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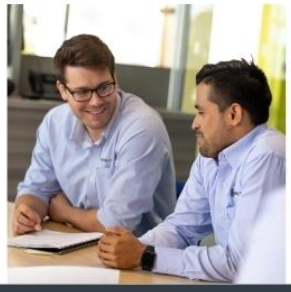
DEVELOPMENT APPROVAL

Approval no: DEV2024/1583

Date: 6 August 2025

Queensland Government



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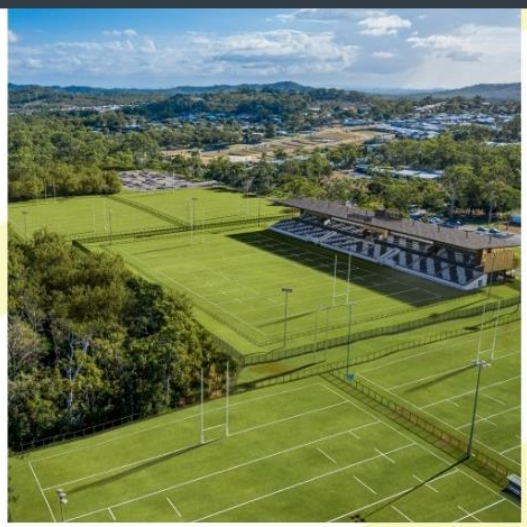

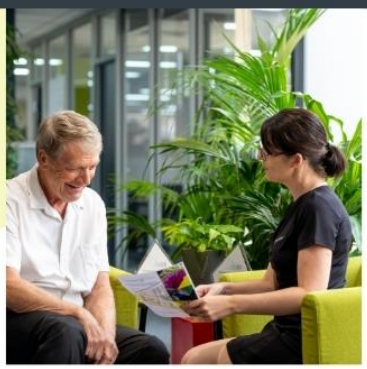

916-944 Greenbank Road, North Maclean
Conceptual Stormwater Management Plan

Client:	Nucrush Group
Project Number:	BE230342
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Recipients are responsible for eliminating all superseded documents in their possession.

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MORETON BAY I SUNSHINE COAST I IPSWICH I BANGALOW

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1. Introduction

1.1 Background

This Conceptual Stormwater Management Plan (CSMP) has been prepared by Burchills for Nucrush Pty Ltd ('the Applicant') in support of a Priority Development Area (PDA) Development Application for a Material Change of Use to establish a concrete batching plant and other industrial uses on the subject site at 916-944 Greenbank Road, North Maclean.

The application is submitted to Economic Development Queensland (EDQ) as the delegate for the Minister for Economic Development Queensland (MEDQ) for PDA Development Applications in the Greater Flagstone Priority Development Area (GFPDA).

The Development Application is comprised of the following components:

- PDA Development Permit for Material Change of Use for Medium impact industry (Concrete batching plant); and
- PDA Development Permit for Material Change of Use for a Plan of Development for Low impact industry, Service industry and Warehouse land uses.

This report pertains specifically to the western portion of the site, herein referred to as the 'balance' of the site. Westera Partners has prepared a separate Stormwater Management Plan for the concrete batching plant proposed over the eastern site extents.

1.1.1 Regulatory Requirements and Technical Guidelines

The strategies proposed in this CSMP have been developed to address the requirements of the Logan Planning Scheme 2015, and have also been prepared in accordance with the following guidelines:

- Greater Flagstone Urban Development Area Development Scheme (ULDA, 2011);
- State Planning Policy July 2017 (DSPIP, 2017);
- Queensland Urban Drainage Manual (QUDM) – Second Edition 2008 (DNRW, 2008);
- Australian Rainfall & Runoff: A Guide to Flood Estimation (Ball J, 2016);
- Australian Government – Bureau of Meteorology (Bureau of Meteorology, n.d.);
- MUSIC Modelling Guidelines (Water By Design, 2010);
- WSUD Technical Guidelines for South East Queensland – Version 1 (Healthy Waterways, BCC, MBWCP, 2006) ; and
- Best Practice Erosion and Sediment Control (IECA, 2008).

1.2 Purpose

The main objectives of this CSMP have been established from the criteria set out in the Logan Planning Scheme 2015 and are summarised as follows:

- Protect receiving water quality by limiting the quantity of key pollutants discharged in stormwater from urban development;
- to prevent increased in-stream erosion downstream of urban areas by controlling the magnitude and duration of sediment-transporting flows; and
- to protect in-stream ecosystems from the significant effects of increased runoff frequency by capturing the initial portion of runoff from impervious areas.

1.3 Scope

To achieve the above mentioned objectives, this CSMP details the following:

- Site description including:
  - Topography;
  - Land Use; and
  - Vegetation.
- Stormwater Quantity:
  - Control measures to ensure no net increase in peak discharge from the subject site (up to the 1% Average Exceedance Probability (AEP)).
- Stormwater Quality:
  - Address requirements of the State Planning Policy July 2017 .

2. Site Details

2.1 Location

The subject site is located at 916-944 Greenbank Road, North Maclean and is comprised of a single allotment. The lot is properly described as Lot 2 on SP267252 and occupies an area of 2.53ha.

The site is identified by the Logan City Council Planning Scheme as being within the Greater Flagstone PDA Zone. Figure 2.1 below identifies the location of the subject site.

Figure 2.1 Site Locality Map (Metromap, 2024)

2.2 Existing Land Uses and Topography

The subject site is currently used for industrial purposes, with numerous temporary structures and storage containers on the existing hardstand surface. The site is very flat with an average fall of < 0.5% to the perimeter.

For further details relating to the topography of the subject site and the delineation of catchments please refer to Appendix E.

2.3 Downstream Environment

As stated above, there is little to no grade across the site, and runoff discharges as overland sheet flow over all site boundaries. Flows which discharge via the western and southern boundaries are conveyed via a table drain in the northern verge of Greenbank Road to the 2 x 450 RCP culvert under Greenbank Road. Runoff which discharges the northern site boundary to the Scott Lane road reserve, is conveyed to the large, undeveloped floodplain located immediately north of the site. Ultimately, all site runoff discharges to the Logan River, approximately 1 km downstream.

2.4 Rainfall

Mean annual rainfall for the site has been estimated at 926 mm from the data set obtained from the nearest Bureau of Meteorology (BOM) station number 40542 at Maclean Bridge (BOM, 2017).

2.5 Proposed Development

The development proposal involves a Priority Development Area (PDA) Development Application for a Material Change of Use to establish a concrete batching plant and other industrial uses on the subject site.

The proposed development layout is shown below in Figure 2.2, and on the Proposed Plans of Development within Appendix A.

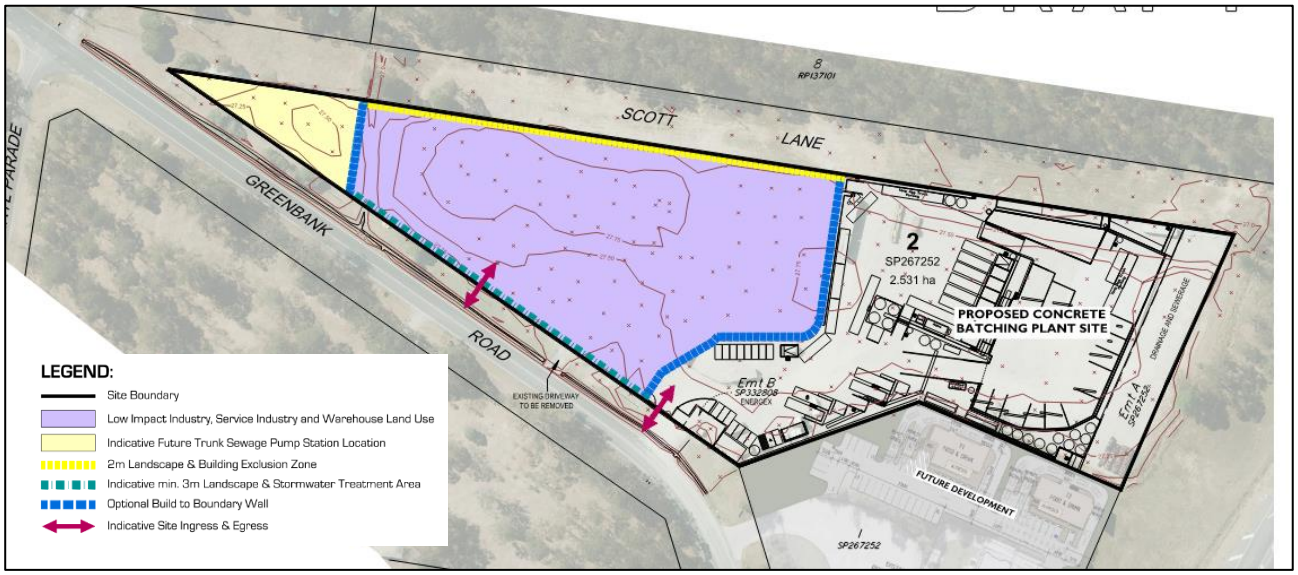


Figure 2.2 Proposed Development

This CSMP pertains specifically to the western, low impact industry portion of the site. Westera Partners has prepared a separate Stormwater Management Plan for the proposed concrete batching plant.

3. Stormwater Quantity Assessment

3.1 Overview

The following section of this report outlines the measures required to meet the above-mentioned objective in regard to stormwater quantity. In order to meet these objectives, it is necessary to ensure that post development discharge from the site will not create a worse situation for downstream property owners than that which existed prior to the development (i.e. non-worsening) (IPWEAQ, 2017).

Due to the increase in impervious areas within the proposed development, peak stormwater flow rates will increase. In order to mitigate these flow rates from the developed site it is proposed to implement an On Site Detention (OSD) system. OSD systems temporarily store stormwater runoff and release flows at a controlled rate that is no greater than the pre-developed peak rate.

3.2 Drainage Catchment Parameters

Drainage catchments have been delineated using site survey in the pre-development scenario, and development plans in the post developed scenario. Pre and post development catchment parameters are summarised in Table 3.1. Further catchment parameters used within the XP-SWMM model are included in Appendix C.

Table 3.1 Catchment Parameters

Scenario	Catchment ID	Total Area (ha)	Impervious (%)	Catchment Slope (%)
Pre-developed	A	1.117	50	0.5
Post-developed	A	1.117	91*	0.5

*Note: fraction impervious based on previous development layout. Refer to Appendix D for breakdown of catchment areas.

3.3 Conveyance of Flows

Important information about the conveyance of flows for the pre-development and post-development scenarios are included in Table 3.2 below.

Table 3.2 Conveyance of Flows

Subject	Description
Lawful Points of Discharge	One (1) Lawful Point of Discharge exists for the balance area, defined as the table drain in the northern verge of Greenbank Road
Pre-Development	In the pre-development scenario, runoff from the site is conveyed overland to the LPD.
Post-Development	In the post-development scenario, runoff from the balance area will be captured by the internal drainage system and conveyed to the proposed stormwater basin. Detained and treated flows will discharge directly to the table drain in the northern verge of Greenbank Road.

3.4 XP-SWMM Analysis

XP-SWMM (version 2019) software was utilised to model the performance of the proposed stormwater quantity control measures. This modelling software is a link-node model capable of performing hydrology and hydraulics of stormwater drainage systems simultaneously.

Laurenson's Hydrology has been adopted as the runoff routing method within XP-SWMM. Sub-catchment routing in this method is carried out using the Muskingum procedure, which is a storage routing method based on the storage equation.

Details of the assumptions and input parameters used within the XP-SWMM model inputs are included in Appendix C.

3.4.1 Rational Method Comparison

The Rational Method has been used to gain an initial understanding of the relative impact of the proposed development on peak flow rates at the site's LPD. The Rational Method is a basic method for assessing peak flow rates and is considered suitable given the catchment area is less than 500 ha and the time of concentration within the contributing catchments is less than 30 minutes (IPWEAQ, 2017).

It should be noted that although the Rational Method has been used as an initial estimate of site peak flows, it has not been used for the design of any mitigation measures nor has been used for calibration of the runoff XP-SWMM model. A comparison between the peak discharge values obtained using the Rational Method and the XP-SWMM model for the 1% AEP event at the Lawful Point of Discharge is contained in Table 3.3 below.

Table 3.3 Rational Method vs XP-SWMM Generated Peak Discharges

Scenario	Catchment ID	Rational (m^3/s)	XP-SWMM (m^3/s)	Difference (%)
Pre-Developed	A	0.52	0.45	14
Post-Developed	A	0.88	0.80	9

The peak discharges generated by XP-SWMM and the Rational Method are similar in comparison and are considered acceptable for this assessment.

3.4.2 Performance of OSD

To confirm the performance of the proposed OSD system, a pre- and post-development model was constructed. These models compare the total runoff hydrographs for all AEP events from 63% to 1%. A summary of the modelling results for different ARI events is contained in Table 3.3. Results of the modelling indicate the proposed system is capable of maintaining pre-development peak flow rates for all storm events up to the 1% AEP event.

Table 3.4 XPSWMM-Generated Pre-Development vs Post-Development (Mitigated) Peak Discharges

AEP Event	Pre-Development		Post-Development	
	Critical Duration	Peak Discharge (m^3/s)	Critical Duration	Peak Discharge (m^3/s)
1%	30min TP8	0.45	15min TP2	0.45
2%	30min TP7	0.39	15min TP2	0.37
5%	15min TP2	0.37	15min TP10	0.30
10%	15min TP10	0.29	15min TP10	0.25
18%	10min TP7	0.26	10min TP7	0.18
39%	10min TP7	0.20	10min TP7	0.15
63%	10min TP7	0.15	10min TP7	0.14

3.5 On Site Detention (OSD) Details

The proposed OSD systems are to be implemented to ensure a non-worsening of peak discharges.

Table 3.5 below contains the details of the proposed OSD systems within the subject site.

Table 3.5 OSD Details

Outlet Structures				1% AEP Detention Volume (m^3)
Orifice	Pit	Outlet Pipe	Spillway	
2 x 200 x 400mm orifices at invert of basin	0.9 x 0.9m pit Crest 0.5m above invert of basin	2 x 300mm dia. 1.0% grade	2m weir, 0.6m above invert	170

4. Stormwater Quality Assessment

4.1 Overview

The following section of this report outlines the measures required to meet the above-mentioned objective with regards to stormwater quality for the operational phase of the development.

4.2 Water Quality Objective (WQO)

In accordance with the Logan Planning Scheme 2015, the total effect of permanent water quality control measures is to achieve reductions in the mean annual load generated by the development site at a minimum of:

- 90% for Gross Pollutants (>5mm);
- 80% for Total Suspended solids (TSS);
- 60% for Total Phosphorus (TP); and
- 45% for Total Nitrogen (TN).

This will ensure the environmental values of the downstream receiving waters are maintained and have been chosen as the WQO for the development.

4.3 Treatment Train

Water quality modelling was carried out for the proposed treatment train using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software to demonstrate that the load-based reduction targets can be achieved. Details of the MUSIC model input parameters used are included in Appendix D.

An end-of-line stormwater treatment system is proposed in the form of a bioretention basin. Further details of the proposed bioretention systems are included in Table 4.1 below and Appendix E of this report.

Table 4.1 Proposed Bio-retention Basin Parameters

Basin ID	A
Extended Detention Depth (m)	0.3*
Filter Media Area (m^2)	100
Filter Media Depth (m)	0.4
Transition Layer (m)	0.1
Drainage Layer (m)	0.2

*Note: Due to the level constraints on-site, it is proposed to provide an equivalent volume of extended detention over the entire basin floor, which would equate to a standard 300mm Extended Detention Depth over the filter media.

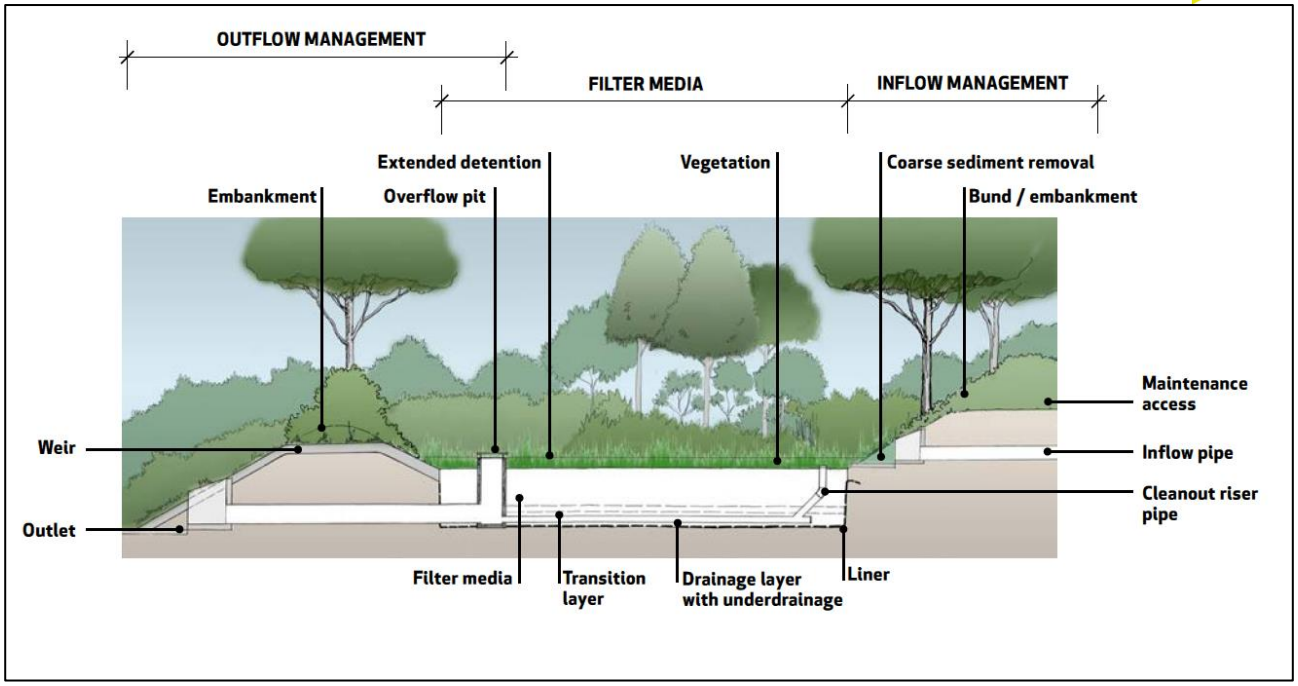


Figure 4.1 Typical Bioretention Basin (Water By Design, 2014)

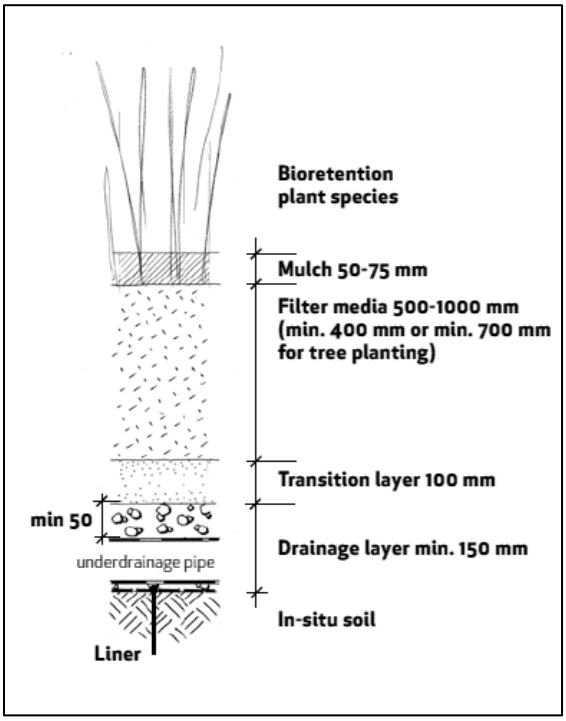


Figure 4.2 Typical Bioretention Drainage Profile (Water By Design, 2014)

4.4 MUSIC Results

Results of the MUSIC modelling for the treatment train effectiveness are summarised in Appendix D. The results indicate the 80%, 60%, 45% and 90% reduction target for TSS, TP, TN and gross pollutants respectively are achieved for the rainfall data set simulated.

Table 4.2 Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Water Quality Objective (%)
TSS	1920	367	80.9	80
TP	3.49	0.894	74.4	60
TN	16.7	8.67	48.2	45
GP	177	0	100	90

NOTE: All simulations have been run with pollutant export estimation set to “stochastic generation”.

A screen capture of the MUSIC model and treatment train effectiveness results are presented in Figure 4.3.

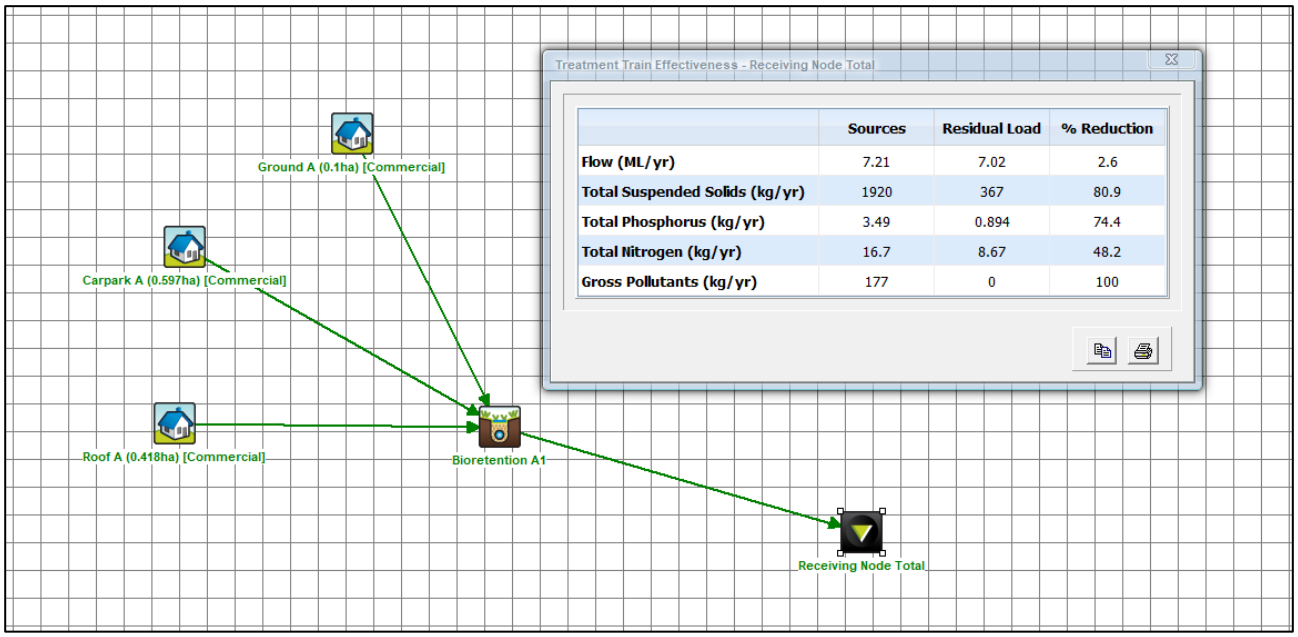


Figure 4.3 Treatment Train Layout & MUSIC Results

5. Erosion and Sediment Control

5.1 Best Management Practices

Stormwater runoff quality during the construction phase of this development shall be managed in accordance with Best Practice Erosion and Sediment Control (IECA, 2008), which is the current recognised construction industry best management practice (BMP) for erosion and sediment control.

Erosion and Sediment Control (ESC) plans are required to be implemented during the construction phase to minimise environmental harm to on-site stormwater treatment devices and downstream receiving waters.

It is important to note that the measures identified below are a generic approach to construction phase stormwater quality management. Erosion and sediment control is highly dependent on local site conditions and staging of the proposed earth disturbing activities. Therefore, further details of the erosion and sediment control systems and procedures will be provided for each development stage when more information is available regarding in-situ soils and development staging.

Conceptual construction phase erosion and sediment control drawings are included in the stormwater management plan drawings in Appendix E of this report.

5.2 Erosion Hazard Assessment

As part of the IECA guidelines, an erosion hazard assessment is to be completed to identify low-risk and high-risk short-term land disturbances within a given region (IECA, 2008). This Erosion Hazard Assessment estimates a TASK number which triggers if a site should be treated as high or low risk in regard to erosion control measures. A trigger value for high-risk site of 200 will be adopted for future stage as recommended by IECA. High risk sites trigger further need for assessment.

Table 5.1 Erosion Hazard Assessment

Catchment ID	Area (m^2)	Duration of Disturbance (months)	Slope Factor	K Factor	TASK Number
A	11,160	3	0.21	0.040	281.2

From Table 5.1 the results show that the internal catchment requires high-risk ESC treatment. Given the development proposal is at a conceptual phase, further details of the erosion and sediment control systems and procedures will be provided at the detailed design stage.

5.3 Erosion Control Standard

The best practice erosion control measures for high-risk development as detailed in Best Practice Erosion and Sediment Control (IECA, 2008) include the following:

- All reasonable and practical steps to be taken to apply best practice erosion control measures to completed earthworks, or otherwise stabilise such works, prior to anticipated rainfall - including existing unstable, undisturbed, soil surfaces under the management or control of the building/construction works;
- Land clearing limited to maximum 4 weeks work;
- Disturbed soil surfaces stabilised with minimum 75% cover within 10 days of completion of works within any area of a work site;
- Staged construction and stabilisation of earth batters; and
- Soil stockpiles and unfinished earthworks are suitably stabilised (covered) if disturbance is expected to be suspended for a period exceeding 10 days.

5.4 Sediment Loss Estimate

The potential volume of sediment loss from the subject site has been estimated using the Revised Universal Soil Loss Equation (RUSLE).

RUSLE calculates annual soil loss rates based on:

$$A = R. K. LS. C .P$$

Where:

A = annual soil loss due to erosion (t/ha/yr)

R = rainfall erosivity factor

K = soil erodibility factor

LS = topographic factor derived from slope length and slope gradient

C = cover and management factor

P = erosion control practice factor

Table 5.2 Potential Sediment Loss (RUSLE)

Catch. ID	Area (ha)	Soil Type*	Slope Length (m)	Slope Grade (%)	Intensity $^{6}I_{2}$ (mm/h)	R	K	LS	C	P	A (t/ha/yr)	Yield (m^3/yr)
A	1.116	NA	50	0.5	10.7	2496	0.04	0.13	1	1.3	16.9	14.5

*Note soil testing will need to be carried out to confirm soil type

5.5 Sediment Control Standard

Table B1 of the guidelines (IECA, 2018) provides a method for determining the sediment control standard for construction activities based on the estimated soil loss rate. Based on the size of the development, it is likely that Type 3 sediment controls are required for this site. A list of Type 3 and supplementary sediment control techniques is provided in Table 5.3 below based on Table 4.5.3 and Table 4.5.4 of the guidelines (IECA, 2008). These control techniques provide a guide that is recommended to be used to minimise the downstream effect of sediments.

Table 5.3 Sediment Control Techniques

Techniques	Type 3 Controls	Supplementary Controls
Sheet flow treatment	• Buffer Zone • Excavated Drop Inlet Protection • Fabric Drop Inlet Protection • Fabric Wrap Field Inlet Sediment Trap • Filter Fence • Modular Sediment Trap • Straw Bale Barrier • Sediment Fence	• Grass Filter Strips • Fibre Rolls • Stiff Grass Barrier
Concentrated flow treatment	• Coarse Sediment Trap • Modular Sediment Trap • U-Shaped Sediment Trap	• Straw Bale Barrier • Kerb Inlet Sediment Traps (on-grade and sag inlet traps, including Gully Bags) • Check Dam Sediment Traps
De-watering sediment control	• Filter Fence • Grass Filter Bed • Hydrocyclone • Portable Sediment Tank • Sediment Fence	• Grass Filter bed
Instream sediment control	• Modular Sediment Barrier • Sediment Filter Cage	• Straw Bale Barrier (short-term device only)
Other		• Construction exits (Rock Pads, Wash Bays)

6. Conclusion

This Conceptual Stormwater Management Plan (CSMP) has been prepared for Nucrush Group and is to accompany the Development Application for the subject site. The strategies proposed in this CSMP have been developed to address the requirements of the Logan Planning Scheme 2015 and have been prepared in accordance with relevant guidelines. This CSMP pertains to the proposed industrial development over the western portion of the site, and should be read in conjunction with the Stormwater Management Plan prepared by Westera Partners for the proposed concrete batching plant in the eastern extents of the site. The following conclusions have been made as a result of this study.

As a result of the proposed development, the magnitude of the peak stormwater discharge exiting the site will increase. An On-Site Detention system is proposed to ensure pre-development peak flow rates are maintained at the LPD. The proposed detention basin will have a 1% AEP storage volume of 170m^3.

An Erosion Hazard Assessment has identified that the internal catchment is high-risk with regard to erosion potential. It has been identified that Type 3 sediment control techniques will be required as a minimum during the construction phase of the development.

A bioretention system is proposed to treat stormwater runoff from the developed site. A filter area of 100m^2 is proposed to achieve Logan City Council's WQOs.

Provided the stormwater management strategy described in this report is fully implemented, the proposed development shall not cause any adverse impacts on the downstream environment.

Appendix A – Proposed Plans of Development

DESIGN CRITERIA

Development is to be in accordance with the provision of the Industry and Business Area -PDA Guideline No. 10 (May 2015 version), except for the following provisions:

A. All advertising devices are to be in accordance with Logan City Council's Planning Scheme.
B. End of trip facilities can be provided by operators if deemed necessary.
C. All refuse storage areas, materials, plant areas and services will be suitably screened to all boundaries.
D. Buildings are shaped, designed and finished so that the maximum length of unvaried or unarticulated (blank) wall does not exceed 20 metres (unless facing a side or rear property boundary).
E. Roofing materials are pre coloured and non-reflective.
F. Glazing treatment must use non-reflective materials/products.
G. Where buildings face the public realm areas, including streets, parks and walkways, significant overlooking and surveillance opportunities must be incorporated with positive CPTED practice. Where public use walkways are incorporates between or within sites, the buildings must front activated zones to these walkways in accordance with positive CPTED practice.
H. All service areas, plant and air conditioning plant is to be screened, integrated into the building, or located on the roof with screening.
I. Site coverage may be up to 80% provided:
   - All other landscaping and development requirements of the Plan of Development are complied with;
   - Development is in context with, and visually compatible with the appearance of any neighbouring buildings;
   - Adequate pedestrian access and amenity is provided at ground level.
K. Greenbank Road and Scott Lane frontage:
   - Building development along the Scott Lane must be setback a minimum of 2.0 metres;
   - Any building located within 3.0m of Greenbank Road must include an articulated facade and a minimum of 2 colours (which may contain glazing).
L. Zero setbacks to side and rear boundaries will be permitted subject to sight lines and other constraints affecting adjoining development.
M. Bicycle parking will be provided at the rate of one space per five car parking spaces.
N. Landscaping:-
   - Preference is to be given to utilising plant species that are native and endemic to the area and are low maintenance species.
   - All street frontages, not developed as Built to Boundary buildings will require a 2.0m minimum width landscape strip, except at vehicular and pedestrian access points.
O. Car parking:-
   - Car parking will be provided in accordance with Table 1.
   - Service vehicles must enter and leave the Site in a forward direction.
   - Where an onsite refuse collection area is provided, access and manoeuvring areas are designed and provided to enable access by a refuse collection vehicle based on the Design Service Vehicle in Austroads/Standards Australia HB72 Design Vehicles and Turning Path Templates.
   - All premises are identified by the provision of a street number in a prominent location, preferably near the site entry, i.e. on the kerb or letterbox or by signage on the building or site.

DEVELOPMENT STANDARDS

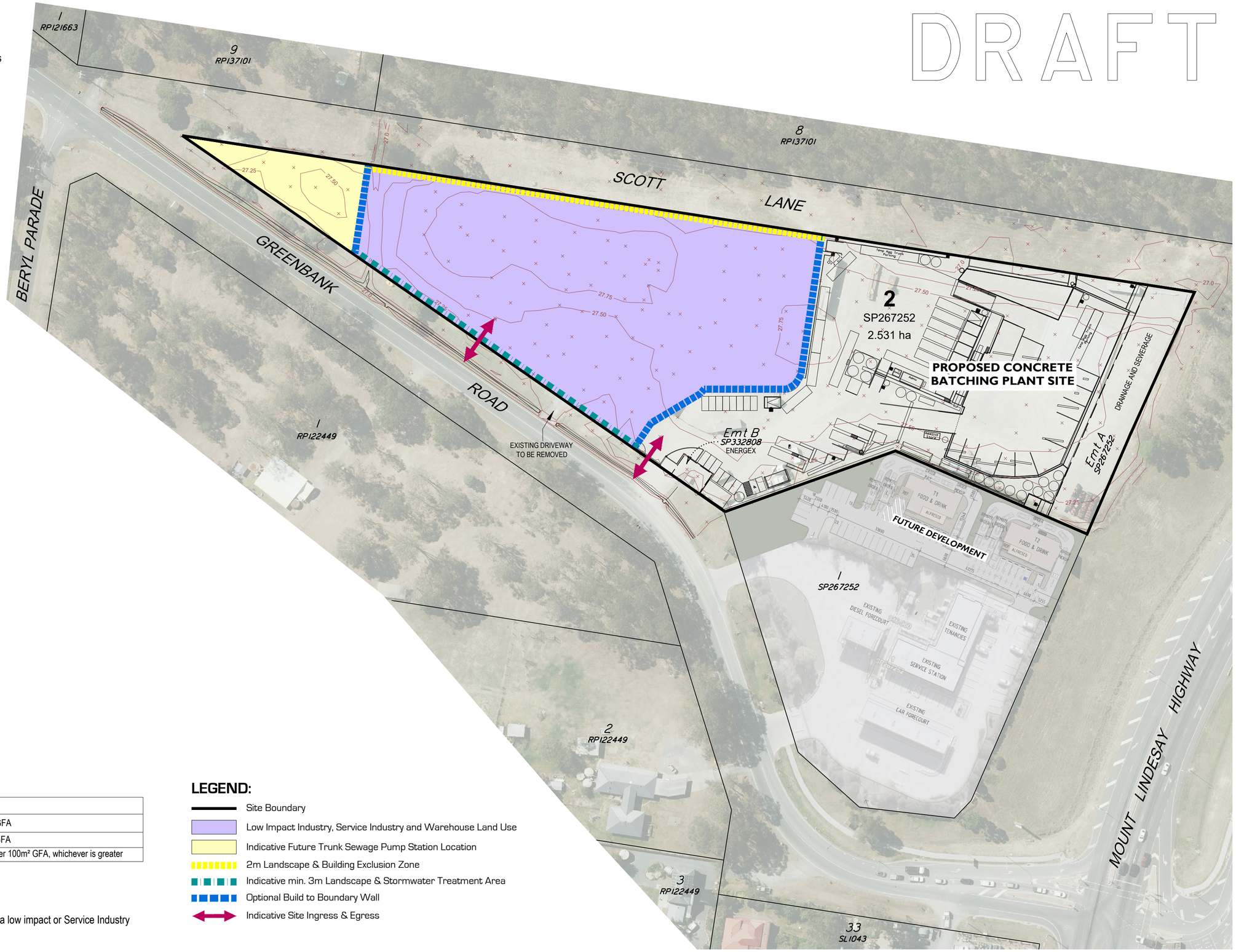
All engineering works are to comply with the PDA Guideline No. 13 Engineering Standards, dated September 2017.
Driveway construction is to be in accordance with Council standards.

TABLE 1

Approved Uses *	Car Parking Rate
Low Impact Industry #	2 spaces per tenant + 1 per 100m² of GFA
Service Industry	2 spaces per tenant + 1 per 100m² of GFA
Warehouse	1 space per 2 employees or, 1 space per 100m² GFA, whichever is greater

NOTE:

\# Includes ancillary shop for the sale of goods directly associated with a low impact or Service Industry



LEGEND:

- Site Boundary
- Low Impact Industry, Service Industry and Warehouse Land Use
- Indicative Future Trunk Sewage Pump Station Location
- 2m Landscape & Building Exclusion Zone
- Indicative min. 3m Landscape & Stormwater Treatment Area
- Optional Build to Boundary Wall
- Indicative Site Ingress & Egress

PLAN REF: AU015412-POD-4
DATE: 4 DECEMBER 2024
CLIENT: NERANG PASTORAL CO. PTY LTD
DRAWN: BJB
SCALE (A2): 1:1000
SHEET: 1 of 1

PLAN OF DEVELOPMENT

Lot 2 on SP267252
916 - 944 GREENBANK ROAD, NORTH MACLEAN

10 0 10 20 30 40

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ABN 97 117 883 173
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A TETRA TECH COMPANY

Appendix B – Time of Concentration and Rational Method Calculations

Design storm event flows across the site were derived using the Rational Method as per the above-mentioned manuals. This involved:

- Determination of a C10 value (derived in accordance with QUDM Table 4.05.3(b) and Council guidelines). A value of 0.7 was applied to the pre-development catchment and 0.83 was applied to the post-development catchment;
- Adoption of design rainfall using BoM IFD data; and
- Calculation of design flows through the site for Q100, Q50, Q20, Q10, Q5, Q2, Q1 and $Q3_{month}$, where $Q3_{month}$ is deemed to be 50% of Q1.

Summaries of the hydrologic calculations are contained in Table B.6-1 and Table B.6-2 for pre and post-development (un-mitigated) scenarios respectively.

Table B.6-1 Pre-Development Hydrology

Catch.	Area (ha)	tc (min)	I_{100} (mm/hr)	C	Q_{100} (m^3/s)	I_{50} (mm/hr)	C	Q_{50} (m^3/s)	I_{20} (mm/hr)	C	Q_{20} (m^3/s)	I_{10} (mm/hr)	C	Q_{10} (m^3/s)	I_5 (mm/hr)	C	Q_5 (m^3/s)	I_2 (mm/hr)	C	Q_2 (m^3/s)	I_1 (mm/hr)	C	Q_1 (m^3/s)	Q_{3month} (m^3/s)
A	1.12	14.64	196.55	0.86	**0.52**	177.33	0.82	**0.45**	151.97	0.75	**0.35**	131.75	0.72	**0.29**	113.46	0.68	**0.24**	89.63	0.61	**0.17**	70.71	0.57	**0.13**	**0.06**

Table B.6-2 Un-Mitigated Post-Development Hydrology

Catch.	Area (ha)	tc (min)	I_{100} (mm/hr)	C	Q_{100} (m^3/s)	I_{50} (mm/hr)	C	Q_{50} (m^3/s)	I_{20} (mm/hr)	C	Q_{20} (m^3/s)	I_{10} (mm/hr)	C	Q_{10} (m^3/s)	I_5 (mm/hr)	C	Q_5 (m^3/s)	I_2 (mm/hr)	C	Q_2 (m^3/s)	I_1 (mm/hr)	C	Q_1 (m^3/s)	Q_{3month} (m^3/s)
A	1.12	5.00	283.00	1.00	**0.88**	253.00	0.99	**0.78**	215.00	0.91	**0.61**	186.00	0.86	**0.50**	159.00	0.82	**0.40**	125.00	0.73	**0.28**	98.80	0.69	**0.21**	**0.11**

Laurenson Routing Parameters

In this study, the "Laurenson" routing method was applied to XP-SWMM for hydrograph generation. To enable this method to be used, each catchment must be split into pervious (undeveloped) and impervious (developed) portions. Adopted parameters for the Laurenson routing method included:

The fraction impervious has been determined by analysis of aerial photographs and the proposed development layout.

- Manning Roughness coefficient (n):
  - Pervious portion: 0.035; and
  - Impervious portion: 0.015.

Initial Loss (IL) and Continuing Losses (CL) have been applied to the hydrologic model. Details of IL and CL parameters applied in the XP-SWMM model are presented in Table C.6-3.

Table C.6-3 Adopted Initial & Continuing Losses

Impervious Area		Pervious Area	
IL (mm)	CL (mm/hr)	IL (mm)	CL (mm/hr)
0	0	26	1.9

Analysis of the catchment has been undertaken to determine the average slope, with the results of this being applied to the model.

Table C.6-4 Pre-Development Catchment Parameters

Catchment	Impervious Area			Pervious Area		
	Area (ha)	Impervious (%)	Slope (%)	Area (ha)	Impervious (%)	Slope (%)
A	0.559	100	1	0.559	0	1

Table C.6-5 Post-Development Catchment Parameters

Catchment	Impervious Area			Pervious Area		
	Area (ha)	Impervious (%)	Slope (%)	Area (ha)	Impervious (%)	Slope (%)
A1	1.017	100	1	0.101	0	1

.

Rainfall and Evapotranspiration

MUSIC modelling was based on 6-minute interval data obtained from the Bureau of Meteorology (BOM) for rainfall station 40659 GREENBANK, QLD, as summarised in Table D.6-6.

Table D.6-6 Meteorological and Rainfall Runoff Data Reporting Table

Input	Data Used in Modelling
Rainfall station	40659 GREENBANK
Time step	6 minute
Modelling period	10 years
Mean annual rainfall (mm)	745
Rainfall runoff parameters	Industrial
Pollutant export parameters	Industrial

Catchment Parameters

Based on the proposed land uses within the development, the site has been modelled as urban land use as detailed in Table D.6-7. The site has been divided into roof, ground and road source nodes based on a typical industrial development layout.

Table D.6-7 Land Use Parameters

Catchment	Source Area	Land Use	Area (ha)	Imperviousness (%)
A	Roof	Industrial	0.418	100
	Ground	Industrial	0.100	10
	Road	Industrial	0.599	100

The MUSIC catchment plan with full breakdown of rood, ground and road areas is presented in Appendix D. The pollutant loads and runoff parameters for each source node have been based on the data from the Water by Design MUSIC Modelling Guidelines (2010), as summarised in Table D.6-8 and Table D.6-9.

Table D.6-8 Rainfall Runoff Parameters

Parameter	All Nodes
Landuse	Industrial
Rainfall threshold (mm)	1
Soil storage capacity (mm)	18
Initial storage (% capacity)	10
Field capacity (mm)	80
Infiltration capacity coefficient a	243
Infiltration capacity coefficient b	0.6
Initial depth (mm)	50
Daily recharge rate (%)	0
Daily baseflow rate (%)	31
Daily seepage rate (%)	0

Table D.6-9 Pollutant Load Parameters

Industrial	Total Suspended Solids (log mg/L)		Total Phosphorous (log mg/L)		Total Nitrogen (log mg/L)	
	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Storm Flow Concentration	1.30(1) 2.43(2) 2.16(3)	0.38	-0.89(1) -0.30(2) -0.39(3)	0.34	0.37	0.34
Base Flow Concentration	0(1) 0.78(2,3)	0(1) 0.39(2,3)	0(1) -0.60(2,3)	0(1) 0.50(2,3)	0(1) 0.32(2,3)	0(1) 0.30(2,3)

NOTE: (1) values applied to 'Roof' areas
(2) Values applied to 'Carpark' areas
(3) Values applied to 'Ground' areas

Treatment Node Parameters

The following sections describe the modelling parameters applied to MUSIC for each of the treatment nodes included as part of the water quality assessment.

Bioretention System

Table D.6-10 Bioretention Parameters

Basin ID	All
Has the filter area been calculated appropriately (Y / N / N/A)	Y
Extended detention depth (m)	0.3
Filter area (m^2)	100
Unlined filter media perimeter (m)	0.01
Saturated hydraulic conductivity (mm/hour)	200
Filter depth (m)	0.4
TN content of filter media (mg/kg)	400
Orthophosphate content of filter media (mg/kg)	30
Is the base lined (Y/N)	Yes
Effectiveness of plant TN removal (effective/ineffective/unvegetated)	Effective
Overflow weir width (m)	2
Exfiltration rate (mm/hr)	0.00
If an exfiltration rate has been used, have node water balance losses been used in calculation of treatment train effectiveness (Y / N / N/A)	N/A
If exfiltration rate has been used, is the exfiltration rate justified (Y / N / N/A)	N/A
Underdrain present (Y/N)	Yes
Submerged zone with carbon present?	No
Depth of submerged zone (m)	N/A
Confirmation that K and C* remain default	Yes

Appendix E – Conceptual Stormwater Management Plans

PROJECT No.:	DRAWING No. :	VERSION:
BE230342	N000	A

DATE : 06.12.24

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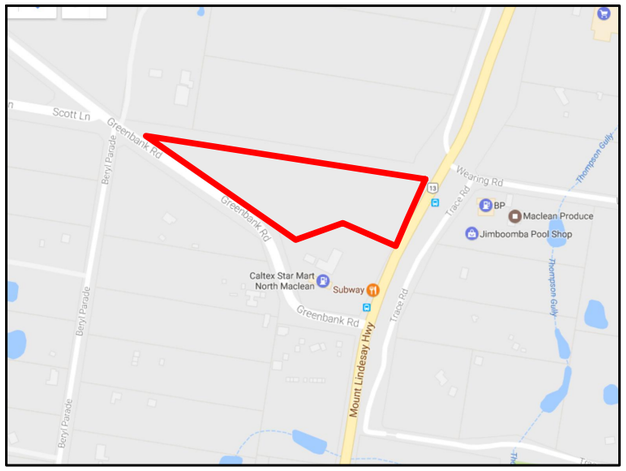
CONCEPTUAL STORMWATER MANAGEMENT DRAWINGS



LOCALITY PLAN

SCHEDULE OF DRAWINGS	
Drawing No.	Drawing Title
N000	LOCALITY AND DRAWING INDEX PLAN
N200	PRE-DEVELOPMENT CATCHMENT PLAN
N201	POST-DEVELOPMENT CATCHMENT PLAN
N202	MUSIC CATCHMENT PLAN
N400	OPERATIONAL CONTROL PLAN
N401	OPERATIONAL CONTROL TYPICAL CROSS SECTION
N500	EROSION & SEDIMENT CONTROL PLAN
N501	EROSION & SEDIMENT CONTROL TYPICAL CROSS SECTION

PREPARED FOR

NUCRUSH GROUP PTY LTD

PREPARED BY

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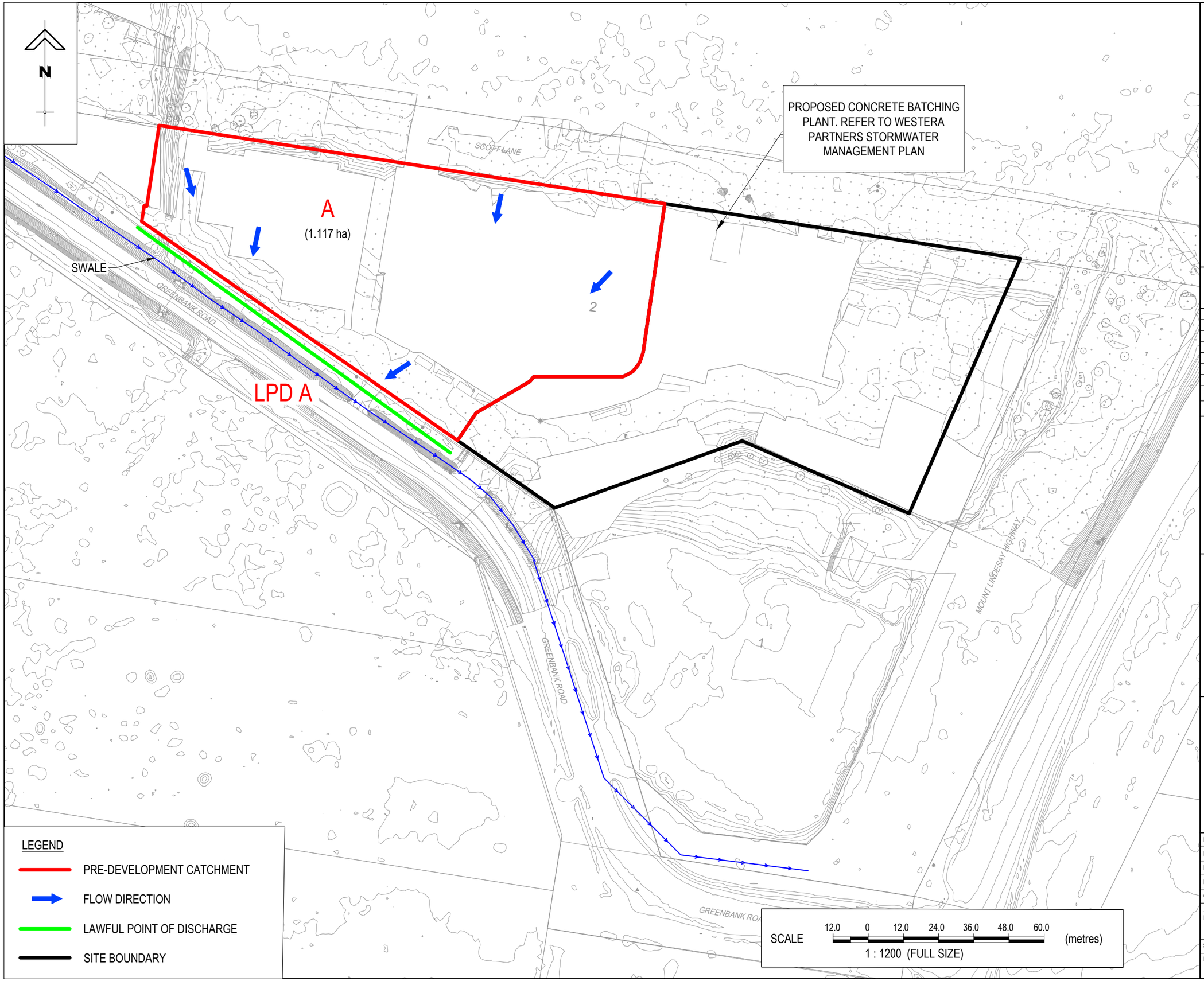

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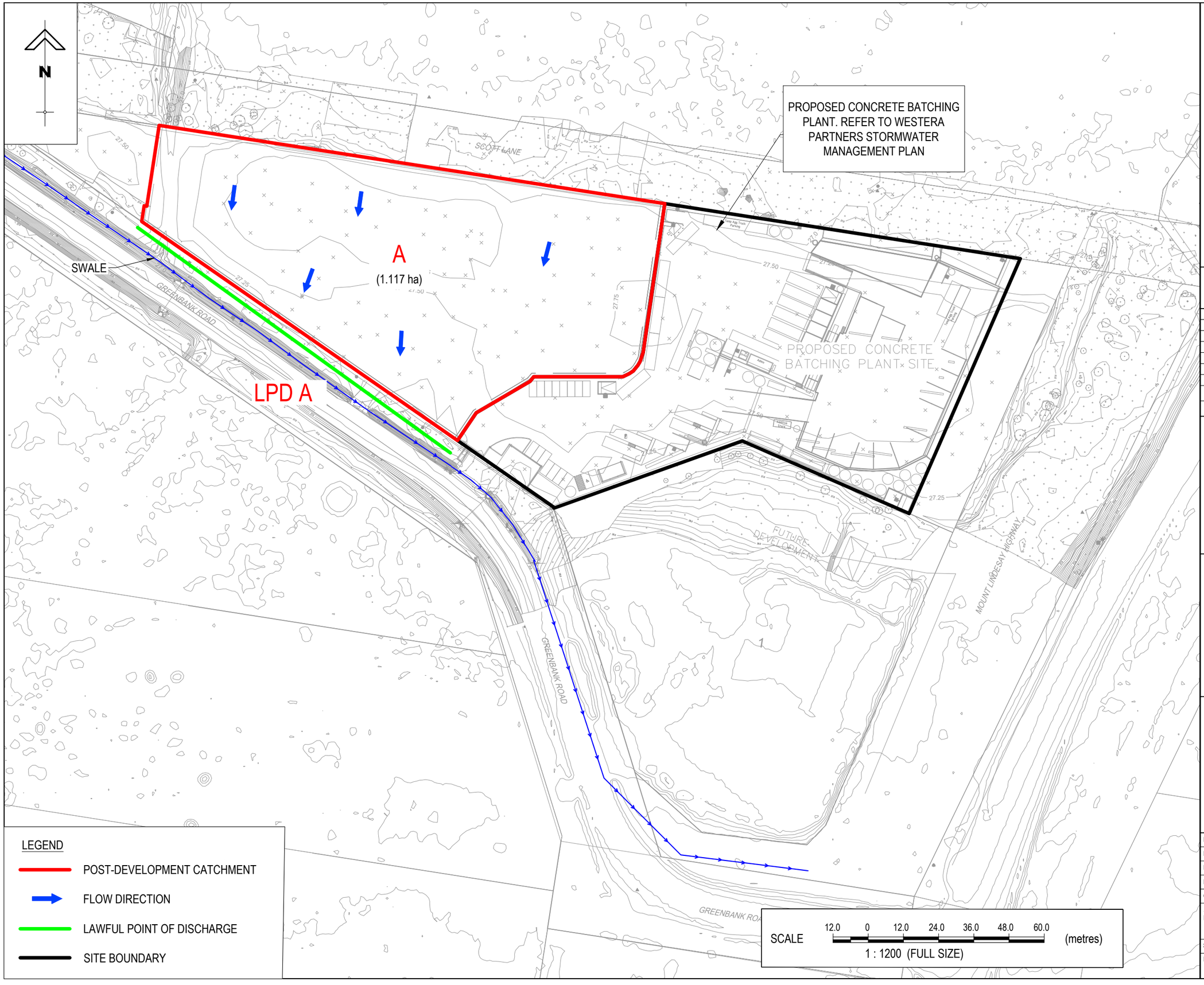
DRAWING TITLE :

PRE-DEVELOPMENT CATCHMENT PLAN (BALANCE AREA)

DEVEL. APPLIC. No. :		DATE : 06.12.24
PROJECT LEADER :	ANDREW GREGORY	
DESIGNER :	ELLY RICKETTS	
DRAFTSPERSON :	TK	
CHECKED :	LUCAS FAULKNER	
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS	ABN 76 166 942 365	
	RPEQ No. :	
SCALE : 1:1200	DATUM :	FULL SIZE : A3
PROJECT No.: BE230342	DRAWING No. : N200	VERSION: A



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DRAWING TITLE :

POST-DEVELOPMENT CATCHMENT PLAN

DEVEL. APPLIC. No. :			DATE : 06.12.24
PROJECT LEADER :	ANDREW GREGORY		
DESIGNER :	ELLY RICKETTS		
DRAFTSPERSON :	TK		
CHECKED :	LUCAS FAULKNER		
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS		ABN 76 166 942 365 RPEQ No. :	
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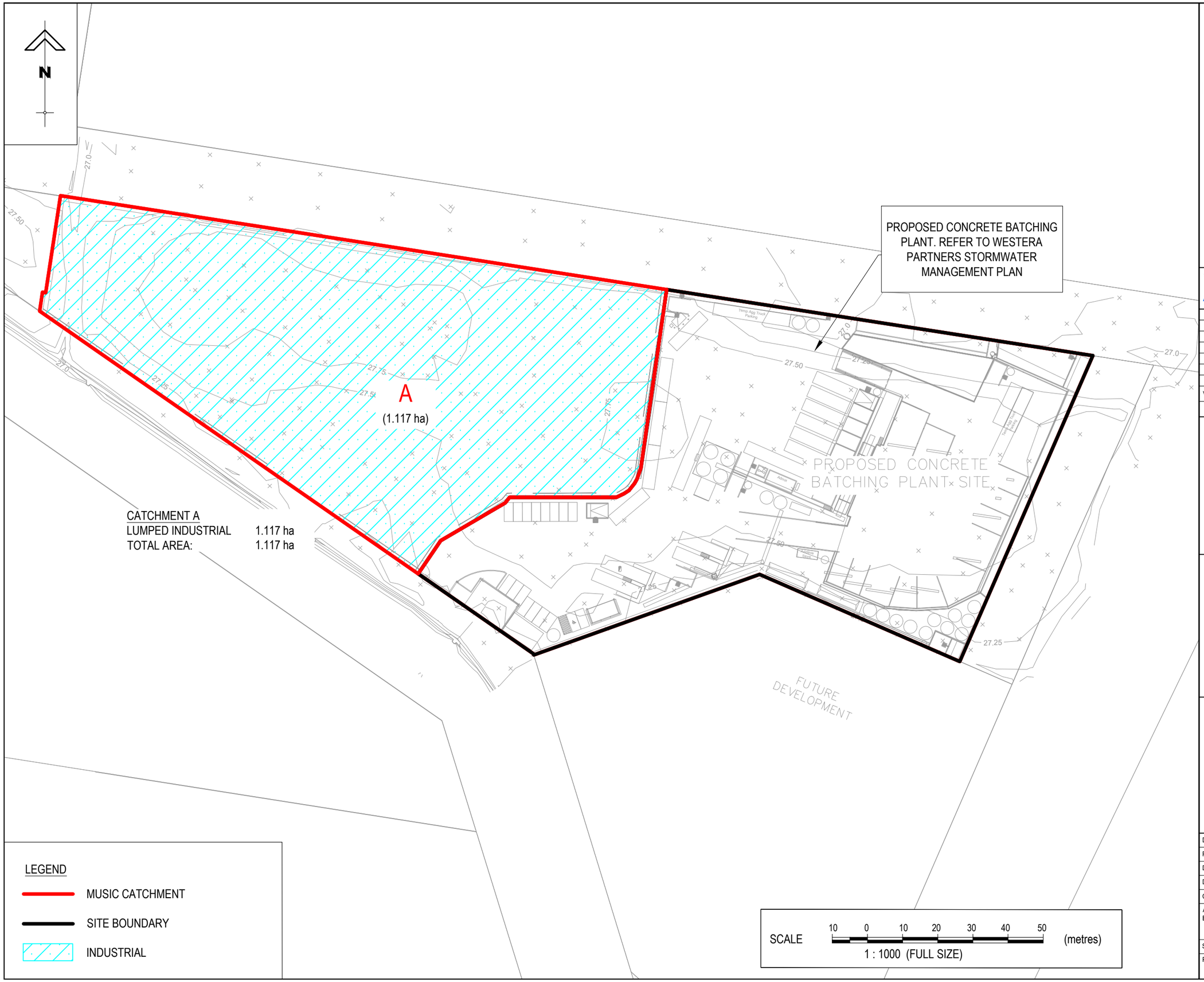
PROJECT No.: BE230342	DRAWING No. : N201	VERSION: A	



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DRAWING TITLE :

MUSIC CATCHMENT PLAN

DEVEL. APPLIC. No. :	DATE : 06.12.24
PROJECT LEADER : ANDREW GREGORY	
DESIGNER : ELLY RICKETTS	
DRAFTSPERSON : TK	
CHECKED : LUCAS FAULKNER	
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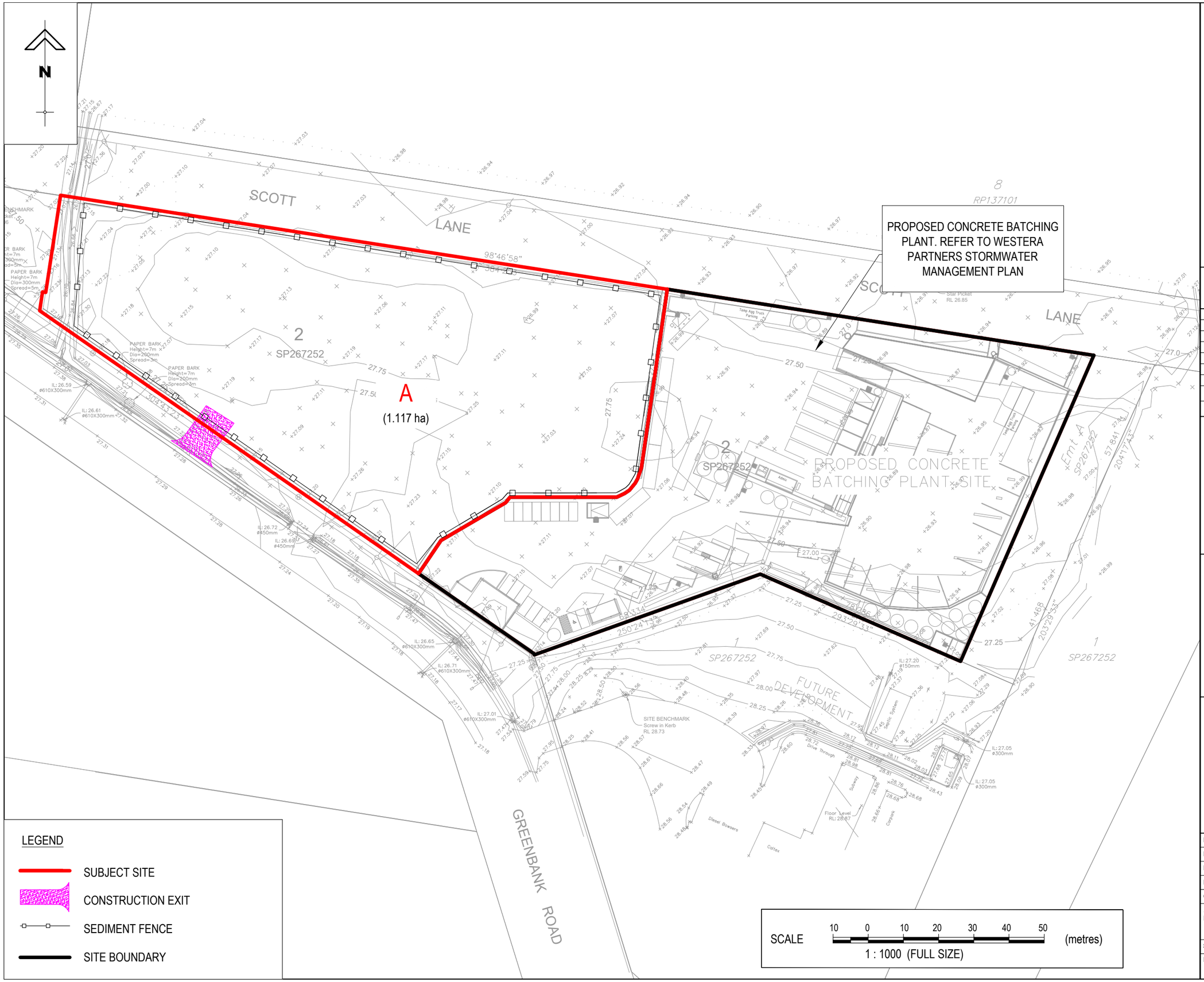
PROJECT No.: BE230342	DRAWING No. : N202 VERSION: A



LEGEND

- SUBJECT SITE
- CONSTRUCTION EXIT
- SEDIMENT FENCE
- SITE BOUNDARY

SCALE 10 0 10 20 30 40 50 (metres)

1 : 1000 (FULL SIZE)

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DRAWING TITLE :

EROSION & SEDIMENT CONTROL PLAN

DEVEL. APPLIC. No. :		DATE : 06.12.24	
PROJECT LEADER :	ANDREW GREGORY		
DESIGNER :	ELLY RICKETTS		
DRAFTSPERSON :	TK		
CHECKED :	LUCAS FAULKNER		
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS ABN 76 166 942 365			
		RPEQ No. :	
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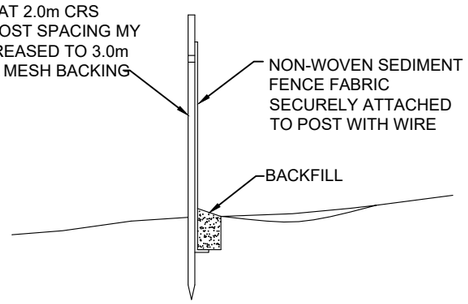
PROJECT No.: BE230342		DRAWING No. : N300	VERSION: A



SEDIMENT FENCE DETAIL

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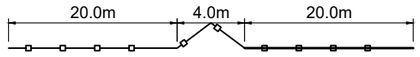

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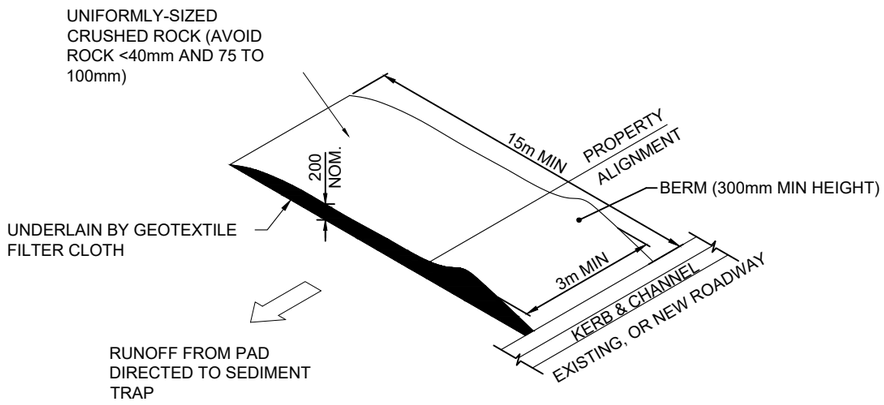

STABILISED CONSTRUCTION ACCESS

N.T.S.

GENERAL NOTES:

1. THIS DRAWING HAS BEEN PREPARED AS A GUIDE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MANAGE SITE SEDIMENT AND EROSION CONTROL MEASURES AND DURING THE CONSTRUCTION PERIOD INSTALL ADDITIONAL MEASURES WHERE SCOUR OR SEDIMENT TRANSPORT IS LIKELY TO OCCUR.
2. DELAY CLEARING, GRUBBING AND TOPSOIL STRIPPING UNTIL NECESSARY.
3. COMMENCE WORK ON SITE ONLY AFTER SEDIMENT AND EROSION CONTROL MEASURES ARE IN PLACE.
4. MANAGE SITE ENTRY/EXIT POINTS TO ENSURE SEDIMENT IS NOT TRACKED OFF SITE.
5. SHAKEDOWN AREA: PROVIDES FOR CONSTRUCTION, SERVICE AND STAFF VEHICLES ENTERING PUBLIC ROADS. CONTRACTOR SHALL LOCATE TO SUIT SITE ACTIVITIES. CONSTRUCTED AS 250mm THICK LAYER OF COARSE (150mm -200mm) RIVER GRAVEL OVER A SINGLE LAYER OF HIGH STRENGTH GEOTEXTILE (15m x 5m).
6. THE CONTRACTOR SHALL INSTALL EITHER STORMWATER INLET SEDIMENT TRAPS OR THE EXCAVATED INLET ARRANGEMENT AT ALL STORMWATER STRUCTURES DURING THE CONSTRUCTION.
7. FILTER ROLLS SHALL BE INSTALLED AT GULLY PITS IMMEDIATELY AFTER GULLY PIT CONSTRUCTION AND LEFT IN PLACE DURING THE MAINTENANCE PERIOD. OPERATION OF ROLLS DURING PERIODS OF HEAVY RAIN TO BE MONITORED TO PREVENT FLOODING AND EROSION DAMAGE ELSEWHERE.
8. ARRANGE FOR EROSION CONTROL MEASURES TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE SOURCE OF EROSION.
9. ENSURE STOCKPILED TOPSOIL AND EARTHWORKS ARE NOT ERODED BY WIND AND STORMWATER RUN-OFF AND ARE PROVIDED WITH A SILT FENCE AROUND THE LOW SIDE.
10. ERECT SILT FENCES WHERE SHOWN ON THE DRAWINGS, GENERALLY ALONG THE LOW SIDE OF THE CONSTRUCTION SITE AND ALONG A LINE OF CONSTANT LEVEL. AS AN ALTERNATIVE TO BURYING THE SILT FENCE LOWER EDGE, THE CONTRACTOR MAY ELECT TO PLACE 200mm OF THE FABRIC ON THE GROUND UP-SLOPE OF THE FENCE AND COVER WITH 100mm MIN LAYER OF AGGREGATE.
11. TO PREVENT EROSION, TOPSOIL AND SEED IMMEDIATELY AFTER COMPLETION OF BULK EARTHWORKS TO FINISHED PROFILES.
12. PRIOR TO COMPLETION OF CONSTRUCTION OF PAVEMENT AND SEALING, PLACE SANDBAGS AT 45° TO ARREST SCOUR AGAINST KERB AND CHANNEL AS FOLLOWS:
    ROAD GRADE 0.5% - 5% - 25m MAX CRS.
    5% - 10% - 10m MAX CRS.
    10% - 15% - 15m MAX CRS.
    15% - 20% - 5m MAX CRS.
13. SWEEP EXTERNAL ROADS WHERE SEDIMENT HAS BEEN DROPPED FROM CONSTRUCTION VEHICLES. DO NOT WASH SILT INTO THE STORMWATER SYSTEM.
14. ALL SEDIMENT AND EROSION CONTROL STRUCTURES, TRENCHES ETC. SHALL BE REGULARLY MAINTAINED AND INSPECTED FOR EFFECTIVENESS.

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EROSION & SEDIMENT CONTROL PLAN TYPICAL CROSS SECTION

DEVEL. APPLIC. No. :	DATE : 06.12.24
PROJECT LEADER : ANDREW GREGORY	
DESIGNER : ELLY RICKETTS	
DRAFTSPERSON : TK	
CHECKED : LUCAS FAULKNER	
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS ABN 76 166 942 365	
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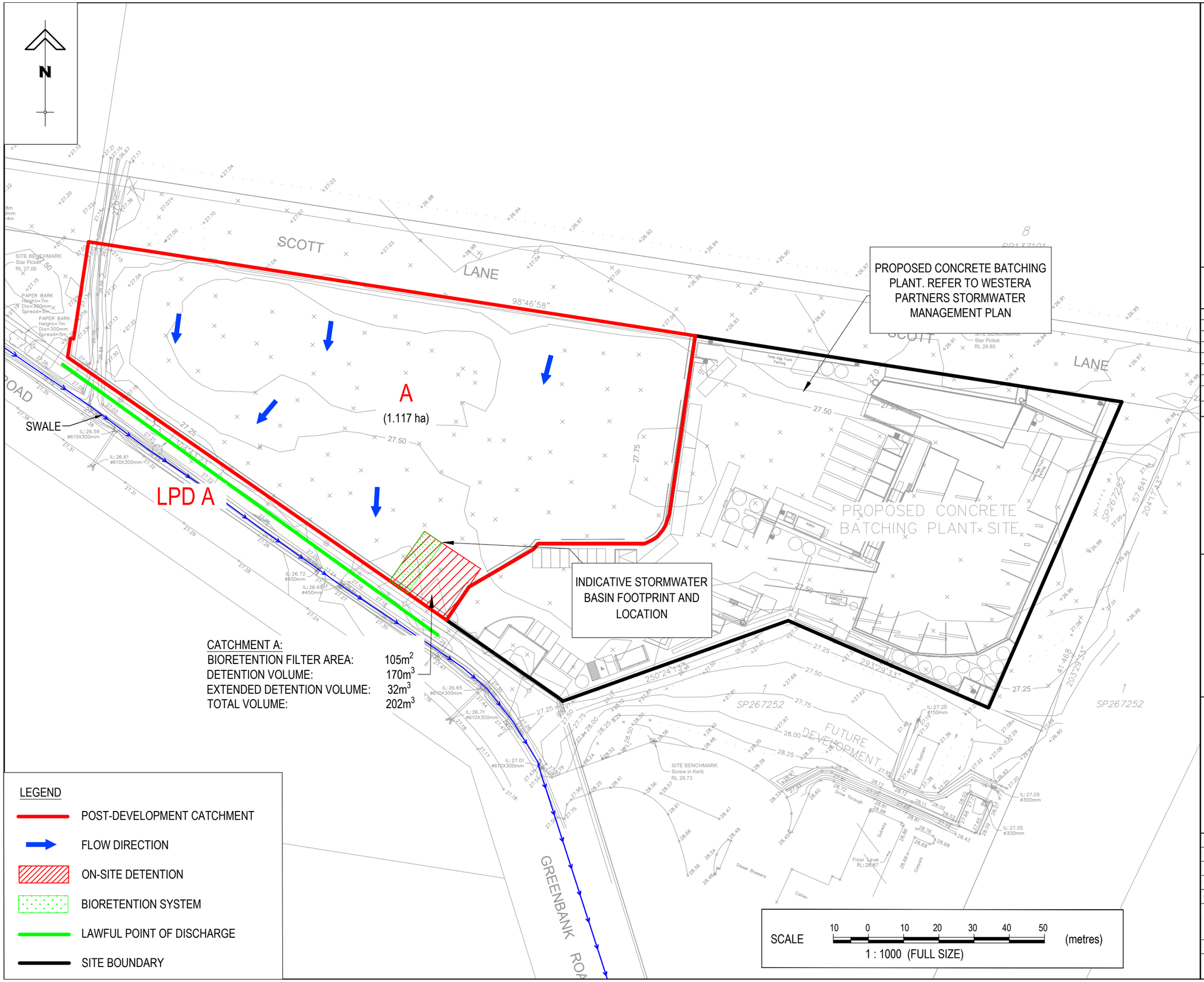
PROJECT No.: BE230342	DRAWING No. : N301 / VERSION: A



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DRAWING TITLE :

OPERATIONAL CONTROL PLAN

DEVEL. APPLIC. No. :	DATE : 06.12.24
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CHECKED : LUCAS FAULKNER	
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PROJECT No.: BE230342	DRAWING No. : N400 VERSION: A