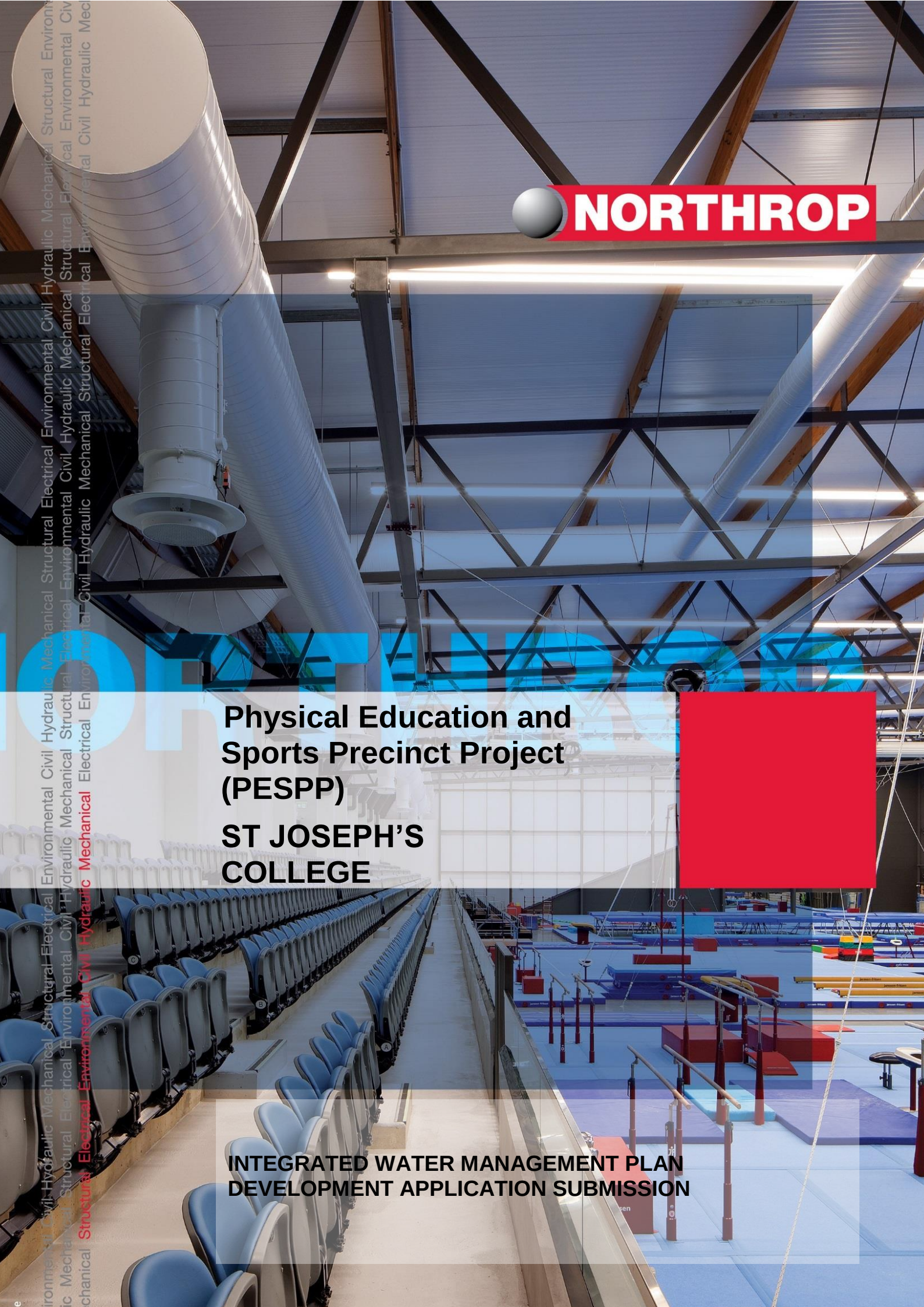

Physical Education and Sports Precinct Project (PESPP)

ST JOSEPH'S COLLEGE

INTEGRATED WATER MANAGEMENT PLAN
DEVELOPMENT APPLICATION SUBMISSION

Disclaimer

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S166502-CR01-1 St Joseph's College Sports Courts –Stormwater Management Report

Rev	Description	Prepared by	Reviewed by	Issue Date	Client App	Approval Date
1	Extracted from the Stormwater Management Report for inclusion in EIS	SN	JN	01.08.18		
2	Re-issued for DA submission	AC	JN	08/05/19		

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1 Introduction

Northrop Consulting Engineers (Northrop) has been engaged by Bloompark Consulting Pty Ltd (Bloompark) to prepare documentation in support of a Development Application (DA) Submission to Hunters Hill Council (Council) for the St. Joseph's College, Physical Education and Sports Precinct Project (PESPP). This development is required to pass a test of adequacy and meet the Secretary's Environmental Assessment Requirements (SEARs).

St Joseph's College (SJC) submitted a State Significant Development Application (SSD 17_897) to the NSW Department of Planning and Environment (DPE) in 2018 proposing the Physical Education and Sports Precinct Project (PESPP) building. Following exhibition and notification of SSD 17_897, the DPE issued a Response to Submissions (RtS) letter on 23 November 2018.

This report has been resubmitted in response to the Key Issues identified by DPE, the PESPP building has been amended as follows:

- Luke Street Setback: A 4.3m building setback to Luke Street is proposed (compared with 1.3m in the original SSD), providing for a new landscaped buffer including the planting of significant trees between the PESPP and stone wall. The increased setback also simplifies the required construction solution to protect the stone wall.

- Building height: A 2.7m reduction in height (-19%) is proposed. This is achieved by increasing the excavation depth to lower the entire building and relocating the roof plant away from Luke Street. The amended building height is predominantly 11.4m compared with 14.1m in the original SSD (the amended height is 14m to 15m to the relocated plant room which is located well away from Luke Street).

This report outlines the integrated water management strategy developed in accordance with the SEARs issued for the project, and Council's requirements as set out in Hunters Hill Council Consolidated Development Control Plan 2013. The strategy covers stormwater harvesting and reuse, and Water Sensitive Urban Design measures to manage stormwater quality, and is intended to be read in conjunction with the Stormwater Management Report (S166502-CR01-3) prepared by Northrop.

2 Related and Documents

This report is to be read in conjunction with the following documents:

a. Development Application documentation prepared by Northrop:
   i. 166502_DAC01.01 Cover Sheet, Drawing Schedule and Locality Plan
   ii. 166502_DAC02.01 General Arrange Plan
   iii. 166502_DAC03.01 Concept Sediment and Erosion Control Plan
   iv. 166502_DAC03.02 Sediment and Erosion Control Details
   v. 166502_DAC04.01 Concept Stormwater Management Plan – Ground Floor
   vi. 166502_DAC04.02 Concept Stormwater Management Plan – Lower Ground Floor
   vii. 166502_DAC05.01 Details Sheet
   viii. 166502_DAC06.01 Catchment Plan;

b. Hunters Hill Council Consolidated Development Control Plan 2013;
c. NSW MUSIC Modelling Guidelines 2015;
d. Green Star – Design & As Built v1.2 by Green Building Council of Australia
e. S166502-CR01-3 Stormwater Management Report V3 by Northrop
f. SSD 8970 SEARs_030118 (Secretary's Environmental Assessment Requirements)

3 Site Description and Proposed Development

The site is located in the Sydney Lower North Shore suburb of Hunters Hill, bounded by Mary Street to the west, Mark Street to the north, Luke Street to the east, and Gladesville Road to the south. The yellow highlighted area is the overall St. Joseph's College Hunters Hill boundary. The proposed development is located in the southeast corner of St Joseph's College, highlighted in green, henceforth referred to as "the site". The proposed development covers an area of approximately 0.59 ha.

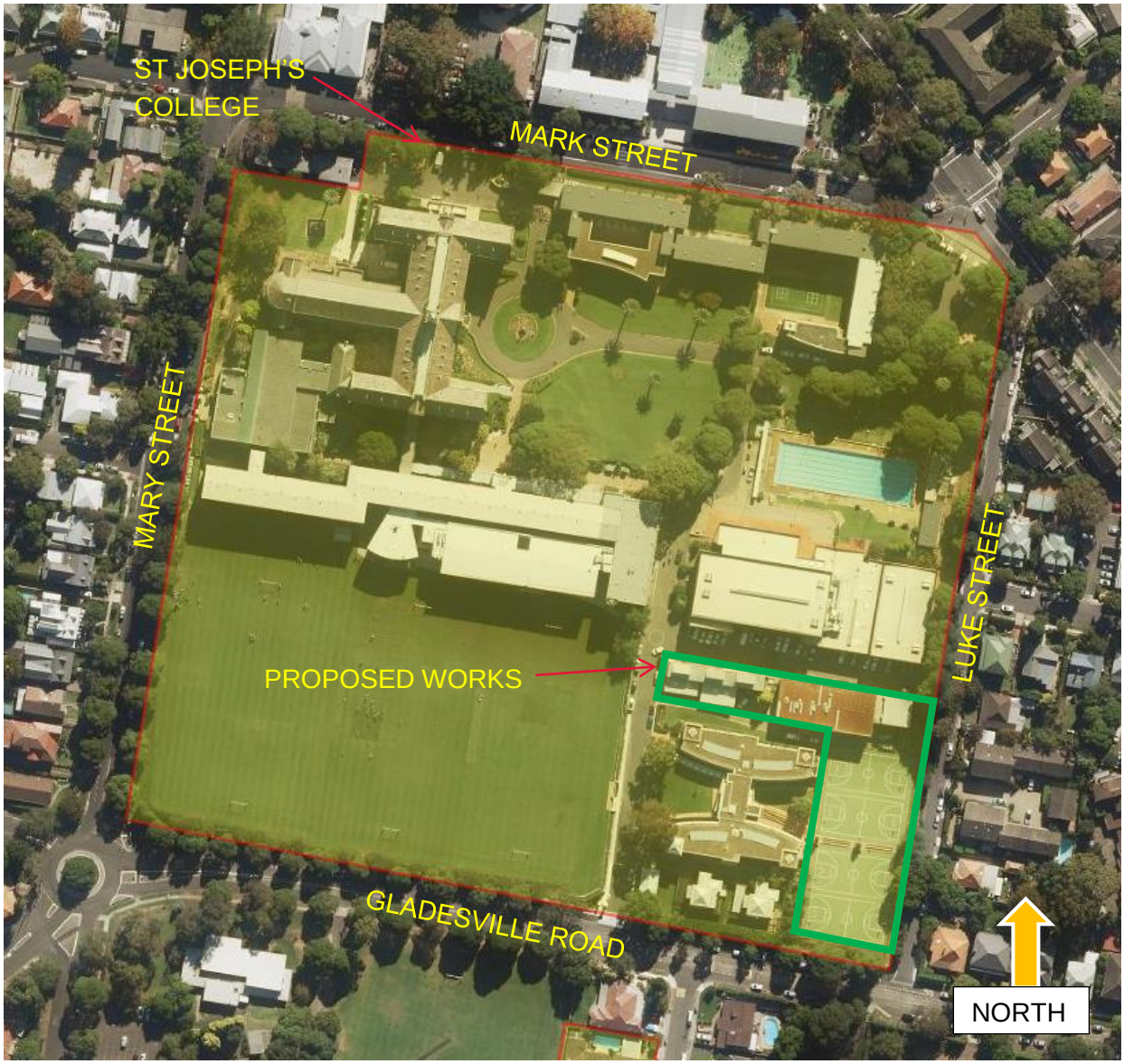

Figure 1 - Locality Plan

The site consists of significant impervious areas included paved roadways, footpaths, roof and hardstand for sports courts. Landscaped or impervious areas occupy approximately 6.4% of

the site. However there are extensive irrigated sports fields (A/B/C fields totalling 1.5ha) within the school boundary which provide an opportunity for stormwater reuse to meet integrated water management objectives.

The proposed development will involve:

1. Demolition of the following existing buildings (which are not heritage significant) near the intersection of Luke Street and Gladesville Road:
   (a) College Shop
   (b) Healy Gym and Maintenance Workshop
   (c) Outdoor Sports Courts
   (d) Workshop/Storage and Shed.

2. Construction of the Physical Education and Sports Precinct Project (PESPP) comprising the following facilities:
   (a) Lower Ground Floor: New car parking, maintenance workshops, storage, offices, amenities etc. A net increase of 55 car parking spaces is proposed (85 new spaces to be provided in the SCP basement less 30 at grade spaces to be removed)
   (b) Ground floor: Three indoor sports courts, amenities, kitchen and entry lobbies
   (c) First Floor: Void over sports courts, bench seating (180 seats), staff facilities, two general learning areas and foyer
   (d) Driveway entry to the PESPP (no new vehicular cross overs)
   (e) Landscaping and tree removal/replacement.

3. Construction of a new single storey building to accommodate the relocated Healy Gym in the north-western corner of the site near the intersection of Mary Street and Mark Street.

4. New kiosk substation and landscaping in the north-eastern corner of the site

Refer to the architectural drawings prepared by TKD Architects for more details.

4 Objectives and Controls

Secretary's Environmental Assessment Requirements (SEAR's)

The SEAR relating to integrated water management is number 13 – *Prepare an Integrated Water Management Plan detailing proposed alternative water supplies, proposed end uses of potable and non-potable water, and water sensitive urban design.*

Development Control Plan Objectives

The stormwater management strategy for this proposal has been developed in accordance with Part 5.6 'Stormwater Management' of the Hunters Hill Consolidated DCP 2013.

The Hunters Hill Consolidated DCP 2013 states the following objectives:

(i) Water balance
- Reduce post-development volumes of stormwater which are discharged from the site
- Prevent adverse impacts upon environments such as bushland, wetlands and estuaries which are sensitive to increased stormwater flows

(ii) Stormwater pollution
- Satisfy discharge standards which are specified by the current catchment management plans
- Reduce pre-development discharges of water-borne pollutants which are discharged from the site
- Capture stormwater flows and remove pollutants during regular rainfall events

(iii) Flood mitigation
- Ensure that developments do not contribute to increased risk of flooding during moderate rainfall events with an average recurrence interval of up to 1.5 years
- Ensure that developments are compatible with the design and capacity of existing stormwater systems
- Avoid damage to stream banks, adjacent bushland and aquatic habitat due to stormwater that is discharged in a large volume or at a high velocity

5 Harvesting and Re-use

Summary of Proposed Tank

A 30kL rainwater reuse tank has been incorporated in this development, with approximately half of the new proposed roof area connected to it (1744m^2).

A first flush system is to be included to ensure only high-quality water is captured for fit-for-purpose reuse. The rainwater tank will be located under the basement slab adjacent to the OSD tank, and overflows into the OSD tank via a dividing weir (refer to Stormwater Management Plan and drawings DAC04.02 and DAC05.01 prepared by Northrop). The top of the weir level is set above the 1 in 100-year water level in the OSD tank, to ensure no cross-contamination between the tanks.

The collected water will be pumped to existing rainwater tanks that are used to irrigate 1.5ha of existing playing fields, and to supplement the current non-potable supply.

The tank will be equipped with the following:

- Solid access lid and step irons;
- High level overflow to adjacent OSD tank;
- Duty and standby pump configured for alternative operation;
- Backup fuel generator;
- Mains water top-up; and
- Associated float valves and control panels.

Demand Calculations

The water usage demand of the playing fields was provided by St Joseph's College via Bloompark Consulting in email correspondence dated 27/09/2017. As being the following:

- *Each 10min cycle of the irrigation sprinklers uses 21.6kL of water*
- *During summer there is one cycle per day, 5 days/week (=108kL/week)*
- *During winter there is one cycle per day, 2 days/week (=43.2kL/week)*

Both "summer" and "winter" cycles were assumed to be 26 weeks each.

The total annual demand was calculated as follows:

- Summer total = 26 x 108 = 2808kL
- Winter total = 26 x 43.2 = 1123.2kL
- Total annual demand = summer total + winter total = 3931.2kL

MUSIC Modelling Results

The following parameters were entered in MUSIC to model the rainwater tank water balance (for further information about MUSIC modelling inputs, such as rainfall data, refer to Section 6).

- Roof Area to Tank = 1744m^2
- Tank Volume = 30kL
- Initial Volume = 15kL (assumed half full at the start of the run)
- Annual Demand = 3931.2kL/year
- Annual demand was distributed using potential evapotranspiration (PET) minus rainfall.

The proposed 30kL rainwater tank will meet around 30% of the total sports field demand, supplying a total of 1190kL of water per year. This is addition to the rainwater already supplied by the existing tank for irrigation.

Potable Water Saving

The cost of potable water is assumed to be $2.04/kL, based off a water bill supplied by St Joseph's College (dated 6/09/2017). The 30kL tank supplies 1190kL of water, thereby reducing the demand for potable water by this amount. The annual saving in potable water, due to the 30kL tank alone, is: 1190 x $2.04 = $2,427.6 / year.

6 Stormwater Quality Management

Catchment Plan

The proposed extent of works has been divided into the following five sub-catchments:

- C1 – Roof Catchment = 3582m^2
- C2 – Driveway Catchment = 527m^2
- C3 – Landscape Catchment = 1082m^2
- C4 – Hardstand Catchment = 714 m^2

Catchment areas are illustrated in Figure 2 below.

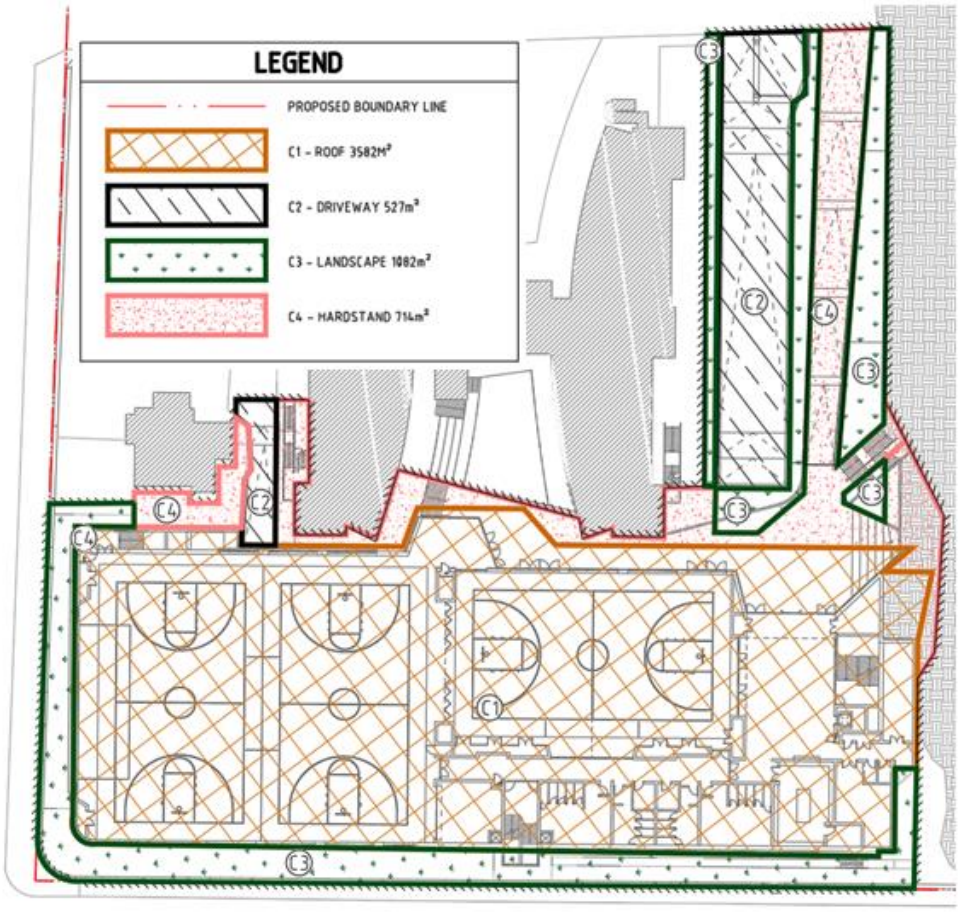

Figure 2 – Catchment Areas

Adopted Water Quality Objectives

The main objectives for stormwater quality are indicated in Hunters Hill Consolidated DCP 2013 and are presented in Table 1 below:

Table 1 - Water Quality Targets – Hunters Hill Council

Pollutant	% Reduction Post-Development Average Annual Load Reduction
Total Suspended Solids (TSS)	80
Total Phosphorous (TP)	45
Total Nitrogen (TN)	45

This development is also aiming to achieve the stormwater pollution targets listed in 'Green Star – Design & As Built v1.2' developed by Green Building Council of Australia. The targets are presented in Table 2 below:

Table 2 - Water Quality Targets – Green Star

Pollutant	% Reduction Post-Development Average Annual Load Reduction
Gross Pollutant (GP)	90
Total Suspended Solids (TSS)	80
Total Phosphorous (TP)	60
Total Nitrogen (TN)	45
Total Petroleum Hydrocarbons	90
Free Oils	90

Stormwater Quality Management Scheme

The stormwater treatment train has two stages of treatment; pit inlet filter baskets (Enviropods) that will provide pre-treatment by capturing gross pollutants, the coarser suspended solids and petroleum hydrocarbons/free oils. The secondary treatments are provided by proprietary filter cartridges in the downstream catchment and will remove nutrients such as nitrogen and phosphorous and petroleum hydrocarbons/free oils.

Rainfall Data

For the analysis of the MUSIC modelling, historical rainfall records were obtained from the Bureau of Meteorology for Station No. 066062 at Sydney (Observatory Hill). The MUSIC analysis was undertaken using a 6 min time step for year 1962 to 1966 of historical data.

The mean annual rainfall for the modelled data was 1279mm, which compares closely to the all-time recorded mean annual rainfall for Sydney (Observatory Hill) of 1215.7. The evapotranspiration values have been entered from the default data provided by the MUSIC software for the Sydney area.

Methodology

The water quality modelling software MUSIC v6 was used to analyse the performance of the treatment train. Figure 3 below shows the MUSIC node and link diagram used to describe the proposed treatment train. The model has been built to assess the adequacy of the Stormwater treatment measure proposed and to ensure that the quality of stormwater meets the objectives prior to stormwater runoff leaving the site.

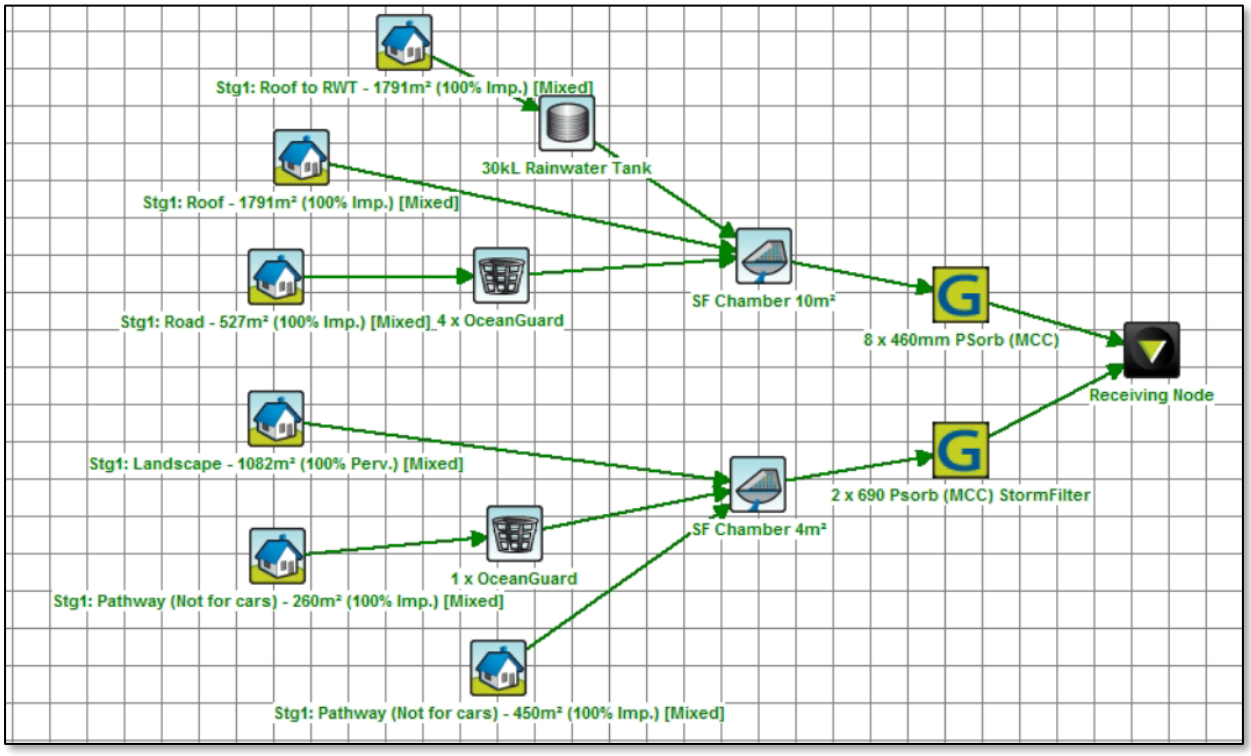

Figure 3 – MUSIC Link and Node Diagram

The following rainfall and runoff parameters shown in Table 3 have been utilised.

Table 3 – Rainfall Runoff Parameters

Parameter	Recommended Values
Rainfall Threshold (mm/day)	1.0
Soil Storage Capacity (mm)	120
Initial Storage (% of Capacity)	30
Field Capacity (mm)	80
Infiltration Capacity Coefficient – a	200
Infiltration Capacity Exponent – b	1
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow Rate (%)	5

Daily Deep Seepage Rate (%)	0

The pollutant concentration parameters used in the model were based on information provided in NSW MUSIC Modelling Guidelines 2015. The parameters are listed in Table 4 below:

Table 4 - Water Quality Parameters for MUSIC Source Nodes

Land- Use Category		Log TSS (mg/L)		Log TP (mg/L)		Log TN (mg/L)	
		Storm Flow	Base flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Residential	Mean	2.15	1.20	-0.60	-0.85	0.30	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12
Roofs	Mean	1.30	-	-0.89	-	0.30	-
	Std Dev	0.32	-	0.25	-	0.19	-
Road	Mean	2.43	1.20	-0.30	-0.85	0.34	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12

Model Results

The water quality model created provides an indication of the pollutant removal rates expected when a treatment train of water quality measures is applied to the proposed development. Based on the modelled results the treatment measures proposed surpass the minimum objectives indicated in council's DCP and in Green Star – Design & As Built v1.2.

Table 5 below presents the compliance of the treatment train.

Table 5 - MUSIC Model Results

Pollutant	Before Treatment	After Treatment	% Reduction	% Target (Council)	% Target (Green Star)	Compliance
Total Suspended Solids (kg/yr)	531	97.2	81.4	80	80	OK
Total Phosphorus (kg/yr)	1.39	0.459	67.2	45	60	OK
Total Nitrogen (kg/yr)	13.9	7.52	45.7	45	45	OK
Gross Pollutants (kg/yr)	143	0	100	n/a	90	OK
Total Petroleum Hydrocarbons/ Free Oils (kg/yr)	10.7	0.653	93.9	n/a	90	OK

Proposed Stormwater Treatment Train

In order to achieve the reduction targets the following treatment devices are required as part of the treatment train:

- Stormwater360 690mm Stormfilter Cartridges

A total of two (2) cartridges are to be introduced to the design as a major filter device located within the Water Quality Chamber at the end of the treatment train.

- Stormwater360 460mm Stormfilter Cartridges

A total of eight (8) cartridges are to be introduced to the design as a major filter device located within the WSUD tank at the end of the treatment train.

- Stormwater360 Envirpod 200 Inserts

Enviropod 200 inserts will be used as a pre-treatment for stormwater runoff to capture litter and coarse sediment surface flows on the site. Enviropod inserts are to be installed on all surface inlet pits across the site.

- 30kL Rainwater Tank

A 30kL rainwater tank will be implemented to capture stormwater runoff generated off the roof of the sports courts. The collected rainwater will be used for irrigation of the landscaped areas across the site.

Additional rainwater tank storage has been provided to facilitate any further development.

Refer to Northrop's Development Application drawing 166502-DAC04.01 and 166502-DAC04.02 for the location and size of the proposed located systems and information relating to the proposed WSUD products.

7 Stormwater Quantity Management

Adopted Water Quantity Objectives

This site is located in Zone 1 of Hunters Hill Municipality catchment management zones. As such, the On-site Detention (OSD) has been designed in accordance with parameters provided in Hunters Hill Consolidated DCP 2013. The storage volume & PSD requirements table is presented in Table 6 below:

Table 6 - OSD targets within Zone 1

Zone 1	For Flood Mitigation	For Erosion Control
PSD (l/s/100m^2 Imp)	1.8	0.41
SSR (m^3/100m^2 Imp)	3.04	1.2

This development is also aiming to achieve the Stormwater Reduced Peak Discharge targets listed in 'Green Star – Design & As Built v1.2' developed by Green Building Council of Australia. The targets are that the post-development peak event stormwater discharge does not exceed the pre-development peak event for the Average Recurrence Interval (ARI) specified in Table 7:

Table 7 - Reduced Peak Discharge Targets – Green Star

Climate Change Scenarios	Design ARI
Climate change and adaptation assessment identifies that there is a low risk of increased rainfall and/or flooding during the design life of the project.	1 year ARI
Climate change and adaptation assessment identifies that there is a medium or high risk of increased rainfall and/or flooding during the design life of the project.	5 year ARI

Stormwater Quantity Management Scheme

The stormwater quantity management strategy has been designed so that the total storage detention volume complies with council's minimum volume requirement and the Green Star Peak Discharge Reductions. Such storage volume has been provided in an on-site detention tank.

To manage stormwater quantity discharge across the site, the OSD tank will incorporate an orifice plate to ensure peak flows generated under proposed conditions do not exceed the permissible site discharge (PSD) provided by Hunters Hill Council Consolidated DCP 2013.

The OSD tank has been designed with the following parameters:

Table 8 - OSD parameters

	For Flood Mitigation	For Erosion Control	Imp. Area Contributing to OSD	Target	Provision	Compliance
PSD	1.8 **(l/s/100m² Imp)**	0.41	4835m²	106.85	104	OK
SSR	3.04 **(m³/100m² Imp)**	1.2	4835m²	205	224	OK

The Peak Discharge Reductions are presented in the table 9 below:

Table 9 - Peak flow reductions

Design ARI	Pre-development	Post-development
1 year	0.128 m³/s	0.039 m³/s
5 year	0.19 m³/s	0.057 m³/s

The pipe system has been designed in accordance with AS 3500 Part 3 Stormwater drainage with a suitable size to accommodate the 1 in 20 Year ARI rainfall event. The runoff generated from the proposed driveway, pathway, landscape area and half of roof area will be captured by a network of stormwater pits and pipes prior to discharging into the OSD tank. The runoff generated from the other half of proposed roof will be collected by a 30kL rainwater tank prior to discharging into the OSD tank. Restricted runoff from the OSD tank will be discharged into Council's existing kerb inlet pit located at the frontage of the site on Gladesville Road. Access to the OSD tank has been provided via the access lid located on lower ground floor and the access grate located at the southwest corner of the proposed building.

For more details refer to Northrop's DA Stormwater Management Drawings.

8 Conclusion

Northrop has been engaged by Bloompark Consulting Pty Ltd (Bloompark) to prepare an Integrated Water Management Plan in support of a Development Application submission to Hunters Hill Council for the proposed St. Joseph's College, Physical Education and Sports Precinct Project (PESPP).

A water quality and reuse management strategy has been developed for the proposed development in accordance with Part 5.6 'Stormwater Management' of Council's DCP 2013.

A stormwater treatment train has been developed to manage the discharge of pollutants from the site. The treatment train includes the implementation of a 30kL rainwater tank to capture and reuse stormwater runoff generated across the roof of the proposed buildings. Additional

rainwater tank volume has been provided to facilitate any further development. The rainwater tank will be used in conjunction with:

- Stormwater360 Stormfilter cartridges, or equivalent approved unit, which will be installed within the OSD tank to capture and treat stormwater
- Stormwater360 Enviropod 200 inserts, or equivalent approved units, which will be installed within stormwater inlet pits to capture gross pollutants and nutrients

The findings of this report and associated concept designs indicates effective Water Quality Treatment measures can be integrated into the proposed development in accordance with council's Hunters Hill Consolidated DCP 2013, and that no major factors relating to stormwater management would preclude the proposed development of the site.