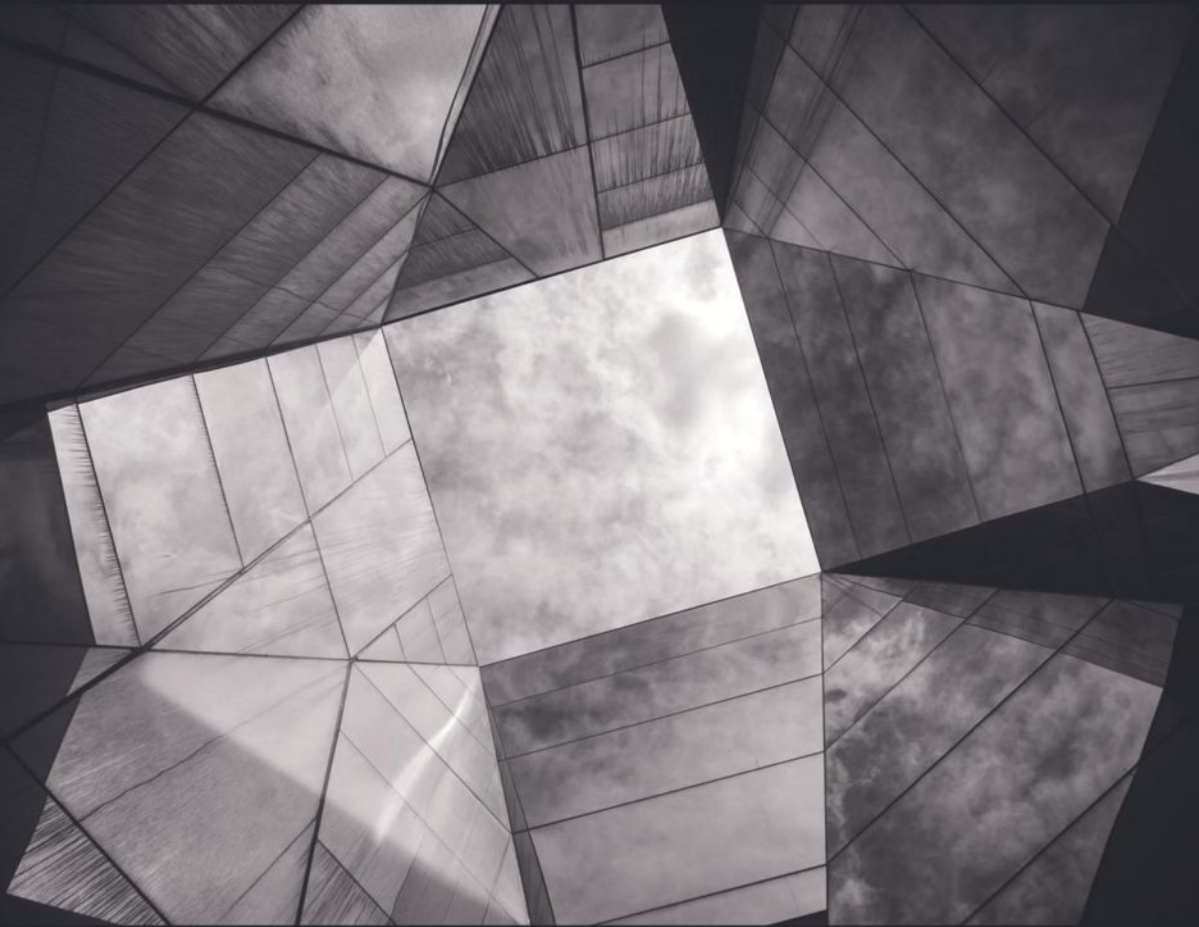


NAXOS

ENGINEERS

SITE BASED STORMWATER MANAGEMENT PLAN QUANTITY & QUALITY



PROPOSED RESIDENTIAL SUBDIVISION

290 FREEMAN RD, INALA QLD 4077

ROOFBROOK CONSULTING ENGINEERS PTY LTD

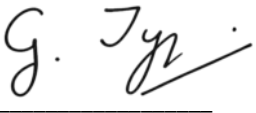
LOCAL AUTHORITY: Brisbane City Council
REPORT NUMBER: 25-136-SBSMP-V2
DATE PREPARED: July 2026
APPLICATION No: A006548499

NAXOS ENGINEERS PTY LTD
ABN 65 613 555 687
PO Box 224, Spring Hill QLD 4004
1300 598 544
info@naxosengineers.com.au

Naxos Engineers Pty Ltd ©2026

This document is copyright, all rights reserved. Other than for the specific purpose and subject to the conditions prescribed under the Copyright Act 1968 (Commonwealth), no part of it in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) be reproduced, stored in a retrieval system or transmitted without prior written permission from Naxos Engineers Pty Ltd.

This document has been prepared exclusively for the client in accordance with the terms of the agreement between Naxos Engineers Pty Ltd and the client (including the scope of works forming part of that agreement). Naxos Engineers owes no duty to any third party in respect of, and shall not be liable to the extent that any third party relies upon, this document.

DOCUMENTATION INFORMATION	
Publication Ref:	25-136 – SBSMP – V2
Local Authority:	Brisbane City Council
Application No.:	A00658499
Address:	290 Freeman Rd, Inala QLD 4077
Publication Date:	July 2026
Version Number:	Version 2
Version Author:	Jack Baillie
Authorised By	 Gregg Tyquin RPEQ 1528
Version Date:	July 2026

REVISION/CHECKING				
REV	ISSUE DATE	ISSUED BY	REVIEWED BY	REVISION TYPE
1	12.06.2026	JACK BAILLIE	GREGG TYQUIN	ORIGINAL ISSUE
2	14.07.2026	JACK BAILLIE	GREGG TYQUIN	ISSUE FOR APPROVAL

TABLE OF CONTENTS

1.0	INTRODUCTION.....	6
1.1.	OVERVIEW.....	6
1.2.	AVAILABLE INFORMATION.....	6
2.0	SCOPE OF REPORT.....	7
3.0	SITE CHARACTERISTICS.....	8
3.1.	LOCATION.....	8
3.2.	PRE-DEVELOPMENT SITE DESCRIPTION AND USE.....	9
3.3.	EXISTING STORMWATER DISCHARGE.....	10
3.4.	EXISTING LAWFUL POINT OF DISCHARGE.....	11
3.5.	EXISTING FLOODING AND EXTERNAL CATCHMENTS.....	11
4.0	PROPOSED SITUATION.....	12
4.1.	PROPOSED LAND USE.....	12
4.2.	DEVELOPED STORMWATER DISCHARGE.....	13
4.3.	DEVELOPED LAWFUL POINT OF DISCHARGE.....	13
5.0	STORMWATER QUANTITY (RATIONAL METHOD).....	14
5.1.	STORMWATER ANALYSIS (RATIONAL METHOD).....	14
5.2.	PRE-DEVELOPMENT (RATIONAL METHOD).....	14
5.3.	UN-MITIGATED POST-DEVELOPMENT (RATIONAL METHOD).....	15
5.4.	PRE- vs UN-MITIGATED POST-DEVELOPMENT (RATIONAL METHOD).....	16
6.0	STORMWATER QUANTITY (DRAINS).....	17
6.1.	STORMWATER QUANTITY ANALYSIS (DRAINS).....	17
6.2.	GENERAL DRAINS INPUTS AND PARAMETERS.....	18
6.3.	SUB-CATCHMENT SPECIFIC PARAMETERS.....	18
6.4.	PRE- vs UN-MITIGATED POST-DEVELOPMENT (DRAINS).....	19
6.5.	MITIGATED POST-DEVELOPMENT DESIGN.....	19
6.6.	PRE- vs MITIGATED POST-DEVELOPMENT (DRAINS).....	20
6.7.	PROPOSED BASIN QUANTITY PARAMETERS.....	20
7.0	STORMWATER QUALITY.....	21
7.1.	SITE CLASSIFICATION.....	21
7.2.	STATE PLANNING POLICY ASSESSMENT.....	22
7.3.	POLLUTANTS OF CONCERN.....	22
7.4.	CONSTRUCTION PHASE.....	23
7.5.	OPERATIONAL PHASE.....	23
7.6.	WATER QUALITY OBJECTIVES.....	23
8.0	MUSIC MODELLING.....	24
8.1.	OVERVIEW.....	24

8.2.	RAINFALL DATA	24
8.3.	RAINFALL RUNOFF PARAMETERS.....	25
8.4.	POLLUTANT EXPORT PARAMETERS.....	26
8.5.	SOURCE NODE PARAMETERS.....	26
8.6.	STORMWATER QUALITY MANAGEMENT STRATEGY.....	28
8.7.	TREATMENT NODE PARAMETERS.....	29
8.8.	BIO-RETENTION MATERIAL PROPERTIES.....	30
8.9.	MUSIC ANALYSIS / RESULTS	31
9.0	STORMWATER QUALITY BEST MANAGEMENT PRACTICE	32
9.1.	SELECTION OF SQBMP's.....	32
10.0	MONITORING AND MAINTENANCE	33
10.1.	MAINTENANCE REQUIREMENTS	33
10.2.	MAINTENANCE FREQUENCY	33
10.3.	MAINTENANCE RECORD.....	33
11.0	EROSION AND SEDIMENT (E&S) MANAGEMENT	34
11.1.	OBJECTIVES	34
11.2.	E&S MANAGEMENT DURING DEVELOPMENT PHASES.....	34
11.3.	EROSION CONTROL MEASURES.....	35
11.4.	SEDIMENT CONTROL MEASURES	36
12.0	CONCLUSION.....	37
12.1.	LAWFUL POINT OF DISCHARGE	37
12.2.	STORMWATER QUANTITY	37
12.3.	STORMWATER QUALITY	37
12.4.	EROSION AND SEDIMENT CONTROL	37

APPENDICES

Appendix A – PROPOSED SUBDIVISION LAYOUT

Appendix B – DETAIL SURVEY

Appendix C - BCC MAPPING RESULTS

Appendix D - BCC FLOODWISE PROPERTY REPORT

Appendix E – CONCEPT CIVIL PLANS

Appendix F – RATIONAL METHOD CALCS

LIST OF FIGURES

Figure 3-1	SITE LOCATION.....	8
Figure 3-2	SITE AERIAL	9
Figure 3-3	EXISTING BCC STORMWATER INFRASTRUCUTRE	10
Figure 3-4	LOOKING WEST FROM BRAMPTON STREET	11
Figure 6-5	OVERALL DRAINS MODEL LAYOUT	17
Figure 6-6	MITIGATED POST-DEVELOPMENT DRAINS MODEL LAYOUT	19
Figure 8-7	SUBCATCHMENT 1/1 SOURCE NODE.....	27
Figure 8-8	SUBCATCHMENT 2/1 SOURCE NODE.....	27
Figure 8-9	SUBCATCHMENT 3/1 SOURCE NODE.....	27
Figure 8-10	PROPOSED STORMWATER TREATMENT TRAIN	28
Figure 8-11	BIORETENTION BASIN TREATMENT NODE	29
Figure 8-12	SWALE TREATMENT NODE	29

LIST OF TABLES

Table 3-1	PROPERTY DESCRIPTION.....	8
Table 3-2	PRE-DEVELOPMENT CATCHMENT PROPERTIES.....	9
Table 4-3	POST-DEVELOPMENT CATCHMENT PROPERTIES	12
Table 5-4	PRE-DEVELOPMENT RATIONAL METHOD PARAMETERS.....	14
Table 5-5	PRE-DEVELOPMENT PEAK DISCHARGE (RATIONAL METHOD)	14
Table 5-6	UN-MITIGATED POST-DEVELOPMENT RATIONAL METHOD PARAMETERS.....	15
Table 5-7	UN-MITIGATED POST-DEVELOPMENT PEAK DISCHARGE (RATIONAL METHOD) 15	
Table 5-8	PRE-DEVELOPMENT vs UN-MITIGATED POST-DEVELOPMENT (RATIONAL METHOD) 16	
Table 6-9	PRE-DEVELOPMENT DRAINS PARAMETERS.....	18
Table 6-10	UN-MITIGATED POST-DEVELOPMENT DRAINS PARAMETERS	18
Table 6-11	MITIGATED POST-DEVELOPMENT DRAINS PARAMETERS.....	18
Table 6-12	PRE-DEVELOPMENT vs UN-MITIGATED POST-DEVELOPMENT (DRAINS).....	19
Table 6-13	PRE-DEVELOPMENT vs MITIGATED POST-DEVELOPMENT (DRAINS)	20
Table 7-14	STATE PLANNING POLICY CHECKLIST	22
Table 8-15	TYPICAL POLLUTANTS	22
Table 8-16	WATER QUALITY OBJECTIVES	23
Table 8-17	MEAN POTENTIAL EVAPO-TRANSPIRATION VALUES	24
Table 8-18	POLLUTANT GENERATION INPUTS	25
Table 8-19	POLLUTANT EXPORT PARAMETER INPUTS.....	26
Table 8-20	SUMMARY OF FILTER MEDIA PROPERTIES.....	30
Table 8-21	FILTER MEDIA PARTICLE SIZING CHART.....	30
Table 8-22	TRANSITIONAL LAYER MATERIAL PROPERTIES.....	30
Table 8-23	DRAINAGE LAYER MATERIAL PROPERTIES	31
Table 8-24	SUMMARY OF POLLUTANT TARGETS FOR TREATMENT TRAIN.....	31
Table 9-25	TYPICAL SQBMP'S	32

1.0 INTRODUCTION

1.1. OVERVIEW

Naxos Engineers Pty Ltd has been engaged by our client Roofbrook Consulting Engineers Pty Ltd to prepare a Site-Based Stormwater Management Plan for a residential subdivision at 290 Freeman Road, Inala QLD 4077 (subject site).

This Report will form part of the Development Application which will be submitted to Brisbane City Council (BCC) as supporting documentation for the proposed Development.

1.2. AVAILABLE INFORMATION

- Proposed Subdivision Layout prepared by Lawson Surveys. (Appendix A)
- Detail Survey Plan prepared by Lawson Surveys. (Appendix B)
- BCC Overlay and Utility Mapping Documentation. (Appendix C)

2.0 SCOPE OF REPORT

This Report will address the following stormwater issues:

- Identify the location of the lawful discharge points for the Development,
- Prepare a stormwater concept plan for the proposed Development,

STORMWATER QUANTITY

- Identify the increase in stormwater runoff that will be generated by the Development (if any),
- If required identify management strategies to ensure that stormwater discharge from the Development is maintained at pre-Development flows for all storm events up to and including Q100, and
- Identify the location of the lawful discharge points for the Development and demonstrate that the proposed stormwater discharge will not adversely affect the downstream properties and drainage systems.

STORMWATER QUALITY

- Identify the Development sites classification (high or low risk) and the relevant planning policies and guidelines that the Development must comply with,
- If applicable, identify Water Quality Objective Targets as determined by Local Authority Planning Schemes & Department of Environment & Resource Management.
- Identify a suitable “stormwater treatment train” aimed to comply with the set Water Quality Objectives.
- If applicable, demonstrate compliance to the determined Water Quality Objectives with the use of “Model for Urban Stormwater Improvement Conceptualisation” Software (MUSIC Version 6.0.1).
- Prepare a conceptual stormwater layout highlighting all stormwater quality treatment devices proposed for this Development.
- Provide details on monitoring and maintenance requirements for all stormwater treatment devices incorporated within this Development.

EROSION AND SEDIMENT CONTROL

- Provide details of an Erosion and Sediment Control Management Plan which can be developed at the later stage during Operational Work.

3.0 SITE CHARACTERISTICS

3.1. LOCATION

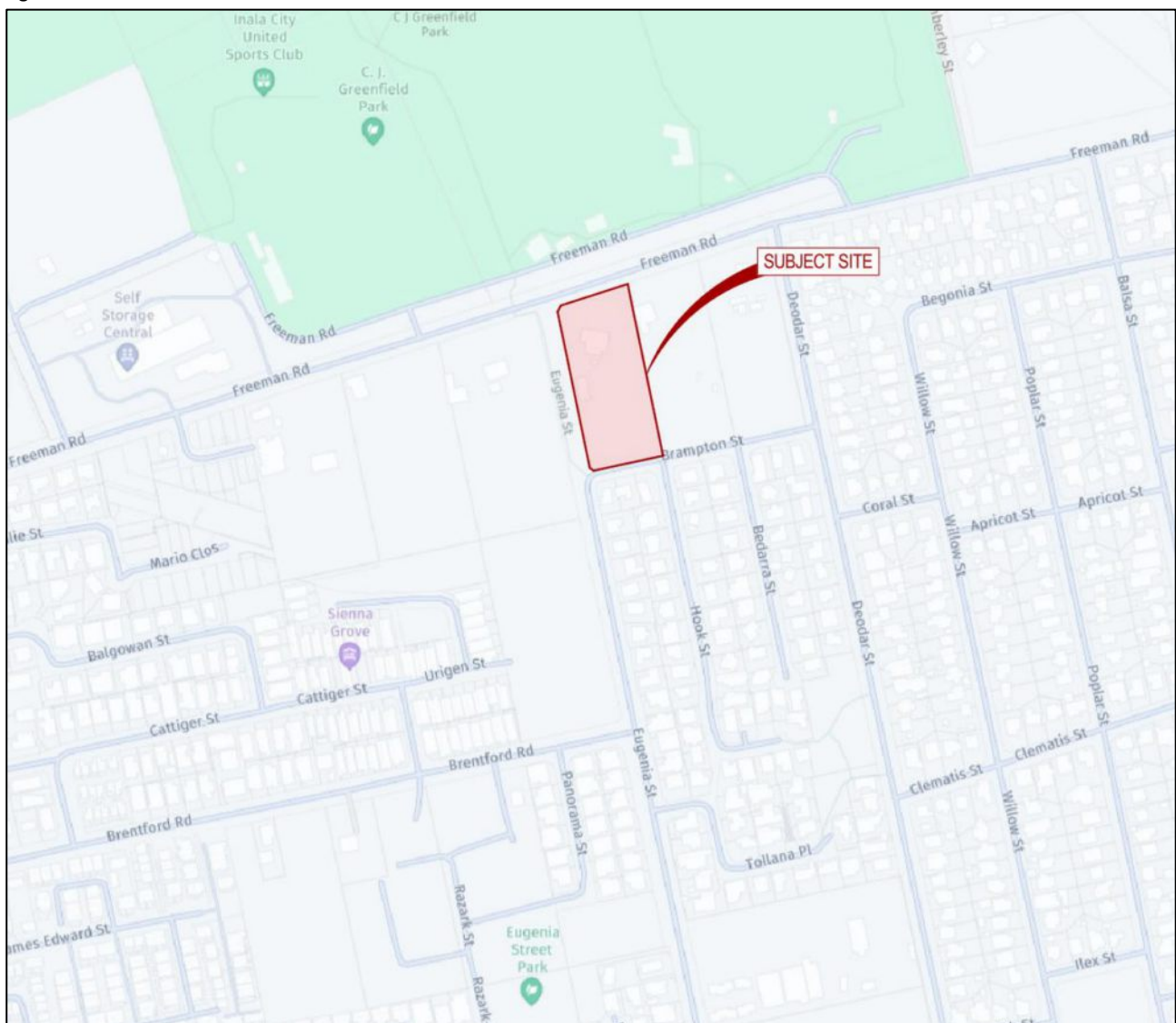
The Table below outlines the property details that have been extracted from the BCC Property Lot Report generated for the subject site.

Table 3-1 PROPERTY DESCRIPTION

Subject Site Street Address	290 Freeman Road, Inala 4077 QLD
Lot / RP Descriptions	Lot 45 RP52227
Title Area	9,853m ²
City Plan 2014 Zone	LMR3 – Low-Medium Density Residential (Up to 3 storeys)

The Figure below illustrates the sites locality.

Figure 3-1 SITE LOCATION



3.2. PRE-DEVELOPMENT SITE DESCRIPTION AND USE

As illustrated in Figure 3-2 below, the site is currently utilised for residential purposes with a single dwelling located on the site with associated sheds, paths and driveways.

Ground levels across the site range from RL 30.73m – 20.23m in the northern portion and from RL26.12m – 21.27m in the southern portion. Both the northern and southern portions of the site grade towards a central low point (existing unformed channel) that grades from west to east across the site with levels ranging from RL 22.01m – 19.68m.

The pre-Development site catchment properties are summarised in Table 3-2 below:

Table 3-2 PRE-DEVELOPMENT CATCHMENT PROPERTIES

Sub-Catchment ID	Area (Ha)	Fraction Impervious	Time of Concentration	C10	C100
EX/1	0.9853	0.10	15 mins	0.660	0.78

Figure 3-2 SITE AERIAL



3.3. EXISTING STORMWATER DISCHARGE

Based on the available information, including BCC records and the detailed survey prepared for the site, the following existing stormwater infrastructure has been identified adjacent to and within the subject site:

An unformed, open drain (BCC Asset ID: T11000004) traverses the site in a meandering alignment from west to east, occupying the central low-lying corridor of the lot. This drain functions as the primary stormwater conveyance path for the site and upstream catchment, receiving overland flow from both the northern and southern site sub-catchments and in addition flows from the upstream external catchment.

The drain is unlined and currently unformed, with no engineered channel geometry.

Discharge from the wider upstream catchment is introduced to the open drain via either the existing headwall structure (BCC Asset ID: L15147040), located in the south-western corner of the site or from the unmapped upstream channel where flows continue under the Eugenia Street foot bridge.

The existing dwelling on-site currently discharges roof water to surface level, where it combines with general surface runoff and conveys southward in accordance with the natural contours, ultimately draining to the open drain.

Figure 3-3 EXISTING BCC STORMWATER INFRASTRUCTURE



Figure 3-4 LOOKING WEST FROM BRAMPTON STREET



3.4. EXSITING LAWFUL POINT OF DISCAHRGE

As outlined in the Section above the existing lawful point of discharge for the subject site is the existing unformed open drain (BCC Asset ID: T11000004).

3.5. EXISTING FLOODING AND EXTERNAL CATCHMENTS

The proposed Development is affected by Overland Flow flooding. Refer to the Hydraulic Report prepared by Naxos Engineers for further information in regard to the Overland Flow flooding at the subject site

4.0 PROPOSED SITUATION

4.1. PROPOSED LAND USE

The proposed Development involves the demolition of the existing dwelling and associated structures, followed by the reconfiguration of Lot 45 on RP52227 into 10 new lots in accordance with the subdivision layout.

The full subdivision layout is provided within Appendix A.

The proposed subdivision yields the following:

- 8 x residential allotments ranging in area from 332m² to 2287m², intended for residential use.
- 1 x 3,043m² drainage reserve lot for the existing unformed open channel (T11000004)
- 1 x 400m² lot for stormwater management.

The stormwater management lot (Proposed Lot 101) is proposed to accommodate a proposed stormwater treatment basin designed to address both water quality and quantity objectives as detailed within the following Sections this Report

The drainage reserve lot (Proposed Lot 100) is proposed over the existing unformed open drain, to facilitate ongoing access and maintenance by BCC.

The post-Development catchment properties for the subject site are summarised in Table 4-3 below:

Table 4-3 POST-DEVELOPMENT CATCHMENT PROPERTIES

Sub-Catchment ID	Area (Ha)	Fraction Impervious	Time of Concentration	C10	C100
1/1	0.5300	0.60	5	0.78	0.94
2/1	0.3043	0.00	5	0.70	0.84
3/1	0.1510	0.60	5	0.78	0.94
LUMPED/1	0.9853	0.40	5	0.78	0.94

The ultimate fraction impervious has been estimated at 0.60 for lot areas (1/1 and 3/1) in accordance with QUDM Table 4.5.1, assuming all future lot Development will be undertaken in accordance with the site's Brisbane City Council zoning of Low-Medium Density Residential.

Refer to Sketch SK004 within Appendix E for location of stormwater sub-catchments.

4.2. DEVELOPED STORMWATER DISCHARGE

The proposed Development will alter the stormwater runoff characteristics of the site as a result of the increase in impervious area associated with the proposed subdivision.

At the direction of Brisbane City Council, the proposed basin has been designed to account for the total site catchment — effectively over-treating and over-detaining the northern runoff to compensate for the unmitigated southern discharge. This ensures that the combined post-Development discharge from the site does not exceed pre-Development peak flows at the lawful point of discharge.

Further details regarding the basin design, including storage volumes, outlet configurations, and MUSIC modelling results, are provided in the following sections of this Report.

The site has been divided into two sub-catchments to reflect the proposed drainage strategy, as summarised below:

SUB-CATCHMENT 1/1 (NORTHERN LOTS)

Stormwater runoff generated from the northern lots will be collected via a proposed stormwater network consisting of pit and pipes that are to convey all runoff from sub-catchment 1/1 to the proposed combined bioretention and detention basin located on Proposed Lot 101. Once the stormwater is treated and attenuated it will be discharged to the existing unformed open drain (BCC Asset ID: T11000004).

SUB-CATCHMENT 2/1 (OPEN DRAIN - BYPASS)

Runoff from the existing unformed open drain (Proposed Lot 100) will bypass the proposed stormwater quality and quantity basin and continue downstream as overland flow.

SUB-CATCHMENT 3/1 (SOUTHERN LOTS - BYPASS)

Runoff from the southern lots will be collected via a proposed reticulated stormwater network and be discharged directly to the unformed open drain, bypassing the proposed stormwater quality and quantity basin.

LUMPED/1 (ANALYSIS CATCHMENT)

This catchment is utilised purely for analysis of the un-mitigated post-Development scenario. It consists of the entire subject site assuming, in an un-mitigated scenario, all runoff will match the pre-Development discharge conditions outlined within Section 3.3 above.

4.3. DEVELOPED LAWFUL POINT OF DISCHARGE

As outlined above, the proposed Development will maintain the existing lawful point of discharge to the existing unformed open drain (BCC Asset ID: T11000004).

5.0 STORMWATER QUANTITY (RATIONAL METHOD)

5.1. STORMWATER ANALYSIS (RATIONAL METHOD)

The Rational Method has been adopted to estimate the peak stormwater discharge for a range of design storm events from Q1 through to Q100. This methodology is consistent with the hydrological assessment requirements outlined in the Queensland Urban Drainage Manual (QUDM, 2017, 4th Edition).

The Rational Method provides an appropriate level of accuracy for small urban catchments, such as the subject site, where catchment areas are less than 200 hectares and flow conditions are primarily governed by overland and pipe conveyance systems.

The following sections summarise the input parameters adopted for the calculations, including catchment area, runoff coefficients, time of concentration, and rainfall intensities, and present the resulting peak discharge rates for both pre-Development and post-Development (unmitigated) scenarios.

Detailed Rational Method calculations, including parameter derivations and assumptions, are provided in Appendix F of this Report.

5.2. PRE-DEVELOPMENT (RATIONAL METHOD)

The following parameters have been adopted for the pre-Development scenario:

Table 5-4 PRE-DEVELOPMENT RATIONAL METHOD PARAMETERS

Parameter	Value	Reference
Time of Concentration	15 mins	(QUDM – Figure 4.4)
Fraction Impervious	0.100	(Refer to Pre-Development Catchment Plan)
Rainfall intensity $^1I_{10}$	61.80mm/hr	(Retrieved from BoM IFD Table)
Run-off Co-efficient C_{10}	0.660	(QUDM – Table 4.5.4)
Catchment Area	0.9853	(BCC Property Lot Report – Refer Table 3-1)

Refer to Drawing SK001 within Appendix E for the Pre-Development Catchment Plan.

Using the parameters outlined in Table 5-4 above the following results were calculated.

Table 5-5 PRE-DEVELOPMENT PEAK DISCHARGE (RATIONAL METHOD)

Storm Event		C	I (mm/hr)	Peak Discharge (m³/s)
Q1	100% AEP	0.560	74	0.114
Q2	50% AEP	0.595	85	0.138
Q5	20% AEP	0.665	116	0.211
Q10	10% AEP	0.700	137	0.262
Q20	5% AEP	0.735	157	0.316
Q50	2% AEP	0.805	183	0.403
Q100	1% AEP	0.840	203	0.467

Full Rational Method Calculations are available within Appendix F.

5.3. UN-MITIGATED POST-DEVELOPMENT (RATIONAL METHOD)

As outlined in Sections 4.1 and 4.2 above, the post-Development scenario comprises two distinct sub-catchments, each discharging to the existing unformed open drain.

For the purposes of this un-mitigated post-Development Rational Method assessment the entire lumped catchment as detailed in Table 4-3 was analysed.

The extent and parameters for each sub-catchment are illustrated within drawing SK002 available within Appendix E.

The following parameters have been adopted for the un-mitigated lumped post-Development catchment:

Table 5-6 UN-MITIGATED POST-DEVELOPMENT RATIONAL METHOD PARAMETERS

Parameter	Value	Reference
Time of Concentration	5 mins	(QUDM – Figure 4.4)
Fraction Impervious	0.600	(Refer to Pre-Development Catchment Plan)
Rainfall intensity $^1I_{10}$	61.80mm/hr	(Retrieved from BoM IFD Table)
Run-off Co-efficient C_{10}	0.780	(QUDM – Table 4.5.4)
Catchment Area	0.9853	(BCC Property Lot Report – Refer Table 3-1)

Using the parameters outlined in Table 5-6 above the following results were calculated.

Table 5-7 UN-MITIGATED POST-DEVELOPMENT PEAK DISCHARGE (RATIONAL METHOD)

Storm Event	C	I (mm/hr)	Peak Discharge (m ³ /s)
Q1 100% AEP	0.624	107	0.183
Q2 50% AEP	0.663	122	0.221
Q5 20% AEP	0.741	168	0.341
Q10 10% AEP	0.780	199	0.425
Q20 5% AEP	0.819	229	0.513
Q50 2% AEP	0.897	269	0.660
Q100 1% AEP	0.936	300	0.768

Full Rational Method Calculations are available within Appendix F.

5.4. PRE- vs UN-MITIGATED POST-DEVELOPMENT (RATIONAL METHOD)

A comparison of the un-mitigated post-Development discharge with the pre-Development discharge is presented in Table 5-6 below:

Table 5-8 PRE-DEVELOPMENT vs UN-MITIGATED POST-DEVELOPMENT (RATIONAL METHOD)

Storm Event		Pre-Development Peak Discharge (m ³ /s)	Post-Development Peak Discharge (m ³ /s)	Net Difference in Peak Discharge (m ³ /s)
Q1	100% AEP	0.114	0.183	+ 0.069
Q2	50% AEP	0.138	0.221	+ 0.083
Q5	20% AEP	0.211	0.341	+ 0.130
Q10	10% AEP	0.262	0.425	+ 0.163
Q20	5% AEP	0.316	0.513	+ 0.197
Q50	2% AEP	0.403	0.660	+ 0.257
Q100	1% AEP	0.467	0.768	+ 0.301

The results indicate an increase in post-Development discharge to the existing unformed open drain due to the reduction in time of concentration and the increase in impervious areas.

Therefore, on-site detention will be provided to limit post-Development flows to less than or equal to the pre-Development rates.

Further design details are provided in Section 6 of this Report.

6.0 STORMWATER QUANTITY (DRAINS)

6.1. STORMWATER QUANTITY ANALYSIS (DRAINS)

As identified in Table 5-6 above, there is an increase in stormwater discharge when comparing the pre-Development peak discharge rates to the un-mitigated post-Development peak discharge rates across all storm events.

The identified increase in peak discharge across the full range of storm events will generally have a negative impact on the neighbouring properties downstream of the subject site. Therefore, an on-site detention system is proposed to be incorporated into the proposed Development.

As outlined in Section 4.1 the proposed lot layout has been designed to incorporate a proposed combined bioretention and detention basin (Proposed Lot 101). The proposed on-site detention will be utilised to ensure that the mitigated post-Development discharge rates do not exceed the pre-Development discharge rate.

Once the mitigated post-Development peak discharge is attenuated to equal to or less than the corresponding pre-Development discharge rate for each storm event, it is not envisaged that the proposed Development will cause nuisance or an adverse impact to the neighbouring properties.

The Development of the DRAINS model and the proposed combined bioretention and detention basin are detailed in the following Sections of this Report.

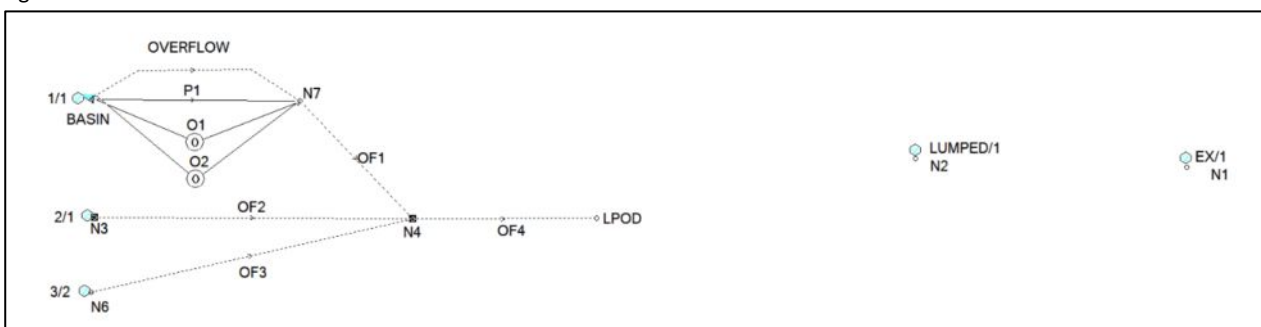
DRAINS MODEL

DRAINS is an industry-standard stormwater drainage design and analysis software package developed by Watercom Pty Ltd, widely adopted across Southeast Queensland for the design and assessment of urban stormwater systems. The software facilitates hydrological and hydraulic analysis of drainage networks in accordance with the Queensland Urban Drainage Manual (QUDM, 2017) and Australian Rainfall and Runoff (ARR, 2019).

The pre-Development, post-Development (unmitigated), and post-Development (mitigated) scenarios were modelled within DRAINS, with the mitigated model incorporating the proposed combined bioretention and detention basin on Proposed Lot 101.

The DRAINS model that includes all the scenarios outlined above is illustrated in Figure 6-5 below.

Figure 6-5 OVERALL DRAINS MODEL LAYOUT



6.2. GENERAL DRAINS INPUTS AND PARAMETERS

DRAINS HYDROLOGICAL MODEL AND PARAMETERS

The Extended Rational Method (ERM) was adopted as the hydrological model within DRAINS, consistent with the requirements of QUDM for small urban catchments.

The following runoff coefficients were adopted:

- Impervious Areas: C10 = 0.900
- Pervious Areas: C10 = 0.500

Overland flow travel times were calculated by DRAINS using the Friend's Equation.

DRAINS RAINFALL DATA INPUTS

The site-specific rainfall intensities and temporal patterns were obtained from the BoM IFD database, and the ARR2019 Data Hub respectively.

Both datasets were imported into DRAINS, which for each design storm event (Q1 to Q100) generates 10 temporal pattern bursts across all durations between 5 minutes and 24 hours. The resulting peak discharge for each design storm event represents the median worst-case result across all durations and burst patterns analyzed.

6.3. SUB-CATCHMENT SPECIFIC PARAMETERS

PRE-DEVELOPMENT (EX/1)

Table 6-9 PRE-DEVELOPMENT DRAINS PARAMETERS

Catchment ID	Surface Type	Area (Ha)	Proportion	Time of Concentration
EX/1	Impervious	0.0985	0.100	15
	Pervious	0.8868	0.900	15

UN-MITIGATED POST-DEVELOPMENT (LUMPED/1)

Table 6-10 UN-MITIGATED POST-DEVELOPMENT DRAINS PARAMETERS

Catchment ID	Surface Type	Area (Ha)	Proportion	Time of Concentration
LUMPED/1	Impervious	0.4086	0.100	15
	Pervious	0.5767	0.900	15

MITIGATED POST-DEVELOPMENT (DRAINS)

Table 6-11 MITIGATED POST-DEVELOPMENT DRAINS PARAMETERS

Catchment ID	Surface Type	Area (Ha)	Proportion	Time of Concentration
1/1	Impervious	0.3180	0.60	5
	Pervious	0.2120	0.40	10
2/1	Impervious	0.0000	0.000	N/A
	Pervious	0.3043	1.000	5
3/1	Impervious	0.0906	0.60	5
	Pervious	0.0604	0.40	10

6.4. PRE- vs UN-MITIGATED POST-DEVELOPMENT (DRAINS)

The pre- and un-mitigated post-Development peak discharge results produced within the DRAINS model using the Extended Rational Method hydrological model are outlined in the following table.

Table 6-12 PRE-DEVELOPMENT vs UN-MITIGATED POST-DEVELOPMENT (DRAINS)

Storm Event		Pre-Development	Post-Development	Net Difference in
		Peak Discharge (m³/s)	Peak Discharge (m³/s)	Peak Discharge (m³/s)
Q1	100% AEP	0.059	0.106	+ 0.047
Q2	50% AEP	0.079	0.142	+ 0.063
Q5	20% AEP	0.112	0.202	+ 0.090
Q10	10% AEP	0.136	0.247	+ 0.111
Q20	5% AEP	0.164	0.298	+ 0.134
Q50	2% AEP	0.207	0.374	+ 0.167
Q100	1% AEP	0.245	0.424	+ 0.189

The results indicated above are consistent with the findings of the Rational Method assessment conducted with Section 5 of this Report.

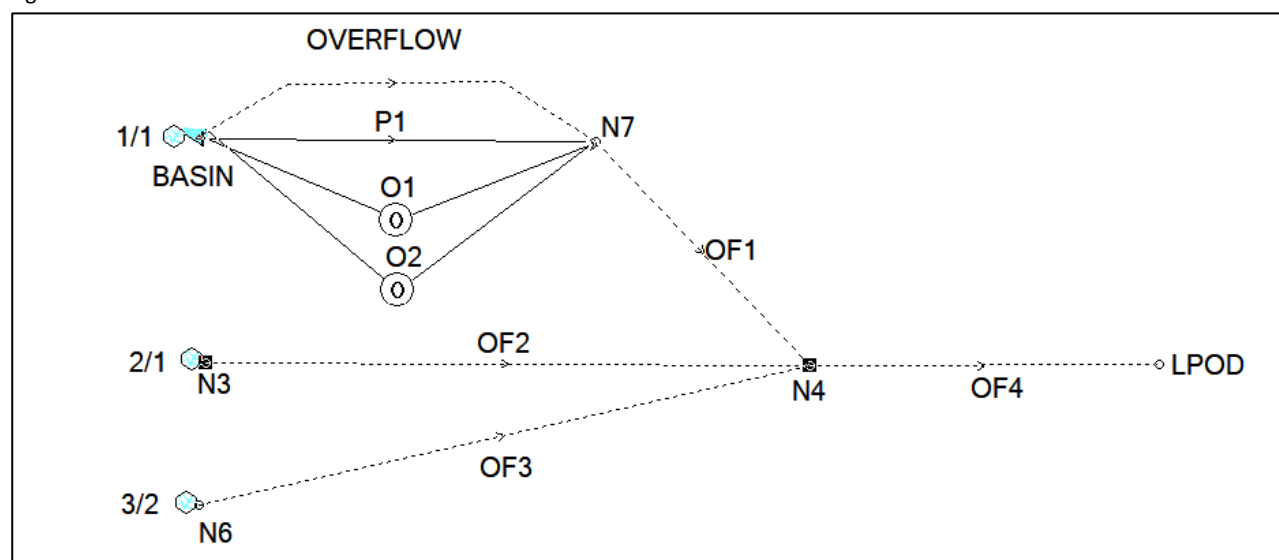
There is an increase in post-Development discharge to the existing unformed open drain across the full range of storm events due to the reduction in time of concentration and the increase in impervious areas.

Therefore, on-site detention is to be provided to limit post-Development flows to less than or equal to the pre-Development rates. The design of the proposed combined bioretention and detention basin is outlined below.

6.5. MITIGATED POST-DEVELOPMENT DESIGN

To mitigate the post Development peak flows a combined bioretention and detention basin was modelled within 'DRAINS'. A detailed extract of this mitigated post-Development portion of the DRIANS model is provided in the Figure below.

Figure 6-6 MITIGATED POST-DEVELOPMENT DRAINS MODEL LAYOUT



6.6. PRE- vs MITIGATED POST-DEVELOPMENT (DRAINS)

The pre- and mitigated post-Development peak discharge results produced within the DRAINS model using the Extended Rational Method hydrological model are outlined in the following table.

Table 6-13 PRE-DEVELOPMENT vs MITIGATED POST-DEVELOPMENT (DRAINS)

Storm Event		Pre-Development Peak Discharge (m ³ /s)	Mitigated Post-Development Peak Discharge (m ³ /s)	Net Difference in Peak Discharge (m ³ /s)
Q1	100% AEP	0.059	0.058	- 0.001
Q2	50% AEP	0.079	0.075	- 0.004
Q5	20% AEP	0.112	0.100	- 0.012
Q10	10% AEP	0.136	0.122	- 0.014
Q20	5% AEP	0.164	0.144	- 0.020
Q50	2% AEP	0.207	0.183	- 0.024
Q100	1% AEP	0.245	0.240	- 0.005

As is tabulated above, the proposed combined bioretention and detention basin is successful in attenuating post-Development flows to the existing unformed open drain to less than the pre-Development case and is therefore considered successful.

The details of the proposed basin are outlined in the Section below.

6.7. PROPOSED BASIN QUANTITY PARAMETERS

The proposed combined bioretention and detention basin is located on Proposed Lot 101 and has been designed to attenuate post-Development peak flows to equal to or less than pre-Development rates across all storm events from Q1 to Q100. The basin properties adopted within the DRAINS model are summarised below:

PROPOSED BASIN PROPERTIES:

- Storage Volume: 160m³
- Depth: 1.590m
- Slope Batters: 1 in 4
- Overflow Weir RL: Base + 1.300m
- Pit Grate RL: Base + 1.150m
- Orifice 1: Ø0.160m @ Base + 0.300m
- Orifice 2: Ø0.125m @ Base + 0.800m
- Outlet Pipe: Ø450
- Q100 Water Level: Base + 1.290m

7.0 STORMWATER QUALITY

7.1. SITE CLASSIFICATION

The implementation of a suitable Stormwater Management Plan for the proposed Development is determined from the following:

- Identify if compliance with the Department of Environment and Resource Management, State Planning Policy is required, or
- Identify if compliance with the local authorities Stormwater Quality is required, or
- Implement Best Management Practice Guidelines for low-risk sites as per local authority Development guidelines.

Either compliance objective will still be designed based on the following key principles:

- The use of Water Sensitive Urban Design (WSUD) principles is to be adopted throughout the site where possible,
- Water Quality controls are to be considered under two separate phases of the Development, the construction phase and the operational phase,
- The construction phase requires the assessment of the site during the construction and maintenance period of the Development.
- The operational phase requires assessment of the site over the total life of the site and its water quality control measures.

7.2. STATE PLANNING POLICY ASSESSMENT

To determine whether compliance with the Department of Environment and Resource Management (DERM) State Planning Policy 4/10 Healthy Waters is required, it is required to undertake the State Planning Policies Assessment Benchmarks for Water Quality. Below is an extract from the state Planning Policy July 2017 (page 46) detailing the Assessment Benchmarks in table format. If any of the trigger questions are answered Yes, then compliance is expected with the State Planning Policy. If all trigger questions are answered No, then stormwater quality best management practices will be adopted.

Table 7-14 STATE PLANNING POLICY CHECKLIST

Development Application Types			
Material Change in Use MCU	Yes / No?	Reconfiguration of Lots ROL	Yes / No?
A material change of use for an urban purpose that involves premises 2500m ² or greater in size? AND , If yes:	N/A	Reconfiguring a lot for an urban purpose that involves premises 2500m ² or greater in size AND will result in six or more lots? OR	YES
Will result in six or more dwellings. OR	N/A	Operational work for an urban purpose that involves disturbing a land area. 2500m ² or greater in size?	YES
Will result in an impervious area greater than 25% of the Development area?	N/A		

As demonstrated in the table above, one or more trigger questions have answered 'Yes', therefore Naxos Engineers has identified that the Development is deemed 'High Risk' and requires the implementation of the State Planning Policy.

7.3. POLLUTANTS OF CONCERN

The pollutants of concern are summarised below. These pollutants can have adverse environmental impacts within the downstream catchment. It is proposed to adopt Site-Based Water Sensitive Urban Design to provide capture and treatment to the below mentioned pollutants.

Table 8-15 TYPICAL POLLUTANTS

POLLUTANT	SOURCE
LITTER	PAPER, CONSTRUCTION PACKAGING, FOOD WASTE, CEMENT, OFF - CUTS
SEDIMENT	UNPROTECTED EXPOSED SOILS, STOCKPILES, EROSION
HYDROCARBONS	FUEL AND OIL SPILLS, LEAKS FROM MACHINERY
TOXIC MATERIALS	CEMENT SLURRY, ASPHALT PRIMER, SOLVENTS, CLEANING AGENTS
PH ALTERING SUBSTANCES	ACID SULPHATE SOILS, CEMENT SLURRY, WASH WATER
THERMAL POLLUTION	VEHICLES AND MACHINERY, INCREASED IMPERVIOUS AREAS

7.4. CONSTRUCTION PHASE

During the construction phase, the potential exists for significant increases in the number of pollutants, particularly sediment, escaping from the site. During this period, an Erosion and Sediment Control Plan is required to be prepared as part of the overall Environmental Management Plan prepared for the construction phase.

An Erosion and Sediment Control Plan will be prepared during the detailed design phase of the Development. This plan will be prepared in accordance with Local Authority Guidelines and with recognised industry standards. This plan may also be submitted to Gold Coast City Council for Operational Works Approval.

7.5. OPERATIONAL PHASE

Table 7-14 State Planning Policy Checklist above has identified the Development as a 'High Risk' site.

As this Development has been identified as 'High risk', identification of the relevant Water Quality Objectives is required.

7.6. WATER QUALITY OBJECTIVES

For this Development, it is necessary to identify the Water Quality Objectives (WQO's) with regards to the future stormwater discharge from the site. Based on "Urban Stormwater Quality Planning Guidelines 2010" obtained from Queensland Government, Department of Environment and Resource Management, the removal of the following pollutants from stormwater discharge will be required to meet the Water Quality Objectives.

Table 8-16 WATER QUALITY OBJECTIVES

INDICATOR	ENTIRE % REDUCTION
TSS (Total Suspended Solids)	80%
TP (Total Phosphorus)	60%
TN (Total Nitrogen)	45%
GP (Gross Pollutants)	90%

8.0 MUSIC MODELLING

8.1. OVERVIEW

To design a stormwater quality treatment system that achieves the WQO's outline in Section 7.6 of this Report, MUSIC Version V6.3.0 was used to assess pollutants and the performance of the proposed stormwater treatment train to be adopted for this Development. Modelling was undertaken in accordance with "Water by Design – Music Modelling Guidelines - 2018"

8.2. RAINFALL DATA

The following rainfall data & modelling parameters were input into the MUSIC model:

- Council: Brisbane City Council
- Station ID: 40659
- Station Name: Greenbank Thompson Road
- Climate Period for MUSIC: 19/12/1975 – 31/07/2010
- Mean Annual Rainfall over Period: 752mm
- Time Step Adopted: 6 minutes

The following Mean Potential Evapo-Transpiration Values were obtained from "Water By Design – Music Modelling Guidelines Version 3.0 – 2018" and the below table represented the values adopted for this MUSIC model.

Table 8-17 MEAN POTENTIAL EVAPO-TRANSPIRATION VALUES

MEAN POTENTIAL EVAPO-TRANSPIRATION (mm) (CLIMATE ATLAS OF AUSTRALIA)											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
181	139	137	102	72	62	63	81	108	138	159	184

8.3. RAINFALL RUNOFF PARAMETERS

The following recommended MUSIC rainfall run-off parameters were obtained from “Water by Design – Music Modelling Guidelines Version 3.0 – 2018” and the below table represented the values adopted for this MUSIC model.

Table 8-18 POLLUTANT GENERATION INPUTS

PARAMETER	Urban Residential	Commercial & Industrial	Rural Residential	Forested
Rainfall Threshold (mm)	1	1	1	1
Soil Storage Capacity (mm)	500	18	98	120
Initial Storage (% Capacity)	10	10	10	10
Field Capacity (mm)	200	80	80	80
Infiltration Capacity Coefficient a	211	243	84	200
Infiltration Capacity Exponent b	5.0	0.6	3.3	1.0
Initial Depth (mm)	50	50	50	50
Daily Recharge Rate (%)	28	0	100	25
Daily Baseflow Rate (%)	27	31	22	3
Daily Deep Seepage Rate (%)	0	0	0	0

NOTE: The highlighted columns represent the rainfall runoff parameters adopted for the Development.

8.4. POLLUTANT EXPORT PARAMETERS

The following pollutant export parameters were obtained from “Water by Design – Music Modelling Guidelines Version 3.0 – 2018” and the below table represented the values adopted for this MUSIC model.

Table 8-19 POLLUTANT EXPORT PARAMETER INPUTS

Land Use	Flow Type	Surface Type	Total Suspended Solids (Log10 mg/L)		Total Phosphorus (Log10 mg/L)		Total Nitrogen (Log10 mg/L)	
			Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
RESIDENTIAL URBAN	Baseflow Parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
		Roads	1.00	0.34	-0.97	0.31	0.20	0.20
		Ground Level	1.00	0.34	-0.97	0.31	0.20	0.20
	Stormflow Parameters	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
		Roads	2.43	0.39	-0.30	0.31	0.26	0.23
		Ground Level	2.18	0.39	-0.47	0.31	0.26	0.23
FORESTED	Baseflow Parameters	N/A	0.51	0.28	-1.79	0.28	-0.59	0.22
	Stormflow Parameters	N/A	1.90	0.20	-1.10	0.22	0.075	0.24

8.5. SOURCE NODE PARAMETERS

The MUSIC source nodes shown within the following Figures have been configured to represent the contributing catchments within the subject site using the values outlined in the Sections above, including:

SUB-CATCHMENT 1/1 (NORTHERN LOTS)

Modelled as Urban Residential with a fraction impervious of 0.60, reflecting the ultimate developed condition of the northern lots in accordance with the site's Low-Medium Density Residential zoning.

SUB-CATCHMENT 2/1 (OPEN DRAIN - BYPASS)

Modelled as Forested with a fraction impervious of 0.00, representing the existing unformed open drain.

SUB-CATCHMENT 3/1 (SOUTHERN LOTS - BYPASS)

Modelled as Urban Residential with a fraction impervious of 0.60, reflecting the ultimate developed condition of the southern lots in accordance with the site's Low-Medium Density Residential zoning.

The extent of the sub-catchments are shown on SK001 within Appendix E.

Figure 8-7 SUBCATCHMENT 1/1 SOURCE NODE

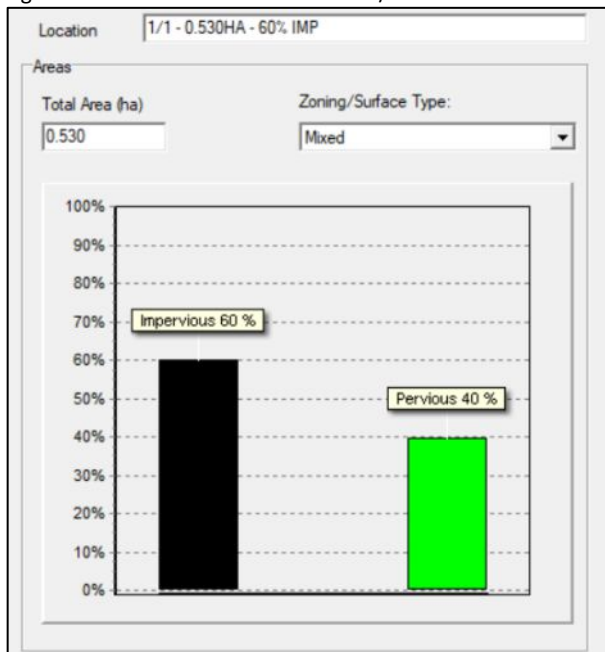


Figure 8-8 SUBCATCHMENT 2/1 SOURCE NODE

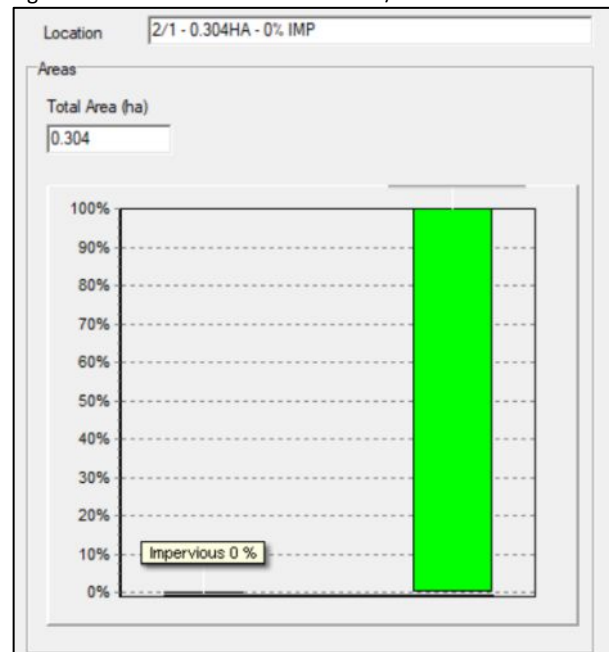
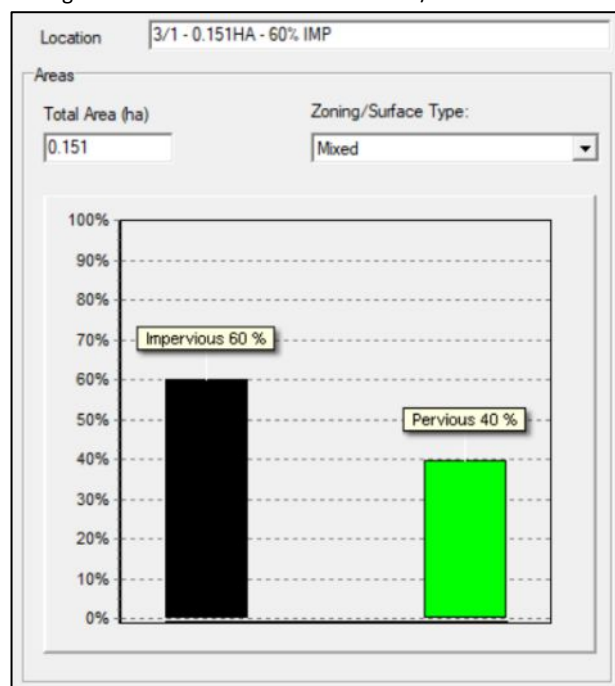


Figure 8-9 SUBCATCHMENT 3/1 SOURCE NODE

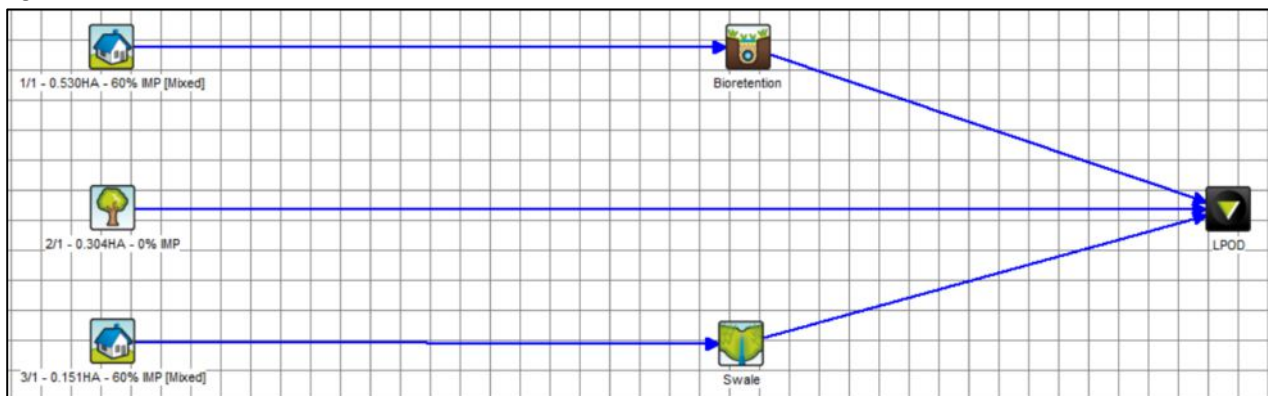


8.6. STORMWATER QUALITY MANAGEMENT STRATEGY

The proposed stormwater quality treatment train has been designed to achieve the required pollutant reduction targets in accordance with the SPP WQO's as outlined in Section 7.6 of this Report.

The treatment train shown in Figure 8-10 below represents the ultimate flow path of stormwater runoff from the MUSIC source nodes through the proposed stormwater quality improvement devices then to the LPOD.

Figure 8-10 PROPOSED STORMWATER TREATMENT TRAIN



THE PROPOSED TREATMENT TRAIN CONSISTS OF:

- Sub-Catchment 1/1 (Northern Lots)
 - Runoff from the northern lots is collected via the internal reticulated drainage network and directed to the proposed combined bioretention and detention basin on Lot 101 for treatment prior to discharge to the lawful point of discharge (existing unformed open drain, BCC Asset ID: T11000004).
- Sub-Catchment 2/1 (Open Drain - Bypass)
 - Runoff from the drainage reserve (Lot 100) bypasses the treatment system and discharges directly to the lawful point of discharge, consistent with the existing unformed open drain.
- Sub-Catchment 3/1 (Southern Lots - Bypass)
 - Runoff from the southern lots receives minor passive treatment via a vegetated swale, representing the natural filtration, prior to discharge to the lawful point of discharge.

8.7. TREATMENT NODE PARAMETERS

Screenshots of the Bioretention and Swale MUSIC treatment nodes are provided in the Figures below:

Figure 8-11 BIORETENTION BASIN TREATMENT NODE

Location: Bioretention	
Inlet Properties Low Flow By-pass (cubic metres per sec) 0.000 High Flow By-pass (cubic metres per sec) 100.000	
Storage Properties Extended Detention Depth (metres) 0.30 Surface Area (square metres) 75.00	
Filter and Media Properties Filter Area (square metres) 75.00 Unlined Filter Media Perimeter (metres) 40.00 Saturated Hydraulic Conductivity (mm/hour) 200.00 Filter Depth (metres) 0.50 TN Content of Filter Media (mg/kg) 400 Orthophosphate Content of Filter Media (mg/kg) 30.0	
Infiltration Properties Exfiltration Rate (mm/hr) 0.00	
Lining Properties Is Base Lined? ☐ Yes ☒ No	
Vegetation Properties ☒ Vegetated with Effective Nutrient Removal Plants ☐ Vegetated with Ineffective Nutrient Removal Plants ☐ Unvegetated	
Outlet Properties Overflow Weir Width (metres) 2.00 Underdrain Present? ☒ Yes ☐ No Submerged Zone With Carbon Present? ☐ Yes ☒ No Depth (metres) 0.45	
Fluxes... Notes... More	

Figure 8-12 SWALE TREATMENT NODE

Location: Swale	
Inlet Properties Low Flow By-Pass (cubic metres per sec) 0.000	
Storage Properties Length (metres) 70.0 Bed Slope (%) 1.00 Base Width (metres) 0.0 Top Width (metres) 2.0 Depth (metres) 0.25 Vegetation Height (metres) 0.100 Exfiltration Rate (mm/hr) 0.00	
Calculated Swale Properties Mannings N 0.249 Batter Slope 1:4 Velocity (m/s) 0.099 Hazard 0.025 Cross sectional Area (m ²) 0.25 Swale Capacity (cubic metres per sec) 0.025	

8.8. BIO-RETENTION MATERIAL PROPERTIES

FILTER MATERIAL

The filter media for the bio-filtration system must meet certain specifications to ensure the structural and treatment properties of the designed bio-retention system are not reduced between maintenance periods.

Where there is not a locally available soil-based material that complies with the properties outlined in Table 8-21 below, it is possible to engineer an appropriate filter medium. Refer to Monash University's Bio-filtration Filter Media Guidelines (Version 3.01), Prepared by the Facility for Advancing Water Bio-filtration (FAWB) June 2009 in Chapter 4 of Appendix C – Guidelines for Filter Media in Bio-filtration Systems.

Similarly, filter media must be correctly installed with an appropriate level of compaction during installation. Guidelines currently recommend that filter media be lightly compacted during installation to prevent migration of fine particles. In small systems, a single pass with a vibrating plate should be used to compact the filter media, while in large systems, a single pass with roller machinery (e.g., a drum lawn roller) should be performed (FAWB, 2009).

Table 8-20 SUMMARY OF FILTER MEDIA PROPERTIES

INDICATOR	REQUIRED TO SUIT MUSIC	Min Requirement
Hydraulic Conductivity (mm/hr)	>180 mm/hr	>100 mm/hr
Filter Material Particle Size	Nominal 0.45mm	Refer Particle Sizing Chart
Nitrogen Content	800 mg/kg	<1000 mg/kg
Orthophosphate Content	20 – 80 mg/kg	<80 mg/kg
Organic Matter Content	> 5%	MIN 3%
PH	5.5 – 7.5	5.5 – 7.5
Electronic Conductivity (EC)	1.2 ds/m	1.2 ds/m

Table 8-21 FILTER MEDIA PARTICLE SIZING CHART

MATERIAL	% IN FILTER MATERIAL	PARTICLE SIZING
CLAY & SILT	3%	< 0.05 mm
VERY FINE SAND	5% - 30%	0.05 – 0.15 mm
FINE SAND	10% - 30%	0.15 – 0.25 mm
MEDIUM TO COURSE SAND	40% - 60%	0.25 – 1.00 mm
COURSE SAND	7% – 10%	1.00 – 2.00 mm
FINE GRAVEL	< 3%	2.00 – 3.40 mm

TRANSITION LAYER MATERIAL

The transition layer material shall be a clean, well-graded sand material containing <2% fines and shall be designed to avoid migration of the filter media into the transition and drainage layers. The minimum depth of transition material shall be 100mm

Table 8-22 TRANSITIONAL LAYER MATERIAL PROPERTIES

MATERIAL	REQUIRED TO SUIT MUSIC
Clean well graded Sand	$D_{15} \text{ (transition)} \leq 5 \times D_{85} \text{ (filter)}$

DRAINAGE LAYER MATERIAL

The drainage material shall be washed / clean fine gravels as per the following table. For a more sustainable solution materials such as crushed recycled concrete may also be used, however they must be washed and not contain fine particles that may potentially block the drainage pipes. There should be a minimum 50mm of drainage material above any drainage pipe to avoid ingress of the sand from the transition layer, therefore the minimum drainage layer depth will be $d + 50\text{mm}$ (d = pipe diameter). All drainage pipes shall be graded at a minimum 1%, so the drainage layer depth will be increased to suit the fall towards the outlet.

Table 8-23 DRAINAGE LAYER MATERIAL PROPERTIES

MATERIAL	REQUIRED TO SUIT MUSIC
Clean Fine Gravel	2.0 – 5.0 mm Washed Screening $D_{15} \text{ (drainage)} \leq 5 \times D_{85} \text{ (transition)}$ No fines (washed)

8.9. MUSIC ANALYSIS / RESULTS

A MUSIC analysis was carried out based on the proposed treatment train shown in Figure 8-10 of this Report. The results of the annual pollutant load reductions tabulated below.

Table 8-24 SUMMARY OF POLLUTANT TARGETS FOR TREATMENT TRAIN

INDICATOR	WQO's Target	WQO's ACHIEVED	OBJECTIVES MET
TSS (Total Suspended Solids)	80%	80.9%	YES
TP (Total Phosphorus)	60%	73.1%	YES
TN (Total Nitrogen)	45%	53.4%	YES
GP (Gross Pollutants)	90%	100%	YES

As shown above the proposed treatment train is effective in meeting the Water Quality Objectives and therefore will be adopted for the subject site.

PROPOSED BASIN QUALITY PARAMETERS

The bioretention component of the proposed combined basin has been designed to achieve the required WQO's. The key quality parameters adopted within the MUSIC model are summarised below:

- Bioretention Filter Area: 75.00m²
- Bioretention Filter Depth: 0.500m
- Extended Detention Depth: 0.300m

9.0 STORMWATER QUALITY BEST MANAGEMENT PRACTICE

9.1. SELECTION OF SQBMP's

There exist a number of publications describing the different types, functions, applications, and performance of many SQBMP's. Water Sensitive Urban Design should be used to look at the integration of SQBMP's within any Stormwater Quality Management Plan. Some of the more typical SQBMP's are listed in the below table for consideration.

Table 9-25 TYPICAL SQBMP'S

STORMWATER QUALITY BEST MANAGEMENT PRACTICES	
Treatment Device / Practice	Benefits
Site Maintenance	Reduce the amount of gross pollutants and sediment runoff generated by the Development by maintaining vegetated areas and the removal of debris and litter.
Rubbish Bins	Reduce the amount of gross pollutants generated by the Development by collecting and dumping litter and/or waste.
Filter Baskets (within inlet pits)	Reduction in gross pollutants and total suspended solids generated by the Development by filtering water prior to entering the stormwater system which traps litter, debris and fine sediment.
Gross Pollutant Traps (GPT's)	Removal of gross pollutants generated by the Development site. Some GPT's that are available on the market today can also remove hydrocarbons from runoff, thus reducing any oil and fuel pollutants generated by the Development.
Rainwater Re-Use	Re-using generated site runoff for landscaping and irrigation purposes etc. will reduce pollutant loads generated by the Development site.
Grass Swales	Directing site runoff to grass swales prior to discharging will have a reduction to the total pollutants generated by the Development.
Sand Filters (Bio-Retention)	Directing site runoff to a bio-retention basin prior to discharging will have a reduction to the total pollutants generated by the Development.

When choosing to adopt selected SQBMP's, it is important to identify the expected pollutants that the proposed Development will generate during its operational phase. A summary of the expected typical pollutants can be found within Table 8-15 of this Report.

Based on the expected pollutants and this Development's expected residential activities, the following is a summary of the SQBMP's that are recommended to be adopted as a minimum.

- Grassed Swales

GRASSED SWALES

Grassed swales will be incorporated within the Development to convey and passively treat stormwater runoff from the southern lots prior to discharge to the existing unformed open drain. The swales provide a degree of gross pollutant and sediment removal through filtration and settling as runoff passes over the vegetated surface.

10.0 MONITORING AND MAINTENANCE

10.1. MAINTENANCE REQUIREMENTS

Routine maintenance of the proposed infrastructure is required to minimise the potential for untreated stormwater discharging from the site.

The stormwater treatment device(s) shall be maintained using the following documentation;

- Manufacturers specifications for proprietary stormwater management devices,
- Maintenance checklists and rectification works attached to this Report.

10.2. MAINTENANCE FREQUENCY

More detailed performance information with regard to maintenance frequency and scheduled maintenance tasks for the site can be obtained by actively developing a maintenance log (refer below); however, it does not supersede maintenance requirements outlined in the manufacturers' specifications for proprietary elements of the SBSMP.

10.3. MAINTENANCE RECORD

A record of all maintenance checks for all stormwater controls on-site should be kept to evolve an appropriate maintenance routine to reflect the particular characteristics of the adopted treatment devices. It will also allow management of the site to refine the maintenance frequencies listed in this Report, which were based on generic devices located in typical urban environments.

The record is to be used to create a chain of responsibility for maintenance and should include details of the following:

- The date of maintenance,
- The name of the persons performing the maintenance,
- What types of maintenance actions were performed for each water quality device,

The environmental state of the device including an estimate of the type and weight of litter removed and the amount of sediment captured where appropriate.

11.0 EROSION AND SEDIMENT (E&S) MANAGEMENT

11.1. OBJECTIVES

The objective of Erosion and Sediment Management is to limit soil erosion and control sediment discharge from the proposed Development by using suitable control devices during the four (4) primary phases; Existing, Earthworks, Construction and the Proposed Use.

Typical ESC measures that will be incorporated into these Development phases are highlighted in the following section.

11.2. E&S MANAGEMENT DURING DEVELOPMENT PHASES

PHASE 1 - EXISTING

Prior to construction commencing, the following sediment and erosion control measures will be implemented to minimise disturbance and ensure water quality is maintained:

- Designation of transport routes to ensure minimal vegetation disturbance. Transport routes will have construction exits in accordance with IECA Aust Guidelines,
- Construction entry/exit to be installed and will comprise of a designed gravel pad or placement of hardwood logs in accordance with the IECA Aust Guidelines,
- Install sediment fences around the proposed site (along tow of batter alignment),
- Install check dams if required, and
- Install dust control fences adjacent to the proposed earthworks areas (along property boundary) if required.

PHASE 2 - EARTHWORKS AND PHASE 3 - CONSTRUCTION

The following measures will be undertaken to mitigate water quality impacts during construction phase:

- Sediment fences to be erected at the base of all batters and stockpiles to prevent sediment transportation off site,
- Turf filter strips to be placed along all road verges,
- Diversion swales to divert sediment laden water,
- Rock check dams are to be placed intermittently along diversion swales,
- Re-vegetation of all disturbed areas as soon as possible,
- All sediment control structures to be maintained in an effective manner and inspected after each stormwater event. No structure is to accumulate sediment above 40% of its capacity,
- Regular monitoring of water quality to determine the effectiveness of the sediment and erosion control measures.

PHASE 4 - PROPOSED DEVELOPMENT

Once construction is completed, the following strategies will be implemented to limit soil erosion and control sediment discharge leaving the site:

A monitoring program will be established for the stormwater treatment devices.

11.3. EROSION CONTROL MEASURES

The time of disturbance on-site should be kept to a minimum by ensuring that construction works immediately follow the earthworks phase. Consideration to staging works should be given to minimise the area of exposed works at any given time.

Areas that may be subject to concentrated flow and that have been cleared may require turfing to ensure gully erosion does not start.

Any overburden that is not to be taken off-site should be stockpiled nearby and covered to prevent the mobilization of any particles into the drainage system.

The remaining exposed areas of the site are to be damped down as deemed necessary by the site supervisor to prevent dust. All batters are to have mulch or erosion control mats installed immediately after achieving final level.

Dust fencing is to be installed around the perimeter of earthworks to prevent wind velocities at ground level over the site if required.

The site is to be landscaped and revegetated in accordance with the approved Landscape Plans immediately after completion of construction activities to minimise the risk of erosion from exposed earthworks.

11.4. SEDIMENT CONTROL MEASURES

With reference to the IECA Aust Guidelines and Current Best Practice methods, there are four fundamental sediment control principles that have been identified for use during construction for this Development site and are as follows:

CONSTRUCTION EXIT

A dedicated construction exit is to be located at the sites entry and exit point for vehicles. This exit will be established to facilitate the removal of soil, mud, dust and debris from the tyres of vehicles prior to leaving the construction site. The construction exit can comprise of a gravel pad designed or placement of hardwood logs, constructed and maintained in accordance with the IECA Aust Guideline. Alternatively, a vibratory grid system can be hired or constructed. The advantages of the grid system include ease of movement, and they can be used for several years.

SEDIMENT FENCES

Sediment fencing is to be established down slope of any exposed earthworks where there is a risk of contaminated water leaving the site prior to clearing and site works commencing. Sediment fencing may be required at regular spacing down the disturbed grade to limit rutting caused by concentration of sheet flow. Sediment fences shall be used to protect any temporary stockpile areas on an as-needs basis. Sediment collected from sediment barriers is to be regularly removed and either taken off site as part of the earthworks phase of the proposed Development or stockpiled for use during revegetation.

SEDIMENT BARRIERS

Sediment barriers are to be constructed around all stormwater drainage inlet points where contaminated water may drain to. This will aid in ensuring sediments are settled out prior to flows entering the underground stormwater drainage system. Sediment barriers are to be gravel wrapped in geotextile 'sausage' or similar.

TURF FILTER STRIPS

If required, turf filter strips approximately 600mm minimum wide can be placed on the upstream side of the proposed concreted footpath. These will act in conjunction with sediment fences to further treat any overland flow from the site. Turf filter strips are to be constructed and maintained in accordance with the IECA Aust Guidelines.

12.0 CONCLUSION

12.1. LAWFUL POINT OF DISCHARGE

The proposed Development will maintain the existing lawful point of discharge to the existing unformed open drain (BCC Asset ID: T11000004). No change to the lawful point of discharge is proposed as part of this Development.

12.2. STORMWATER QUANTITY

As demonstrated by the Rational Method and DRAINS modelling presented in Sections 5 and 6 of this Report, the proposed Development results in an increase in post-Development peak discharge across all storm events due to the increase in impervious area and reduction in time of concentration relative to the pre-Development condition.

A combined bioretention and detention basin is proposed on Proposed Lot 101 to attenuate post-Development peak flows from the northern catchment (Sub-Catchment 1/1).

At the direction of Brisbane City Council, the basin has been designed to account for the total site catchment, effectively over-detaining the northern runoff to compensate for the unmitigated southern discharge.

As outlined in Table 6-13 of this Report the DRAINS modelling confirms that the mitigated post-Development discharge does not exceed pre-Development rates for all storm events from Q1 to Q100 and the proposed Development is therefore considered acceptable in terms of stormwater quantity.

12.3. STORMWATER QUALITY

The proposed Development has been identified as 'High Risk' under the State Planning Policy (2017), requiring compliance with the applicable Water Quality Objectives for TSS, TP, TN, and gross pollutants.

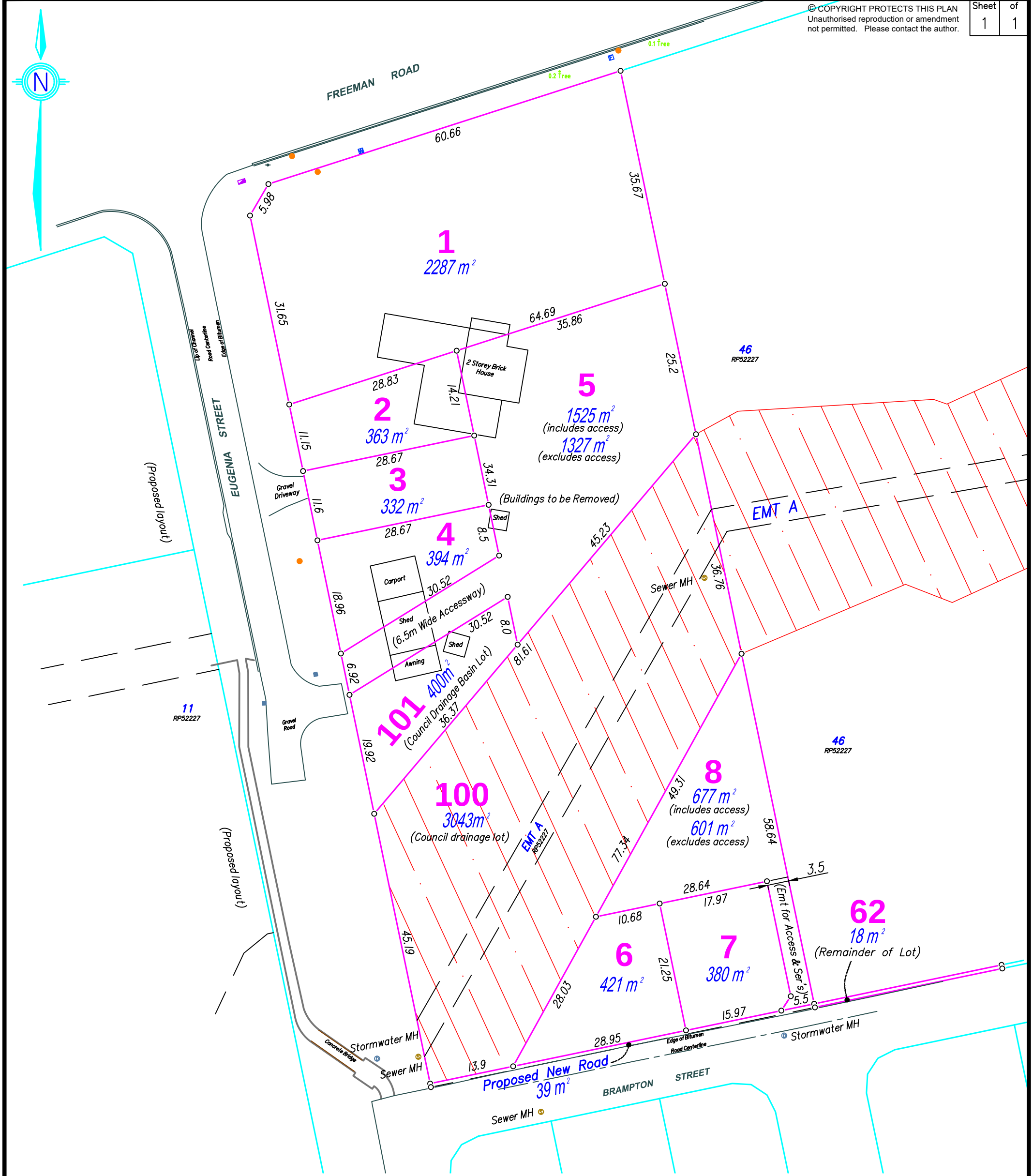
A MUSIC assessment was undertaken and demonstrates that the proposed treatment train, incorporating the combined bioretention and detention basin on Proposed Lot 101 for the northern catchment and a vegetated swale for the southern catchment. The proposed treatment train as illustrated in Figure 8-10 achieves the required pollutant reduction targets as tabulated in Table 8-24.

The proposed Development is therefore considered acceptable in terms of stormwater quality.

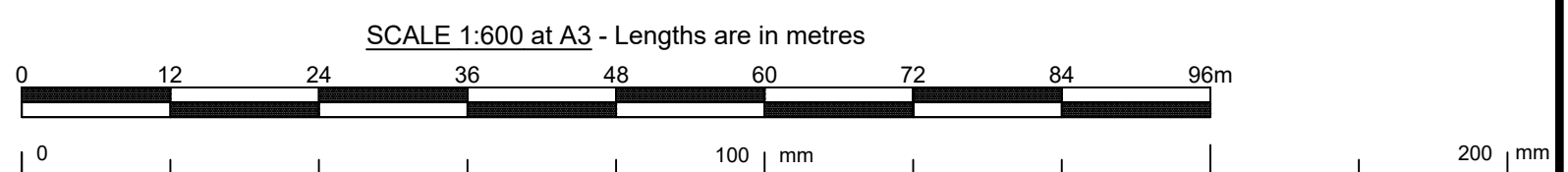
12.4. EROSION AND SEDIMENT CONTROL

An Erosion and Sediment Control (ESC) plan will be completed as part of the detailed design phase of this Development and shall incorporate the recommendations included within this Report. This Report and plan shall remain on site at all times, and it is the responsibility of the Contractor on-site to ensure the assembly and maintenance of all devices throughout the Development.

Appendix A – PROPOSED SUBDIVISION LAYOUT

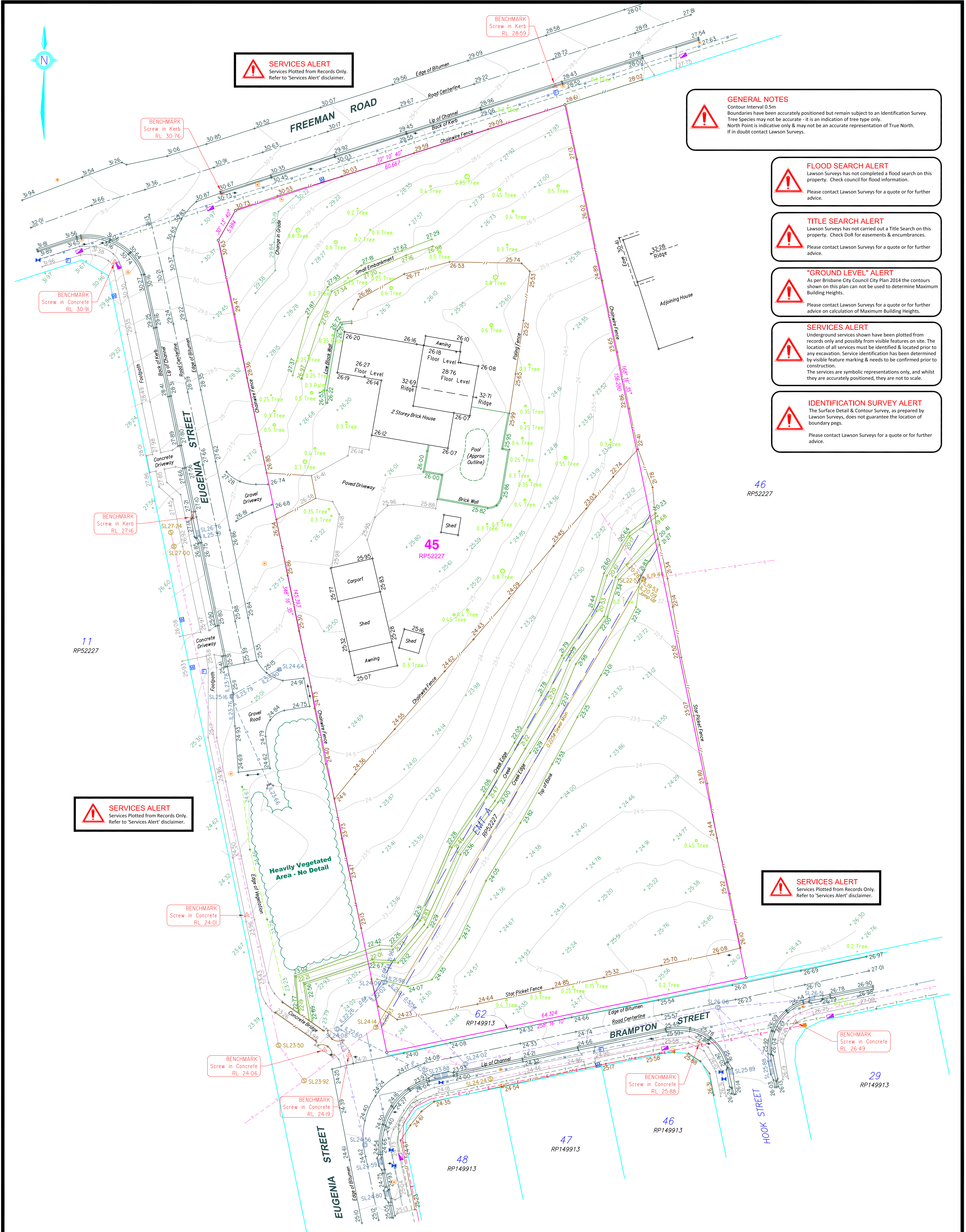


- NOTES**
- 1) DIMENSIONS AND AREAS ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEY.
 - 2) TOTAL AREA OF SUBDIVISION - 9878m²
 - 3) CONTOURS AND SITE DETAILS FROM LAWSON SURVEYS DETAIL AND CONTOUR SURVEY DATED 3/06/2025.
 - 4) ALL STRUCTURES ON SITE TO BE REMOVED.
 - 5) POSSIBLE WATERWAY CORRIDOR SUBJECT TO CHANGE. BCC APPROVAL & HYDRAULICS STUDY.



SUBDIVISION PROPOSAL PLAN Lots 1 - 8, 62, 100, 101 & Easements Cancelling Lot 45 on RP52227 & Lot 62 on RP149913		 LAWSON SURVEYS A.B.N 46 272 949 047 CONSULTING LAND SURVEYORS 9B / 62 BISHOP STREET KELVIN GROVE QLD 4059 Ph 07 3352 3326 Fax 07 3352 6991 mail@lawsonsurveys.com.au www.lawsonsurveys.com.au		
LOCATION 288 Freeman Road Inala				
LEVEL DATUM AHD - VIDE BCC EBIMAP	DRAWN CM/SPK DWG 21478 Prop.G	LOCAL AUTHORITY BRISBANE CITY COUNCIL	REFERENCE 21478	ISSUE G DATE 5/05/2026

Appendix B – DETAIL SURVEY



PLAN SHOWING SURFACE DETAIL & CONTOURS		CLIENT	DUYEN TIEN	
LEVEL DATUM AHD - VIDE PSM 11439 RL 22.893	SCALE 1:300 @ A1	LOCATION	290 FREEMAN ROAD INALA	
LOCAL AUTHORITY BRISBANE CITY COUNCIL	DATE 03/06/2025	RPD	LOT 45 ON RP52227	
MERIDIAN DP332581	SURVEYED BY RC			
DWG NAME ACAD-21478-DT	DRAWN BY RC			



A.B.N 46 272 949 047
CONSULTING LAND SURVEYORS
9B / 62 BISHOP STREET
KELVIN GROVE QLD 4059
Ph 07 3352 3326 Fax 07 3352 6991
mail@lawsonsveys.com.au
www.lawsonsveys.com.au

© COPYRIGHT PROTECTS THIS PLAN
Unauthorised reproduction or amendment
not permitted. Please contact the author.

REFERENCE **21478-DT**

A	03/06/2025	INITIAL ISSUE
ISSUE	DATE	COMMENTS

Appendix C - BCC MAPPING RESULTS



Waterway corridors



Local waterway corridor

Local Government Authorities



LGA boundary

Property boundaries holding



Property Holding



City Plan 2014 — Zoning overlay

	Refer to Part 10 of the planning scheme
	LDR Low density residential
	CR1 Character residential (Character)
	CR2 Character residential (Infill housing)
	LMR1 Low-medium density residential (2 storey mix)
	LMR2 Low-medium density residential (2 or 3 storey mix)
	LMR3 Low-medium density residential (Up to 3 storeys)
	MDR Medium density residential
	HDR1 High density residential (Up to 8 storeys)
	HDR2 High density residential (Up to 15 storeys)
	TA Tourist accommodation
	NC Neighbourhood centre
	DC1 District centre (District)
	DC2 District centre (Corridor)
	MC Major centre
	PC1 Principal centre (City centre)
	PC2 Principal centre (Regional centre)
	LII Low impact industry
	IN1 General industry A
	IN2 General industry B
	IN3 General industry C
	SI Special industry
	II Industry investigation
	SR Sport and recreation
	SR1 Sport and recreation (Local)
	SR2 Sport and recreation (District)
	SR3 Sport and recreation (Metropolitan)
	OS Open space
	OS1 Open space (Local)
	OS2 Open space (District)
	OS3 Open space (Metropolitan)
	EM Environmental management
	CN Conservation
	CN1 Conservation (Local)
	CN2 Conservation (District)
	CN3 Conservation (Metropolitan)
	EC Emerging community
	EI Extractive industry
	MU1 Mixed use (Inner city)

-  MU2 Mixed use (Centre frame)
-  MU3 Mixed use (Corridor)
-  RU Rural
-  RR Rural residential
-  T Township
-  CF1 Community facilities Major health care
-  CF2 Community facilities Major sports venue
-  CF3 Community facilities Cemetery
-  CF4 Community facilities Community purposes
-  CF5 Community facilities Education purposes
-  CF6 Community facilities Emergency services
-  CF7 Community facilities Health care purposes
-  SC1 Specialised centre (Major education and research facility)
-  SC2 Specialised centre (Entertainment and conference centre)
-  SC3 Specialised centre (Brisbane Markets)
-  SC4 Specialised centre (Large format retail)
-  SC5 Specialised centre (Mixed industry and business)
-  SC6 Specialised centre (Marina)
-  SP1 Special purpose (Defence)
-  SP2 Special purpose (Detention facility)
-  SP3 Special purpose (Transport infrastructure)
-  SP4 Special purpose (Utility services)
-  SP5 Special purpose (Airport)
-  SP6 Special purpose (Port)

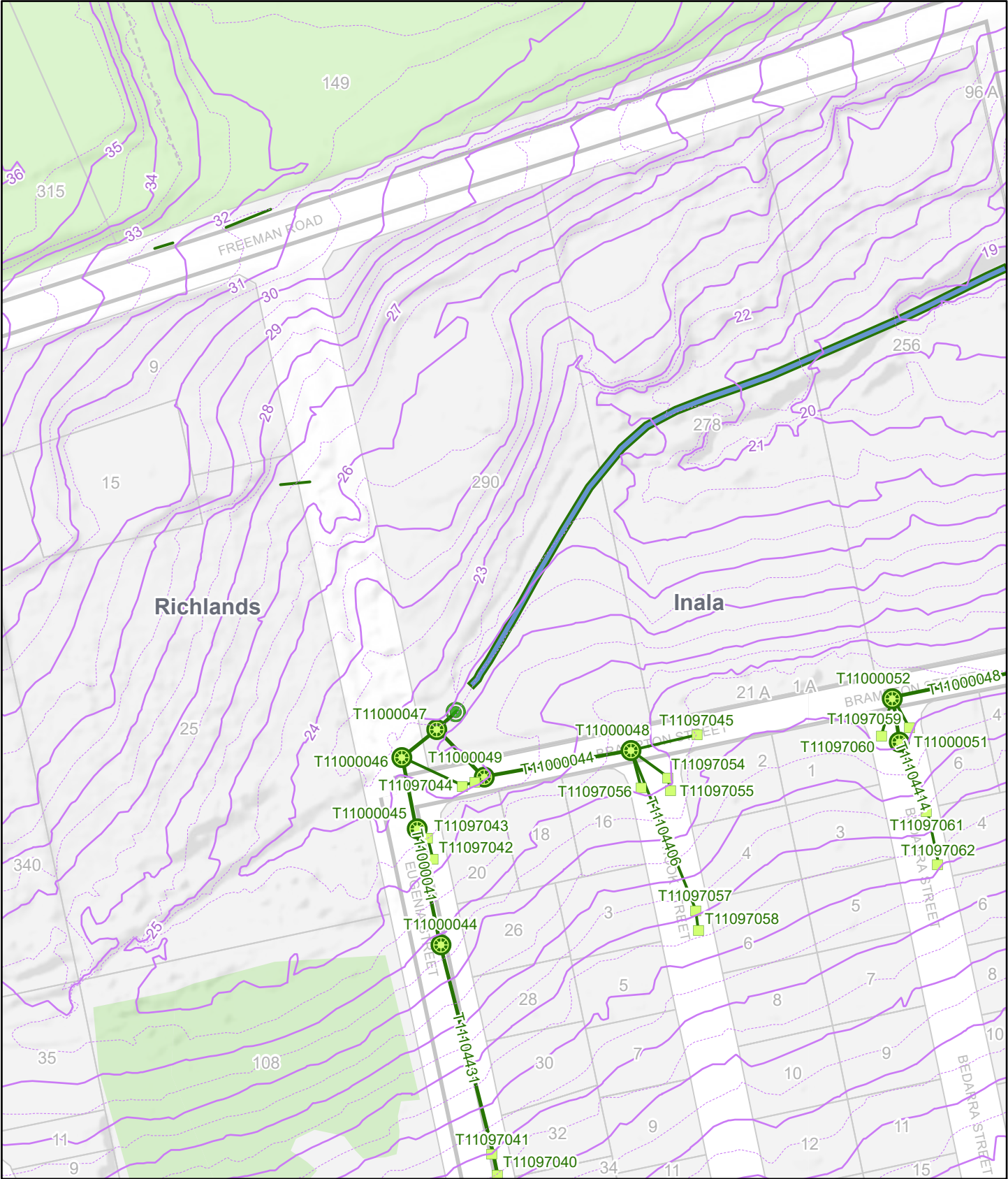
Local Government Authorities

-  LGA boundary

Property boundaries holding

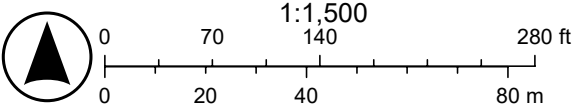
-  Property Holding

290 Freeman -SWD



12/06/2026, 10:02:37

- | | | |
|------------------------------|----------------------|--------------------|
| Contours — 2002 | ● Junction | Surface Drain |
| Intermediate - 1m Contour | ● Stormwater Manhole | Waterbody |
| Supplementary - 0.5m Contour | Pipe | Artesian Well |
| Culvert | DRAIN | Detention Basin |
| End Structure | FOUL WATER | Lake |
| End cap | GULLY CONNECT | Sealed Plan |
| Flood Gate | ROOF WATER | Property Parcel |
| Pipe End Outlet | SQID | Parcel Outside BCC |
| Gully | | |



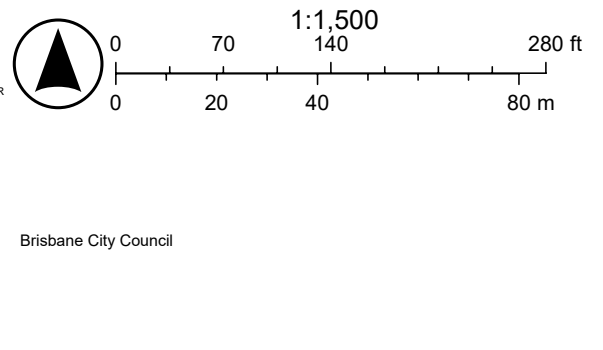
Brisbane City Council

290 Freeman - Water and Sewer



12/06/2026, 10:02:59

Water Control Valve		Water System Valve		GIBBAULT JOINT	
	Reflex		BALL		TAPPING BAND
	Scour		BUTTERFLY		TAPPING
	Air		GATE		REDUCER
	Pressure Sustaining		Water Fitting		WYE
	Pressure Reducing		BEND		TEE
	Altitude		PIGGING POINT		RESERVOIR INLET
	Flow Control		END CAP		RESERVOIR OUTLET
			CROSS		
			JOINT		



Appendix D - BCC FLOODWISE PROPERTY REPORT

FloodWise Property Report

290 FREEMAN RD, INALA 4077
Lot 45 on RP52227



Dedicated to a better Brisbane

THE PURPOSE OF THIS REPORT IS FOR BUILDING AND DEVELOPMENT

Brisbane City Council's FloodWise Property Report provides technical flood planning information including estimated flood levels, habitable floor level requirements and more. This report uses the adopted flood planning information in **Brisbane City Plan 2014**, that guides how land in Brisbane is used and developed for the future. Find out more about [planning and building](#). To understand how to be resilient and prepare for floods, visit Council's [Be Prepared](#) webpage. Find more information about [how to read a FloodWise Property Report](#).

This property has no flood levels

Brisbane City Council has not assigned flood level information for this property however it may be affected by one or more flood or property development flags. Please refer to the Flood Planning and Development Information below for details. The property may have 0.2% AEP flood level which will appear on the Flood Planning Information table if applicable. For professional advice or detailed assessment of a property contact a Registered Professional Engineer of Queensland.

Visit the [Be Prepared](#) page to find more information on how to prepare your home or business for potential flooding.

 **Combined** 1% AEP for river, creek and storm tide flood extent (if applicable) from the adopted Brisbane City Plan 2014. Read more about [Brisbane City Plan 2014](#).



Brisbane City Council | Includes material © The State of Queensland, all rights reserved, 2019. | © Brisbane City C... Powered by Esri

Are you resilient and ready for flood?

- Sign up to the Brisbane Severe Weather Alert at brisbane.qld.gov.au/beprepared
- Visit bom.gov.au for the latest weather updates.
- Have an evacuation plan, emergency kit and important phone numbers ready.
- Observe where water flows from and to during heavy rain.
- Consider how flood-resilient building techniques will have you home faster and with less damage.

Life threatening emergencies
000 Police/fire/ambulance
(mobiles **000** and **112**)

State Emergency Service (SES) **132 500**
Energex **13 19 62**
Brisbane City Council **3403 8888**

Technical Summary

This section of the FloodWise Property Report contains more detailed flood information for this property so **surveyors, builders, certifiers, architects, and engineers can plan and build** in accordance with Council's planning scheme.

Find more information about [planning and building](#) in Brisbane or talk to a Development Services Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

Property Information Summary

The following table provides a summary of flood information for this property. More detailed flood level information is provided in the following sections of this report.

Property Summary	Level (mAHD) / Comment	Data Quality Code
Minimum ground level	21.1	C
Maximum ground level	30.6	C
Indicative existing floor level	26.3	C

Flood Planning and Development Information

This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

Flood overlay code

The Flood overlay code of Council's planning scheme uses the following information to provide guidelines when developing properties. The table below summarises the flood planning areas (FPAs) that apply to this property. Development guidelines for the FPAs are explained in [Council's planning scheme](#).

Flood planning areas (FPA)		
River	Creek / waterway	Overland flow
		Applicable

To find more information about Council's flood planning areas (FPAs) for Brisbane River and Creek/waterway flooding to guide future building and development in flood prone areas, please review [Council's Flood Planning Provisions](#).

Coastal hazard overlay code

The Coastal hazard overlay code of Council's planning scheme uses the following information to provide guidelines when conducting new developments. The table below summarises the coastal hazard categories that apply to this property. Development guidelines for the following Coastal hazard overlay sub-categories are explained in Council's [planning scheme](#).

Coastal hazard overlay sub-categories
There are currently no Coastal hazard overlay sub-categories that apply to this property.

Note: Where land is identified within one for more flood planning areas on the Flood overlay or is identified within one of the Storm tide inundation area sub-categories on the Coastal hazard overlay, the assessment criteria that provides the highest level of protection from any source of flooding applies.

Property development flags

Waterway corridor - This property may also be located within a mapped waterway corridor as identified in the Waterway corridors overlay map of Council's planning scheme. Please consider this in conjunction with Council's planning scheme requirements.

Overland flow path - Mapping indicates this property may be located within an overland flow path. Overland flow flooding usually occurs when the capacity of the underground piped drainage system is exceeded and/or when the overland flow path is blocked. It is recommended you consult a Registered Professional Engineer of Queensland (RPEQ) to determine this property's habitable floor level and flooding depth. Please refer to Council's planning scheme for further information.

Large allotment - This property is either a Large Allotment of over 1000 square metres or is located within a Large Allotment. Flood levels may vary significantly across allotments of this size. Further investigations may be warranted in determining the variation in flood levels and the minimum habitable floor level across the site.
For more information or advice, please consult a Registered Professional Engineer of Queensland (RPEQ).

Useful Flood Information Definitions

Australian Height Datum (AHD) - The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Annual Exceedance Probability (AEP) - The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance.

- **0.2% AEP** - A flood event of this size is considered rare but may still occur. A flood of size or larger has a 1 in 500 chance or a 0.2% probability of occurring in any year.
- **1% AEP** - A flood of this size or larger has a 1 in 100 chance or a 1% probability of occurring in any year.
- **2% AEP** - A flood of this size or larger has a 1 in 50 chance or a 2% probability of occurring in any year.
- **5% AEP** - A flood of this size or larger has a 1 in 20 chance or a 5% probability of occurring in any year.
- **20% AEP** - A flood of this size or larger has a 1 in 5 chance or a 20% probability of occurring in any year.

Data quality

- **Data Quality Code A** - Level data based on recent surveyor report or approved as-constructed drawings.
- **Data Quality Code B** - Level data based on ground-based mobile survey or similar.
- **Data Quality Code C** - Level data derived from Airborne Laser Scanning or LiDAR information.

Defined Flood Level (DFL) - The DFL is used for commercial and industrial development. The Defined flood level (DFL) for Brisbane River flooding is a level of 3.7m AHD at the Brisbane City Gauge based on a flow of 6,800 m/s. DFL is only applicable for non-residential uses affected by Brisbane River flooding.

Flood planning area (FPA) - Council has developed five Flood planning areas (FPAs) as part of Brisbane City Plan 2014 Flood overlay mapping for Brisbane River, Creek/waterway flooding and Overland flow to guide future building and development in flood prone areas. Storm tide flooding is mapped separately. The FPAs are designed to recognise the flood hazard for different flooding types. Flood hazard is a combination of frequency of flooding, the flood depth, and the speed at which the water is travelling. [Find more information here.](#)

Maximum and minimum ground level - Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum habitable floor level (dwelling house) - The minimum level in metres AHD at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family, and rumpus rooms) must be constructed as required by the Brisbane City Plan 2014.

Indicative existing floor level - The approximate level in metres AHD of the lowest habitable floor in the existing building (excluding apartments). The data is sourced from a range of sources with varying accuracy levels.

Property - A property will contain 1 or more lots. The multiple lot warning is shown if you have selected a property that contains multiple lots.

Residential flood level (RFL) - This flood level for the Brisbane River equates to the 1% annual exceedance probability (AEP) flood level.

To learn more, visit [Brisbane City Council's Flood Information Hub](#)

Brisbane City Council's Online Flood Tools

Council provides several online flood tools:

- to guide planning and development
- to help residents and businesses understand their flood risk and prepare for flooding.

Council's online flood tools for planning and development purposes include:

- **FloodWise Property Report**
- **Flood Overlay Code**

For more information on Council's planning scheme and online flood tools for planning and development:

- phone (07) 3403 8888 and ask to talk to a Development Services Planning Information Officer

- visit brisbane.qld.gov.au/planning-building

Council's Planning Scheme - The Brisbane City Plan 2014 (planning scheme) has been prepared in accordance with the Sustainable Planning Act as a framework for managing development in a way that advances the purpose of the Act. In seeking to achieve this purpose, the planning scheme sets out the Council's intention for future development in the planning scheme area, over the next 20 years.

Disclaimer

1. Defined flood levels and residential flood levels, minimum habitable floor levels and indicative existing floor levels are determined from the best available information to Council at the date of issue. These levels, for a particular property, may change if more detailed information becomes available or changes are made in the method of calculating levels.
2. Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property Report. Council disdaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.



Planning to build or renovate?

For information, guidelines, tools and resources to help you track, plan or apply for your development visit brisbane.qld.gov.au/planning-building

You can also find the Brisbane City Plan 2014 and Neighbourhood Plans as well as other information and training videos to help, with your building and development plans.

Appendix E – CONCEPT CIVIL PLANS

290 FREEMAN ROAD, INALA QLD 4077
PROPOSED RESIDENTIAL SUBDIVISION
ROOFBROOK CONSULTING ENGINEERS PTY LTD



LOCALITY PLAN
SCALE N.T.S

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER

WHILE EVERY CARE IS TAKEN BY NAXOS ENGINEERS PTY LTD TO ENSURE THE ACCURACY OF THE DATA SUPPLIED BY LOCAL AUTHORITIES, DIAL BEFORE YOU DIG (DBYD) RECORDS, AS CONSTRUCTED INFORMATION AND DETAILED SURVEY, WE MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT ITS ACCURACY, RELIABILITY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE AND DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY (INCLUDING WITHOUT LIMITATION, LIABILITY IN NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES (INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGE) AND COSTS WHICH MAY BE INCURRED AS A RESULT OF DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY AND FOR ANY REASON.

WATER RETICULATION LEGEND		
EXISTING	PROPOSED	ITEM DESCRIPTION
		WATER RETICULATION MAIN - POTABLE
		WATER RETICULATION MAIN - RECYCLED
		DISUSED WATER RETICULATION MAIN
		FIRE HYDRANT
		ISOLATION VALVE
		SCOUR VALVE
		AIR VALVE
		DEAD END
		CONNECTOR
		TEST/CHLORINATION POINT
		REDUCER
		PIPE MATERIAL CHANGE
		ISOLATION VALVE TO REMAIN CLOSED PENDING CLEARANCE OF NEW MAIN
		WATER METER (SMALL / LARGE)
		FLUSHING POINT
		HYDRANT - OPERATIONAL PURPOSES ONLY
		BOUNDARY VALVE
		FLOW METER
		THRUST / ANCHOR BLOCK
		ENCASING / ENVELOPER PIPE
		WATER SERVICE CONDUIT
NOTES: 1. THIS IS A GENERIC LEGEND. NOT ALL ITEMS WITHIN THIS LEGEND MAY BE PRESENT ON THIS PLAN AND THE SCALE OF THE ITEMS MAY BE DIFFERENT TO THE ITEMS PRESENTED ON THIS PLAN.		

STORMWATER DRAINAGE CATCHMENT LEGEND		
EXISTING	PROPOSED	ITEM DESCRIPTION
		STORMWATER DRAINAGE PIPE CULVERT
		STORMWATER DRAINAGE BOX CULVERT
		STORMWATER MANHOLE
		STORMWATER GULLY PIT (LIP IN LINE)
		STORMWATER GULLY PIT (KERB IN LINE)
		STORMWATER FIELD INLET WITH GRATE
		STORMWATER FIELD INLET WITH DOME
		STORMWATER TRENCH GRATE
		STORMWATER HEADWALL
		STORMWATER OVERLAND FLOW PATH
		STORMWATER CATCHMENT BOUNDARY
		STORMWATER IMPERVIOUS SURFACE
		STORMWATER PERVIOUS SURFACE
		STORMWATER CATCHMENT NAME (NOTE: RW (PREFIX) DENOTES ROOFWATER CATCHMENT)
NOTES: 1. THIS IS A GENERIC LEGEND. NOT ALL ITEMS WITHIN THIS LEGEND MAY BE PRESENT ON THIS PLAN AND THE SCALE OF THE ITEMS MAY BE DIFFERENT TO THE ITEMS PRESENTED ON THIS PLAN.		

SERVICES LEGEND		
EXISTING	PROPOSED	ITEM DESCRIPTION
		ELECTRICAL SERVICE - UNDERGROUND
		ELECTRICAL SERVICE - OVERHEAD
		GAS MAIN
		TELECOMMUNICATIONS - UNDERGROUND
		TELECOMMUNICATIONS - OVERHEAD
		TELECOMMUNICATIONS - NBN
		TELECOMMUNICATIONS - OPTIC FIBRE
		SEWER MAIN
		WATER RETICULATION MAIN - RECYCLED
		WATER RETICULATION MAIN - POTABLE
		STORMWATER DRAINAGE
		ROOFWATER DRAINAGE

SEWERAGE RETICULATION LEGEND		
EXISTING	PROPOSED	ITEM DESCRIPTION
		GRAVITY MAIN
		DISUSED / ABANDONED GRAVITY MAIN
		FLOW DIRECTION
		PROPERTY CONNECTION
		RISING MAIN
		DISUSED / ABANDONED RISING MAIN
		MANHOLE STRUCTURE (MH)
		MAINTENANCE STRUCTURE (MS)
		TERMINAL ENTRY POINT (TEP)
		LOT CONTROL LEVEL
		ALLOTMENT FALL
		STRUCTURE NAME
		BEND NAME (HB DENOTES HORIZONTAL BEND) (VB DENOTES VERTICAL BEND)
NOTES: 1. THIS IS A GENERIC LEGEND. NOT ALL ITEMS WITHIN THIS LEGEND MAY BE PRESENT ON THIS PLAN AND THE SCALE OF THE ITEMS MAY BE DIFFERENT TO THE ITEMS PRESENTED ON THIS PLAN.		

ISSUE FOR APPROVAL

290 FREEMAN ROAD, INALA QLD 4077

NAXOS
ENGINEERS

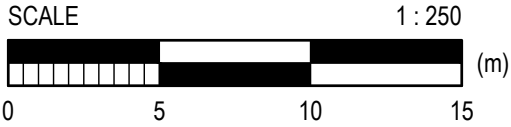
T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

Surveyor:
LAWSON SURVEYS
Plan Ref.: ACAD-21478-DT
Level Datum AHD
AHD-VIDE PSM 11439
RP Description:
LOT 45
RP52227
Size of Land:
9853m²

Orig. Drg. Size
A1
Job No.
23-136
Drawing No.
SK000
Scale:
N.T.S
Rev.
A1

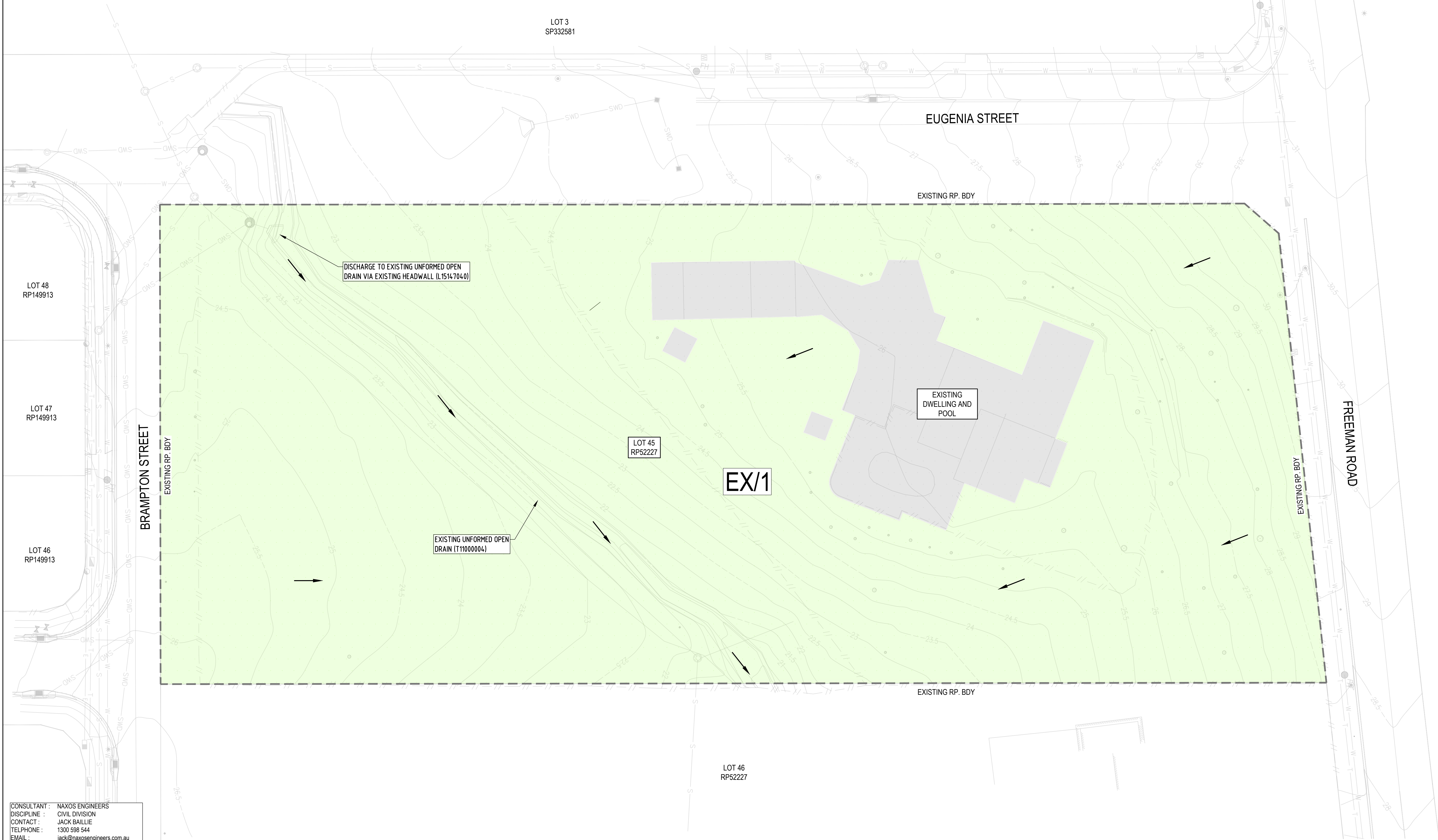
PRELIMINARY

NOTE:
REFER TO SK000 FOR LEGEND.



ISSUE FOR APPROVAL

STORMWATER CATCHMENT TABLE					
STORM EVENTS: MINOR 10yr, MAJOR 100yr			INTENSITY (1hr/10yr ARI): 61.80mm/Hr		
CATCHMENT NAME	CATCHMENT AREA (ha)	FRACTION IMPERVIOUS	TIME OF CONCENTRATION	MINOR COEFFICIENT	MAJOR COEFFICIENT
EX1	0.9853	0.10	15.00	0.70	0.84



CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : JACK BAILLIE
TELEPHONE : 1300 598 544
EMAIL : jack@naxosengineers.com.au

NAXOS
ENGINEERS

T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley, Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

AMENDMENTS			
No.	DATE	DESCRIPTION	DRAWN
A	10.06.2026	PRELIMINARY ISSUE	CW
B	14.07.2026	ISSUE FOR APPROVAL	JB

Associated Consultant:
ASSOCIATED CONSULTANT

Approved: GREGG TYQUIN

RPEQ. 1528 Date:

Drawn: CW

Checked: JB

Design: JB

Supervisor: JB

DISCLAIMER NOTE:

THIS PLAN WAS PREPARED FOR DISCUSSION AND ESTIMATING PURPOSES. THE LAYOUT SHOWN IS INDICATIVE ONLY AND MAY BE SUBJECT TO LOCAL AUTHORITY / GOVERNMENT REQUIREMENTS AND FURTHER DETAILED ENGINEERING DESIGN.

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON OR CORPORATION OTHER THAN LISTED AS THE 'CLIENT' ON THIS PLAN.
NAXOS ENGINEERS PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE SUFFERED HOWEVER SO ARISING TO ANY PERSON OR CORPORATION WHO MAY USE OR RELY ON THIS PLAN IN CONTRAVENTION OF THE TERMS OF THIS CLAUSE. ALL COPIES OF THIS PLAN MUST INCLUDE THIS DISCLAIMER.

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER

WHILE EVERY CARE IS TAKEN BY NAXOS ENGINEERS PTY LTD TO ENSURE THE ACCURACY OF THE DATA SUPPLIED BY LOCAL AUTHORITIES, DIAL BEFORE YOU DIG (DBYD) RECORDS, AS CONSTRUCTED INFORMATION AND DETAILED SURVEY, WE MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT ITS ACCURACY, RELIABILITY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE AND DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY (INCLUDING WITHOUT LIMITATION, LIABILITY IN NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES (INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGES) AND COSTS WHICH MAY BE INCURRED AS A RESULT OF DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY AND FOR ANY REASON.



Size of Land:
9853M²
Scale:
1:250

Client:

Project:

PRE-DEVELOPMENT CATCHMENT PLAN

ROOFBROOK CONSULTING ENGINEERS PTY LTD

290 FREEMAN ROAD, INALA QLD 4077
PROPOSED RESIDENTIAL SUBDIVISION

Job No.

25-136

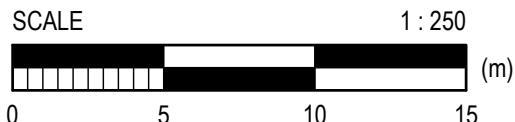
Drawing No.

SK001

Revision:

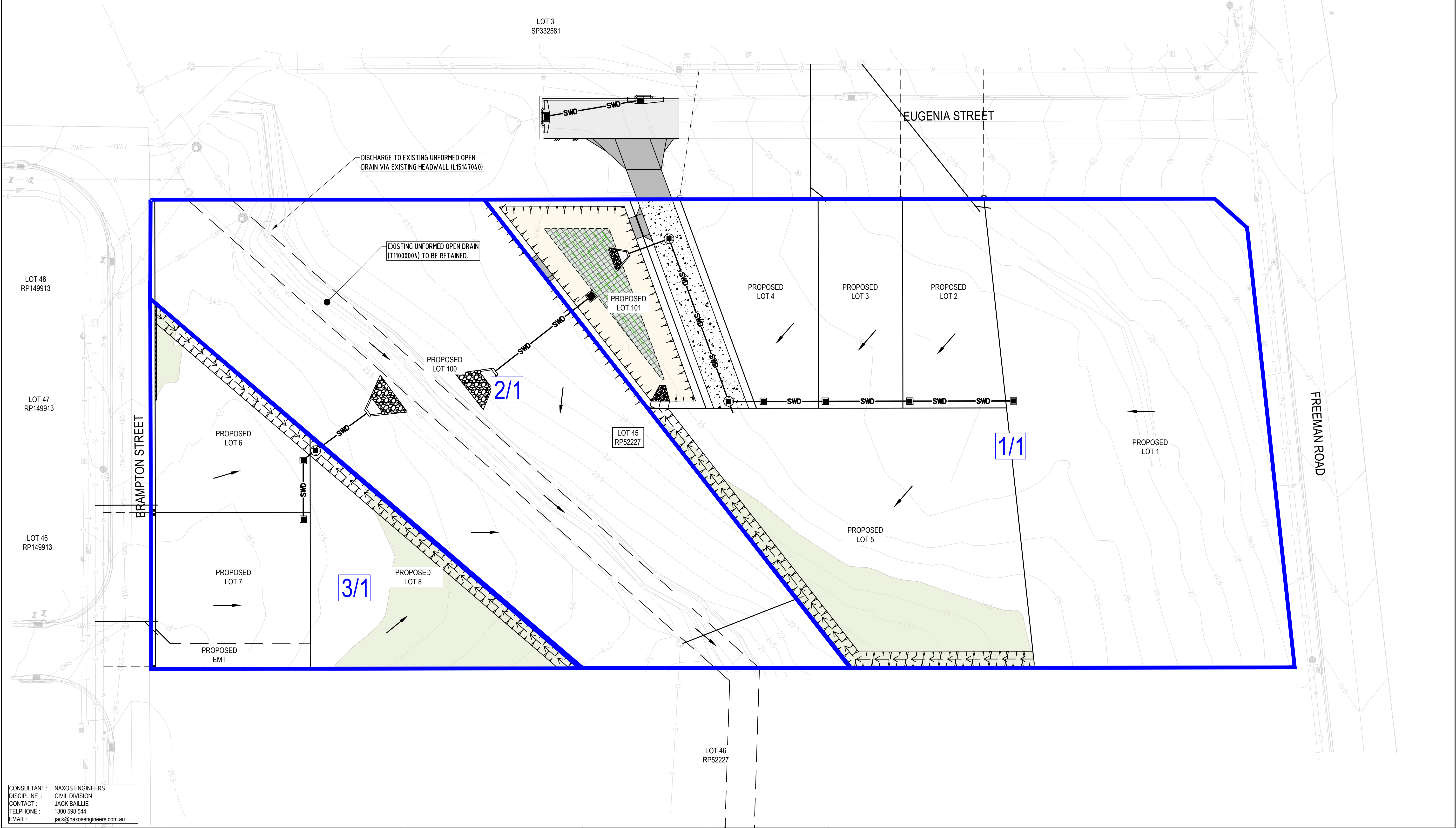
B

NOTE:
REFER TO SK000 FOR LEGEND.



ISSUE FOR APPROVAL

STORMWATER CATCHMENT TABLE					
STORM EVENTS: MINOR 10yr, MAJOR 100yr INTENSITY (1hr/10yr ARI): 61.80mm/Hr					
CATCHMENT NAME	CATCHMENT AREA (ha)	FRACTION IMPERVIOUS	TIME OF CONCENTRATION	MINOR COEFFICIENT	MAJOR COEFFICIENT
1/1	0.530	0.60	5	0.78	0.94
2/1	0.304	0	10	0.70	0.84
3/1	0.151	0.60	5.00	0.78	0.94



CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : JACK BAILLIE
TELEPHONE : 1300 598 544
EMAIL : jack@naxosengineers.com.au

NAXOS
ENGINEERS

T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley, Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

AMENDMENTS			
No.	DATE	DESCRIPTION	DRAWN
A	10.06.2026	PRELIMINARY ISSUE	CW
B	14.07.2026	ISSUE FOR APPROVAL	JB

Associated Consultant: ASSOCIATED CONSULTANT			
Approved: GREGG TYQUIN			
RPEQ. 1528	Date:	Drawn: CW	Design: JB
		Checked: JB	Supervisor: JB

DISCLAIMER NOTE:
THIS PLAN WAS PREPARED FOR DISCUSSION AND ESTIMATING PURPOSES. THE LAYOUT SHOWN IS INDICATIVE ONLY AND MAY BE SUBJECT TO LOCAL AUTHORITY / GOVERNMENT REQUIREMENTS AND FURTHER DETAILED ENGINEERING DESIGN.

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON OR CORPORATION OTHER THAN LISTED AS THE 'CLIENT' ON THIS PLAN.

NAXOS ENGINEERS PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE SUFFERED HOWEVER SO ARISING TO ANY PERSON OR CORPORATION WHO MAY USE OR RELY ON THIS PLAN IN CONTRAVENTION OF THE TERMS OF THIS CLAUSE. ALL COPIES OF THIS PLAN MUST INCLUDE THIS DISCLAIMER.

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER
WHILE EVERY CARE IS TAKEN BY NAXOS ENGINEERS PTY LTD TO ENSURE THE ACCURACY OF THE DATA SUPPLIED BY LOCAL AUTHORITIES, DIAL BEFORE YOU DIG (DBYD) RECORDS, AS CONSTRUCTED INFORMATION AND DETAILED SURVEY, WE MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT ITS ACCURACY, RELIABILITY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE AND DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY (INCLUDING WITHOUT LIMITATION, LIABILITY IN NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES (INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGE) AND COSTS WHICH MAY BE INCURRED AS A RESULT OF DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY AND FOR ANY REASON.

North: Orig. Dwg. Size A1	Size of Land: 9853M²	Client: ROOFBROOK CONSULTING ENGINEERS PTY LTD	Job No. 25-136	Revision: B
	Scale: 1:250	Project: 290 FREEMAN ROAD, INALA QLD 4077 PROPOSED RESIDENTIAL SUBDIVISION	Drawing No. SK002	
	POST-DEVELOPMENT CATCHMENT PLAN			

SCALE 1 : 250

0 5 10 15 (m)

NOTE:
REFER TO SK000 FOR LEGEND

SCALE
0 5 10 15 (m)
1 : 250

ISSUE FOR APPROVAL

EXISTING FIRE HYDRANT (RHY469923)

LOT 3
SP332581

CONTRACTOR TO LOCATE AND CONNECT TO EXISTING MANHOLE (MH579931)

EXISTING MANHOLE (MH579930)

PROPOSED DN160 PE100 SDR21 DUAL SEWER PROPERTY CONNECTION

PROPOSED DN160 PE100 SDR21 DUAL SEWER PROPERTY CONNECTION

EXISTING #225 AC (LS100070) SEWER MAIN

EUGENIA STREET

PROPOSED DUAL DN20 WATER METERS WITH DN40 ROAD CROSSING SERVICE AND 2 x DN32 INDIVIDUAL WATER SERVICES.

PROPOSED 45° JUNCTION OR APPROVED SADDLE FROM DN160 TO 2 x DN110.

EXISTING DN180 PE WATER MAIN

PROPOSED DN160 PE100 SDR21 DUAL SEWER PROPERTY CONNECTION

PROPOSED DUAL DN20 WATER METERS WITH DN40 ROAD CROSSING SERVICE AND 2 x DN32 INDIVIDUAL WATER SERVICES.

PROPOSED DUAL DN20 WATER METERS WITH DN40 ROAD CROSSING SERVICE AND 2 x DN32 INDIVIDUAL WATER SERVICES.

PROPOSED DN110 PE100 SDR21 SEWER PROPERTY CONNECTION

2 X PROPOSED DN110 PE100 SDR21 SEWER PROPERTY CONNECTIONS

PROPOSED DN20 WATER METER WITH DN32 WATER SERVICE.

PROPOSED 45° JUNCTION OR APPROVED SADDLE FROM DN160 TO 2 x DN110.

PROPOSED LOT 100

PROPOSED LOT 101

PROPOSED LOT 4

PROPOSED LOT 3

PROPOSED LOT 2

BRAMPTON STREET

EXISTING Ø150 CI WATER MAIN (RS71678)

EXISTING Ø150 AC (LS98761) SEWER MAIN

LOT 48 RP149913

LOT 47 RP149913

LOT 46 RP149913

PROPOSED LOT 6

PROPOSED DN110 PE100 SDR21 SEWER PROPERTY CONNECTION

DN40 PE WATER SERVICE

PROPOSED DN160 PE100 SDR21 DUAL SEWER PROPERTY CONNECTION.

PROPOSED LOT 7

PROPOSED DN110 PE100 SDR21 SEWER PROPERTY CONNECTION

PROPOSED EMT

DN32 PE WATER SERVICE

PROPOSED DUAL DN20 WATER METERS WITH DN40 ROAD CROSSING SERVICE AND 2 x DN32 INDIVIDUAL WATER SERVICES.

PROPOSED LOT 8

EXISTING CONNECTION (PC171680) TO BE EXTENDED AND REUSED FOR PROPOSED LOT 5 SUBJECT TO CCTV REQUIREMENTS.

PROPOSED LOT 5

EXISTING Ø150 CI WATER MAIN (RS11170)

FREEMAN ROAD

PROPOSED LOT 1

LOT 45 RP52227

LOT 46 RP52227

CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : JOE FINOCCHIARO
TELEPHONE : 1300 698 544
EMAIL : joe@naxosengineers.com.au

T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley, Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

[illegible]

Approved: GREGG TYQUIN

RPEQ. 1528	Date
------------	------

Checked:	Supervisor:
JB	JB

Checked:	Supervisor:
JB	JB

DISCLAIMER NOTE:

THIS PLAN WAS PREPARED FOR DISCUSSION AND ESTIMATION PURPOSES. THE LAYOUT SHOWN IS INDICATIVE ONLY AND MAY BE SUBJECT TO LOCAL AUTHORITY / GOVERNMENT REQUIREMENTS AND FURTHER DETAILED ENGINEERING DESIGN.

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON OR CORPORATION OTHER THAN LISTED AS THE "CLIENT" ON THIS PLAN.

NAXOS ENGINEERS PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE SUFFERED HOWEVER SO ARISING TO ANY PERSON OR CORPORATION WHO MAY USE OR RELY ON THIS PLAN IN CONTRAVENTION OF THE TERMS OF THIS DISCLAIMER. ALL COPIES OF THIS PLAN MUST INCLUDE THIS DISCLAIMER.

AND DETAILED SURVEY WE MAKE NO
REPRESENTATIONS OR WARRANTIES ABOUT ITS
ACCURACY, RELIABILITY, COMPLETENESS OR
SUITABILITY FOR ANY PARTICULAR PURPOSE AND
DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY
(INCLUDING WITHOUT LIMITATION, LIABILITY IN
NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES
(INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGE)
AND COSTS WHICH MAY BE INCURRED AS A RESULT OF
DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY
AND FOR ANY REASON.

North:	Size of Land:
	9853M ²
Orig. Drg. Size A1	Scale:
	1:250

Client:	
Project:	

11

RO

OF

BR

00

290 | P R O F

COM
FREE
POSE

INSURANCE

ULTI
N ROA
ESIDI

ING

AD, I

ENTI

GENERAL ANALYTICAL SUMMARY

NGI
A QLD
UBDI

NE
D 407
VISION

ERS
77
ON

S P

TY

LTD

D

Job No.	25-
Drawing	SK

136
No.
003

Revision

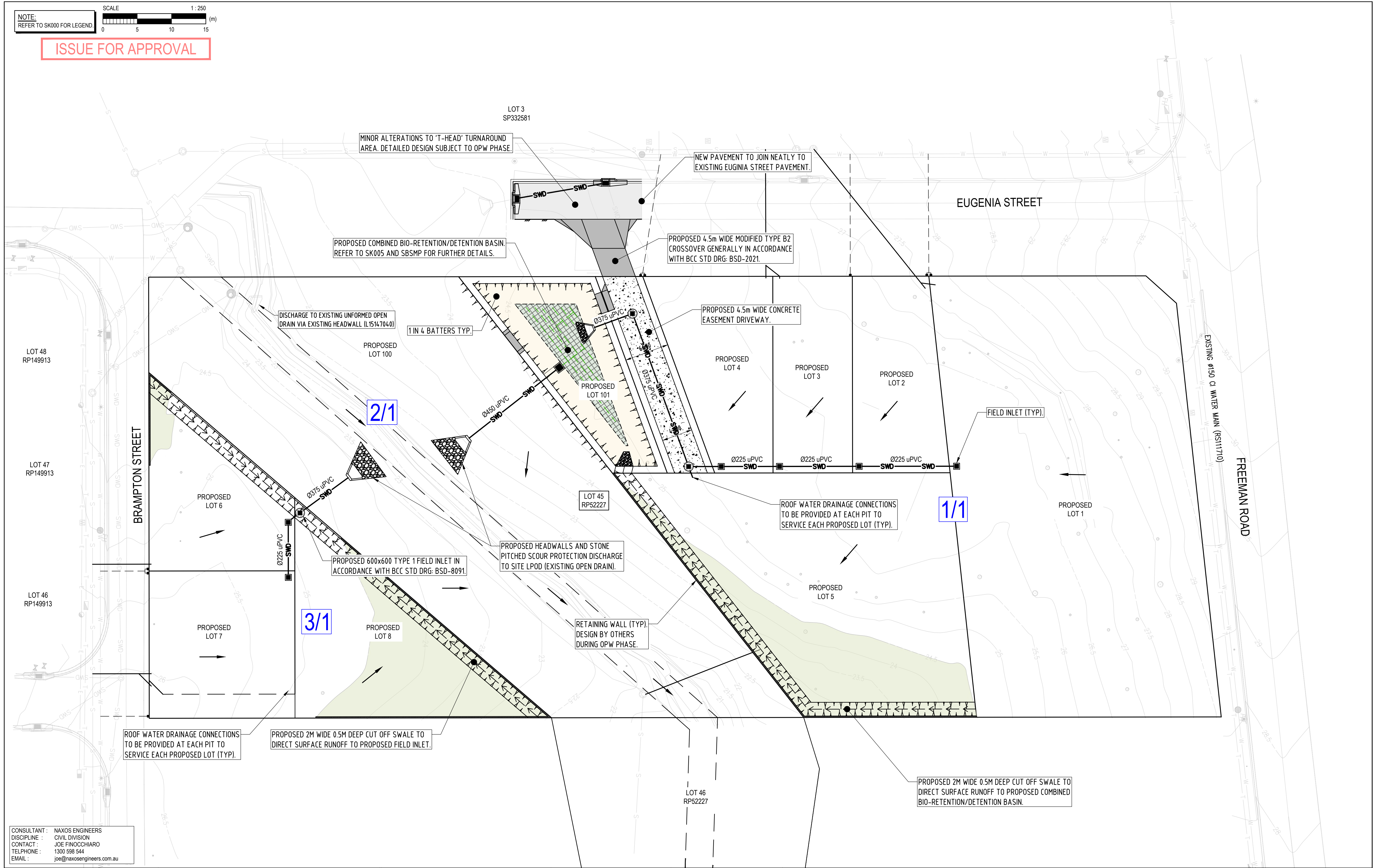
B

[illegible]

NOTE:
REFER TO SK000 FOR LEGEND.



ISSUE FOR APPROVAL



CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : JOE FINOCCHIARO
TELEPHONE : 1300 598 544
EMAIL : joe@naxosengineers.com.au

NAXOS
ENGINEERS

T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley, Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

AMENDMENTS			
No.	DATE	DESCRIPTION	DRAWN
A	10.06.2026	PRELIMINARY ISSUE	CW
B	14.07.2026	ISSUE FOR APPROVAL	JB

Associated Consultant:
ASSOCIATED CONSULTANT

Approved: GREGG TYQUIN

RPEQ: 1528 Date:

Drawn: CW

Design: JB

Checked: JB

Supervisor: JB

DISCLAIMER NOTE:

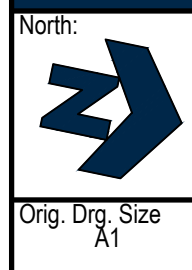
THIS PLAN WAS PREPARED FOR DISCUSSION AND ESTIMATING PURPOSES. THE LAYOUT SHOWN IS INDICATIVE ONLY AND MAY BE SUBJECT TO LOCAL AUTHORITY / GOVERNMENT REQUIREMENTS AND FURTHER DETAILED ENGINEERING DESIGN.

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON OR CORPORATION OTHER THAN LISTED AS THE 'CLIENT' ON THIS PLAN.

NAXOS ENGINEERS PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE SUFFERED HOWEVER SO ARISING TO ANY PERSON OR CORPORATION WHO MAY USE OR RELY ON THIS PLAN IN CONTRAVENTION OF THE TERMS OF THIS CLAUSE. ALL COPIES OF THIS PLAN MUST INCLUDE THIS DISCLAIMER.

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER

WHILE EVERY CARE IS TAKEN BY NAXOS ENGINEERS PTY LTD TO ENSURE THE ACCURACY OF THE DATA SUPPLIED BY LOCAL AUTHORITIES, DIAL BEFORE YOU DIG (DBYD) RECORDS, AS CONSTRUCTED INFORMATION AND DETAILED SURVEY, WE MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT ITS ACCURACY, RELIABILITY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE AND DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY (INCLUDING WITHOUT LIMITATION, LIABILITY IN NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES (INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGE) AND COSTS WHICH MAY BE INCURRED AS A RESULT OF DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY AND FOR ANY REASON.



Size of Land:
9853M²
Scale:
Orig. Dwg. Size
A1

Client:
Project:

CONCEPT STORMWATER PLAN

ROOFBROOK CONSULTING ENGINEERS PTY LTD

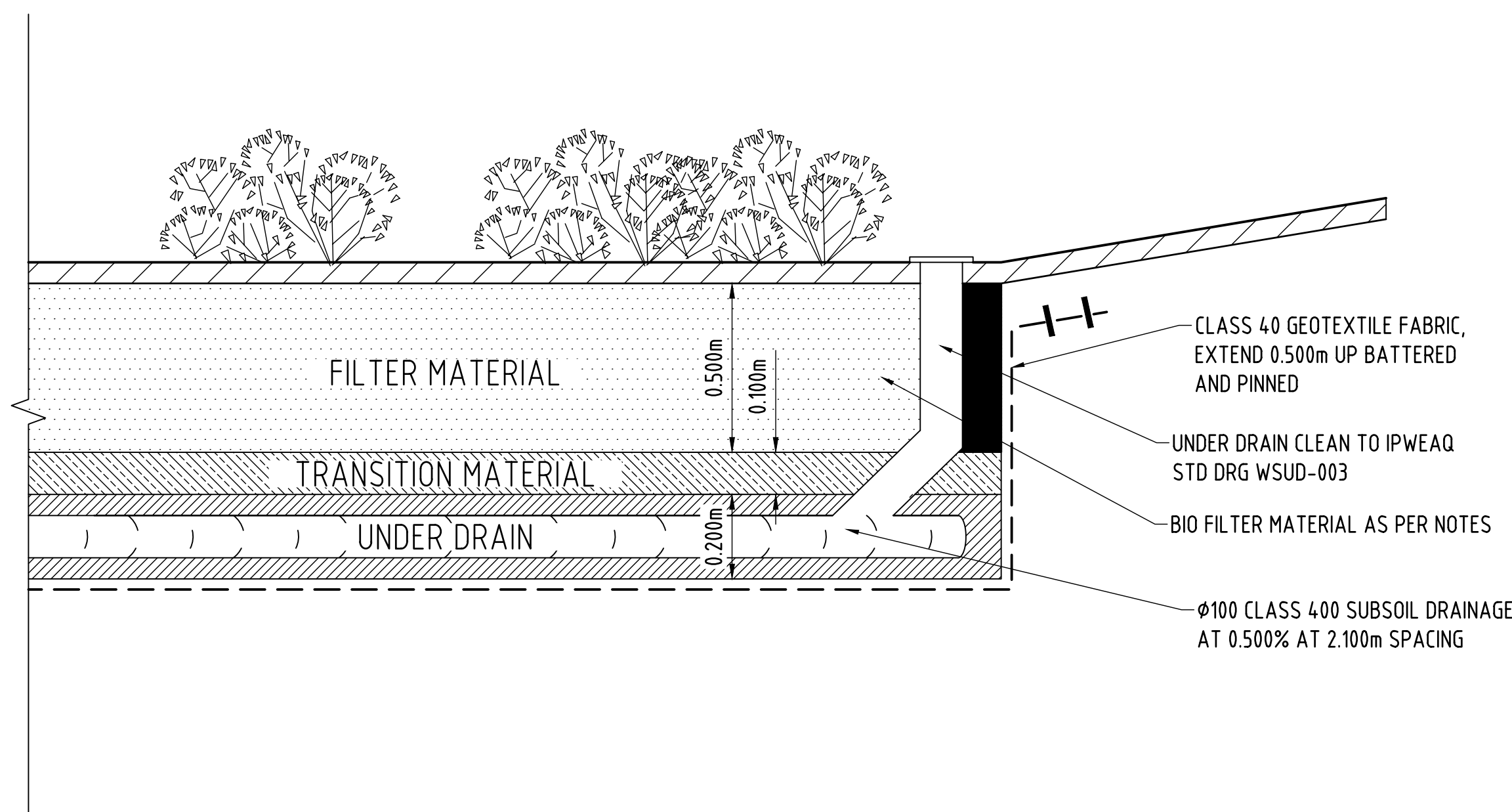
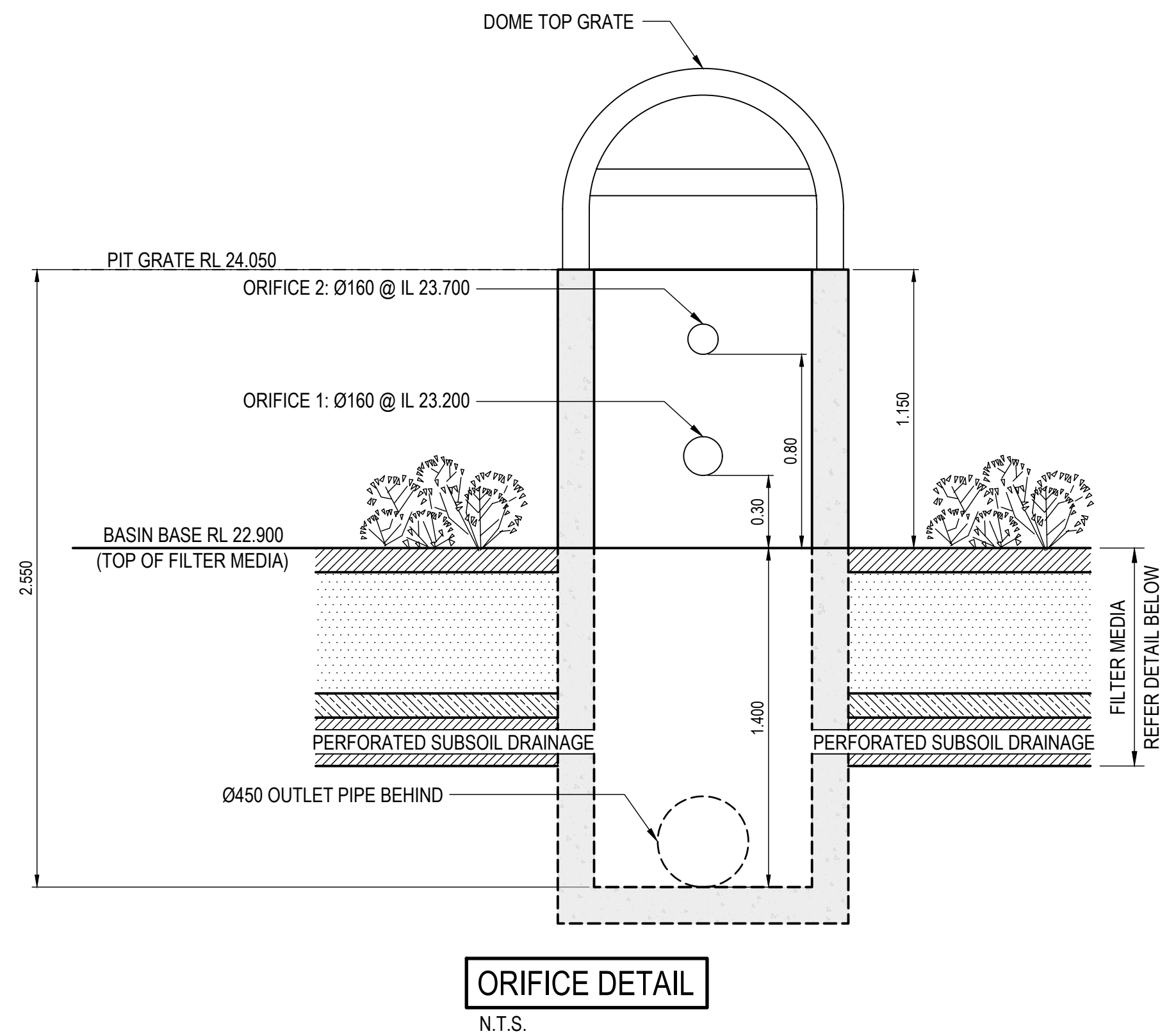
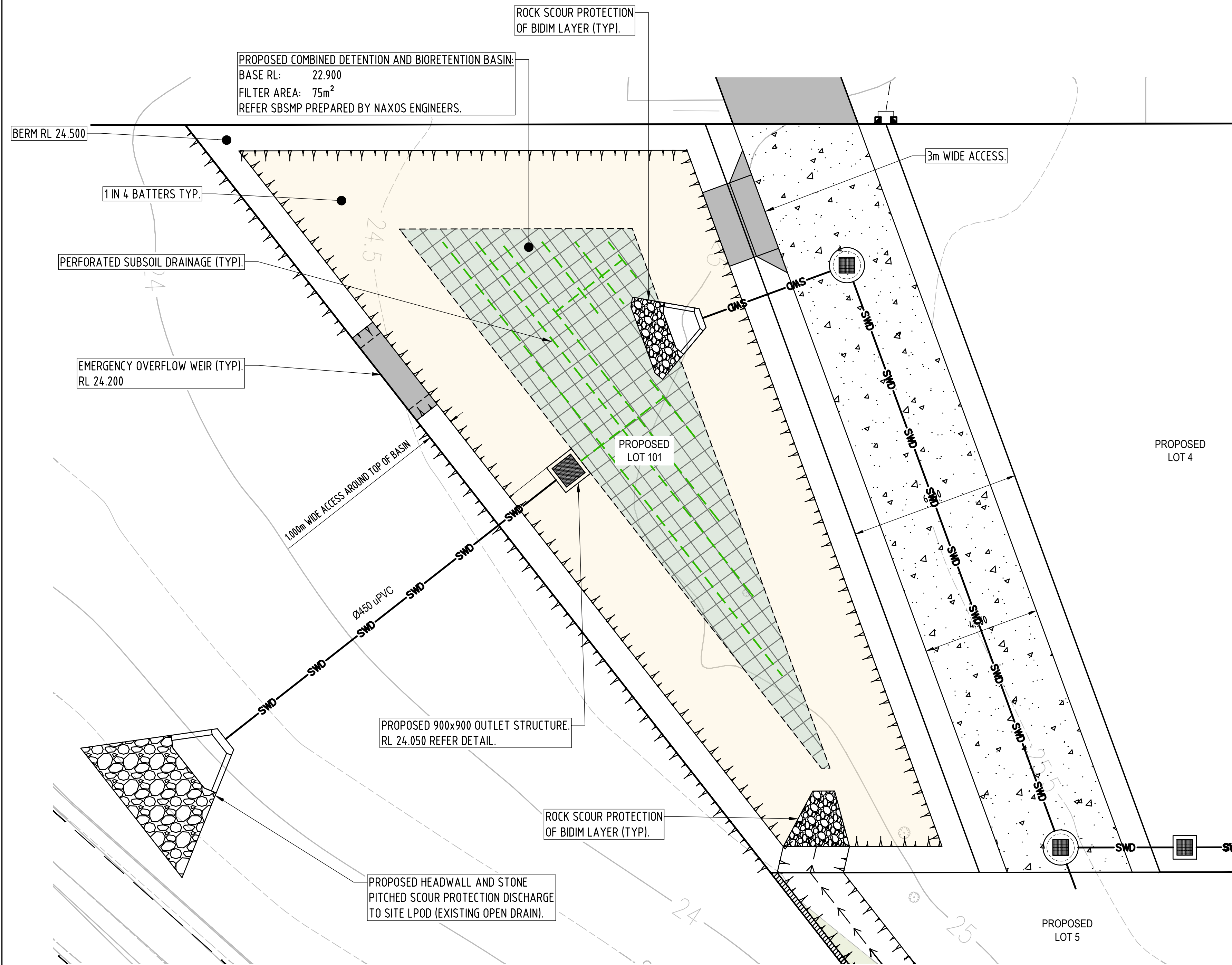
290 FREEMAN ROAD, INALA QLD 4077
PROPOSED RESIDENTIAL SUBDIVISION

Job No.
25-136

Drawing No.
SK004

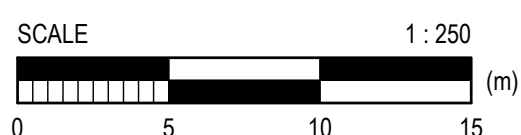
Revision:

B



CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : JOE FINOCCHIARO
TELEPHONE : 1300 598 544
EMAIL : joe@naxosengineers.com.au

NOTE:
REFER TO SK000 FOR LEGEND.



ISSUE FOR APPROVAL

NAXOS
ENGINEERS

T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley, Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

AMENDMENTS			
No.	DATE	DESCRIPTION	DRAWN
A	10.06.2026	PRELIMINARY ISSUE	CW
B	14.07.2026	ISSUE FOR APPROVAL	JB

Associated Consultant:
ASSOCIATED CONSULTANT

Approved: GREGG TYQUIN

RPEQ. 1528 Date:

Drawn: CW

Checked: JB

Design: JB

Supervisor: JB

DISCLAIMER NOTE:

THIS PLAN WAS PREPARED FOR DISCUSSION AND ESTIMATING PURPOSES. THE LAYOUT SHOWN IS INDICATIVE ONLY AND MAY BE SUBJECT TO LOCAL AUTHORITY / GOVERNMENT REQUIREMENTS AND FURTHER DETAILED ENGINEERING DESIGN.

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON OR CORPORATION OTHER THAN LISTED AS THE 'CLIENT' ON THIS PLAN.

NAXOS ENGINEERS PTY LTD ACCEPTS NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE SUFFERED HOWEVER SO ARISING TO ANY PERSON OR CORPORATION WHO MAY USE OR RELY ON THIS PLAN IN CONTRAVENTION OF THE TERMS OF THIS CLAUSE. ALL COPIES OF THIS PLAN MUST INCLUDE THIS DISCLAIMER.

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER:

WHILE EVERY CARE IS TAKEN BY NAXOS ENGINEERS PTY LTD TO ENSURE THE ACCURACY OF THE DATA SUPPLIED BY LOCAL AUTHORITIES, DIAL BEFORE YOU DIG (DBYD) RECORDS, AS CONSTRUCTED INFORMATION AND DETAILED SURVEY, WE MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT ITS ACCURACY, RELIABILITY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE AND DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY (INCLUDING WITHOUT LIMITATION, LIABILITY IN NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES (INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGES) AND COSTS WHICH MAY BE INCURRED AS A RESULT OF DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY AND FOR ANY REASON.

North:
Size of Land:
9853M²
Scale:
1:100
Orig. Dwg. Size
A1

TYPICAL BIORETENTION BASIN FILTER SECTION
SCALE : N.T.S.

CONCEPT BASIN DETAIL PLAN

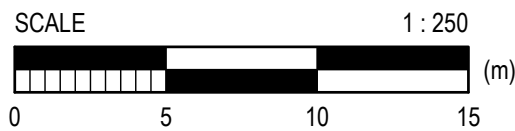
ROOFBROOK CONSULTING ENGINEERS PTY LTD
290 FREEMAN ROAD, INALA QLD 4077
PROPOSED RESIDENTIAL SUBDIVISION

Job No.
25-136
Drawing No.
SK005

Revision:

B

NOTE:
REFER TO SK000 FOR LEGEND.



PRELIMINARY DRAWING



CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : JOE FINOCCHIARO
TELEPHONE : 1300 598 544
EMAIL : joe@naxosengineers.com.au

NAXOS
ENGINEERS

T 1300 598 544
E info@naxosengineers.com.au
Level 1, Suite B
557 Gregory Terrace, Fortitude Valley, Qld 4006
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

AMENDMENTS			
No.	DATE	DESCRIPTION	DRAWN
A	10.06.2026	PRELIMINARY ISSUE	CW

Associated Consultant:
ASSOCIATED CONSULTANT

Approved: GREGG TYQUIN

RPEQ. 1528

Date:

Drawn: CW

Design: CW

Checked: JB

Supervisor: JB

DISCLAIMER NOTE:

THIS PLAN WAS PREPARED FOR DISCUSSION AND ESTIMATING PURPOSES. THE LAYOUT SHOWN IS INDICATIVE ONLY AND MAY BE SUBJECT TO LOCAL AUTHORITY / GOVERNMENT REQUIREMENTS AND FURTHER DETAILED ENGINEERING DESIGN.

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON OR CORPORATION OTHER THAN LISTED AS THE 'CLIENT' ON THIS PLAN.

NAXOS ENGINEERS PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE SUFFERED HOWEVER SO ARISING TO ANY PERSON OR CORPORATION WHO MAY USE OR RELY ON THIS PLAN IN CONTRAVENTION OF THE TERMS OF THIS CLAUSE. ALL COPIES OF THIS PLAN MUST INCLUDE THIS DISCLAIMER.

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER

WHILE EVERY CARE IS TAKEN BY NAXOS ENGINEERS PTY LTD TO ENSURE THE ACCURACY OF THE DATA SUPPLIED BY LOCAL AUTHORITIES, DIAL BEFORE YOU DIG (DBYD) RECORDS, AS CONSTRUCTED INFORMATION AND DETAILED SURVEY, WE MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT ITS ACCURACY, RELIABILITY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE AND DISCLAIM ALL RESPONSIBILITY AND ALL LIABILITY (INCLUDING WITHOUT LIMITATION, LIABILITY IN NEGLIGENCE) FOR ALL EXPENSES, LOSSES, DAMAGES (INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGE) AND COSTS WHICH MAY BE INCURRED AS A RESULT OF DATA BEING INACCURATE OR INCOMPLETE IN ANY WAY AND FOR ANY REASON.



Size of Land:
9853M²

Scale:

Client:

Project:

CONCEPT STORMWATER PLAN

ROOFBROOK CONSULTING ENGINEERS PTY LTD

25-136 - FREEMAN (290)
PROPOSED RESIDENTIAL SUBDIVISION

Job No.
25-136

Drawing No.
SK004

Revision:

A

Appendix F – RATIONAL METHOD CALCS

STORMWATER IFD INPUT

Input Required

Project Number	25-136
Project Address	FREEMAN ROAD, INALA
Description	IFD
Designer	JB
Date	10.06.2026

NAXOS
ENGINEERS

T 1300 598 544
E info@naxosengineers.com.au
50 Leichhardt Street, Spring Hill QLD 4000
PO Box 224, Spring Hill QLD 4004
NAXOSENINEERS.COM.AU

Refer: <http://www.bom.gov.au/water/designRainfalls/index.shtml>

IFD Design Rainfall Intensity (mm/h)

Issued:	10.06.2026
Location Label:	INALA
Requested coordinate:	Latitude -27.581 Longitude 152.9648
Nearest grid cell:	Latitude 27.5875 (S) Longitude 152.9625 (E)

		Duration		Annual Exceedance Probability: (AEP) / Average Recurrence Interval						
				0.632	0.5	0.2	0.1	0.05	0.02	0.01
		Time	Minutes	1	2	5	10	20	50	100
BOM IFD Input ARR 2016		1	1	150.00	171.00	235.00	278.00	320.00	374.00	416.00
		2	2	124.00	141.00	197.00	235.00	274.00	326.00	366.00
		3	3	117.00	133.00	184.00	220.00	255.00	302.00	338.00
		4	4	112.00	127.00	175.00	209.00	241.00	284.00	317.00
		5	5	107.00	122.00	168.00	199.00	229.00	269.00	300.00
		10	10	88.00	100.00	137.00	162.00	186.00	217.00	240.00
	BOM IFD Input ARR 1987	15	15	74.40	84.70	116.00	137.00	157.00	183.00	203.00
		20	20	64.60	73.50	101.00	119.00	137.00	160.00	177.00
		25	25	57.20	65.10	89.60	106.00	122.00	142.00	158.00
		30	30	51.40	58.60	80.70	95.50	110.00	129.00	143.00
		45	45	39.90	45.40	62.70	74.50	86.10	101.00	113.00
		60	60	32.90	37.50	51.80	61.80	71.60	84.60	94.70
		90	90	24.90	28.30	39.20	46.80	54.50	64.80	72.80
		2	120	20.30	23.10	32.00	38.30	44.70	53.30	60.10
		3	180	15.20	17.30	24.10	28.80	33.70	40.40	45.70
		4.5	270	11.50	13.10	18.10	21.80	25.50	30.60	34.80
		6	360	9.45	10.70	14.90	17.90	21.00	25.30	28.70
		9	540	7.20	8.18	11.40	13.70	16.10	19.40	22.10
		12	720	5.95	6.77	9.48	11.40	13.40	16.20	18.50
		18	1080	4.56	5.21	7.33	8.86	10.40	12.70	14.50
		24	1440	3.77	4.32	6.12	7.42	8.76	10.70	12.30
		30	1800	3.24	3.72	5.32	6.47	7.65	9.36	10.80
		36	2160	2.86	3.30	4.73	5.77	6.84	8.40	9.67
		48	2880	2.34	2.70	3.91	4.79	5.70	7.04	8.13
		72	4320	1.73	2.01	2.94	3.63	4.34	5.40	6.27
		96	5760	1.39	1.61	2.36	2.92	3.50	4.37	5.09
		120	7200	1.16	1.34	1.96	2.43	2.92	3.64	4.25
		144	8640	1.00	1.15	1.67	2.07	2.48	3.09	3.61
		168	10080	0.87	1.00	1.45	1.78	2.14	2.65	3.10

STORMWATER DISCHARGE CALCULATION

Refer QUDM 4th Ed. Section 4.3, "The Rational Method"

Project Number	25-136
Project Address	FREEMAN ROAD, INALA
Description	IFD
Author	JB
Date	10.06.2026



NAXOS ENGINEERS PTY LTD
 ABN 65 613 555 687
 PO Box 224, Spring Hill QLD 4004
 1300 598 544
 info@naxosengineers.com.au

Catchment Details

Development Description	Pre-Development	Post-Development
Catchment Area (m ²)	9853	9853
Total Area (ha)	0.985	0.985
Impervious Area (m ²)	950	5910
Pervious Area (m ²)	8903	3943

Fraction Impervious Details

Calculated Fraction Impervious fi	0.096	0.600
Manually override Fraction Impervious (fi)		
Fraction Impervious (fi) used	0.096	0.600
Is Fraction Impervious (fi) is less than 0.2 Yes soil properties required)	(If YES	NO
Soil Description	Medium density bush, or good grass cover or	
Soil Permeability	Low	

1 hour rainfall intensity (¹I₁₀) Details

IFD value calculated from IFD Input (mm/hr)	61.80
Manually override IFD value (mm/hr)	
IFD value used (mm/hr)	61.80

Discharge Coefficient C₁₀ Details

QUDM 10 year Discharge Coefficient C ₁₀	0.700	0.780
Manually override Discharge Coefficient C ₁₀		
10 year Discharge Coefficient C ₁₀ used:	0.700	0.780

Time of Concentration T_c Details

Time of Concentration T _c (min.) :	15.000	5.000
---	--------	-------

Pre-Development

Post-Development

Flood Event	Frequency Factor	Coeff. of Discharge	Intensity	Peak Discharge	Coeff. of Discharge	Intensity	Peak Discharge
ARI	F _y	C _y = F _y x C ₁₀	mm/hr	Q _y	C _y = F _y x C ₁₀	mm/hr	Q _y
1	0.80	0.560	74	0.114	0.624	107	0.183
2	0.85	0.595	85	0.138	0.663	122	0.221
5	0.95	0.665	116	0.211	0.741	168	0.341
10	1.00	0.700	137	0.262	0.780	199	0.425
20	1.05	0.735	157	0.316	0.819	229	0.513
50	1.15	0.805	183	0.403	0.897	269	0.660
100	1.20	0.840	203	0.467	0.936	300	0.768