the hydrological design philosophy described in Section 3.2.3 above, a post-development DRAINS model has been developed to calculate peak flows for a range of storm events, as well as to confirm that the new and existing OSD facilities will adequately attenuate site flows back to the pre-development conditions.

The following new OSD facilities have been proposed to achieve the above requirements:

- Catchment B3 (Yeo Park) – 195m^3 OSD tank located under Oval 3, within the proposed basement carpark
- Catchment D2 (Seaview Street) – a 50m^3 OSD tank located under the delivery hardstand area to collect and attenuate flows entering the Seaview Street Council stormwater system

DRAINS model results have been enclosed as Appendix A to this report. A summary of peak flows for the design storm events has been tabulated below.

Table 3 Summary of Stormwater Discharge and OSD Outflows – Yeo Park Catchment

Catchment Number	20% AEP Pre Peak Flows (m^3/s)	20% AEP Post Peak Flows (m^3/s)	5% AEP Pre Peak Flows (m^3/s)	5% AEP Post Peak Flows (m^3/s)	1% AEP Pre Peak Flows (m^3/s)	1% AEP Post Peak Flows (m^3/s)
A1	0.158	0.149	0.299	0.169	0.480	0.192
B1	0.203	0.288	0.391	0.533	0.640	0.830
B2	0.138	0*	0.239	0*	0.389	0*
B3	0.156	0.186^	0.284	0.205	0.459	0.261
B4	-	0*	-	0*	-	0*
TOTAL	0.655	0.623	1.213	0.907	1.968	1.283

* Discharge for Post-development Catchments B2 and B4 have been included in the discharge from catchment B1, as these catchments drain to the existing above-ground OSD basin on Oval 1

^ Discharge for Post-Development Catchment B3 includes bypass flows to the driveways

Table 4 Summary of Stormwater Discharge and OSD Outflows – Catchment D2 to Seaview Street

Catchment Number	20% AEP Pre Peak Flows (m3/s)	20% AEP Post Peak Flows (m3/s)	5% AEP Pre Peak Flows (m3/s)	5% AEP Post Peak Flows (m3/s)	1% AEP Pre Peak Flows (m3/s)	1% AEP Post Peak Flows (m3/s)
D2	0.052	0.050	0.092	0.066	0.137	0.084

The above results indicate that the post-development peak flows for the affected catchments will be attenuated to the pre-development (greenfield) peak flows.

4 Water Sensitive Urban Design (WSUD)

4.1 Inner West Council WSUD Controls and Requirements

The stormwater quality improvement system for the TGS Renewal Project is designed to comply with the following Council Policies:

- Marrickville DCP (2011) Part 2.17 Water Sensitive Urban Design
- Former Marrickville Council Area – Water Sensitive Urban Design Reference Guideline

An educational establishment land use greater than 2,000m^2 has been selected, with the following Stormwater Quality Targets adopted in accordance with *Marrickville DCP* (2011) *Part 2.17:*

- Control C4 – Stormwater quality load reduction controls are:
  - 90% reduction in the post development mean annual load of Gross Pollutants (greater than 5mm)
  - 85% reduction in the post development mean annual load of Total Suspended Solids (TSS)
  - 60% reduction in the post development mean annual load of Total Phosphorus (TP)
  - 45% reduction in the post development mean annual load of Total Nitrogen (TN)
- Control C5 – Modelling for the determination of the pollution load reductions must be undertaken in MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) and in accordance with Marrickville Council's WSUD Reference Guideline
- Control C7 – All other development types are to submit a WSUD Strategy from a suitably qualified consultant. The WSUD strategy is to detail the potable water saving and stormwater quality control measures that are to be implemented on the site, and to include the following detail:
  - Proposed development – Describe the proposed development at the site, including site boundaries, proposed land uses
  - WSUD objectives – Identify the WSUD objectives that apply to the proposed development
  - Water conservation – Demonstrate how the potable water conservation targets will be met

4.2 Existing Site WSUD Systems

An existing stormwater quality treatment system serves the current TGS campus. The system consists of the following treatment train:

- Two Rocla CDS gross pollutant traps (GPTs) treating stormwater flows entering the Oval 1 (Yeo Park) piped stormwater system
- Indirect treatment measures such as infiltration of stormwater runoff from Oval 2 through sand media and overland flow over grassed surfaces also assist in removing pollutants under the current scenario. Whilst this report does not consider the treatment benefits of such measures, these practically help to reduce pollutant loads in stormwater runoff.
- A comprehensive on-site retention (OSR) system is currently utilised to collect and store surface runoff from Oval 2 for irrigation of the Oval 1 and Oval 3 grassed playing fields. This is described in further detail in Section 5 of this report.

4.3 Proposed WSUD System Upgrades

Similarly to the design philosophy for the OSD system for Yeo Park, the stormwater quality improvement system to the entire Yeo Park catchment is being considered, to ensure that the total pollutant reduction load percentages meet Council's targets.

Key elements of the stormwater quality design philosophy are listed below:

Yeo Park

- A MUSIC model has been developed for the entire Yeo Park catchment, as well as the portion of the Seaview Street catchment that will be developed (Catchment D2)
- Fully pervious areas such as Oval 1 have not been included in the model, as the runoff quality is sufficient to be excluded from the model. This methodology has been confirmed through correspondence with Inner West Council's Engineering Department, with the correspondence attached as Appendix D to this report

- The existing and proposed OSR system has been included in the model for accuracy. An irrigation re-use profile has been derived from input by TGS maintenance staff and validated with available irrigation design guidelines. Details of the irrigation profile are provided in Section 5 of this report
- Enviropod pit inserts will be placed in new grated surface inlet pits to assist with primary treatment
- One of the existing Rocla CDS units will be replaced with a Humeceptor unit to assist with secondary treatment of TSS
- The proposed OSD tank under Oval 3 will incorporate Stormfilter filtration cartridges to assist with secondary treatment of TSS, TN and TP

Catchment D2 (Draining to Seaview Street)

- Enviropod pit inserts will be placed in new grated surface inlet pits to assist with primary treatment
- The OSD tank servicing Catchment D2 (draining to Seaview Street) will incorporate Stormfilter filtration cartridges to assist with secondary treatment of TSS, TN and TP

4.4 WSUD (MUSIC) Modelling

Modelling of the post-development site stormwater quality has been undertaken using the 'Model for Urban Stormwater Improvement Conceptualisation' (MUSIC) software, in accordance with Marrickville DCP Part 2.17 Control C5.

Roof and mixed urban source nodes have been used based on the Architectural plans prepared by PMDL, with the appropriate pervious / impervious percentages selected based on proposed site characteristics.

Rainfall data, monthly evapotranspiration and source node parameters have been modelled in accordance with the Marrickville Water Sensitive Urban Design Reference Guidelines to ensure compliance with Council LGA data.

Where proprietary products such as Enviropod pit inserts and a Humeceptor system have been nominated, the Supplier's design information and treatment nodes have been utilised.

A summary of the MUSIC model layout has been enclosed as Appendix B to this report.

4.5 Results

Results of the total Yeo Park catchment stormwater pollutant load reductions and re-developed Catchment D2 draining to Seaview Street have been enclosed as Appendix B to this report. The results are summarised below:

Table 5 Post-Development MUSIC Model Results

Catchment	Gross Pollutant % Reduction	Total Suspended Solids (TSS) % Reduction	Total Phosphorus (TP) % Reduction	Total Nitrogen (TN) % Reduction
Yeo Park	90.3	92.4	65.5	56.7
Seaview Street (Catchment D2)	100	92.1	69.8	49.2

The above results indicate that stormwater quality controls C4, C5 and C7 achieve greater than the minimum performance requirements.

5 Water Balance Modelling

5.1 Existing On-Site Retention System

Previous construction of the underground carpark to Oval 2 included provision of a 225m^3 OSR chamber within the OSD tank for collection and storage of surface runoff from Oval 2. Stormwater is then treated through a water treatment plant before being used to irrigate the Oval 1 and Oval 3 playing fields.

In addition to the above, 2x 120m^3 intermediate underground water storage tanks are located along the northern end of Oval 1 to hold polished water. A nominal 20m^3 above-ground header tank is located to the east of Oval 1 to assist with irrigation of the playing field.

5.2 Site Water Usage and Demand

The total irrigative area for the Oval 1 and Oval 3 playing fields is estimated as 25,000m^2.

TGS maintenance staff have advised that the following seasonal irrigation water demand profile applies for the site's playing fields:

Table 6 Seasonal Irrigation Water Demand Profile – Existing Site Data

Season	Average Weekly Water Demand (m^3)	Total Water Demand (m^3)
Summer (December to February)	252	3,276
Autumn (March to May)	288	3,744
Winter (June to August)	216	1,512
Spring (September to November)	432	5,616
TOTAL	-	14,148

The above total water demand has been validated against typical irrigation water demand profiles for sports fields in the Sydney metropolitan area. A typical seasonal irrigation water demand profile is shown below:

Table 7 Seasonal Irrigation Water Demand Profile – Typical Design Guidelines. Source: Efficient Irrigation: A Reference Manual for Turf and Landscape (2002)

Season	Weekly Water Demand Range (mm)	Average Weekly Water Demand (mm)	Total Water Demand (m^3)
Summer (December to February)	13-20.7	16.9	5,493
Autumn (March to May)	7.7-12.3	10.0	3,250
Winter (June to August)	5.2-8.4	6.8	2,210
Spring (September to November)	11.4-18.2	14.8	4,810
TOTAL	-		**15,763**

Thus we consider the supplied data from the TGS maintenance staff a conservative water demand profile and representative of likely site constraints (e.g. low water demand in summer due to school holidays and low playing field usage).

The water demand profile in Table 6 has been adopted into the water balance model. A modified monthly reuse has been utilised to represent seasonal demand changes.

5.3 Proposed On-Site Water Retention Upgrades

Potable water supplies in the Sydney area have been identified by Authorities as in short supply. Potential climate change impacts, projected population increases and periods of extended drought put added pressure on these potable water supplies.

Thus, any re-development should consider alternative means to capture rainfall runoff at the source, rather than discharge to receiving stormwater systems that do not utilise stormwater reuse.

As such, the implementation of an integrated approach to water cycle management to minimise demands of potable water supplies through intensive uses such as irrigation of playing fields is proposed at Trinity Grammar School.

The following upgrades and modifications to the TGS OSR system are proposed:

- Modification of the existing OSD / OSR tank under Oval 2 (Catchment A1) to increase OSR storage whilst maintaining the design OSD storage. This will involve raising of the existing OSD and overflow weir walls to utilise excess void air gap space in the tank. Subsequently, the OSR storage volume will increase from 225m^3 to 415m^3.
- Construction of a new 250m^3 OSR storage tank under Oval 3 (Catchment B3) to collect and store stormwater runoff from the grassed playing surface above. The water would then be treated by a centralised water treatment plant prior to being reused for irrigation of the existing playing fields.
- Decommission of the existing 2x 120m^3 intermediate underground water storage tanks, as these will be affected by the new carpark footprint under Oval 3.

The above upgrades will yield an additional 200m^3 of OSR storage for the TGS campus.

5.4 Modelling Assumptions

A water balance model has been created in MUSIC using 1976-2005 daily rainfall data for the Sydney Airport rainfall station, in accordance with the Marrickville WSUD Reference Guideline.

The following modelling assumptions have been incorporated into the water balance model:

- Pre-treatment of the stormwater runoff will occur through gross pollutant pit inserts or an upstream primary treatment device prior to runoff entering the OSR tank. Details of the pre-treatment requirements are not part of the scope of this report and will be developed in conjunction with the hydraulic engineer during the detailed design phase.
- The modelling volumes represent the effective capacity of the OSR tanks and exclude any volumes required for sludge zones and air gaps.
- For modelling simplicity, the water balance model combines both OSR tanks into one tank equal to the combined storage of the tanks.
- Stormwater runoff from Oval 2 (Catchment A1) is considered as fully impervious as it is a synthetic playing field.
- Stormwater runoff from Oval 3 (Catchment B3) is considered as fully pervious as it will be a grassed playing field over the proposed underground carpark.

- No water loss due to secondary and tertiary treatment of the stormwater runoff by the centralised treatment plant has been included in the model.
- No climate change data or reduced rainfall trends have been included in the model.

5.5 Results

The results of the water balance model are presented as Appendix C in this report. A summary of key water balance results is shown below:

Table 8 Summary of Water Balance Model Results

	Flow (ML/year)
Inflow to OSR	20.37
Overflow from OSR	8.79
% Flow Reduction	56.87%
Reuse Supplied	12.13
Reuse Requested	15.00
% Reuse Demand Met	80.83

Water balance modelling shows that a significant portion of potable water demand can be substituted with the non-potable reuse system proposed. Thus, the proposed OSR system is considered to achieve greater performance than the minimum requirements of Marrickville DCP Part 2.17.

6 Flooding

In accordance with Ashfield DCP (2017) Section 2A Part 3 *Flood Hazard* and Schedule 2 *Flood Control Lot Map*, the TGS site has not been identified as a flood control lot. A snapshot of the Flood Control Lot Map for the TGS site is shown below:

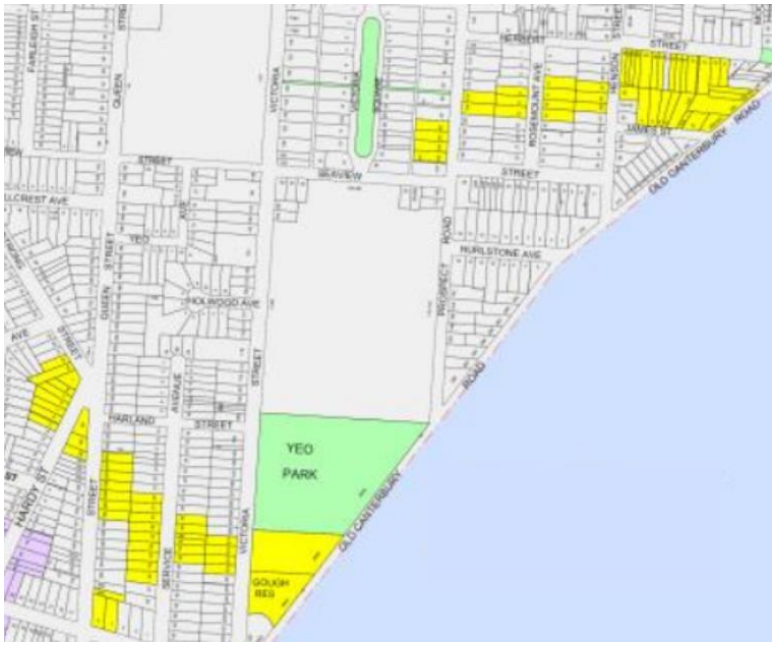


Figure 6 Flood Control Lot Map for TGS Site. Source: Inner West Council (2017)

As such, no further investigations to mainstream or overland flooding external to the site boundaries has been conducted.

7 Soil Erosion and Sedimentation Control

7.1 General Principles

A Soil and Water Management Plan has been prepared for the TGS Renewal Project works, in accordance with the Landcom Managing Urban Stormwater: Soils and Construction Volume 1 (2004).

The following general principles of soil and water management have been applied to the SWMP:

- Minimise the area of soil disturbed and exposed to erosion
- Conserve topsoil for later site rehabilitation/revegetation
- Control water flow from the top of, and through the development area
- Rehabilitate disturbed lands quickly
- Maintain soil and water management measures appropriately during the construction phase

7.2 Sources of Pollution

Based on the proposed development activities, the following sources of pollution during construction that could lead to earthworks erosion, sediment and silt transportation and contamination of downstream stormwater systems have been considered:

- Earthworks undertaken prior to rainfall events without sufficient auxiliary measures to manage drainage

- Earthworks areas that have not been stabilised or are exposed prior to temporary or permanent ground cover
- Establishment time for rehabilitation / revegetation of exposed earthworks
- Localised groundwater dewatering activities during earthworks excavations
- Construction works to existing stormwater pipelines and overland flow paths
- Vehicle entry and exit to the construction site and associated tracking of debris out of the site
- Clearing and grubbing of vegetation / organic matter and stripping of topsoil
- Stockpiling of excavated materials or construction materials (e.g. road base, ordinary and select fill, etc)
- Re-fuelling and general maintenance of construction plant and equipment
- Storage of chemicals, fuel and other hazardous materials
- Ineffective / incorrect installation or maintenance of soil erosion and sedimentation control measures

7.3 Soil and Water Management Strategy

The following construction management methodology has been developed for the TGS Renewal Project works and included in the SWMP:

- Establish sediment fencing to the downstream perimeter of the zone of disturbed works to protect downstream assets and properties
- Installation of stabilised construction entry and exit grids to prevent construction vehicles tracking debris into adjacent Authority roadways and stormwater systems
- Construction of “clean water” diversion drains with rock check dams to divert unpolluted water to the existing stormwater system in a controlled manner
- Construction of “dirty water” catch drains with rock check dams to divert sediment-laden and silt-laden water to proposed sedimentation basins
- Construction of appropriately sized and maintained sedimentation basins to promote settling of gross pollutants and suspended solids. Dosing and flocculation of fine suspended particulates will also be undertaken depending on tested water quality profiles within the sedimentation basin
- Protection of materials stockpiles by suitable wind protection fencing and / or temporary covering of stockpiles
- Protection of existing and recently constructed surface inlet pits with temporary sediment traps using geotextile filter fabric and sandbags
- Protection of existing and recently constructed overland flow paths with vegetated ground cover
- General expedited revegetation and stabilisation of exposed earthworks to prevent sedimentation of stormwater runoff

8 Conclusion

The Renewal Project development incorporates measures to address both stormwater quality and quantity requirements set out Marrickville DCP (2011).

On-site detention will be provided to ensure that pre-development peak flows are achieved in the post-development scenario for both the entire Yeo Park catchment and Catchment D2 draining to Seaview Street.

WSUD initiatives will be implemented by proprietary stormwater quality improvement devices (gross pollutant pit inserts, filter cartridges, Humeceptor and OSR) to achieve the percentage reduction targets for pollutants required by Marrickville DCP (2011).

On-site retention has been implemented through comprehensive collection and storage of surface runoff from Oval 2 and Oval 3 for treatment and irrigation reuse. A water balance model for the OSR system indicates an estimated 80% of irrigation water demand will be satisfied by non-potable sources.

Soil erosion and sediment control measures have been included in a detailed Soil and Water Management Plan (SWMP) for the proposed development. This SWMP has been prepared in accordance with industry best practices and consideration of the anticipated pollution sources to occur during construction.

The above measures achieve the requirements set out by the following documents:

a) Bureau of Meteorology IFD data – sourced from http://www.bom.gov.au

b) Australian Rainfall and Runoff (2019)

c) Landcom Managing Urban Stormwater: Soils and Construction Volume 1 (2004)

d) Ashfield DCP 2016

e) Marrickville DCP 2011 Part 2 – General Provisions, being the following:

   i) 2.17 Water Sensitive Urban Design

   ii) 2.22 Flood Management

   iii) 2.25 Stormwater Management

f) Former Marrickville Council Area – Stormwater and On-Site Detention Code

g) Former Marrickville Council Area – Water Sensitive Urban Design Reference Guideline

h) AS/NZS 3500.3-2018

Yours faithfully,
ACOR Consultants Pty Ltd

Matthew Buttarelli
Associate Senior Civil Engineer

Appendix A DRAINS Model Results

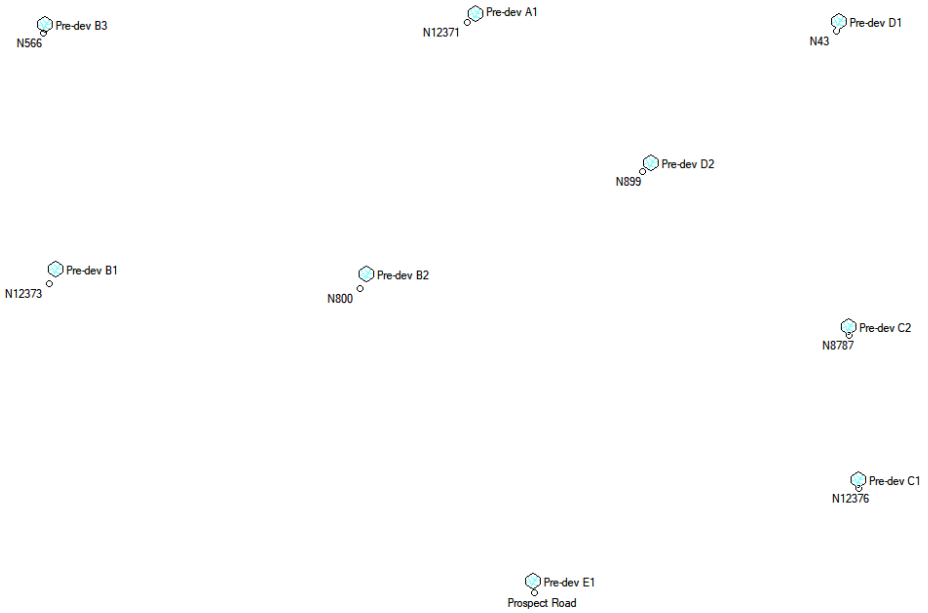


Figure A1 Total Site Pre-Development DRAINS Model Layout

Figure A2 Total Site Pre-Development DRAINS Model – 20% AEP Results

Figure A3 Total Site Pre-Development DRAINS Model – 5% AEP Results

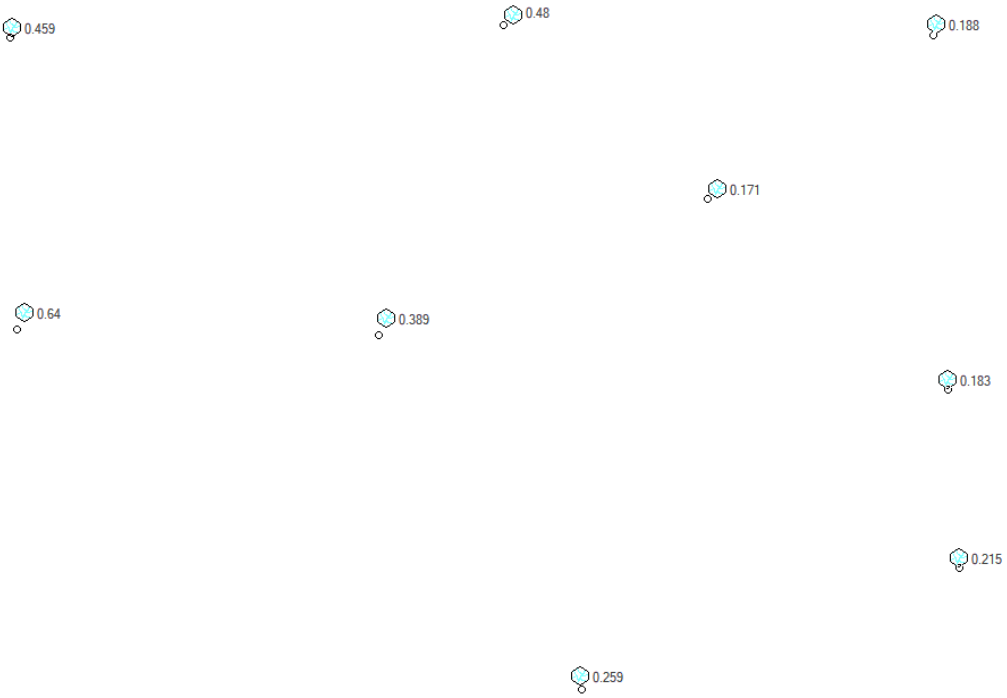


Figure A4 Total Site Pre-Development DRAINS Model – 1% AEP Results

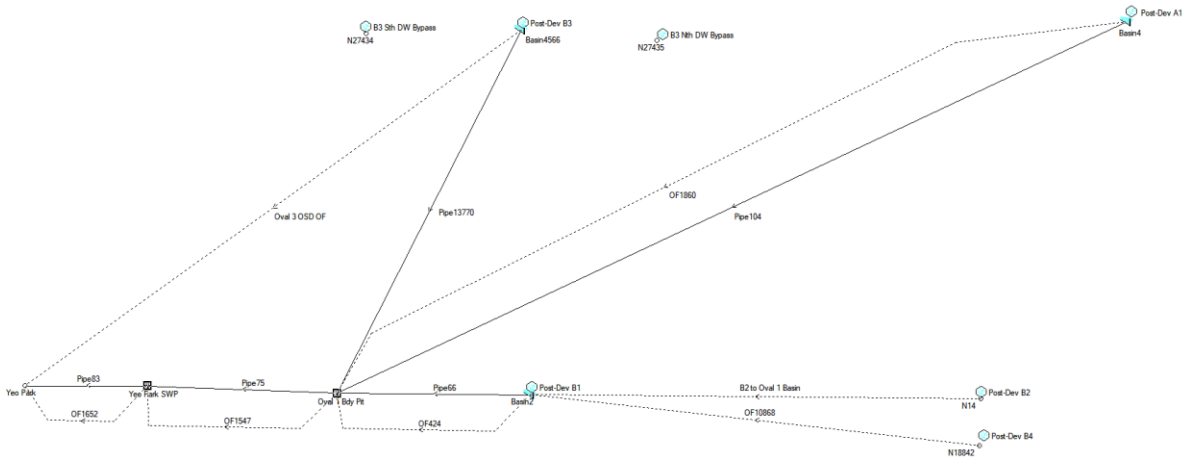


Figure A5 Yeo Park Post-Development DRAINS Model – Layout

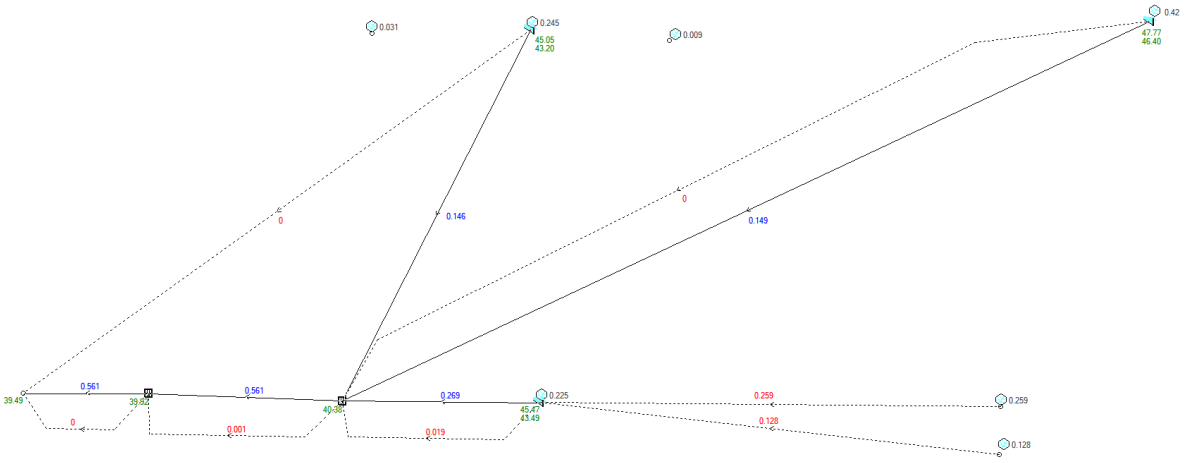


Figure A6 Yeo Park Post-Development DRAINS Model – 20% AEP

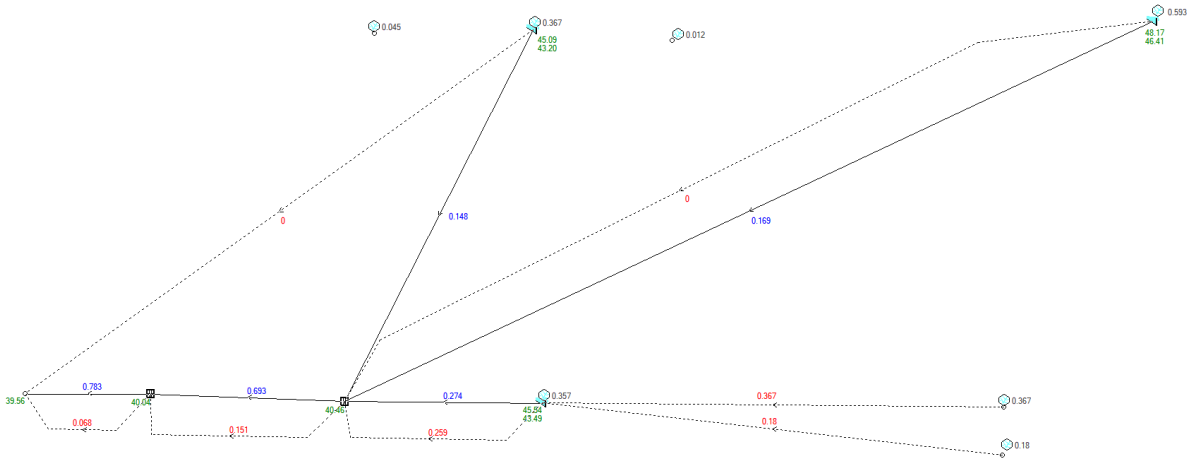


Figure A7 Yeo Park Post-Development DRAINS Model – 5% AEP

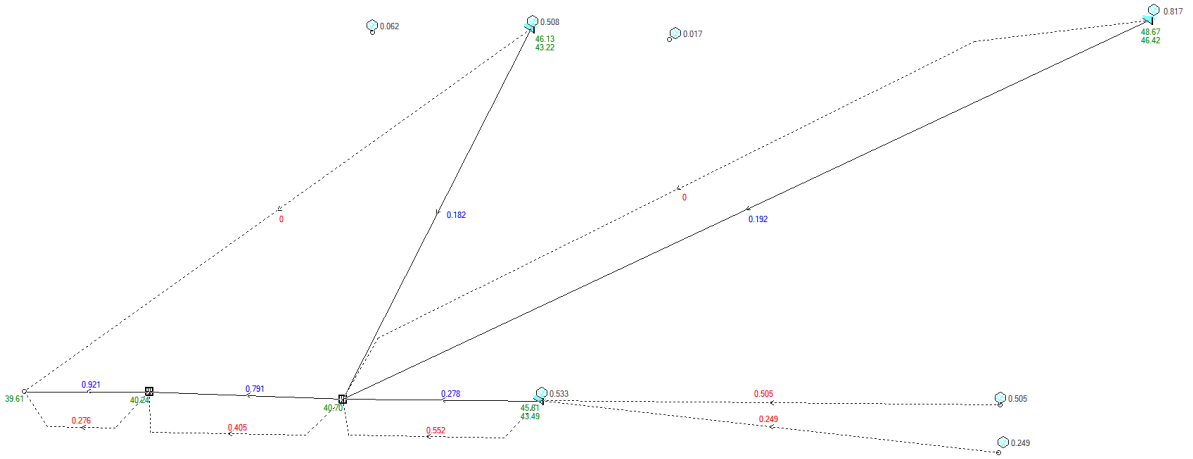


Figure A8 Yeo Park Post-Development DRAINS Model – 1% AEP

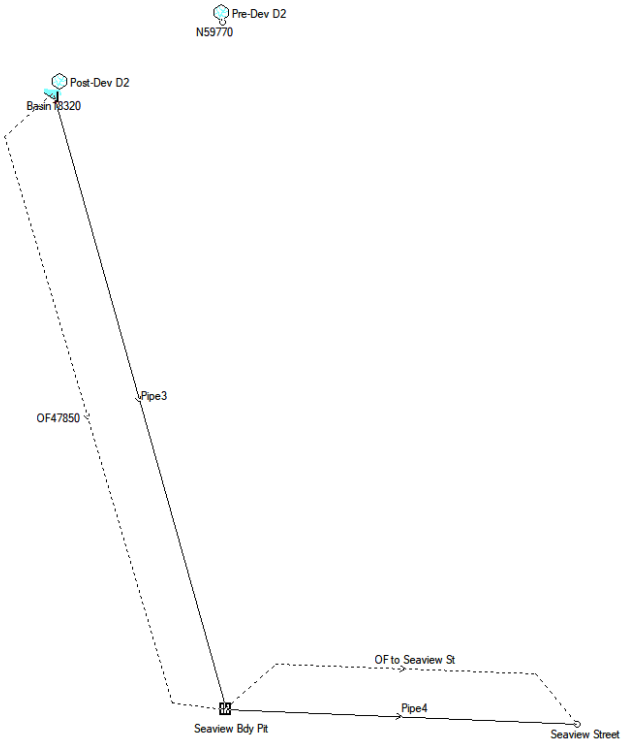


Figure A9 Seaview Street Post-Development DRAINS Model – Layout

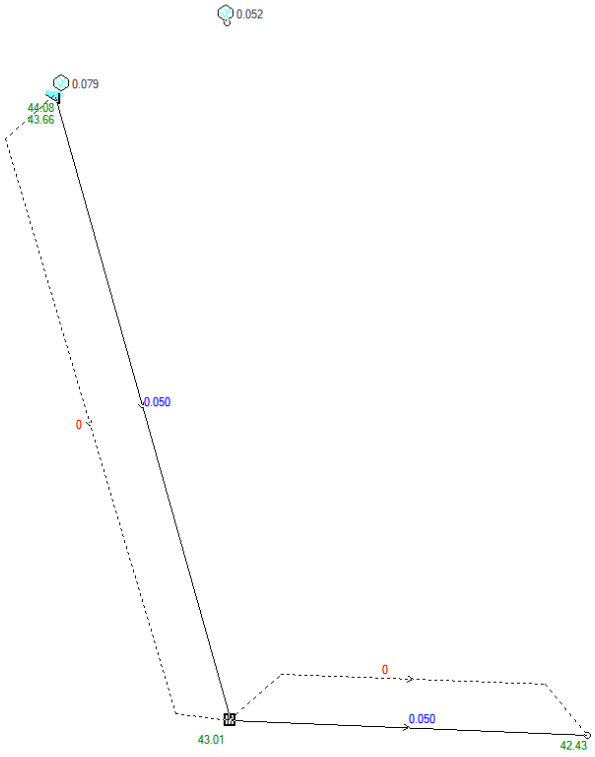


Figure A10 Seaview Street Post-Development DRAINS Model – 20% AEP

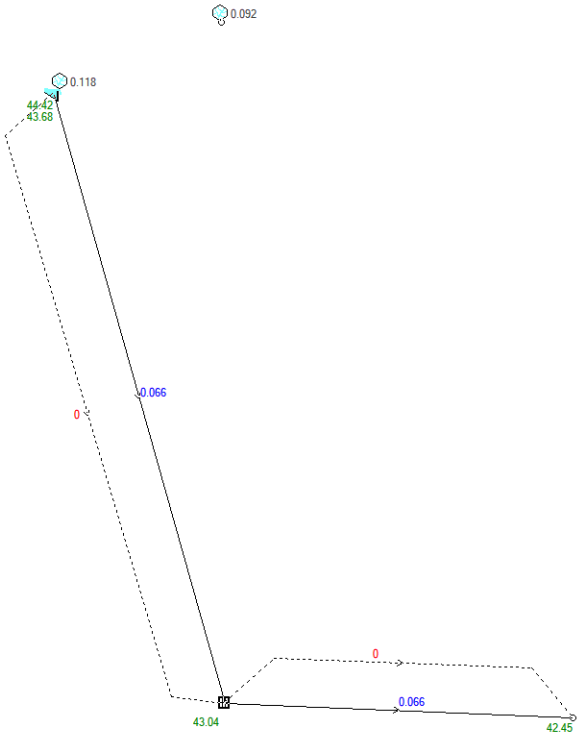


Figure A11 Seaview Street Post-Development DRAINS Model – 5% AEP

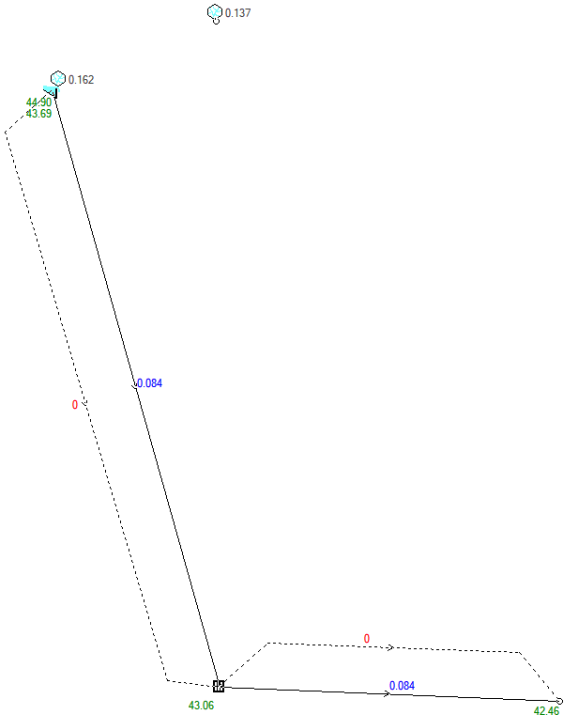


Figure A12 Seaview Street Post-Development DRAINS Model – 1% AEP

Appendix B MUSIC Stormwater Quality Results

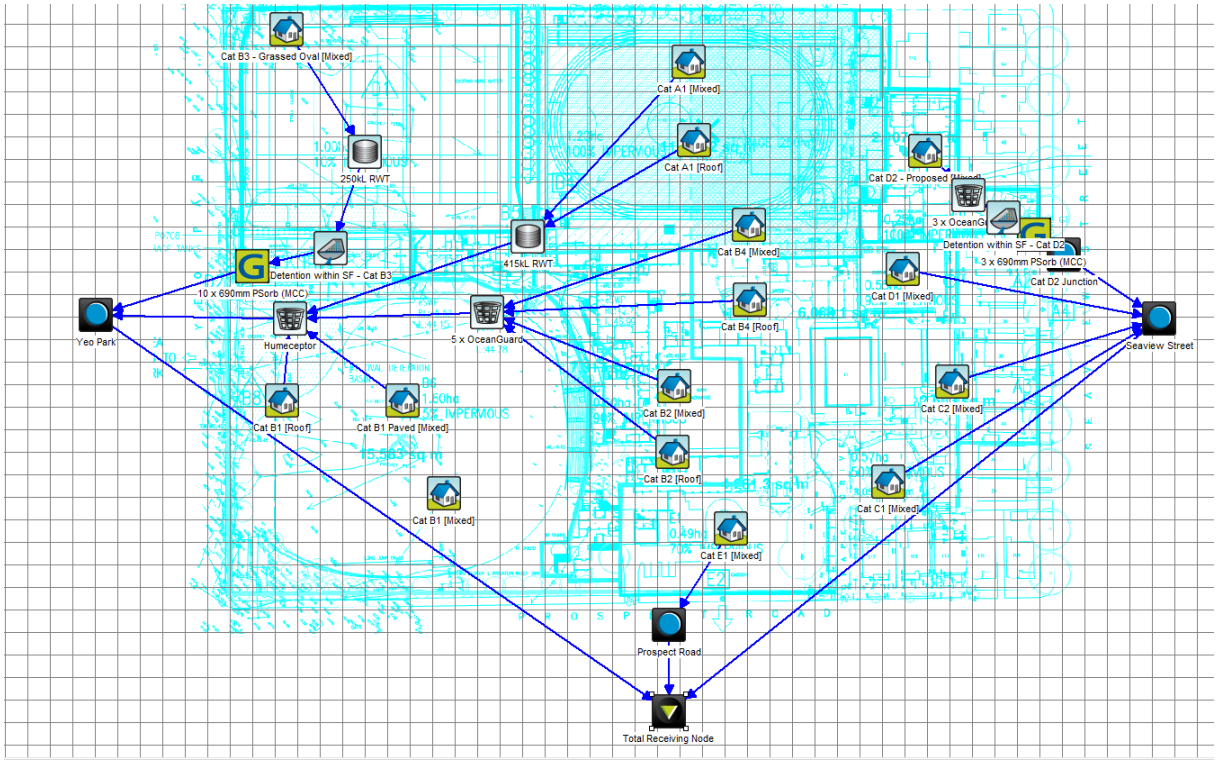


Figure B1 MUSIC Stormwater Quality Model – Layout

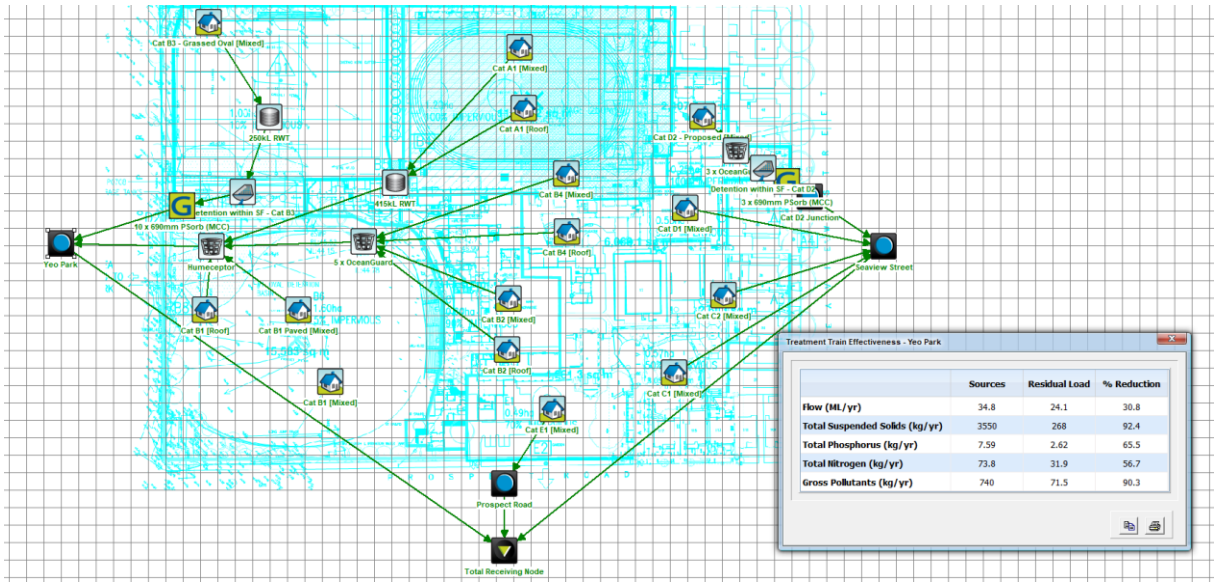


Figure B2 MUSIC Stormwater Quality Model – Yeo Park Results

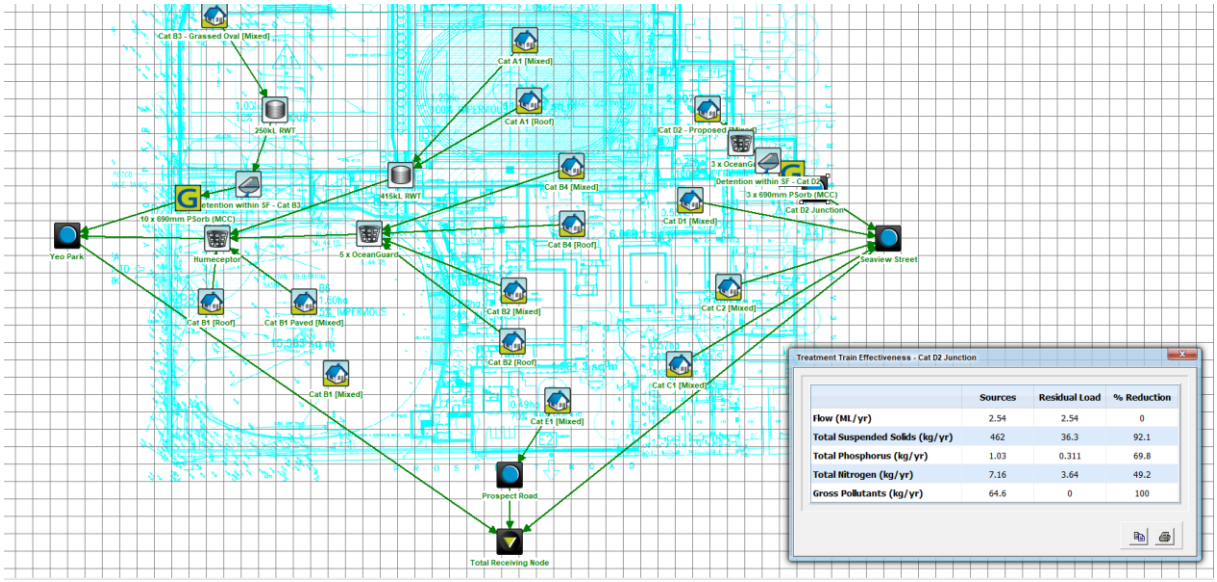


Figure B3 MUSIC Stormwater Quality Model – Catchment D2 (Seaview Street) Results

Appendix C MUSIC Water Balance Results

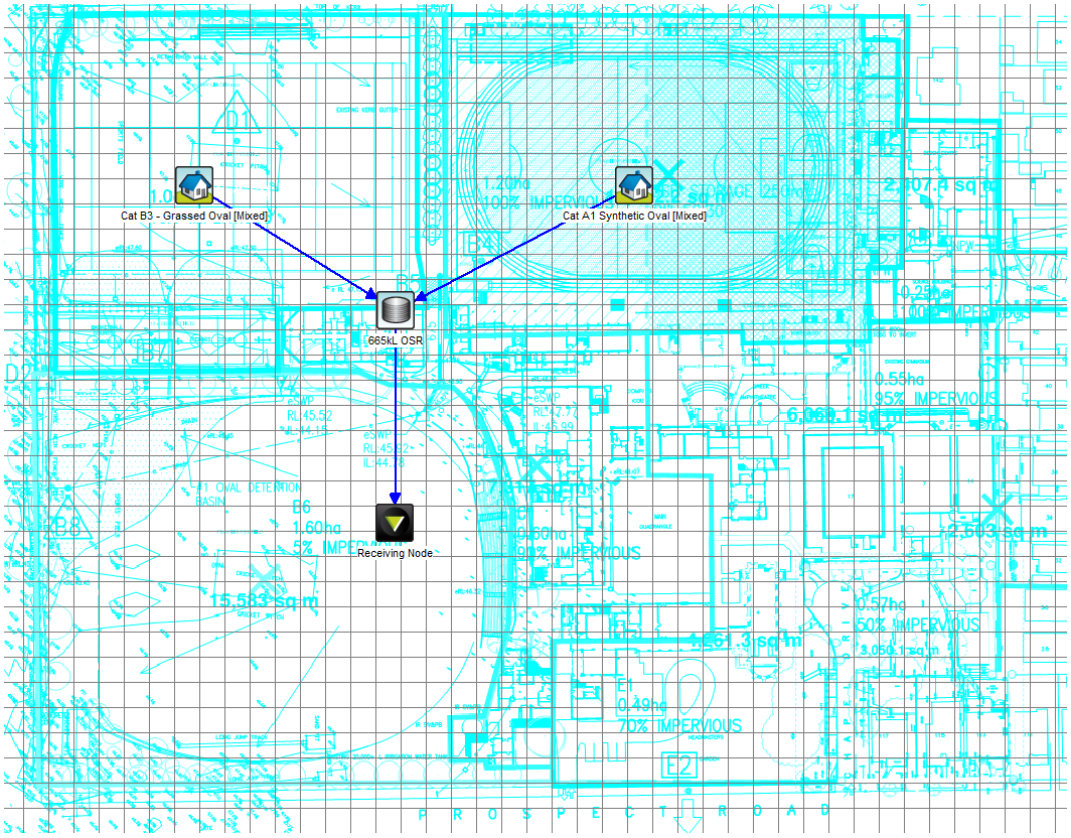
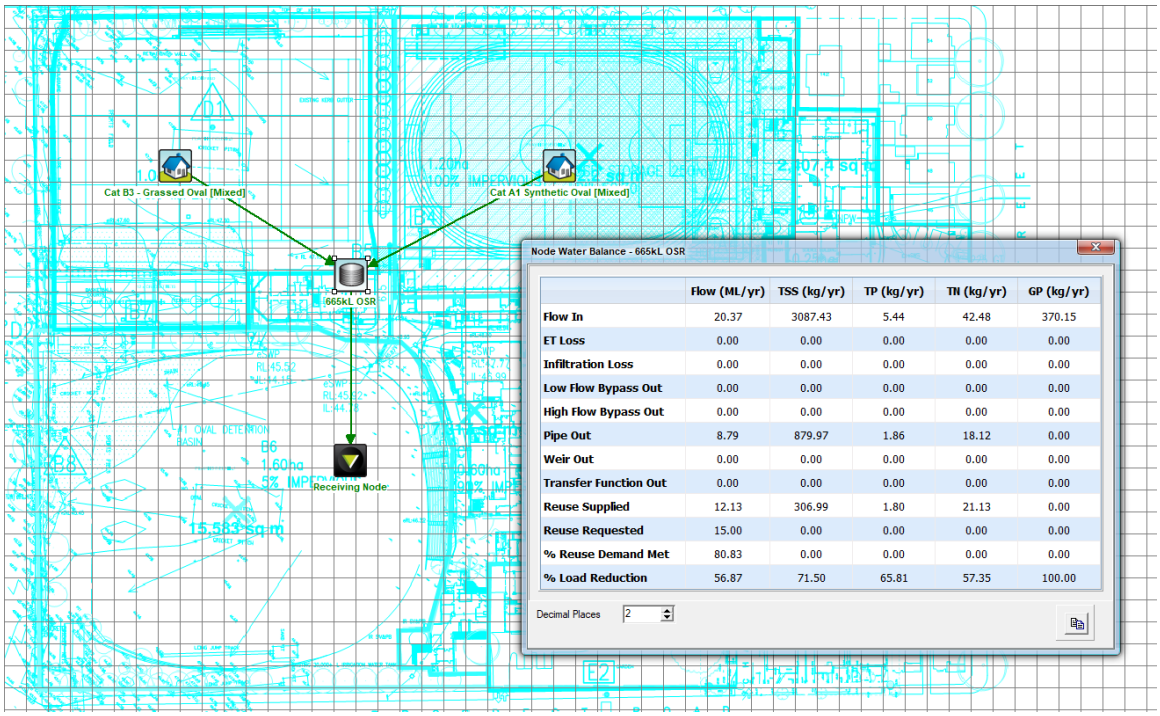


Figure C1 MUSIC Water Balance Model – Layout



	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	GP (kg/yr)
Flow In	20.37	3087.43	5.44	42.48	370.15
ET Loss	0.00	0.00	0.00	0.00	0.00
Infiltration Loss	0.00	0.00	0.00	0.00	0.00
Low Flow Bypass Out	0.00	0.00	0.00	0.00	0.00
High Flow Bypass Out	0.00	0.00	0.00	0.00	0.00
Pipe Out	8.79	879.97	1.86	18.12	0.00
Weir Out	0.00	0.00	0.00	0.00	0.00
Transfer Function Out	0.00	0.00	0.00	0.00	0.00
Reuse Supplied	12.13	306.99	1.80	21.13	0.00
Reuse Requested	15.00	0.00	0.00	0.00	0.00
% Reuse Demand Met	80.83	0.00	0.00	0.00	0.00
% Load Reduction	56.87	71.50	65.81	57.35	100.00

Figure C2 MUSIC Water Balance Model – Results

Appendix D Inner West Council Correspondence dated 4th December 2019

Matthew Buttarelli

From: Joe Bertacco <Joe.Bertacco@innerwest.nsw.gov.au>
Sent: Wednesday, 4 December 2019 4:09 PM
To: Matthew Buttarelli
Cc: Guna Veerasingham; Manel Mariner
Subject: FW: 113-119 Prospect Road SUMMER HILL NEW SOUTH WALES 2130
Attachments: Attachment 2 - Pre-Development Catchment Summary MB_191118.pdf; Attachment 3 - Post-Development Catchment Summary MB_191118.pdf; Attachment 1 - Summary of Areas of Renewal Project Works MB_191118.pdf

Hi Matthew,
Please refer to my responses to you questions below in Red.

Regards

Joe Bertacco | Coordinator Development Engineering
Inner West Council
P: +61 2 9335 2225 | **E:** Joe.Bertacco@innerwest.nsw.gov.au | **M:** 0421 619 358

Ashfield Service Centre: 260 Liverpool Road, Ashfield NSW 2131
Leichhardt Service Centre: 7-15 Wetherill Street, Leichhardt NSW 2040
Petersham Service Centre: 2-14 Fisher Street, Petersham NSW 2049
PO Box 14, Petersham NSW 2049

INNER WEST COUNCIL

Council acknowledges the Traditional Custodians of these lands, the Gadigal-Wangal people of the Eora Nation.

From: Matthew Buttarelli <MButtarelli@acor.com.au>
Sent: Tuesday, 19 November 2019 11:45 AM
To: Manel Mariner <manel.mariner@innerwest.nsw.gov.au>
Cc: Caitlin Russell <CRussell@acor.com.au>
Subject: RE: 113-119 Prospect Road SUMMER HILL NEW SOUTH WALES 2130

Hi Manel,

Thanks for the phone conversation last week. As discussed, we're assisting Trinity Grammar School (TGS) with their "TGS Renewal Project" which involves refurbishment of various areas of the school. The TGS Renewal Project will be undertaken under an SSDA approvals pathway.

There was previous consultation with Inner West Council for this Project, however it is our understanding that the focus of this meeting was Heritage and Architectural items. In this instance, we feel it is important to start engaging with Council's engineer's before the SSDA submission by Q1 / Q2 next year.

Development Context
A summary of the proposed development is as follows:

- New five (5) storey “Teaching & Learning” building at the heart of the Campus
- Renewal and Refurbishment of existing teaching and learning facilities (generally internal reconfigurations of existing buildings);
- Increasing the footprint of an existing carpark under the south-western sports field (Oval 3) and connection to the existing underground car park under the north-western sports field (Oval 2) to improve traffic flow and safety;
- New multipurpose pavilion between Ovals 1 and 3
- Demolition of school-owned residences at 46, 48, 50 and 52 Seaview Street and provision of maintenance and delivery facilities;
- Improvement and extension to Junior School outdoor teaching, assembly and recreational area.
- Other general refurbishments / improvements to pedestrian links across the school grounds and between levels, including more accessible connections between the Junior School, ovals and car park

Queries for Council

1. **Catchments and OSD Requirements**

The TGS campus currently drains to three discharge points:

- Southern portion of the campus to Yeo Park via an existing drainage easement pipeline
- Northern portion of the campus to Seaview Street via existing piped connections to Council stormwater pits within Seaview Street
- A small portion of the eastern catchment drains to Prospect Road via surface flows (existing Heritage area to generally remain in its current condition)

To provide further context to Council, attached are the following catchment sketches:

- **Attachment 1** – Summary of Areas of Renewal Project Works. This document shows the current approximate areas of redevelopment works to each sub-catchment, and the approximate area of the existing to remain in its current condition.
- **Attachment 2** – Pre-Development Catchment Summary. The current break-up of sub-catchment areas.
- **Attachment 3** – Post-Development Catchment Summary. The proposed break-up of sub-catchment areas.

The current OSD strategy for the post-development scenario will be:

- Redirection of “Catchment D4” to Yeo Park (previously Seaview Street) due to site levels and constraints. Site observations and review of flood maps indicates that the sag point of Seaview Street may be affected by existing localised stormwater ponding issues, so preference was given to reducing the catchment draining to Seaview Street. Agreed. Did you mean Catchment B4 please clarify
- A combined model for the whole Yeo Park catchment would be developed (redeveloped and existing areas) to justify that existing and proposed OSD systems would collectively attenuate site flows back to **pre-development (greenfield)** conditions. Agreed
- “Catchment D2” to Seaview Street to be redeveloped would have OSD storage to attenuate flows back to **pre-development (greenfield)** conditions. Agreed
- All existing catchments to remain would drain to their current conditions i.e. no requirement to provide additional OSD storage for these existing areas). Agreed

The above strategy has been developed with Marrickville DCP 2.25 and corresponding OSD guidelines. Could Council please comment whether this OSD strategy aligns with their expectations? Would Council request any additional information for OSD be submitted with the upcoming SSDA submission?. Submission as proposed above is acceptable

2. **Existing Issues to Council Drainage Infrastructure**

Could Council please confirm if there are any drainage constraints to the existing drainage network within Yeo Park and / or Seaview Street which is not readily available? We would like to capture any issues in the design prior to SSDA submission. Still to be investigated and to be confirmed by Council

3. **Water Quality Objectives**

Could Council please confirm that the water quality percentage reduction targets specified in DCP 2.17 Control C3 would only apply to re-developed areas shown on **Attachment 1**? Agreed DCP 2.17 will only apply to renewal areas however controls C4 and C5 will also apply.

Specifically, that we do not have to consider existing fully pervious catchments, such as “Catchment B1” (cricket oval) in the pollution reduction targets? Obviously it will be extremely difficult to achieve pollutant reduction percentages for fully pervious existing catchments such as “Catchment B1”. Agree

4. **Overland Flow Paths**

The existing drainage design methodology for central areas of the site (Catchment A1 and a portion of Catchment D2 as shown on **Attachment 2**) and rely on piping of the 1% AEP flows due to the absence of a defined overland flow path.

Due to existing building constraints we would require to retain this methodology of piping the 1% AEP flows for the new Teaching & Learning Building (**Attachment 3** – Catchment B4) including any system upgrades required in the site's downstream drainage network required. Agreed but must allow for Blockage factors.

Can Council please confirm that this methodology is acceptable? This would be in-line with Marrickville DCP 2.25 Control C23. A HGL analysis to the system would be provided to ensure piped system freeboard is minimum 300mm below surface levels. Agreed methodology acceptable

Happy to discuss further once you have had a chance to review. It might be worthwhile us dropping by Council's office to discuss if you would like to go through the information and other plans further.

Regards,

Matthew Buttarelli | **Associate Senior Civil Engineer**

ENGINEERS | MANAGERS | INFRASTRUCTURE PLANNERS | DEVELOPMENT CONSULTANTS

ACOR Consultants Pty Ltd

Suite 2, Level 1, 33 Herbert Street
St Leonards NSW 2065

T +61 2 9438 5098
E MButtarelli@acor.com.au

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From: Manel Mariner <manel.mariner@innerwest.nsw.gov.au>
Sent: Tuesday, 12 November 2019 9:43 AM
To: Matthew Buttarelli <MButtarelli@acor.com.au>
Subject: 113-119 Prospect Road SUMMER HILL NEW SOUTH WALES 2130

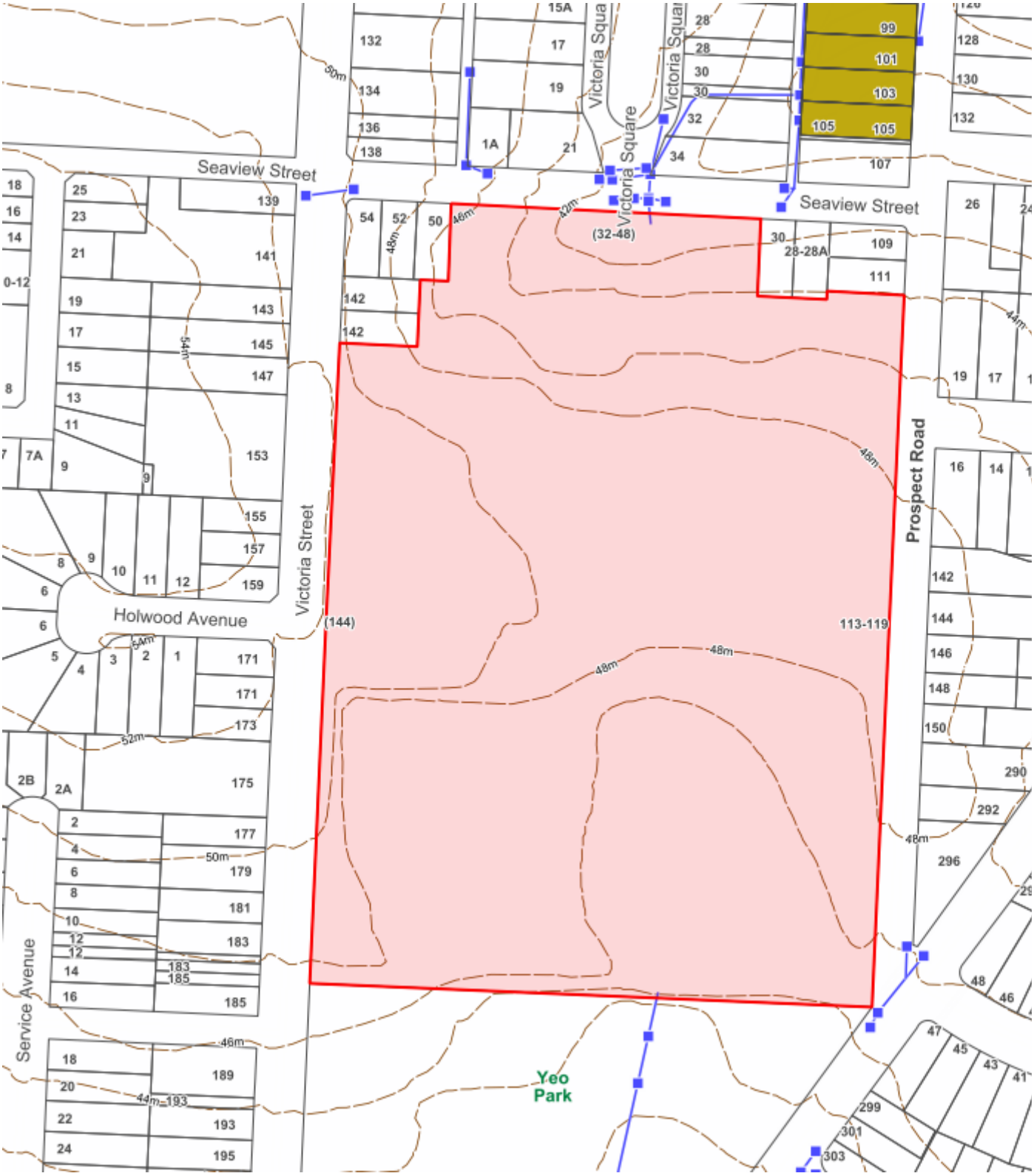
Hi Matthew,

Nice talking to you on the phone.

As commented, find below the stormwater drainage system in the vicinity of Trinity Grammar School.

Let us know if you have any other question. We are happy to help.

Kind regards,



Manel Mariner | Development Engineer
Inner West Council
P: +61 2 9392 5293 | **E:** manel.mariner@innerwest.nsw.gov.au

Ashfield Service Centre: 260 Liverpool Road, Ashfield NSW 2131
Leichhardt Service Centre: 7-15 Wetherill Street, Leichhardt NSW 2040
Petersham Service Centre: 2-14 Fisher Street, Petersham NSW 2049
PO Box 14, Petersham NSW 2049

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