H&H Consulting Engineers Pty Ltd *(trading as Henry & Hymas)*
ABN 77 091 243 355 ACN 091 243 355

Address
Suite 2.01, 828 Pacific Highway Gordon New South Wales 2072

Telephone +61 2 9417 8400
Facsimile +61 2 9417 8337

Email email@hhconsult.com.au
Web www.henryandhymas.com.au

henry&hymas

Quality Management · ISO 9001
Global-Mark.com.au®

henry&hymas

INTERGRATED WATER CYCLE MANAGEMENT REPORT
Alspec Industrial Business Park
Orchard Hills 2748

For DA
March 2024
Revision 04

HENRY & HYMAS
LEVEL 2, 828 PACIFIC HIGHWAY
GORDON NSW 2072
Our Ref: 19221
Tel: (02) 9417 8400
Fax: (02) 9417 8337
E-mail: nheazlewood@hhconsult.com.au

henry&hymas

TABLE OF CONTENTS

1. INTRODUCTION

1.1 General

This Integrated Water Cycle Management Report has been prepared to supplement the Development Application (DA) for the proposed Alspec Industrial Business Park Subdivision Works located on Luddenham Road, Orchard Hills, NSW. Refer to the architectural site plan included within Appendix B for a demonstration of the proposed development and the site.

The proposed works are to consist of the following:

- Construction of a collector road running through the middle of the subject site, connecting Paton's Lane to Luddenham Road.
- Construction of a service road, connecting the collector road to the north-west basins and the transgrid easement.
- Proposed bulk earthworks to set future pads within subdivision.
- Construction of multiple flood basins to manage the flooding of the adjacent watercourse to the North-West of the subject site.
- Construction of multiple water quality, detention and stormwater harvesting basins to satisfy Council's WQUD and stormwater detention requirements.

Refer to Figure 1.1 below showing the proposed arrangement of the road infrastructure and future pads.

Figure 1.1 Locality Sketch

The following Engineering matters have been addressed in this report:

- Water Sensitive Urban Design (WSUD)
- Stormwater Detention
- Flooding
- Sediment and Erosion Control

The purpose of this report is to summarise the stormwater design, as well as the hydraulic and water quality modelling in order to illustrate that the proposed design is in accordance with engineering best practice principals and the requirements set out in Penrith City Council's development control plan.

A full set of DA Drawings is provided in Appendix A of this report.

1.2 Engineering Objectives/ Principles

The stormwater network has been designed to safely convey minor storm events via a pit and pipe stormwater system with provision for larger, more infrequent storm events overland via an overland flow route. The minor storm event for this development is the 1:20yr ARI storm and the major storm event is the 1:100yr ARI storm. This is as per Council's development control plan (DCP).

In order to ensure no negative impact on downstream ecosystems and waterways, stormwater from the subject site is proposed to be managed through the implementation of water quality systems, detention and sediment and erosion control. Refer to sections 2.1, 2.2, 2.3 and Appendix A for further details.

1.3 Council Policies

The civil engineering component of the aforementioned project has been designed in accordance with the following council codes and policies:

- Penrith City Council Development Control Plan 2014 – E17 Luddenham Road Industrial Business Park
- Penrith City Council Development Control Plan 2014
- Penrith City Council Stormwater Drainage Specifications for Building Developments 2018
- Penrith City Council WSUD Technical Guidelines 2015

E17 Luddenham Road Industrial Business Park

Penrith City Council have developed a sub section in the Penrith City Council DCP 2014 with controls specifically tailored for all developments covered by the Luddenham Road Industrial Business Park Precinct. In the event of any inconsistency between this section and the rest of the DCP, the requirements of Section E17 prevail. The stormwater controls are shown in Section 17.6 – Integrated Water Cycle Management of the Penrith City Council Development Control Plan 2014 Section E17 Luddenham Road Industrial Business Park

1.4 The Site & Its Context

The site is identified as Lot 1 and 2 in DP 1293805 and is located alongside Luddenham Road and Patons Lane.

The site currently comprises of the following general layout:

- Lot 1 DP 1293805: A building, horse stables and associated facilities, and a rectangular network of fenced yards for horse and sheep agistment.
- Lot 2 DP 1293805: Open space paddocks for cattle grazing and four dams.

The site is located within the Wianamatta – South Creek Catchment area and is approximately 124.96 hectares, however only 63.62 hectares of the site is proposed to be developed as a part of this project. The western portion of the site is marked as a future Outer Sydney Orbital Corridor, whilst a portion of the site to the south is noted as an environmental conservation area. A portion of the site to the south is also noted as a Western Sydney Freight Corridor. Additionally, a Transgrid electrical easement runs through the north-western part of the site.

1.5 Catchments

Refer to Figure 1.5 below and drawings C250 and C251 within Appendix A showing the existing and proposed catchment plans for the development. In general, the site is separated into 3 sub-catchments:

- The western catchment drains to the watercourse in the western part of the site. This is approximately 49.59 hectares. The proposed stormwater system is to connect to an existing headwall within Patons Lane which directs stormwater to the north to the watercourse.
- The south eastern catchment drains to Luddenham Road. This catchment is approximately 11.35 hectares. The proposed stormwater system is to connect to an existing headwall within Luddenham Road which directs stormwater to the east.
- The north eastern catchment drains to Luddenham Road. This catchment is approximately 2.68 hectares. The proposed stormwater system is to connect to an existing headwall within Luddenham Road which directs stormwater to the east.

The site is proposed to be regraded to suit the new layout as per the architectural plans in Appendix B. The existing catchment areas are to be retained in general. Refer to drawing C251 in Appendix A. The western part of the site is subjected to flooding. All flooding investigations have been undertaken by Arcadis, refer to Appendix D and section 4 for more details.

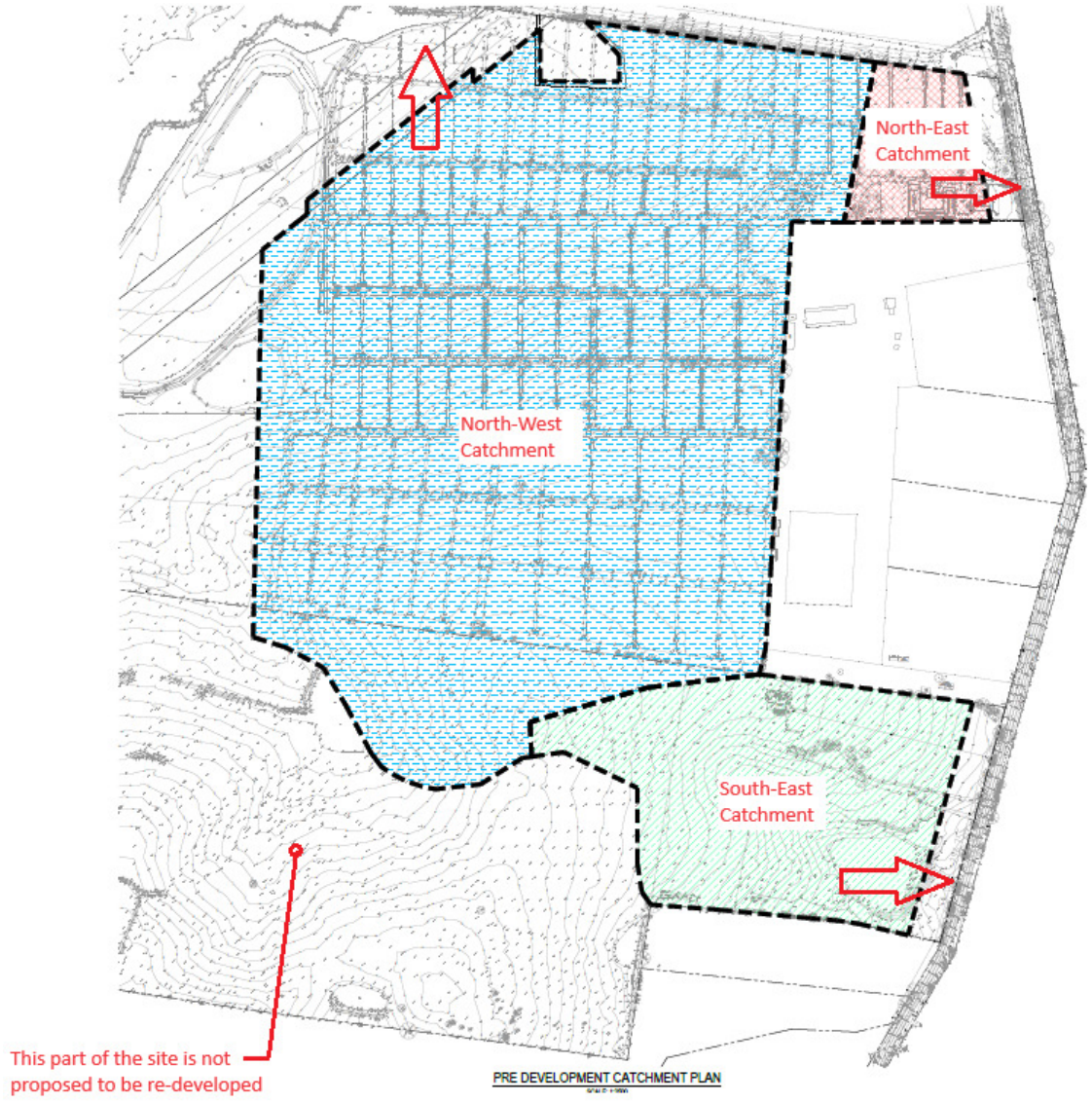


Figure 1.5 Catchment Plan

2. STORMWATER MANAGEMENT

2.1 Introduction

2.1.1 Background

Stormwater controls are proposed to be implemented that ensure that the development does not adversely impact on stormwater flows and water quality of the stormwater system downstream of the site.

The principles and operation of the proposed stormwater system for the development including water quality measures and the components of the internal drainage system are detailed on the Development Application Drawings included in Appendix A.

2.1.2 Key Issues

The key issues and the proposed mitigation measures to be implemented as part of the proposed development are:

- **Stormwater Quantity** - The increased impervious surfaces (such as roads, roofs, driveways, etc) associated with the development will result in an increase in peak stormwater flows from the site during storm events. On Site Detention is required to be considered to ensure that runoff from the development is appropriately managed in accordance with Council's requirements. The site stormwater system has been designed to safely convey the flows through the site and within the capacity of the downstream system. The design and operation of the proposed stormwater system is described in Section 2.2 below.

- **Water Quality** - Urban developments have the potential to increase gross pollutants, sediments, hydrocarbons and nutrient concentrations in stormwater runoff. To limit impact on the downstream water quality, stormwater treatment in the form of gross pollutant traps, and bio retention basins will be provided. Section 2.3 further describes the specific implementation of these measures for the proposed development.

2.2 Stormwater Quantity

As per Penrith City Council's engineering specifications, post-developed flow rates are required to be reduced to pre-developed flow rates up to the 100yr ARI storm event. The stormwater detention strategy varies for each sub-catchment within the site, given the site constraints and proposed layout.

DRAINS Parameters

DRAINS modelling has been undertaken to assess the OSD requirements for the proposed works. Rainfall data of the site was taken from the Australian Rainfall & Runoff (ARR) 2016 Data Hub. Critical storm durations up to 1.5hrs were assessed for both the major and minor storm events.

An ISLAX hydrological model was adopted for all modelling scenarios, with the exception of the north-west pre-developed model, which was based off an XP-RAFTS hydrological model. The parameters for the ISLAX model were as follows:

- Paved area depression storage – 1mm
- Supplementary area depression storage – 1mm
- Grassed area depression storage – 5mm

The site has been graded such that the proposed catchment areas match the site's existing catchment areas, refer to C251 drawing for the post development catchment map. Time of concentration (T_c) values for minor catchment areas alongside the proposed road works were a standard 5 minutes for impervious areas and 10 minutes for pervious areas. However T_c values for increasingly larger areas such as pad sites were more detailed and were based off factors including flow lengths, flow slopes and retardence coefficients.

Pipe drainage within the internal road reserve has been designed to cater, at a minimum, for the 20 year ARI storm event as per Penrith City Council's requirements. The stormwater overflow system has been designed such that overland flows during the 100 year ARI storm event are wholly contained within the road's kerb and gutter system.

North – Western Catchment

The North-Western Catchment totals 49.59ha and drains towards an existing watercourse that runs through the North-Western part of the site. Since this part of the site drains towards the watercourse, the stormwater design for this catchment has considered the flood modelling from Arcadis. The pre-developed flow rates for this catchment have been

calibrated with the data used in the Arcadis flood model. An XP-RAFTS hydrological model has been utilised to estimate the pre-developed conditions for the north-west catchment. The following parameters have been used in order to calibrate with the DRAINS model by Arcadis:

Initial Loss = 10mm
Continuing Loss = 2.5mm/hr
Impervious Area PERN – 0.015
Pervious Area PERN = 0.05 (Rural) and 0.025 (Urban)
B_x = 1.3
Travel time for routing links is based on a 1.5m/s flow velocity

Refer to Table 2.2a which summarises the pre-developed flow rates for the north-west catchment

Total Area for pre-developed catchment C-1J-3A	45.503 hectares
Total Area for pre-developed catchment C-1I-4A-E	13.917 hectares
Peak flow rate for 5% AEP critical storm (combined C-1J-3A and C-1I-4A-E catchments)	4.62 m^3/s
Peak flow rate for 1% AEP critical storm (combined C-1J-3A and C-1I-4A-E catchments)	7.42 m^3/s
Maximum allowable post developed flows in critical 5% AEP storm	0.078$m^3/s/ha$
Maximum allowable post developed flows in critical 1% AEP storm	0.125$m^3/s/ha$

Table 2.2a North-West Pre and Post-developed flows

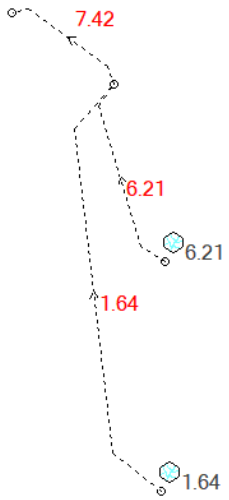


Figure 2.2 Arcadis DRAINS Model 1% AEP Pre- Developed Results

Refer to the DRAINS model '*19221_D2_Arcadis Pre-Dev'* for more details of the pre-developed modelling for the north-west catchment.

Stormwater detention is proposed to be provided in each individual lot within the North-West catchment. These on lot detention storages, which will most likely be in the form of below ground tanks, will be constructed as part of the development works for each pad site. These detention storages are not proposed to be constructed as part of the subdivision works. It should be noted that sediment basins are proposed to be constructed as part of the subdivision works, in order to control sediment and erosion from the pad sites.

In order to ensure that the stormwater system within the collector road and service road have been designed to cater for the final post-developed scenario, preliminary on -site detention storages has been designed in DRAINS for each pad. It is expected that the design of each on-lot OSD will be finalised as a part of the DA submission for each pad site. In general the preliminary OSD storages for each lot has been designed to ensure that the post-developed flows are reduced to below the pre-developed flow rates (refer to the table above). To summarise:

Approximate Storage = 425m^3/ha
Reduce post developed flows in critical 5% AEP storm to = 0.078m^3/s/ha
Reduce post developed flows in critical 1% AEP storm to = 0.125m^3/s/ha

Preliminary OSD Design for the North-West Lots

OSD Tank	Footprint (m^2)	Depth (m)	Volume (m^3)
OSD 1	1,700	1.49	2,533
OSD 2	1,162	1.44	1,673
OSD 3A	1,650	1.39	2,293
OSD 3B	1,300	1.49	1,937
OSD 4A	2,800	1.39	3,892
OSD 4B-1	1,901	1.39	2,642
OSD 4B-2	1,925	1.39	2,676
OSD 4C-1	797	1.49	1,188
OSD 4C-2	944	1.47	1,388

Refer to the DRAINS model '*19221 Drainage design D2 [14]- B LINE.drn'* which has been included as part of the DA submission, for further details. It should be noted that the final design of each on lot OSD system within the north-west catchment will be subject to future detailed design, along with the detailed design of the stormwater system within that lot.

The north-west catchment ultimately drains towards a 4800m^2 bio-retention basin via pit and pipe drainage in the collector road and service road. The bio-retention basin overtops into a 13400m^3 storage basin, which is proposed to store and re-use stormwater for the purposes or irrigation reuse. The key purpose of this storage basin is to provide water quality treatment and to ensure that Council's Mean Annual Run-off Volume (MARV) requirements are satisfied. Flows from the storage basin are captured and directed to the existing Council infrastructure in Patons Lane via a proposed 1800mm diameter pipe.

Refer to the aforementioned DRAINS models and the drawings included within Appendix A which demonstrates that the drainage system has been sized appropriately, and that Council's DCP requirements in terms of stormwater quantity have been addressed.

South – Eastern Catchment

The south-east catchment totals 11.35 hectares and discharges towards Luddenham Road. Given that this catchment has not been considered in the flood modelling, the proposed DRAINS model has been developed separate to any modelling from other consultants. An ISLAX hydrological model was used in the DRAINS modelling.

As per the north-western catchment, stormwater detention is proposed to be provided in each individual lot. These on lot detention storages, which will most likely be in the form of below ground tanks, will be constructed as part of the development works for each pad site.

The stormwater pit and pipe system in the collector road has been designed to cater for flows from the pre-developed pad sites (100% pervious). No future on-lot detention basins have been included in this DRAINS model, as it is expected that the on-lot detention systems will at a minimum be reducing the post-developed flows to the pre-developed flow rates adopted.

The stormwater system is proposed to discharge towards a 2000m^3 storage basin. As per the north-west catchment, the key purpose of this storage basin is to provide water quality treatment and to ensure that Council's Mean Annual Run-off Volume (MARV) requirements are satisfied. Refer to Section 2.4 for more information. Flows from the storage basin discharge towards an existing headwall located in the Luddenham Road reserve to match the existing conditions.

Refer to the DRAINS model '*19221 Drainage design D2[02]- A LINE[06].drn'* which has been included as part of the DA submission, for further details.

North – Eastern Catchment

The north–east catchment totals 2.68 hectares and discharges towards Luddenham Road. As per the south-east catchment, this catchment has not been considered in the flood modelling and therefore the proposed DRAINS model has been developed separate to any modelling from other consultants. An ISLAX hydrological model was used in the DRAINS modelling.

On-site detention, water quality and storage has been provided for the north-east catchment. A total detention storage of 380m^3 has been provided in the form of a combined detention and storage basin. Refer to Table 2.2 as well as the DRAINS model *'19221 Drainage design D2[09]- Pad1.2 OSD.drn'* which has been included as part of the DA submission, for further details.

	Pre-developed flow rate	Post-developed flow rate
5% AEP Critical Storm	0.747 m^3/s	0.494 m^3/s
1% AEP Critical Storm	1.09 m^3/s	0.584 m^3/s

Table 2.2b North-East Pre and Post-developed flows

2.3 Water Quality

Council's requirements also dictate that the stormwater be treated before discharging from the site. The requirements dictate that the post developed pollutants be reduced by the following factors:

- Total Nitrogen to be reduced by 65%
- Total Phosphorus to be reduced by 80%
- Total Suspended Solids to be reduced by 90%
- Gross Pollutants to be reduced by 90%

A MUSIC model has been undertaken in order to design the stormwater quality system. Rainfall data was obtained from the Penrith City Council MUSIC e-link. All pollution generation for source nodes were based off the NSW Music Modelling guidelines. The final post-developed scenario for the subdivision has been modelled, however it should be noted that the water quality treatment measures for each lot is expected to be finalised along with the DA submission for each lot.

The following water quality treatment measures have been proposed in order to satisfy Council's water quality requirements:

North – Western Catchment

- 106 x Oceanguard Pit Baskets to treat surface water from the road surfaces in the north-west catchment. All inlet pits within the road reserve and all surface inlet pits within the future lots of the north-west catchment will be required to be fitted with pit baskets. Based off the expected road surface areas, an estimate of 106 pit baskets has been adopted.
- A volume of 1300kL has been estimated for the total rainwater storage for the north-west lots. It is expected that all roof areas for the north-western lots will be directed to rainwater storage. Stored water will be reused for irrigation purposes in landscaping areas at a rate of 0.4kL/m2/yr. This yields a 91% reuse rate.
- A CDS 2028 GPT
- An end of line 4800 m^2 Bioretention Basin with the following parameters:
    - 300mm detention depth
    - 125mm/hr conductivity
    - 500mm filter depth
    - TN Content of 800 mg/kg
    - Orthophosphate Content of 40 mg/kg
    - Vegetated with effective nutrient removal plants
- An 13,400m3 storage basin with an estimated reuse of 62400kL/yr (based on irrigation area of 10.40 hectares at a rate of 600mm/yr). Refer to drawing C260 showing the proposed irrigation area.

North – Eastern Catchment

- 5x Oceanguard Pit Baskets to treat surface water from road surfaces in the north-east catchment.
- A volume of 100kL has been estimated for the total rainwater storage for the north-east lot. It is expected that all roof areas will be directed to rainwater storage Stored water will be reused for irrigation purposes in landscaping areas at a rate of 0.4kL/m2/yr. This yields an 84% reuse rate.
- A CDS 1009 GPT
- An end of line 180 m^2 Bioretention Basin with the following parameters:
    - 300mm detention depth
    - 125mm/hr conductivity
    - 500mm filter depth
    - TN Content of 800 mg/kg
    - Orthophosphate Content of 40 mg/kg
    - Vegetated with effective nutrient removal plants
- A 400m^3 storage basin with an estimated reuse of 3653 kL/yr (based on irrigation area of 0.609 hectares at a rate of 600mm/yr). The landscaped area within the eastern portion of the subject site will be irrigated. Reticulation design and details to be provided at the detailed design phase.

South – Eastern Catchment

The water quality treatment strategy for the South Eastern Catchment differs from the other two catchments, with water quality devices proposed to be installed on an on-lot basis instead of end of line treatment. The water quality design incorporates the following treatment devices:

- 30 x Oceanguard Pit Baskets to treat surface water from the road surfaces in the south-east catchment. All inlet pits within the road reserve and all surface inlet pits within the future lots of the south-east catchment will be required to be fitted with pit baskets. Based off the expected road surface areas, an estimate of 30 pit baskets has been adopted.
- A volume of 300kL has been estimated for the total rainwater storage for the south-east lot. It is expected that all roof areas will be directed to rainwater storage. Stored water will be reused for irrigation purposes in landscaping areas at a rate of 0.4kL/m2/yr. This yields an 90% reuse rate.
- A CDS 1012 GPT
- 140 x 690mm Psorb Stormfilters to be installed and spread out between all on-lot OSD located in the South-Eastern Catchment area.
- A 2,000m^3 storage basin with an estimated reuse of 13709/yr (based on irrigation area of 2.285 hectares at a rate of 600mm/yr). The landscaped area within the southern portion of the subject site will be irrigated. Reticulation design and details to be provided at the detailed design phase.

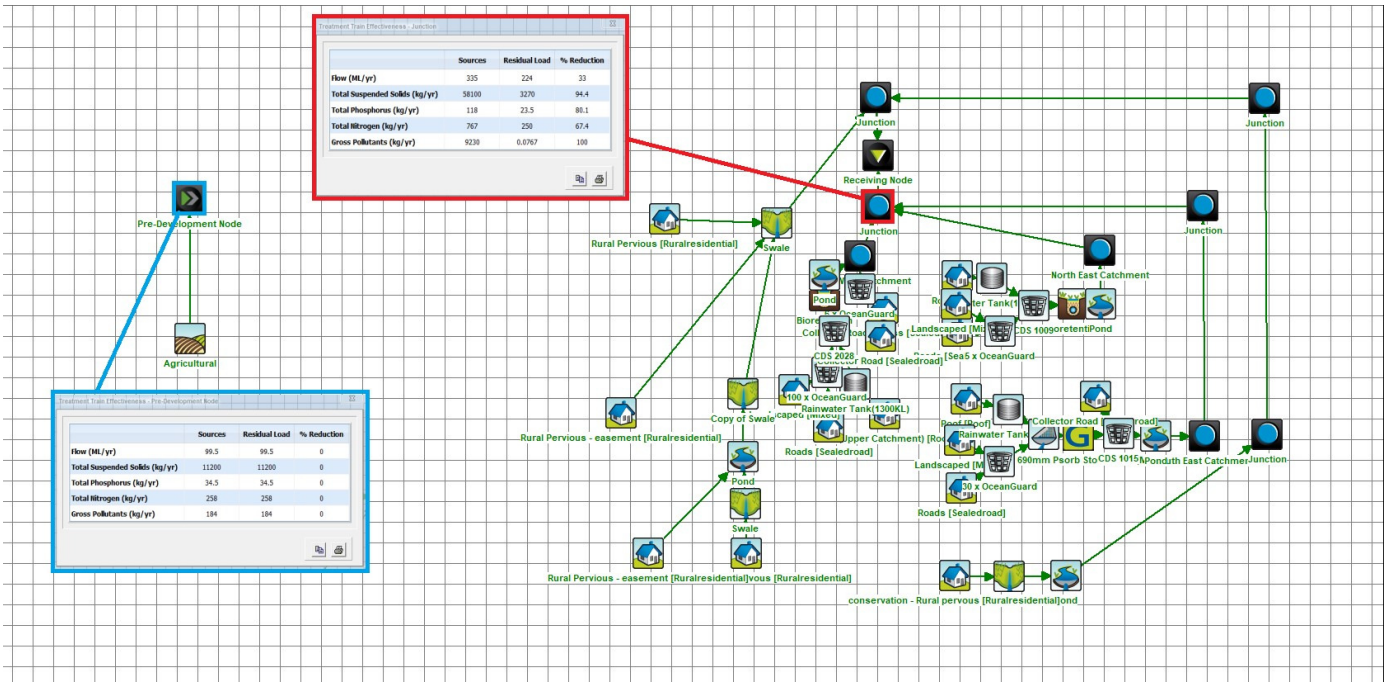


Figure 2.3.1 MUSIC Results

The results from the MUSIC model has been summarised in the table below.

Pollutant	Target Reduction	Pollutant Reduction
Total Nitrogen	65%	67.4%
Phosphorus	80%	80.1%
Suspended Solids	90%	94.4%
Gross Pollutants	90%	100%

Table 2.3.1 Catchment Pollutant Loads

The proposed development meets Penrith City Council's water quality targets as shown by the table above.

Refer to the MUSIC model '*19221_D2 Luddenham OVERALL32.sqz*' which has been included as part of the DA submission, for further details.

SEPP 2021 Compliance

The controls from the SEPP 2021 Chapter 6.6 dictate that:

- The effect on the water quality of the water entering a natural waterbody will be as close as possible to neutral or beneficial.
- The impact on water flow in a natural water body will be minimised.

It should be noted that the post developed pollutant rates have been reduced below the pre developed values as demonstrated in Figure 2.3.1. This outcome, in addition to the stormwater quantity results demonstrated in section 2.2, show that Section 6.6 of the 2021 SEPP Controls for development have been complied with.

Water Reuse

Both rainwater harvesting and stormwater harvesting is proposed to be implemented as of the water quality strategy for the subject site. Council requires 80% of non-potable demand to be provided through rainwater or stormwater harvesting storages. Refer to the aforementioned MUSIC model and the table below which demonstrates the reuse rates that have been achieved with each storage.

Storage	Reuse rate (%)
1300kL Rainwater Tank (NW Catchment)	91%
13400m^3 Storage Pond (NW Catchment)	91%
100kL Rainwater Tank (NW Catchment)	84%
400m^3 Storage Pond (NW Catchment)	76.9%
300kL Rainwater Tank (NW Catchment)	91%
2,000m^3 Storage Pond (NW Catchment)	87%

Table 2.3.2 Stormwater Reuse

Life Cycle Cost Analysis

A life cycle cost analysis of the overall treatment train was exported from the MUSIC model, refer to the below figure for more information. An annual inflation rate of 2.5% was adopted. The life cycle cost analysis was taken over a span of 50 years of which includes installation, maintaining and decommissioning of the treatment train. The total life cycle cost of the treatment train from the year 2023 is $6,186,086. The estimates annual payment cost is $106,954/year. Refer to the MUSIC model and Appendix F for more details.

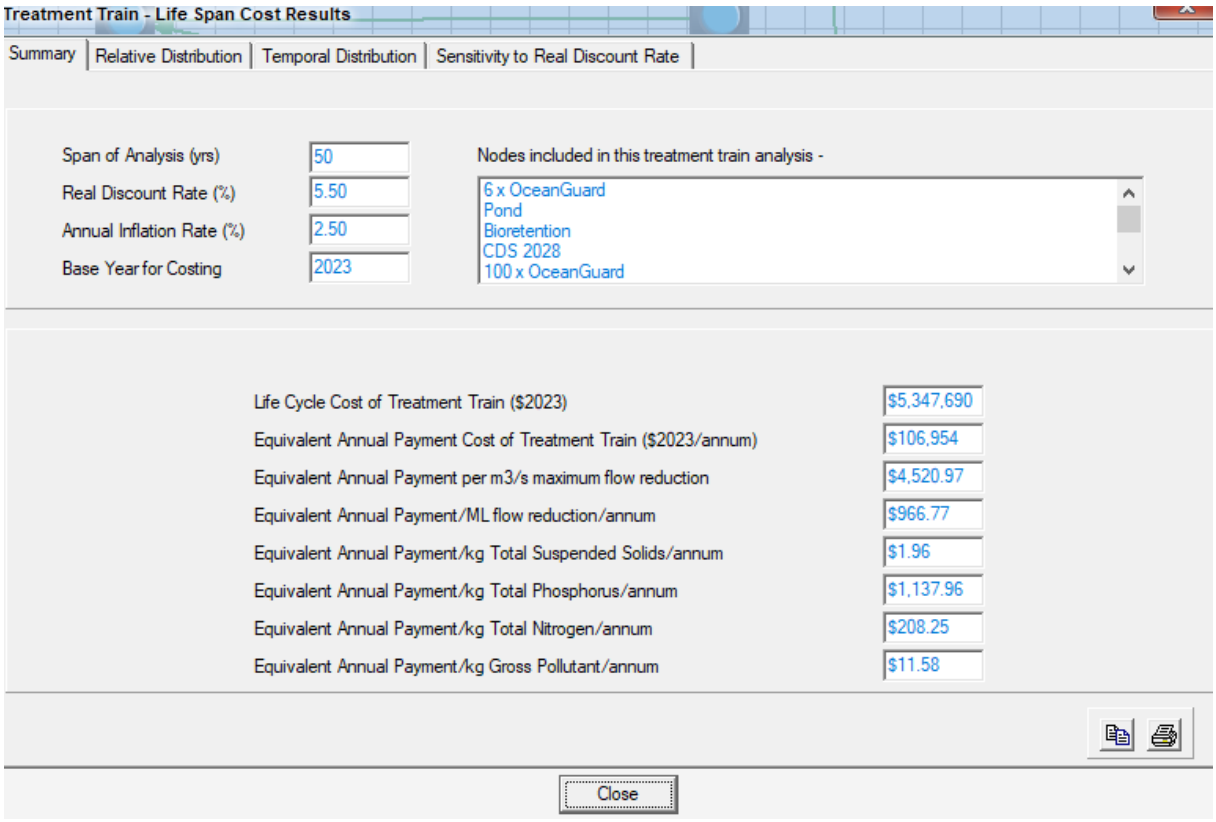


Figure 2.3.2 Life Cycle Cost

An operations and maintenance plan for all stormwater devices during the operational phase of the development has been detailed, refer to Appendix C for more information.

2.4 Mean Annual Runoff Volume (MARV)

As per the E17 Luddenham Road Industrial Business Park DCP, the subject site is required to satisfy the MARV stormwater controls, as outlined in Table E17.7 of the aforementioned DCP. Refer to the table below outlining the requirements.

Option 1: Mean Annual Runoff Volume (MARV) Approach	
MARV	≤ 2 ML/ha/year at the point of discharge to the local waterway
90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway
50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway
10%ile flow	0 L/ha/day at eh point of discharge to the local waterway

Table 2.4.1: MARV Targets

In order to manage the volume of stormwater discharging from the subject site in various storm events, storage basins are required to be implemented as part of the stormwater strategy. Each storage basin will be connected to an irrigation system, which will ensure that the stored water in the basins are being used, and that there is available volume to capture runoff from future storm events. Refer to the summary below, as well as Figure 2.4.1, showing the measures implemented to satisfy the MARV requirements.

- North – Western Catchment: 13400m^3 Storage Basin & 10.4ha Irrigated Area
- North – Eastern Catchment: 400m^3 Storage Basin & 0.609ha Irrigated Area
- South – Eastern Catchment: 2000m^3 Storage Basin & 2.285ha Irrigated Area

Figure 2.4.1: Storage Basins and Irrigation Areas

Figure 2.4.1 shows the total irrigation area associated with the NE, NW and SE storage basins. This total irrigation area is equal to 13.294 hectares. In addition to the above irrigation areas, rainwater tanks will be required to be installed in the future lots. A total of 3 hectares (over the entire estate) within the future lots has been allocated as landscaping area to be irrigated by rainwater tanks.

Refer to the below figures for the proposal's 10%, 50% and 90%ile stormwater flows.

Stormwater Quantity (flow) Targets - MARV			
Indices	**Result**	**Comply**	**Target**
MARV (ML/ha/yr)	1.93	Yes	≤ 2
90%ile	1,157	Yes	1000 to 5000 L/ha/day
50%ile	16	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 2.4.2: MARV Target Compliance

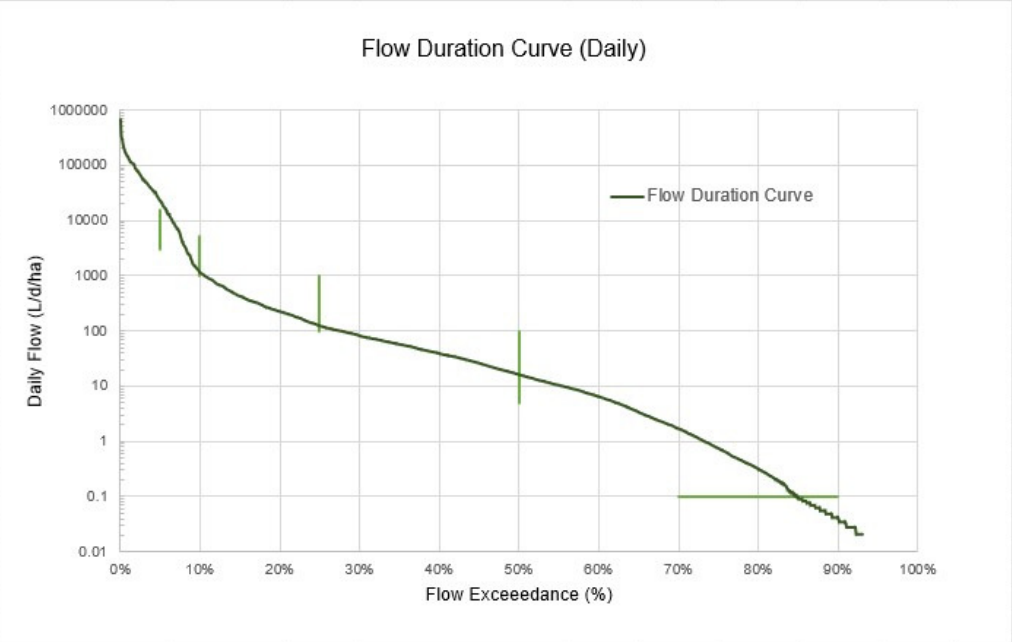


Figure 2.4.3: MARV Target Flow Duration Curve

2.5 Summary of Requirements for Future Lots

Although downstream storage ponds and bio-retention basins have been provided to service the estate, there are additional requirements which will need to be provided as a part of the stormwater design for each lot:

- All lots will need to provide an on site detention system that reduces post developed flows to pre-developed values. This is with the exception of the North-east catchment, which has an on-site detention basin proposed as part of the subdivision works.
- All lots across the estate will need to provide pit baskets in grated pits to act as an additional means to provide water quality treatment.
- All lots in the SE catchment to provide Ocean Protect 690mm Psorb cartridges. A total of 140 on-lot cartridges have been estimated for the SE catchment, which is equivalent to 1 cartridge for every 720m2 of catchment.
- All lots to provide a minimum of 10% pervious surfaces (landscaping or pervious paving).
- A total of 1300kL rainwater storage has been proposed for the lots in the NW catchment.
- A total of 100kL rainwater storage has been proposed for the lots in the NE catchment
- A total of 300kL rainwater storage has been proposed for the lots in the SE catchment
- All lots to provide a total of 3 hectares irrigation areas associated with the on lot rainwater tanks. This is equivalent to approximately 5% of the lot area.
- Refer to the drains models and music model included as part of this DA submission for the complete assumptions and expectations for the management of stormwater flows and treatment across the estate.

3. SEDIMENT AND EROSION CONTROL

Sediment and Erosion Control measures have been implemented to ensure that site run-off is appropriately treated of sediments in accordance with the Penrith City Council's guidelines and the Blue Book "Managing Urban Stormwater- Soils and Construction, 4th Edition (2004) by Landcom.

Sediment and Erosion Control measures have been designed for each pad site. Catch Drains have been designed to collect site run-off during construction. Since each pad site is more than 2000m^2, a sediment basin has been designed for every pad site. The below table is provided to indicate all factors accounted for in the design of every sediment basin. It should be noted that all of the below factors are uniform for all sediment basins on site with the exception of the Length/Slope factor and catchment area.

Constraint	Value	(Source)*
Rainfall Erosivity (R-factor)	2000	Appendix B - Map 10
Length/Slope Gradient Factor, LS	VARY	Appendix A - Table A1
Soil Erodibility (K-factor)	0.042	Appendix C –Table 19
Erosion Control Practice Factor (P-Factor)	1.3	Appendix A - Table A2
Cover Factor (C-Factor)	1.0 (During earthworks)	Appendix A - Figure A5
Calculated Soil Loss, A (RUSLE equation)	VARY	A = R K LS P C
Soil Hydrologic Group	D	Appendix C Table 19
75th Percentile 5-day Rainfall Event	21.8mm (Penrith)	Table 6.3a
Volumetric Runoff Coefficient, Cv	0.50	(App. F Table F2)
Catchment Area, A	VARY	

Table 3.1: Sediment Basin design parameters

Settling Zone volumes and Sediment Zone volumes were calculated using the below calculations

Volume	Formula
Settling Zone Volume	10 Cv A R
Sediment Zone Volume	0.17A(R K LS P C)/1.3 (if <50% of settling zone, nominate 50% of settling zone)
Total Sediment Basin Volume Required :	Settling Zone + Sediment Zone

Table 3.2: Sediment Basin calculations

Below is a table indicating the total sediment basin volumes required for every pad site, bearing in mind that all sediment and settling volumes are dependent on the area of the pad site.

Pad	Area (ha)	Settling zone (m^3)	Sediment zone (m^3)	Total Sediment Basin Vol. (m^3)
Pad 1. East	2.67	409.7	15	424.7
Pad 1. West	5.689	873.3	32	905.3
Pad 2	3.79	581.8	21	602.8
Pad 3a	5.33	818.2	29.3	547.5
Pad 3b North	4.12	632.4	22.7	655.1
Pad 3b South	2.03	311.6	11.2	322.8
Pad 4a	9.04	138.7	49.7	1437.3
Pad 4b	12.34	1894.2	67.9	1962.1
Pad 4c	5.614	861.8	30.9	892.7
Pad 3c	3.32	509.6	18.3	527.9
Pad 5a	2.65	406.8	14.6	421.4
Pad 5b	1.974	303	10.9	313.9

Table 3: Sediment Basin volumes

4. FLOODING

Arcadis have conducted a flooding investigation for the Alspec Industrial Business Park works. The north western part of the site is flood affected in all events up to the PMF storm. Refer to Appendix D for the 1% and 5% AEP post-developed flood mapping. A TUFLOW model has been developed in order to model the pre-developed and post-developed conditions for the watercourse that cuts through the north-western part of the site. It should be noted that only the catchment that is directed to the north-west has been included as part of the Arcadis flood investigation, as the catchments that direct flows to Luddenham Rd have no impact on the flood levels to the Watercourse in the north-west part of the site.

Flood Storage basins have been incorporated into the civil engineering design, as shown on drawings C101 and C104 in Appendix A. These basins and associated stormwater pit/pipe works are proposed in order to mitigate the impacts of the development on flooding. Refer to Figure 4 below showing the aforementioned flood basins and refer to the full flood report by Arcadis for further details of the flood modelling.

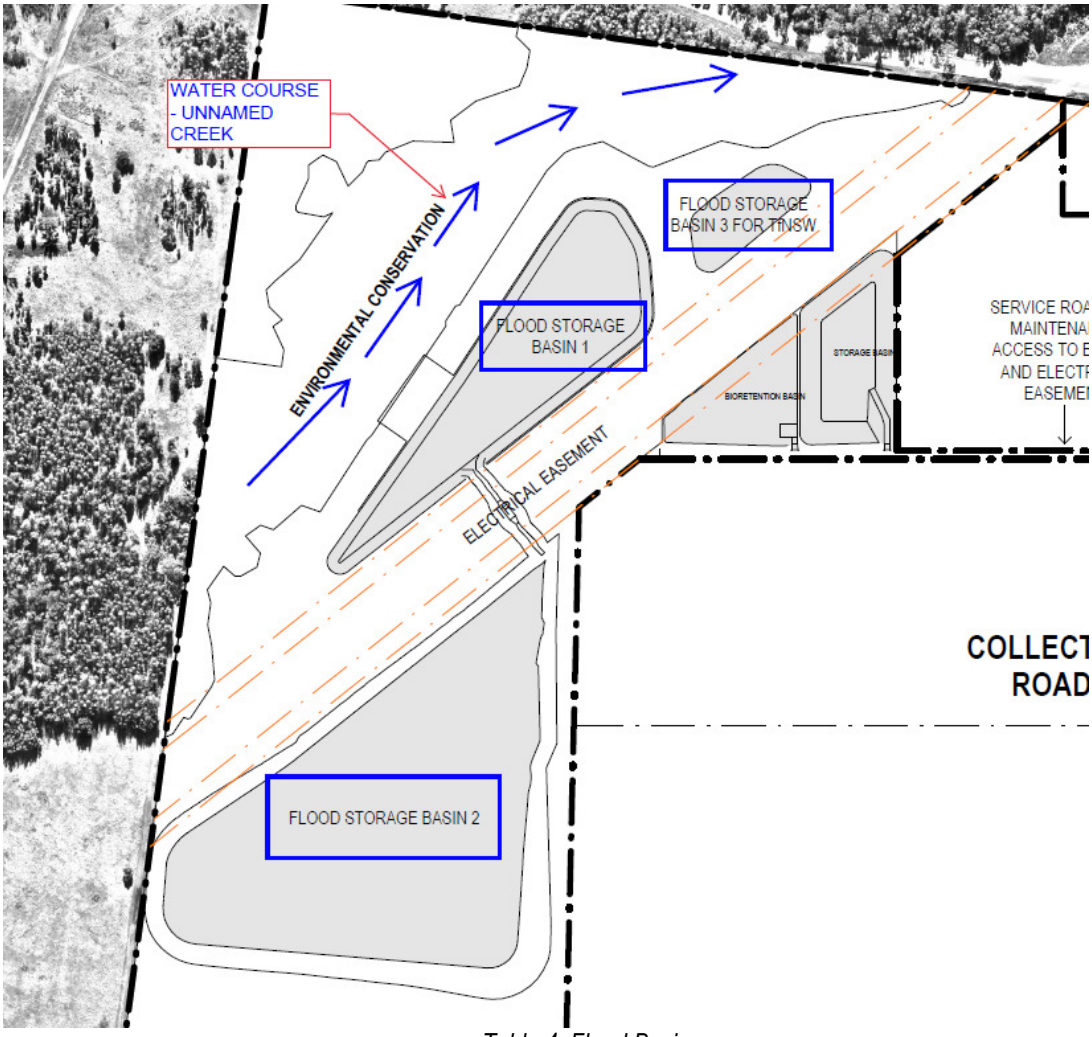
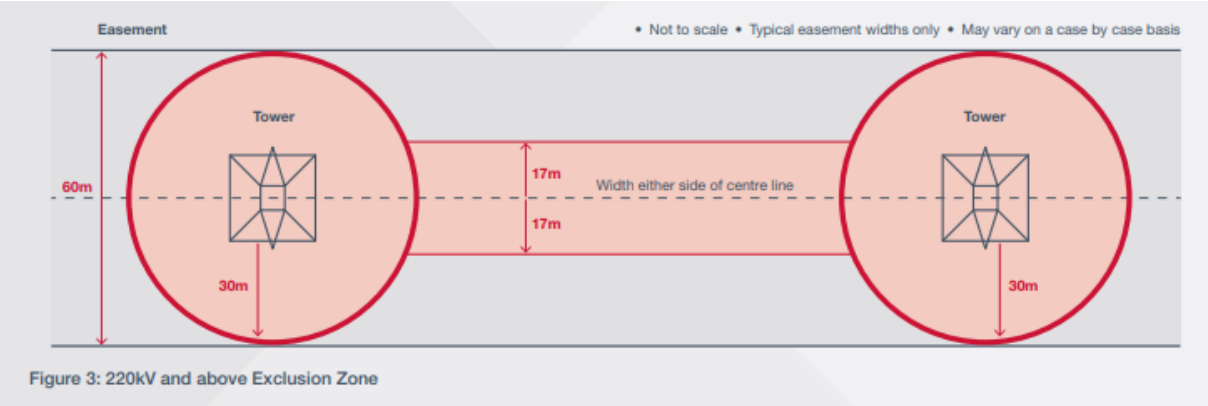


Table 4: Flood Basins

5. TRANSGRID EASEMENT

Refer to drawing C100 – General Arrangement Plan within Appendix A showing the existing easements within the site. There is an existing Transgrid easement for overhead power lines running through the western part of the site. The Transgrid easement has a 34m wide exclusion zone from the centre of the easement, and a 60m diameter exclusion zone around the towers. These details have been shown on the civil drawings and the figure below. Although there are no proposed structures within the Transgrid easement, there are stormwater treatment/detention basins proposed within the easement. Refer to the figure below showing the exclusion zone arrangement within the easement.



Transgrid Easement Layout

6. SITE GRADING AND BULK EARTHWORKS

The proposed basin and collector road levels across the site has been designed with consideration of the following design constraints:

- Ensuring all downstream basins are outside of the 1% flood extent.
- Ensuring all detentions storages are above the 1% flood level.
- Providing sufficient longitudinal fall in the Collector road to ensure that:
    - There is a manageable flood hazard for any flows in the gutter during the PMF event so as to not impact flood evacuation for the lots.
    - The stormwater drainage in the collector road has sufficient fall and thus sufficient capacity.
- Ensure the collector road levels will tie in with the future Luddenham Rd levels and future Paton's Lane levels (with enough flexibility in the design to allow for variances in the future deign of Luddenham Rd and Paton's Lane).
- Ensure basin levels can tie in with the adjacent existing levels.

The proposed pad levels have been designed with consideration of the following design constraints:

- Ensuring the pad levels will enable a functional stormwater system that can provide gravity drainage from the furthest part of the pad and also provide underground detention storage that will be above the 1%AEP HGL of the collector road drainage.
- Ensure some flexibility with driveway locations for each pad with respect to the road levels.
- Balancing cut and fill over the site.
- Balancing the level difference with the various boundaries (including boundaries to the conservation zone, easements, proposed road reserve, and other lot boundaries).

Refer to the bulk earthworks drawing BE01 included in Appendix A, along with drawing C140 and C141 showing site sections. Given the total site area of approximately 123.05 hectares and a total developed area of approximately 72.12 hectares, the net fill of 325,000m^3 required to achieve the proposed bulk earthworks levels is not considered excessive, and is appropriate in order to ensure the overall estate has a functional drainage strategy.

7. CONCLUSION

Appropriate stormwater management practices are proposed to be implemented that minimise the impact of development on the existing stormwater system in terms of water quality whilst ensuring safe and efficient conveyance of runoff and the provision of adequate freeboard to the future warehouses. The design is in accordance with both Penrith City Council's requirements and best practice principles; hence it can be ensured that there will be minimal impact on the existing environment as a result of the proposed development.

In particular, the following controls from the E17 Luddenham Road Industrial Business Park DCP have been addressed within this report:

- Stormwater Quality Targets
- Stormwater Detention
- Sediment and Erosion Control Measures
- Stormwater Flow Targets (MARV)
- Operation and Maintenance of WSUD Infrastructure
- Life Cycle Cost Analysis
- Water Conservation

The proposed stormwater design, as summarised in this report and further detailed in the civil drawings in Appendix A, satisfies each of the above controls.

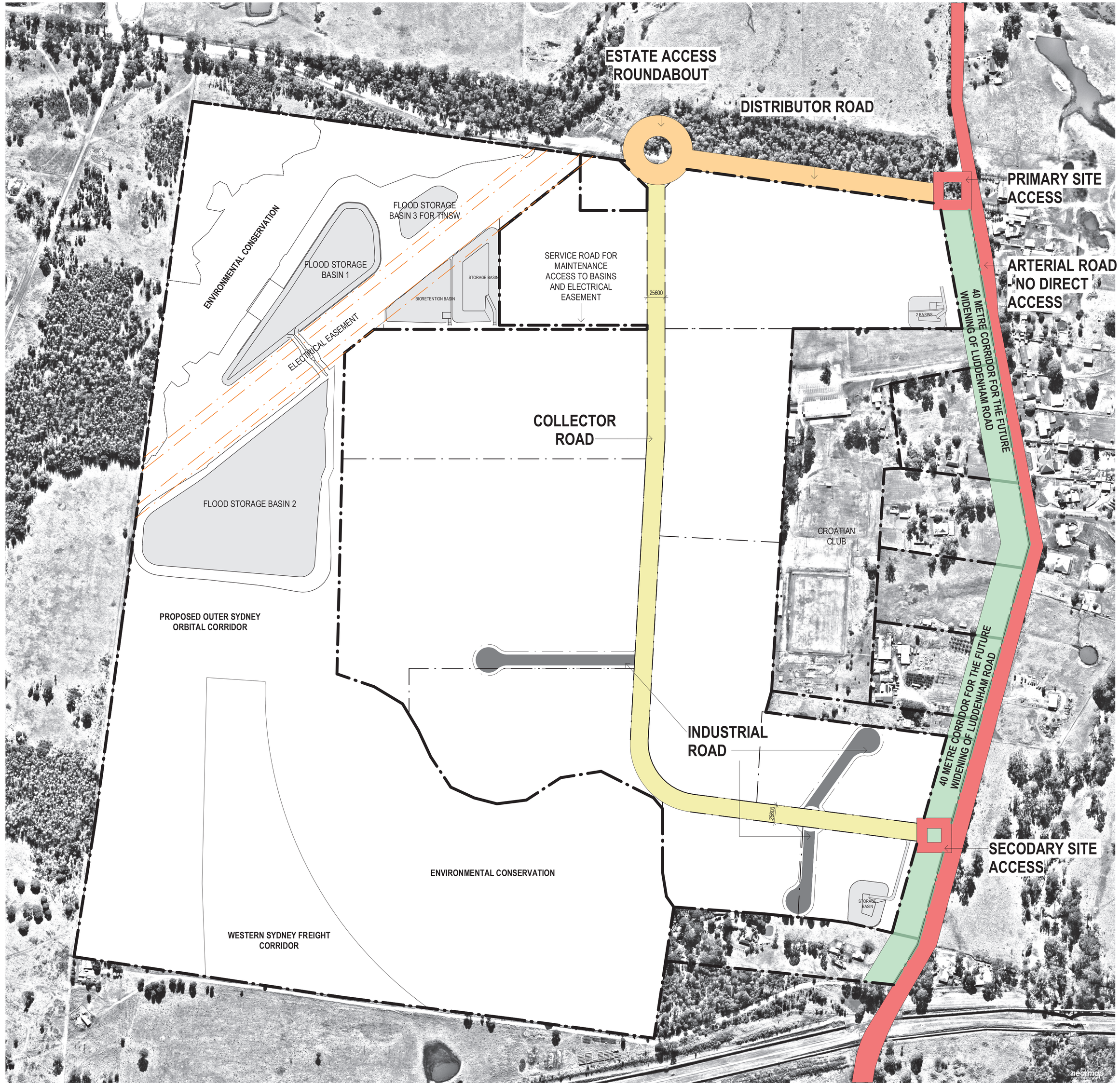
REFERENCES

- Penrith City Council Development Control Plan 2014 – E17 Luddenham Road Industrial Business Park
- Penrith City Council Development Control Plan 2014
- Penrith City Council Stormwater Drainage Specifications for Building Developments 2018
- Penrith City Council WSUD Technical Guidelines 2015
- Technical Guidance for achieving Wianamatta South Creek Stormwater Management Targets guidelines 2022

Appendix A – Civil Plans

Drawings included as separate file due to file size.

Appendix B – Architectural Plans



Client

alspec ALUMINIUM SYSTEMS SPECIALISTS

Issue	Description	Date
A	ISSUED FOR INFORMATION	14/03/24

Project Name
Alspec Industrial Business Park

Project Address
Luddenham Road, Orchard Hills NSW

Key Plan
0 2000 5000

Drawing Title:
LEP & DCP MAPPING - DCP Mapping Overlay of Road Network & Site Access

Author:	Checker:	Sheet Size:	Scale:
MJ	NG	A1	1:3000

Drawing Number: **11178_DA102**

Issue: **A**

nettletontribe

nettleton tribe partnership pty ltd ABN 58 161 683 122

117 Willoughby Road, Crows Nest, NSW 2065
t +61 2 9431 6431
e: sydney@nettletontribe.com.au w: nettletontribe.com.au

15/03/2024 11:12:59 AM C:\Users\Meaghan\Documents\11178_LUDDENHAM ROAD ORCHARD HILLS_AR_ARCH_CENTRAL_meaghanlang.rvt

ALSPEC INDUSTRIAL BUSINESS PARK	
14-Mar-24	DA103
TOTAL LANDTAKE (m²)	**1,253,773**

Zone Name		Zone Area (m²)
C2	Environmental Conservation	252,574
E4	General Industrial	664,317
RU2	Rural Landscape	248,738
TIA	Transport investigation area	22,091
TIN	SEPP (Transport and Infrastructure) 2021	66,054
Lot Subdivision Total		**1,253,773**

Client

alspec ALUMINIUM SYSTEMS SPECIALISTS

HBB

Issue	Description	Date
A	ISSUED FOR INFORMATION	14/03/24

Project Name
Alspec Industrial Business Park

Project Address
Luddenham Road, Orchard Hills NSW

Key Plan
0 2000 5000

Drawing Title:
BULK EARTHWORKS PLANS - Zoning Plan Overlay

Author:	Checker:	Sheet Size:	Scale:
MJ	NG	A1	1:3000

Drawing Number: **11178_DA103**

Issue: **A**

nettletontribe

nettleton tribe partnership pty ltd ABN 58 161 683 122

117 Willoughby Road, Crows Nest, NSW 2065
t +61 2 9431 6431
e: sydney@nettletontribe.com.au w: nettletontribe.com.au

ALSPEC INDUSTRIAL BUSINESS PARK	
14-Mar-24	DA104
TOTAL LANDTAKE (m²)	**1,253,773**

Lot Name	Lot Area (m²)
Lot 1	83,563
Lot 2	36,878
Lot 3	147,357
Lot 4	265,110
Lot 5	46,321
Lot 6	7,152
Lot 7	11,794
Lot 8	34,138
Lot 9	615,089
Lot 99	6,372
Lot Subdivision Total	**1,253,773**

Issue	Description	Date
A	ISSUED FOR INFORMATION	14/03/24

Project Name
Alspec Industrial Business Park

Project Address
Luddenham Road, Orchard Hills NSW

Key Plan
0 2000 5000

Drawing Title:
BULK EARTHWORKS PLANS - Draft Subdivision Plan

Author:	Checker:	Sheet Size:	Scale:
MJ	NG	A1	1:3000

Drawing Number: **11178_DA104** Issue: **A**

nettletontribe

nettleton tribe partnership pty ltd ABN 58 161 683 122

117 Willoughby Road, Crows Nest, NSW 2065
t +61 2 9431 6431
e: sydney@nettletontribe.com.au w: nettletontribe.com.au

ALSPEC INDUSTRIAL BUSINESS PARK	
14-Mar-24	DA105
TOTAL LANDTAKE (m²)	**1,253,773**

Constraints Name	Constraints Area (m²)
40m Luddenham Road Widening Corridor	18,947
Access Road	2,326
Collector Road (25.6 m)	34,138
EE	6,372
Residual Land	612,763
Constraints Total Area(m²)	**674,545**

Pad Name	Pad Area (m²)
Pad 1	83,563
Pad 2	36,878
Pad 3a	53,360
Pad 3b	60,747
Pad 3c	33,249
Pad 4a	90,404
Pad 4b	122,263
Pad 4c	52,443
Pad 5a	26,588
Pad 5b	19,733
Total Developable Area (m²)	**579,228**

Client

alspec ALUMINIUM SYSTEMS SPECIALISTS

Issue	Description	Date
A	ISSUED FOR INFORMATION	14/03/24

Project Name
Alspec Industrial Business Park

Project Address
Luddenham Road, Orchard Hills NSW

Key Plan
0 2000 5000

Drawing Title:
BULK EARTHWORKS PLANS - Lot Pad Arrangement Plan

Author:	Checker:	Sheet Size:	Scale:
MJ	NG	A1	1:3000

Drawing Number: **11178_DA105**

Issue: **A**

nettletontribe

nettleton tribe partnership pty ltd ABN 58 161 683 122

117 Willoughby Road, Crows Nest, NSW 2065
t +61 2 9431 6431
e: sydney@nettletontribe.com.au w: nettletontribe.com.au

Appendix C – Operations and Maintenance Manual

OPERATIONS & MAINTENANCE PLAN
Alspec Industrial Park
Orchard Hills, NSW

henry&hymas

PROPOSED WATER QUALITY MEASURES:

- **STORMWATER PITS, GRATED DRAINS, PIPES**
- **BIO-RETENTION BASINS**
- **ABOVE GROUND BASINS**
- **OCEANPROTECT PITBASKETS**
- **CDS GROSS POLLUTANT TRAPS**

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
STORMWATER PITS, GRATED DRAINS, PIPES			
Pits, grated drains and pipes around the site	Annually	Maintenance Contractor	Check pits, grated drains and pipes for blockages. Remove debris and flush pipes if required.
Check step irons for corrosion	Annually	Maintenance Contractor	Remove grate, examine step iron and repair any corrosion or damage.
Check fixing of step irons is secure	Six monthly	Maintenance Contractor	Remove grate and ensure fixings are secure prior to placing weight on step iron.
BIO-RETENTION BASINS			
Sediment Deposition	Three monthly	Maintenance Contractor	Remove sediment build up from the surface of the bio-retention basin.
Holes or Scour	Three monthly	Maintenance Contractor	Infill any holes in the filter media. Check for erosion scour and repair. Provide energy dissipation if necessary.
Filter media surface porosity	Three monthly	Maintenance Contractor	Inspect for the accumulation of an impermeable layer (such as oily or clayey sediment) that may have formed on the surface of the filter media. A symptom may be that water remains ponded in the raingarden or tree pit for more than a few hours after a rain event. Repair minor accumulations by raking away any mulch on the surface and scarifying the surface of the filter media between plants. For bio-retention tree pits without understorey

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
			vegetation, any accumulation of leaf litter should be removed to help maintain the surface porosity of the filter media.
Litter Control	Three monthly	Maintenance Contractor	Check for litter (including organic litter) in and around treatment areas. Remove both organic and anthropogenic litter to ensure flow paths and infiltration through the filter media are not hindered.
Pests and Diseases	Three monthly	Maintenance Contractor	Assess plants for disease, pest infection, stunted growth or senescent plants. Treat or replace as necessary. Reduced plant density reduces pollutant removal and infiltration performance.
Maintain original plant densities	Three monthly	Maintenance Contractor	Infill planting: Between 6 and 10 plants per square metre should (depending on species) be adequate to maintain a density where the plant's roots touch each other. Planting should be evenly spaced to help prevent scouring due to a concentration of flow.
Weeds	Three monthly	Maintenance Contractor	It is important to identify the presence of any rapidly spreading weeds as they occur. The presence of such weeds can reduce dominant species distributions and diminish aesthetics. Weed species can also compromise the systems long term performance. Inspect for and manually remove weed species. Application of herbicide should be limited to a wand or restrictive spot spraying due to the fact that raingardens and bio-retention tree pits are directly connected to the stormwater system.
Perforated pipe	Six monthly	Maintenance Contractor	Ensure that perforated pipes are not blocked to prevent filter media and plants from becoming waterlogged. A small steady clear flow of water may be observed discharging from the perforated pipe at its connection into the downstream pit some hours after rainfall. Note that smaller rainfall events after dry weather may be completely absorbed by the filter media and not result in flow. Remote camera (e.g. CCTV) inspection of pipelines for blockage and structural integrity could be useful.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
OCEAN PROTECT PIT BASKET			
Visual inspection	Monthly after rain	Maintenance Contractor	During each inspection and clean, details of the mass, volume and type of material observed should be recorded to provide ongoing data for future management plan revisions and the optimization of the maintenance frequency.
Emptying and maintenance	3 to 6 monthly after rain or if bag is 50% full.	Maintenance Contractor	Open gully pit. Place the lifting hooks in the lifting loops of the filter bag. For extremely heavy and overfilled bags either use a hydraulic lifting arm to lift the bag, or remove excess material using a shovel or similar piece of equipment. The use of a post hole shovel is preferable, due to the reduced strain on the back when digging and the ability of the shovel to grab material vertically. Lift the bag vertically off the supporting frame, ensuring that no undue pressure is placed on the filter bag. Lift the bag clear of the stormwater pit. Position the bag over the truck or other collection vehicle, taking hold of the loops at the base of the bag. Lift and empty the filter bag by holding the bottom lifting loops only. Completely empty the filter bag. Brush the filter bag with a stiff brush to remove bound sediment from the filter pores. Check the filter bag. Check the OceanProtect unit. Reinstate filter bag, ensuring bag is installed the correct way. Reinstate pit lids.
ABOVE GROUND STORAGE BASIN			
Litter control	Three monthly or after heavy rain	Maintenance contractor	Check for litter (including organic litter) in and around the storage area. Remove both organic and anthropogenic litter to ensure flow paths are maintained.
Slope	Yearly	Maintenance contractor	Assess batter slope of above ground basin. Rectify batter slope in accordance to design specifications to ensure above ground storage volume and batter stability is maintained.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Inspection after rainfall	Twice a year after rain	Maintenance contractor	Occasionally observe the above ground system after a rainfall event to check infiltration. Identify signs of poor drainage (extended ponding). If poor drainage is identified, check land use and assess whether it has altered from design capacity (eg. Unusually high sediment loads may require installation of a sediment forebay).
Emergency Spill way	Three monthly or after heavy rain	Maintenance contractor	Emergency spillways must be free of trash, debris, and undesirable vegetation to maintain their functionality. Remove these if present. Grass should be carefully maintained as previously described. If applicable, repair concrete or replace riprap as necessary. Repair areas of erosion
Outlet pipe	Every 6 months	Owner	Check for corrosion and remove any sediment build-up. Check the outlet pipe is clear and confirm pipe drains freely by flushing the outlet pipe.
CDS Gross Pollutant Trap			
Sediment Deposition	Refer to manufacturer recommendations	Refer to manufacturer recommendations	Refer to manufacturer recommendations. Using a "Super sucker" type suction cleaner, remove the debris from the sump. For larger units, removal by suction may require the assistance of a suitably qualified "Confined Spaces" worker, lowered into the CDS unit to manually direct the nozzle of the suction hose and remove blockages. Any large items or sticks blocking the nozzle may be put to one side and removed manually on completion of the suction process.

Appendix D – Arcadis Flood Report

FIGURE BA.1
FLOOD DEPTH AND LEVEL
5% AEP EVENT
DEVELOPED CONDITIONS

N

Unnamed Creek

Patons Lane

Endeavour Energy Switching Station

Development Boundary

Flood Contour

Flood Depth (m)

- <= 0.05
- 0.05 to 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

0 100 200 300 400 m

D:\Luddenham\Mapping\FloodMap_Luddenham_01.qgz

FIGURE BA.2
FLOOD DEPTH AND LEVEL
1% AEP EVENT
DEVELOPED CONDITIONS

N

Unnamed Creek

Patons Lane

Endeavour Energy Switching Station

Development Boundary

Flood Contour

Flood Depth (m)

<= 0.05

0.05 to 0.2

0.2 - 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

> 2.0

0 100 200 300 400 m

D:\Luddenham\Mapping\FloodMap_Luddenham_01.qgz

Appendix E: MARV Spreadsheet

ENTER DEVELOPMENT AREA (in cell F2)

Development Area **123.053** ha (i.e. the total catchment areas used in MUSIC)

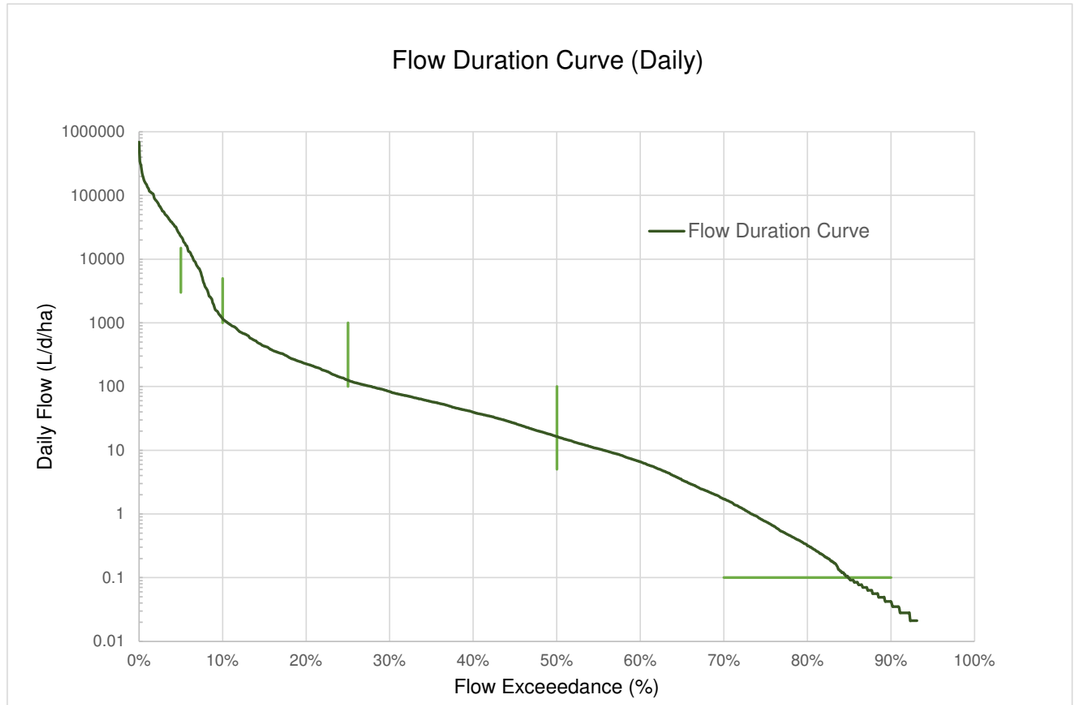
Stormwater Quantity (flow) Targets Option 2- flow percentiles			
Indices	**Result**	**Comply**	**Target**
95%ile	22,790	No	3000 to 15000 L/ha/day
90%ile	1,157	Yes	1000 to 5000 L/ha/day
75%ile	126	Yes	100 to 1000 L/ha/day
50%ile	16	Yes	5 to 100 L/ha/day
Cease to Flow	7%	No	10-30%

Stormwater Quantity (flow) Targets Option 1 - MARV			
Indices	**Result**	**Comply**	**Target**
MARV (ML/ha/yr)	1.93	Yes	≤ 2
90%ile	1,157	Yes	1000 to 5000 L/ha/day
50%ile	16	Yes	5 to 100 L/ha/day
10%ile	0	No	0 L/ha/day

Paste daily flow time series from MUSIC

Date	m3/s	L/ha/day
1/01/1999	0.00217506	1527.18897
2/01/1999	0.00000353	2.47854177
3/01/1999	0.00000348	2.44343494
4/01/1999	0.00000343	2.40832812
5/01/1999	0.00000339	2.38024266
6/01/1999	0.00000334	2.34513584
7/01/1999	0.00000329	2.31002901
8/01/1999	0.00000325	2.28194355
9/01/1999	0.0000032	2.24683673
10/01/1999	0.00000315	2.21172991
11/01/1999	0.00000311	2.18364445
12/01/1999	0.00000307	2.15555899
13/01/1999	0.00000302	2.12045216
14/01/1999	0.00000298	2.0923667
15/01/1999	0.00000294	2.06428124
16/01/1999	0.0000029	2.03619579
17/01/1999	0.00000286	2.00811033
18/01/1999	0.00000282	1.98002487
19/01/1999	0.00015194	106.682616
20/01/1999	0.00041237	289.540019
21/01/1999	0.12764616	89625.0252
22/01/1999	0.49550762	347913.975
23/01/1999	0.00005232	36.7357805
24/01/1999	0.00000359	2.52066996
25/01/1999	0.05484139	38506.1404
26/01/1999	0.00000332	2.33109311
27/01/1999	0.00000321	2.25385809
28/01/1999	0.0000031	2.17662308
29/01/1999	0.000003	2.10640943
30/01/1999	0.0001375	96.5437657
31/01/1999	0.00000282	1.98002487
1/02/1999	0.00000274	1.92385395
2/02/1999	0.00096583	678.144474
3/02/1999	0.0000026	1.82555484
4/02/1999	0.00000253	1.77640529
5/02/1999	0.00000247	1.7342771
6/02/1999	0.00000241	1.69214891
7/02/1999	0.00000235	1.65002072
8/02/1999	0.0000023	1.6149139

Percentile	Flow (L/ha/day)
0.0%	687,457
0.1%	344,492
0.2%	300,109
0.3%	246,508
0.4%	210,893
0.5%	192,152
0.6%	172,359
0.7%	161,253
0.8%	152,837
0.9%	147,305
1.0%	135,223
1.1%	130,529
1.2%	118,215
1.3%	114,706
1.4%	113,021
1.5%	109,166
1.6%	107,516
1.7%	104,707
1.8%	92,333
1.9%	87,364
2.0%	84,210
2.1%	80,737
2.2%	77,595
2.3%	74,659
2.4%	69,881
2.5%	66,808
2.6%	63,104
2.7%	60,618
2.8%	56,614
2.9%	56,113
3.0%	53,461
3.1%	50,795
3.2%	49,171
3.3%	48,239
3.4%	45,882
3.5%	44,177
3.6%	41,919
3.7%	40,945
3.8%	38,905



Appendix F: Water Quality Life Cycle Cost Summary

Treatment Train – Life Span Cost Results

Upstream of Junction

6 x OceanGuard

Pond

Bioretention

CDS 2028

100 x OceanGuard

Rainwater Tank(1300KL)

Pond

Bioretention

CDS 1009

Rainwater Tank(100KL)

5 x OceanGuard

Pond

CDS 1012

140 x 690mm Psorb StormFilter (MCC)

SF Chamber

Rainwater Tank 300kL

30 x OceanGuard

Treatment Train – Life Span Cost Results	
Span of Analysis (yrs)	50
Real Discount Rate (%)	5.50
Annual Inflation Rate (%)	2.50
Base Year for Costing	2023

Costing Results	
Life Cycle Cost of Treatment Train ($2023)	$5,348,304
Equivalent Annual Payment Cost of Treatment Train ($2023/annum)	$106,966
Equivalent Annual Payment per m3/s maximum flow reduction	$4,521.49
Equivalent Annual Payment/ML flow reduction/annum	$966.88
Equivalent Annual Payment/kg Total Suspended Solids/annum	$1.95
Equivalent Annual Payment/kg Total Phosphorus/annum	$1,131.28
Equivalent Annual Payment/kg Total Nitrogen/annum	$208.56
Equivalent Annual Payment/kg Gross Pollutant/annum	$11.58