SITE BASED STORMWATER MANAGEMENT PLAN

FOR THE PROPOSED GREENBANK SHOPPING CENTRE STAGE 2

LOCATED AT
251 TEVIOT ROAD, GREENBANK

PREPARED FOR REGION GROUP

BORNHORST + WARD

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Revision	Date	Description	Author	Rev.	App.
A	Dec 2021	Draft for consultant team review for DA submission	RG	RG	
B	Dec 2021	Update on staging and associated calculations and wording	STIO		
C	Apr 2023	Issue to Client	ST	RG	RG
D	Aug 2023	Response to RFI	ST	RG	RG

Robert Gray: RPEQ 07048

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1. INTRODUCTION

Bornhorst and Ward has been commissioned to investigate and report on the stormwater requirements pertaining to the proposed Stage 2 extension to the Greenbank Shopping Centre located on the corner of Teviot Road and Pub Lane, Greenbank (Lots 1 & 5 on SP214051). The proposal consists of constructing new tenancies, associated carparking and landscaping, and a new access to Pub Lane. Plans of the proposed development can be seen in Appendix A.

This document reports on the existing and proposed civil works and stormwater infrastructure required as part of the proposed development as well as the stormwater quantity and quality management required for the site. The engineering requirements for this proposal shall be in accordance with Engineering Best Management Practices, Logan City Council Planning Scheme 2015, the Queensland Urban Drainage Manual (QUDM 2017) and the State Planning Policy 2017.

This report outlines the preliminary design methodology and calculations in support of a Development Application and should be read in conjunction with other documents issued by the consultant team.

2. SITE CHARACTERISTICS

2.1 LOCATION AND EXISTING FEATURES

The development site, located at 251 Teviot Road has the following existing characteristics:

- The site is bound by residential lots to the north; the existing Greenbank Shopping Centre to the east; Pub Lane to the south; and undeveloped land to the west.
- The existing site is undeveloped and consists of grass and tree cover;
- The total area of the site is 14.100 ha;
- Existing access to the Greenbank Shopping Centre site is achieved via Pub Lane and Teviot Road;
- There are two easements located within the site extents (A & B on SP214051) for drainage;
- The site is located within the Greater Flagstone Priority Development Area.

Refer to Figure 1 for locality details.

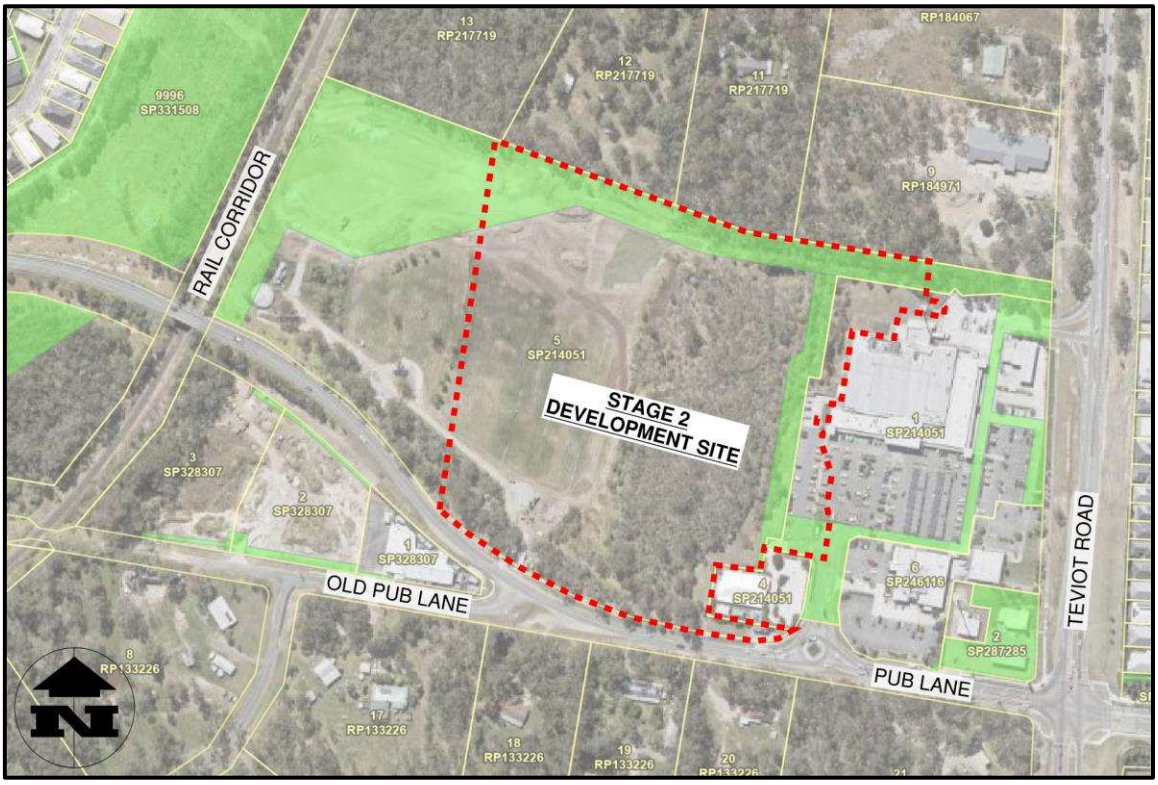


Figure 1: Site Locality Plan

2.2 PROPOSED DEVELOPMENT

The following points outline the extent of works for the proposed development:

- It is proposed to construct new tenancies for the Greenbank Shopping Centre, associated carparking and landscaping, and a new access to Pub Lane.

Refer to the development drawings in Appendix A for further details of the proposed development.

2.3 TOPOGRAPHY AND CATCHMENT CHARACTERISTICS

The topography and catchment characteristics are as follows:

- The high point of the existing Stage 2 site is approximately RL 69.50m AHD located towards the south-eastern corner;
- The development falls from the high point at an approximate grade of 2.3% to a low point of approximately RL 64.25m AHD at the drainage easement to the north;
- During major storm events, runoff from the site discharges as overland flow towards the drainage easement running along the northern boundary, and to the rail corridor located to the west of the site;
- There are no external catchments associated with the development site;
- Runoff from the current centre is captured in roof water and stormwater systems before being directed to an open drain along the northern boundary. A detention basin exists within the Stage 2 development site to service the existing development.

See the survey plan in Appendix C for more information.

2.4 EXISTING FLOODING CONDITIONS

A Logan City Council Flood Report has been obtained for the site and states the following:

- No flood levels or flags for building development purposes exist for the development site.
- The interactive mapping system within Logan PD Hub confirms that the development site is not affected by flooding.
- It is expected that the site is at a low risk of flood inundation.

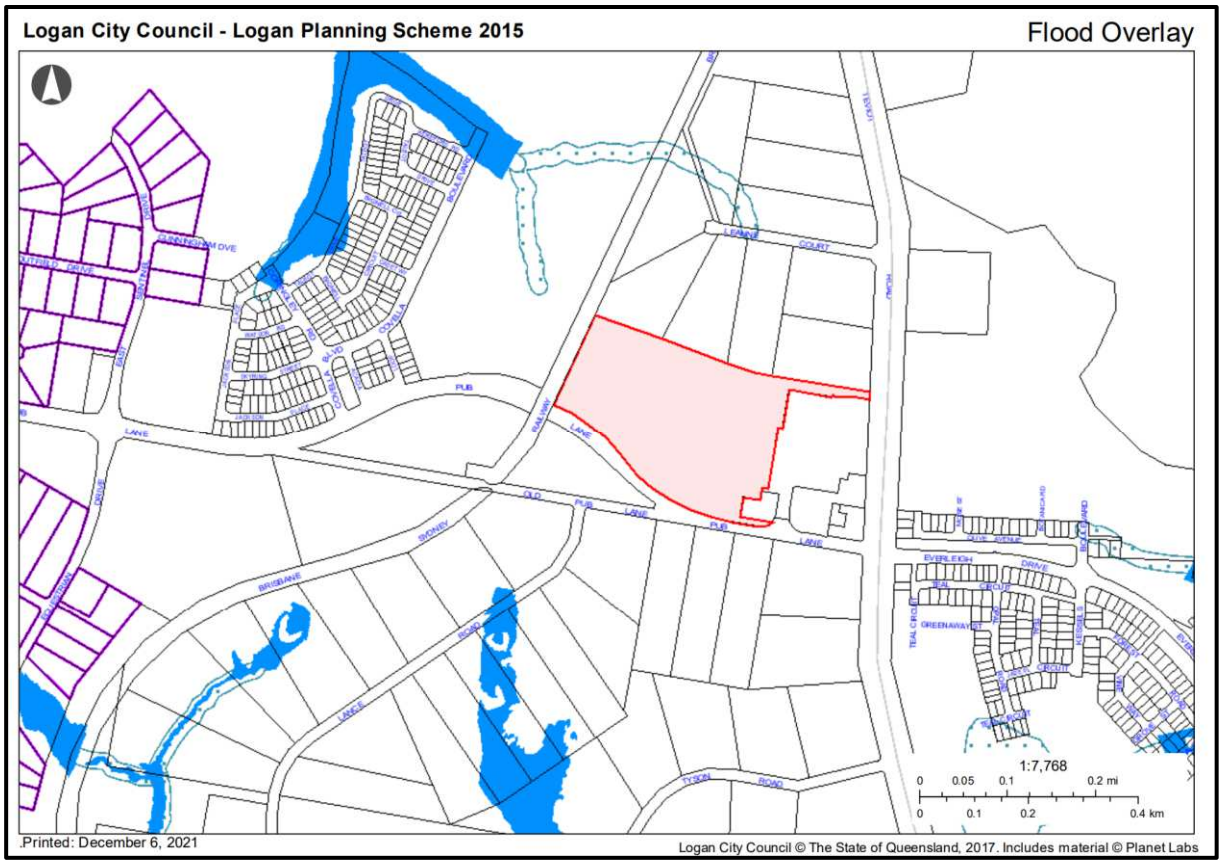


Figure 2: Logan City Council Interactive Flood Map

3. EXISTING AND PROPOSED STORMWATER INFRASTRUCTURE

3.1 EXISTING INFRASTRUCTURE

A Dial Before You Dig Investigation has been completed of the site and its surrounding area. The following stormwater infrastructure was noted:

- There are 3 x 450mm dia. stormwater pipes flowing south from the development site across Pub Lane;
- A large open channel grassed drain exists along the northern boundary, draining the development site towards the west, into a detention basin. Discharge from Stage 1 of the shopping centre enters this drain from 2 locations, each with a Gross Pollutant Trap (GPT) immediately prior to discharge.

Council Asset Plans of the existing stormwater infrastructure can be found in Appendix C of this report.

3.2 PROPOSED STORMWATER DRAINAGE

The following points outline the proposed stormwater infrastructure for the development site:

- As there will be an increase to the impervious area as a result of the development, there will be an expected increase to peak stormwater discharge rates from the site. Based on this, stormwater detention measures are required.
- Considering the development works area is greater than 2500m^2 stormwater quality treatment measures will be required for the site. This is proposed to be in the form of bio-retention basins and stormwater quality improvement devices (SQID). It is noted that alternate and equivalent SQID may be selected following detailed building hydraulic design.
- Minor events will be collected by stormwater piped network;
- Major events will be directed by surface grading within the proposed carpark to a stormwater detention basin;
- Two stormwater detention basins are proposed; one underneath the proposed S1 Tenancy (Basin 1) and one to the north of the proposed western carpark (Basin 2). The Stage 2 development encroaches on the basin constructed for the Stage 1 development and will not be able to remain. Basin 1 is proposed to match the levels of the existing basin and utilise a portion of the existing basin's area. Flows from the drainage channel that currently enter the Stage 1 basin are proposed to be piped via a culvert underneath the proposed Stage 2 Shopping Centre external pavement into Basin 1 beneath the proposed S1 tenancy.
- Basin 1 is proposed to collect:
    - Any overland flow from the existing Stage 1 development that enters the drainage easement along the northern boundary;
    - Minor flows from the existing Stage 1 development, which are proposed to be piped through Stage 2, but will bypass any stormwater treatment;
    - The Stage 2 Shopping Centre northern roof water catchment; and
    - The Stage 2 pavement to the north of the proposed Stage 2 Shopping Centre.
- Basin 2 is proposed to collect:
    - The remainder of overland flow from the Stage 1 development that does not discharge to the drainage easement along the northern boundary;
    - Overland flow from the Stage 2 southern carpark and Stage 2 western carpark; and
    - The Stage 2 Shopping Centre southern roof water catchment.

Refer to the engineering drawings in Appendix B for further information.

4. STORMWATER QUANTITY ANALYSIS

4.1 DETAILED HYDRAULIC MODELLING – XP STORM

A detailed hydrologic and hydraulic analysis using XP Storm software has been undertaken to more accurately model the stormwater flow characteristics of the site.

XP Storm is a hydraulic modelling software tool that utilises detailed hydrograph flow analysis to provide an effective representation of urban stormwater systems. Hydrographs are calculated using the Laurenson Method for runoff routing in conjunction with the Uniform Loss model for determining catchment losses. XP Storm has been used to demonstrate acceptable detention sizing through comparison of the results obtained for the existing and developed mitigated scenarios.

Two reporting points have been determined for the purpose of modelling. Reporting Point 1 is the rail corridor to the west of the site and Reporting Point 2 is Pub Lane to the south. Rational Method calculations were undertaken for the existing and developed catchments determined for the site. It was found that flows discharging to Reporting Point 2 reduced as a result of the proposed development directing more flows to Reporting Point 1. Therefore, only Reporting Point 1 was assessed in XP Storm to determine acceptable detention sizing. Refer to the catchment plans in Figure 3 and Figure 4, and Rational Method calculations in Appendix D for further information.

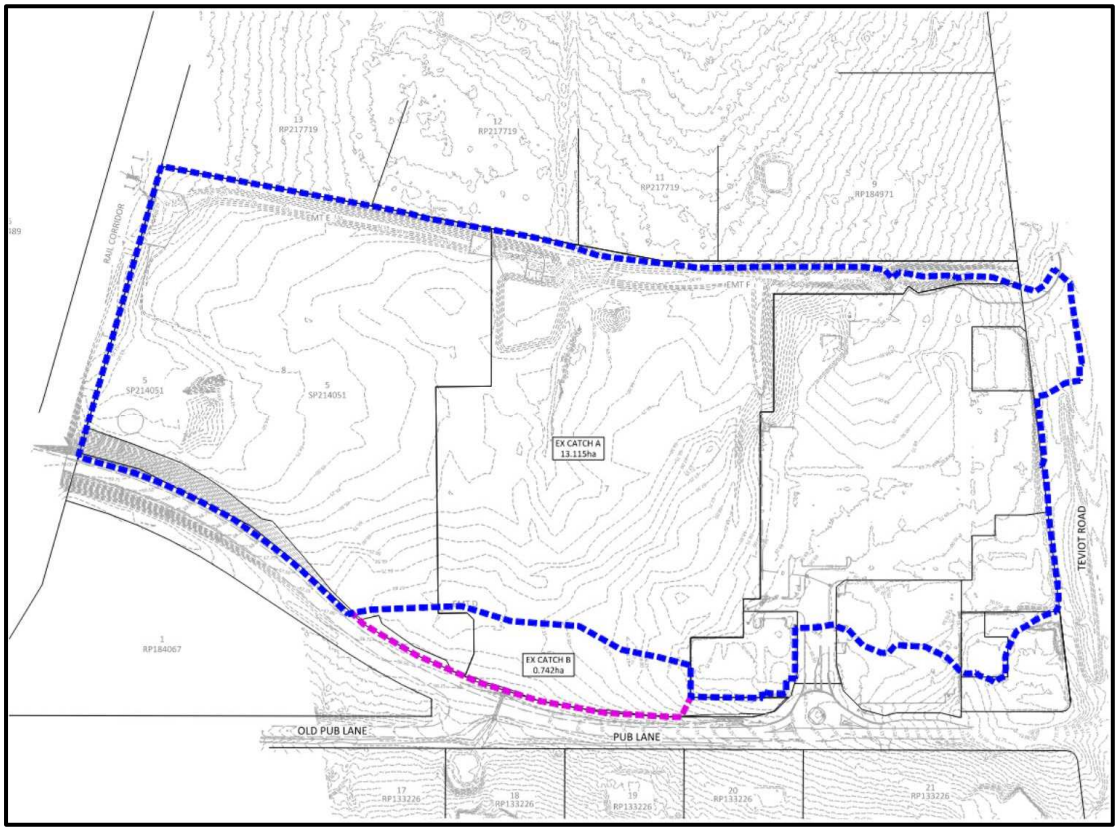


Figure 3: Existing Catchment Plan

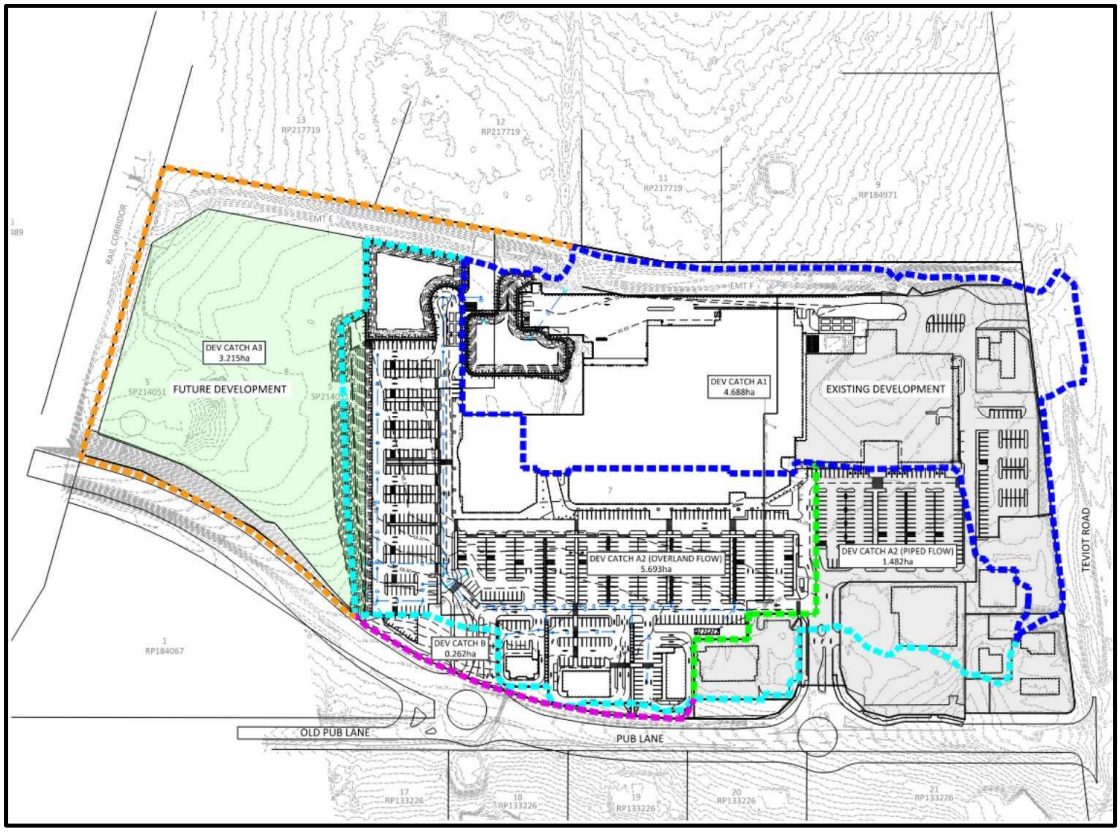


Figure 4: Developed Catchment Plan

4.1.1 Existing Scenario Model

Initially the existing XP Storm model was built using the catchment parameters outlined in Table 1. Site specific initial and continuing loss properties were obtained from the ARR Data Hub.

The catchment outlined below was modelled to Reporting Point 1, the rail corridor to the west of the site.

Table 1: XP Storm Existing Model Parameters

Parameter	Catchment A	
	Pervious Data	Impervious Data
Area (ha)	13.115	-
Slope (%)	0.03	-
Mannings 'n'	0.035	-
Initial Loss (mm)	25	-
Continuing Loss (mm/hr)	1.1	-
Laurenson 'n'	-0.285	-

4.1.2 Results for Existing Scenario

Table 2 indicates the existing total peak discharge rate for Catchment A to the discharge point as outputted by XP Storm. The critical storm duration for the existing catchment was determined by simulating all storm events from the 1 to 100 year ARI storm events for 20, 25, 30, 45, 60, 90, 120 and 180 minute durations. The critical storm events can be seen within the table below.

Table 2: XP Storm Existing Peak Flow Results – Catchment A (m^3/sec)

Storm Duration (min)	ARI (Years)						
	1	2	5	10	20	50	100
20	0.192	0.299	0.821	1.287	1.874	2.326	3.101
25	0.292	0.464	1.066	1.536	2.083	2.831	3.262
30	0.315	0.483	1.234	1.721	2.260	3.013	3.443
45	0.502	0.727	1.499	2.005	2.414	3.133	3.709
60	0.530	0.796	1.498	2.073	2.643	3.319	4.016
90	0.565	0.750	1.474	1.992	2.582	3.082	3.653
120	0.560	0.712	1.383	1.887	2.393	2.826	3.388
180	0.497	0.650	1.229	1.673	2.177	2.542	3.012
Critical	**0.565**	**0.796**	**1.499**	**2.073**	**2.643**	**3.319**	**4.016**

Discharge hydrographs for the existing model have been included in Appendix E.

4.1.3 XP Storm and Rational Method Comparison

Before utilising data from XP Storm, Logan City Council require a comparison of results from XP Storm and the Rational Method was undertaken to ensure that the XP Storm model was functioning correctly. Peak discharge rates from the site in the existing case were compared ("Catchment A" catchment defined in Table 1). The comparison is outlined in Table 3. Detailed Rational Method calculations can be reviewed in Appendix D.

Table 3: Comparison of Rational Method & XP Storm Existing Peak Flows (m^3/sec)

ARI (Years)	Rational Method Result	XP Storm Result
1	0.863	0.565
2	1.049	0.796
5	1.636	1.499
10	2.053	2.073
20	2.496	2.643
50	3.226	3.319
100	3.759	4.016

As indicated, the XP Storm peak discharge results are of the same magnitude as the results initially estimated using the Rational Method. It was therefore concluded that the existing XP Storm model was functioning correctly.

4.1.4 Developed Scenario Model

A developed scenario model was then created with internal catchments and parameters modified from the existing model to suit the proposed development as outlined in Table 4 and Table 5. Refer to DA-C036 for further information.

Table 4: XP Storm Developed Model Parameters – Catchment A Part 1

Parameter	Catchment A1		Catchment A2 (Overland)	
	Pervious Data	Impervious Data	Pervious Data	Impervious Data
Area (ha)	0.703	3.985	0.820	3.661
Slope (%)	0.015	0.015	0.025	0.005
Mannings 'n'	0.035	0.015	0.035	0.015
Initial Loss (mm)	25	0	25	0
Continuing Loss (mm/hr)	1.1	0	1.1	0
Laurenson 'n'	-0.285	-0.285	-0.285	-0.285

Table 5: XP Storm Developed Model Parameters – Catchment A Part 2

Parameter	Catchment A2 (Piped)		Catchment A3	
	Pervious Data	Pervious Data	Pervious Data	Impervious Data
Area (ha)	0.074	0.074	0.820	3.661
Slope (%)	0.01	0.01	0.025	0.005
Mannings 'n'	0.035	0.035	0.035	0.015
Initial Loss (mm)	25	25	25	0
Continuing Loss (mm/hr)	1.1	1.1	1.1	0
Laurenson 'n'	-0.285	-0.285	-0.285	-0.285

4.1.5 Detention Basin Design

For the developed mitigated scenario, two storage nodes representing the proposed detention basins discussed in Section 3.2 were included in the model.

The storage node inputs were sourced from the 12D model for the basins.

Basin 1 was modelled as a 1.3m deep basin and was modelled as outlined in Table 6 below.

Table 6: XP Storm Developed Model Hydraulic Routing – Basin 1

Depth (m)	Area (m^2)	Approximate Volume (m^3)
0.000	1390	0
0.062	1434	87
0.162	1506	234
0.262	1579	388
0.362	1654	550
0.462	1730	719
0.562	1808	896
0.662	1887	1080
0.762	1967	1273
0.862	2049	1474
0.962	2132	1683
1.062	2217	1900
1.162	2303	2126
1.262	2390	2361
1.312	2434	2482

Outlets to Basin 1 were modelled as below:

- Low-flow outlet: 300mm dia. orifice at 0.00m depth.
- Low-flow outlet: 300mm dia. orifice at +0.10m depth.
- Mid-flow outlet: Two 900x600 Dome Top Field Inlets with a 525mm outlet pipe.
- High-flow outlet: 15m long weir with crest at +1.112m depth.

Basin 2 was modelled as a 1.3m deep basin, with levels matching the existing Stage 1 detention basin. The basin was modelled as outlined in Table 7 below.

Table 7: XP Storm Developed Model Hydraulic Routing – Basin 2

Depth (m)	Area (m^2)	Approximate Volume (m^3)
0.000	943	0
0.052	983	50
0.152	1061	152
0.252	1141	262
0.352	1222	381
0.452	1304	507
0.552	1388	641
0.652	1473	785
0.752	1560	936
0.852	1648	1097
0.952	1737	1266
1.052	1828	1444
1.152	1920	1632
1.252	2014	1828
1.300	2057	1926

Outlets to Basin 2 were modelled as below:

- Low-flow outlet: 300mm dia. orifice at 0.00m depth.
- Low-flow outlet: 375mm dia. orifice at +0.10m depth.
- Mid-flow outlet: Two 900x600 Dome Top Field Inlets with a 525mm dia. outlet pipe.
- High-flow outlet: 22m long weir with crest at +1.15m depth.

See drawing DA-C030 in Appendix B for more information.

4.1.6 Results for Developed Scenario

Table 8 indicates the developed total peak discharge rate at the culverts Henderson Road as outputted by XP Storm. The peak flow rate indicated is the combined flow of the site and external catchments. To determine the critical storm event for the developed mitigated case, the 1 to 100 year ARI storm events for 20, 25, 30, 45, 60, 90, 120 and 180 minute durations were simulated in the model.

Table 8: XP Storm Developed Mitigated Peak Flow Results – Catchment A (m^3/sec)

Storm Duration (min)	ARI (Years)						
	1	2	5	10	20	50	100
20	0.435	0.489	0.929	1.436	2.022	2.893	3.336
25	0.456	0.509	0.999	1.604	2.277	3.008	3.369
30	0.464	0.531	1.067	1.643	2.326	2.786	3.140
45	0.495	0.595	1.218	1.868	2.416	2.959	3.270
60	0.512	0.623	1.318	2.071	2.538	3.129	3.689
90	0.509	0.620	1.246	1.990	2.640	3.084	3.588
120	0.501	0.607	1.093	1.777	2.360	2.851	3.198
180	0.466	0.571	0.981	1.633	2.312	2.727	3.170
Critical	**0.512**	**0.623**	**1.318**	**2.071**	**2.640**	**3.129**	**3.689**

Further details of the outputs for the critical events have been located within Appendix E.

4.1.7 Hydraulic Impacts on Downstream Waterway Corridor

A comparison of critical peak flows for the existing and developed mitigated scenarios has been included in Table 9. The hydraulic modelling undertaken has demonstrated that the proposed development will not cause a worsening impact downstream of the site in the Q1-Q100 storm events and that the basins have been adequately sized. **Therefore, the required detention volume for the site in the 1% AEP storm event is 4408m³.**

Discharge hydrographs, stage/water elevations for the detention basin and associated XP Storm outputs have been included in Appendix E of this report to demonstrate the performance of the proposed detention system.

Table 9: XP Storm Existing and Developed Mitigated Peak Discharge Comparison – Catchment A (m³/sec)

ARI (Years)	Existing Critical Discharge	Developed Critical Discharge	Discharge Difference
1	0.565	0.512	**-0.053**
2	0.796	0.623	**-0.173**
5	1.499	1.318	**-0.181**
10	2.073	2.071	**-0.002**
20	2.643	2.640	**-0.003**
50	3.319	3.129	**-0.190**
100	4.016	3.689	**-0.327**

5. STORMWATER QUALITY

5.1 CONSTRUCTION PHASE

As a result of the proposed development, contaminants will be generated during the construction phase. A comprehensive Erosion and Sediment control plan including the construction process will be prepared during the detailed design. This is to be kept on site during the construction phase and will be in accordance with the State Planning Policy 2017 and Logan City Council Planning Scheme.

5.2 OPERATIONAL PHASE

The following is an extract from the Logan Planning Scheme 2015, Schedule 6, PSP 5 – Infrastructure Version 5.1, Section 3.6.1.4 – Stormwater Quality:

Stormwater quality, waterway stability and frequent flow infrastructure is provided to achieve the stormwater management design objectives where the development site is a:

1) *Material change of use for urban purposes where:*
   - a) *the size of the premises is greater than 2,500 m^2; or*
   - b) *it results in the creation of six or more additional dwellings; or*
   - c) *located in the Loganholme local plan area; or*
   - d) *included in the Highway business precinct of the Specialised Centre Zone and located between the Pacific Highway and the southern boundary of the Loganholme local plan area; or*
2) *Reconfiguration of a lot for urban purposes where:*
   - a) *the size of the subject premises is greater than 2,500m^2 and results in an increase number of non-residential lots (e.g. industrial, commercial, etc.); or*
   - b) *it results in the creation of six or more residential lots; or*
   - c) *located in the Loganholme local plan area and results in a total of four or more lots; or*
   - d) *where included in the Highway business precinct of the Specialised Centre Zone and located between the Pacific Highway and the southern boundary of the Loganholme local plan area and results in a total of four or more lots.*

As the proposed development is for a material of use that involves greater than 2,500m^2 of land, the State Planning Policy requirements for water quality are applicable to the proposed development.

5.2.1 Pollutants of Concern

The key pollutants to be targeted and the minimum reductions in mean annual loads described in the State Planning Policy for the South East Queensland Region area outlined in Table 10.

Table 10: South East Queensland Water Quality Objectives

Pollutant	Reduction in Mean Annual Load
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutants (GP)	90%

5.2.2 Modelling/Assessment Approach

A quantitative assessment of stormwater runoff quality was considered for the catchments ultimate developed scenario.

The predicted reductions in mean annual loads of key pollutants have been identified using the "Model for Urban Stormwater Improvement Conceptualisation" (MUSIC), Version 6 (6.3.0). MUSIC is a stormwater quality modelling program that provides estimates of stormwater pollution generation and the performance of stormwater management measures used in series or parallel to form a 'treatment train'.

5.2.3 Meteorological Data

The first step in creating the MUSIC model was to select the appropriate meteorological data set (period and time step) to be used as the basis for the runoff algorithms. Section 3.1 – Meteorological Data and Section 3.2 – Modelling Period and time-step, of the MUSIC Modelling Guidelines details the Rainfall Data and Time Step process requirements of the model, respectively.

The time step used for the MUSIC modelling process was: Logan, 6 Minutes.

5.2.4 Source Nodes

The second step taken in creating the MUSIC models was to define 'Source Nodes' or Sub-Catchments. Source nodes for modelling these catchments were based on the Water by Design reference material: Music Modelling Guidelines. The MUSIC model uses the split catchment approach and consists of commercial source nodes. Catchment areas are outlined below.

Table 11: Source Node Information

Node type	Catchment	Area (ha)	Fraction Impervious
Commercial Road	C1	0.364	100%
	C2	1.033	90%
	C3	0.371	90%
	C4	1.147	90%
Commercial Roof	C1	1.110	100%
	C2	0.653	
	C3	0.103	
	C4	0.022	
Commercial Ground	C1	0.044	20%
	C2	0.168	40%
	C3	0.074	70%
	C4	0.034	30%

5.2.5 Treatment Nodes

The MUSIC model consisted of 6 treatment nodes as detailed in Table 12. Treatment node input parameters were based on the MUSIC Modelling Guidelines and sourced from the product supplier.

Table 12: Selected Stormwater Quality Treatment Devices

Treatment Device	Discussion
Bio-Retention Systems	A bio-retention system is a combination of vegetation and filter substrate that provides treatment of stormwater through filtration, extended detention and some biological uptake. Proposed **Bio-retention C2 Area** (as modelled): • Filter Area = 220.0m^2 • Surface Area = 220.0m^2 • Filter Depth = 0.50m • Extended Detention Depth = 0.30m Proposed **Bio-retention C3 Area** (as modelled): • Filter Area = 122.0m^2 • Surface Area = 122.0m^2 • Filter Depth = 0.50m • Extended Detention Depth = 0.30m Proposed **Bio-retention C4 Area** (as modelled): • Filter Area = 120.0m^2 • Surface Area = 120.0m^2 • Filter Depth = 0.50m • Extended Detention Depth = 0.30m
Gross Pollutant Traps SPEL Stormsacks (or approved equivalent)	A gross pollutant trap is a treatment device designed to capture coarse sediment, trash and vegetation matter in stormwater runoff. Proposed **4 x SPEL (now Atlan) Stormsacks C1** (as modelled): • High flow bypass (total) = 44 L/s
Swale	Swales convey stormwater runoff with vegetation providing effective gross pollutant and course to medium sediment removal, whilst also promoting some infiltration.
Tertiary Treatment Device SPELFilter (or approved equivalent)	The SPELFilter is a proprietary device containing cartridge filtration designed to remove nutrients and sediments from stormwater runoff. Proposed **20 x SPELFilters (now Atlan) C1** (as modelled): • High flow bypass (total) = 56.8 L/s

Refer to the MUSIC information attached in Appendix F for further details.

5.2.6 Proposed Treatment Train

A 'Treatment Train' was developed to target each of the pollutants of concern to be incorporated into the development site layout. This treatment train is illustrated in Figure 5.

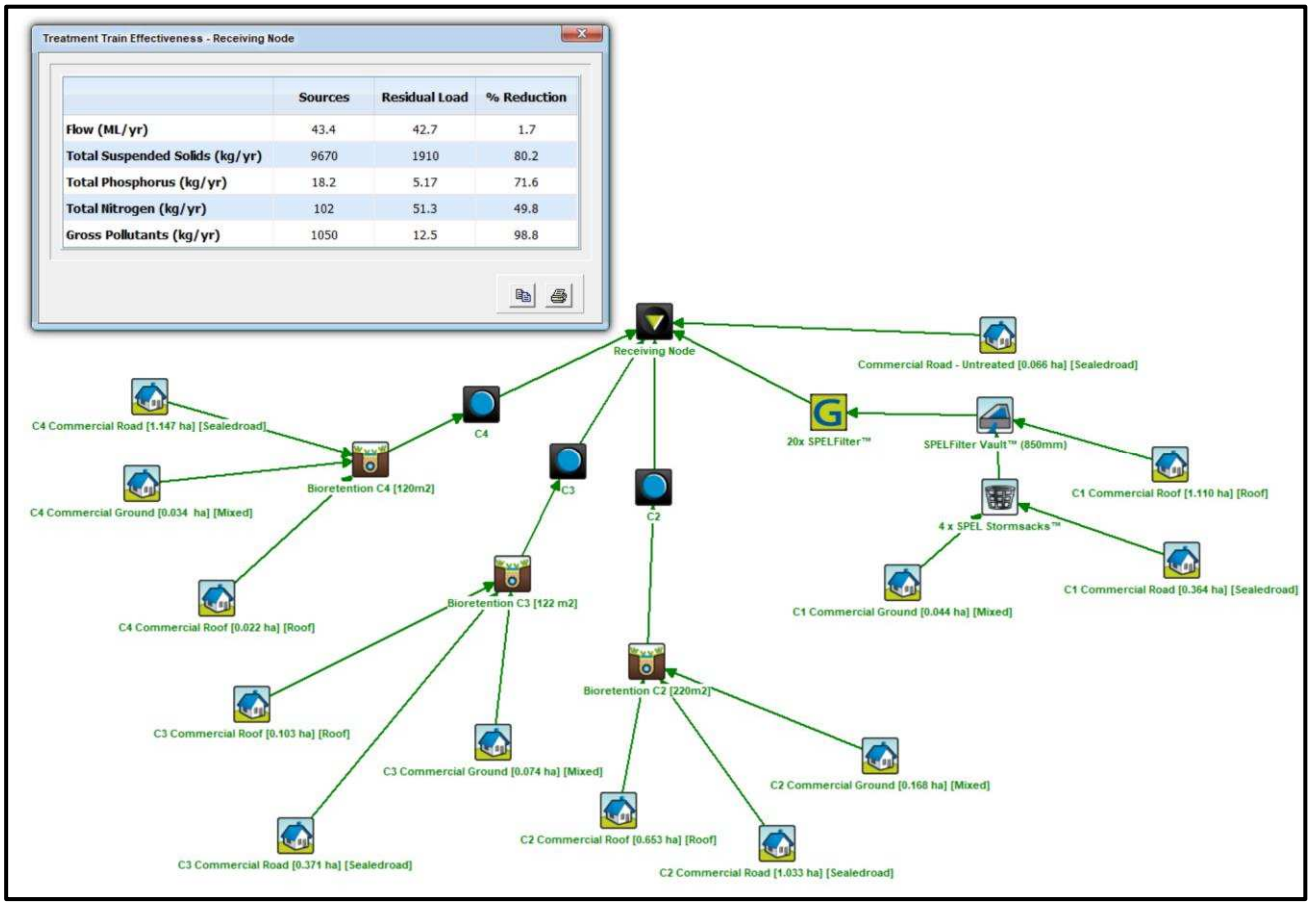


Figure 5: Proposed Treatment Train

5.2.7 Results

The pollutant reductions for the ultimate developed phase of the site, with the inclusion of the detailed treatment train, as obtained from the MUSIC model and analysis are summarised in Table 13.

Table 13: Pollutant Removal Rates Discharge

Pollutant	TSS (%)	TP (%)	TN (%)	GP (%)
Treatment Train Effectiveness	80.2	71.6	49.8	98.8
WQOs	80.0	60.0	45.0	90.0

As indicated in the table above, the removal rates for the target pollutants; total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN) and gross pollutants (GP) are all above the water quality objectives stipulated in the State Planning Policy. Therefore, the proposed treatment train for these areas will yield satisfactory pollutant removal.

6. LOGAN CITY COUNCIL CODES

The relevant Logan City Council Codes with respect to engineering aspects for assessment of the Development Application have been addressed. The codes will assist in assessing operational works requirements. The codes addressed in this report include: -

- Filling and Excavation Code;
- Infrastructure Code.

The completed codes can be found attached in Appendix G of this Report.

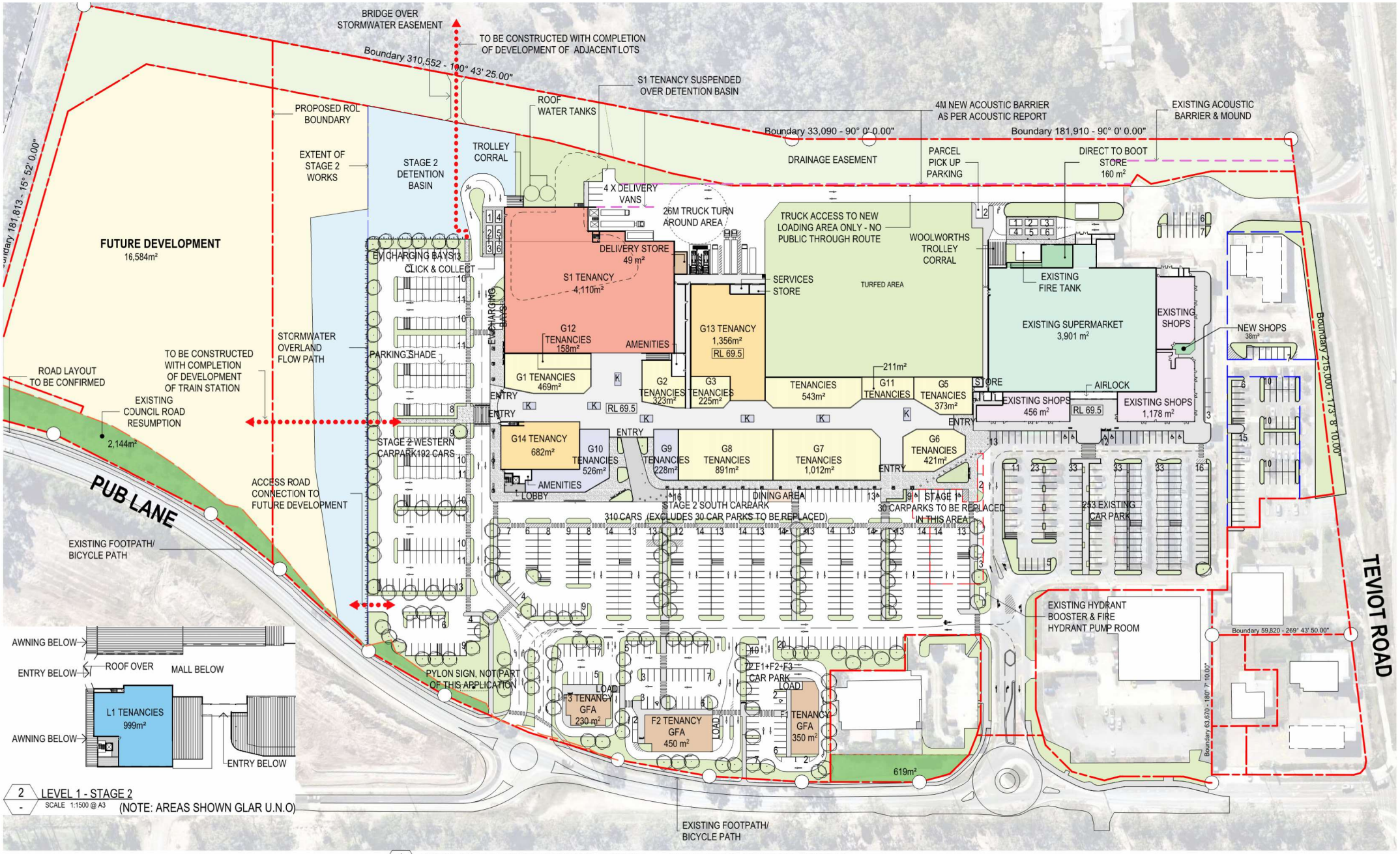
7. SUMMARY

This Engineering Report has demonstrated that the proposed development located at 251 Teviot Road, can be developed in accordance with Engineering Best Management Practice, Logan City Council guidelines, QUDM 2017 and the State Planning Policy 2017. The following points summarise the findings and recommendations:

- The development site is expected to be at low risk of flooding.
- It is proposed that stormwater is discharged to the drainage easement to the north, with a small portion of the site discharging to Pub Lane. Minor flows will be conveyed through the internal drainage system, while major flows will be conveyed via overland flow;
- There will be an increase in peak stormwater runoff as a result of the development, therefore detention will be required;
- During construction the development is considered as a risk with regards to the pollutants generated onsite. A detailed Erosion Sediment Plan will be submitted during the detailed design phase;
- Stormwater runoff is to be treated via bio-retention system or stormwater quality improvement devices (SQID) before being directed to the drainage easement to the north of the site.

APPENDIX A

DEVELOPMENT DRAWINGS



2 - LEVEL 1 - STAGE 2
SCALE 1:1500 @ A3
(NOTE: AREAS SHOWN GLAR U.N.O)

1 - SITE PLAN: PEDESTRIAN DIAGRAM - STAGE 2
SCALE 1:1500 @ A3
(NOTE: AREAS SHOWN GLAR U.N.O)

N

0 15 30 45 60 75 SCALE 1:1500 @ A3

DA SUBMISSION

GREENBANK SHOPPING CENTRE
251 TEVIOT ROAD, GREENBANK
CLIENT - REGION GROUP
TITLE
SITE PLAN: GROUND FLOOR OVERLAY - STAGE 2

ISSUE PURPOSE	DATE	D.	C.	A.
DA-04 FOR APPROVAL	28/07/2023	NH	MC	MC

STATUS

JOB No 6519 | DWG No SD1002 | ISSUE DA-04

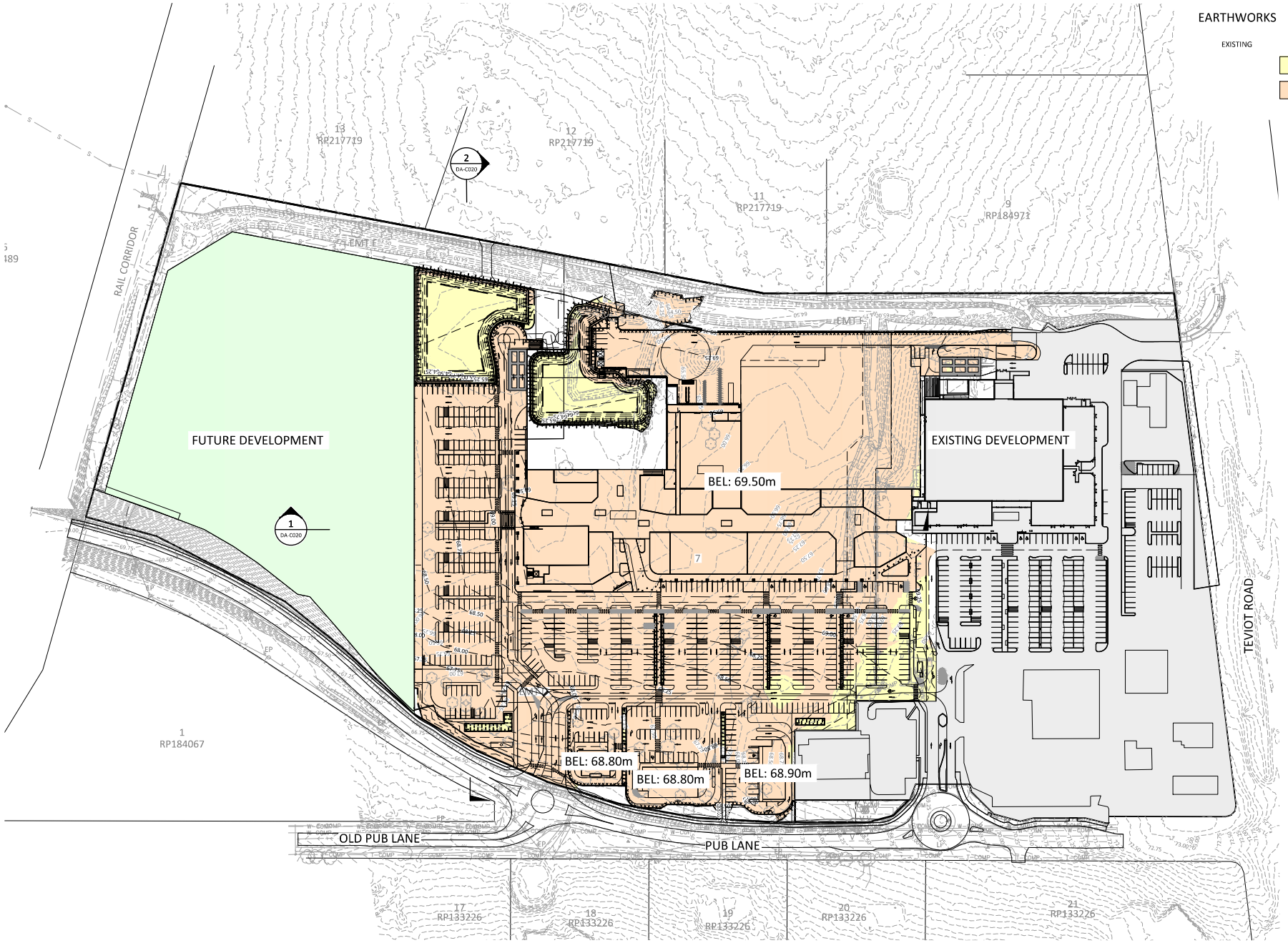
COTTEEPARKER
BRISBANE
T 61 7 3846 7422
COTTEE PARKER ARCHITECTS PTY LTD
ABN 77 010 924 106
COTTEEPARKER.COM.AU

Region GROUP

K:\2100\21006519 Greenbank SC\1 Production\ArchiCAD\Master\6519 Greenbank SC DA Master Stage 3_DMA_Carpark_230711.pln: 28/07/2023: 10:55 AM

APPENDIX B

ENGINEERING DRAWINGS



THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES

UNREDUCED / REDUCED

0 10 20 30 40 50m 1 : 1000 / 1 : 2000

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
D	21.08.23	RESPONSE TO RFI	ETA	ST		
C	27.04.23	ISSUE FOR DA	ETA	ST	RG	
B	26.04.23	DA DRAFT ISSUE	ETA	ST		
A	20.04.23	FOR INFORMATION	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
RPEQ
DATE

CHECKED
DATE

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+61 (7) 3013 4699 www.bornhorstward.com.au

CLIENT: REGION GROUP AU

PROJECT: OLD PUB LANE GREENBANK

SUBJECT: EARTHWORKS LAYOUT

PROJECT No.: 21282

DRAWING No.: DA-C010

REVISION: D

ORIGINAL SIZE A1

J:\2021\21282\05_DRAWINGS\DRG\DA\DRG\DA-C010.DWG
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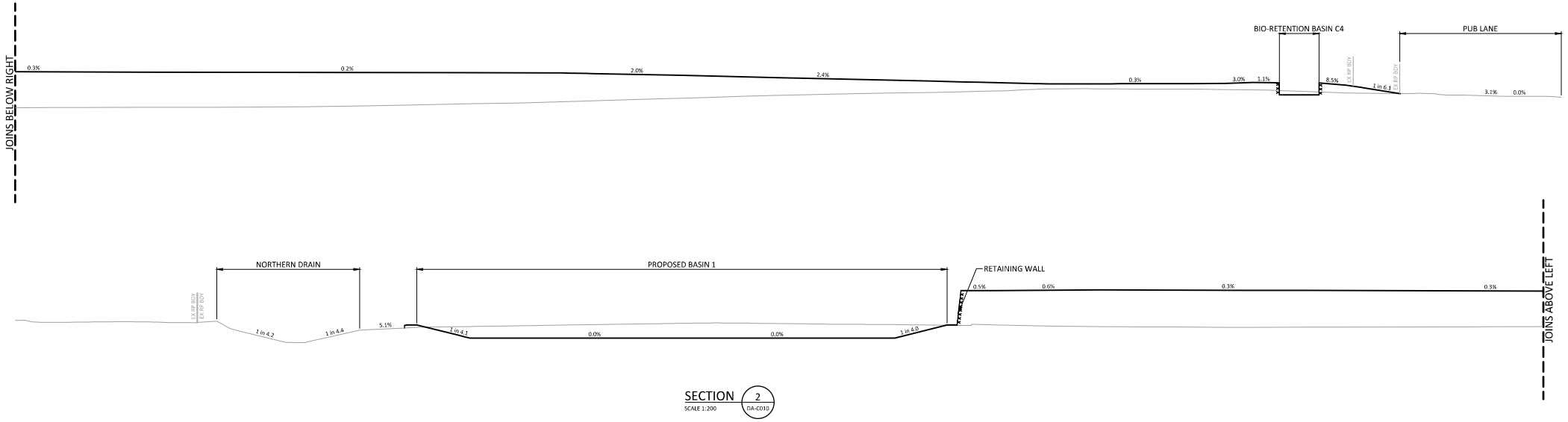
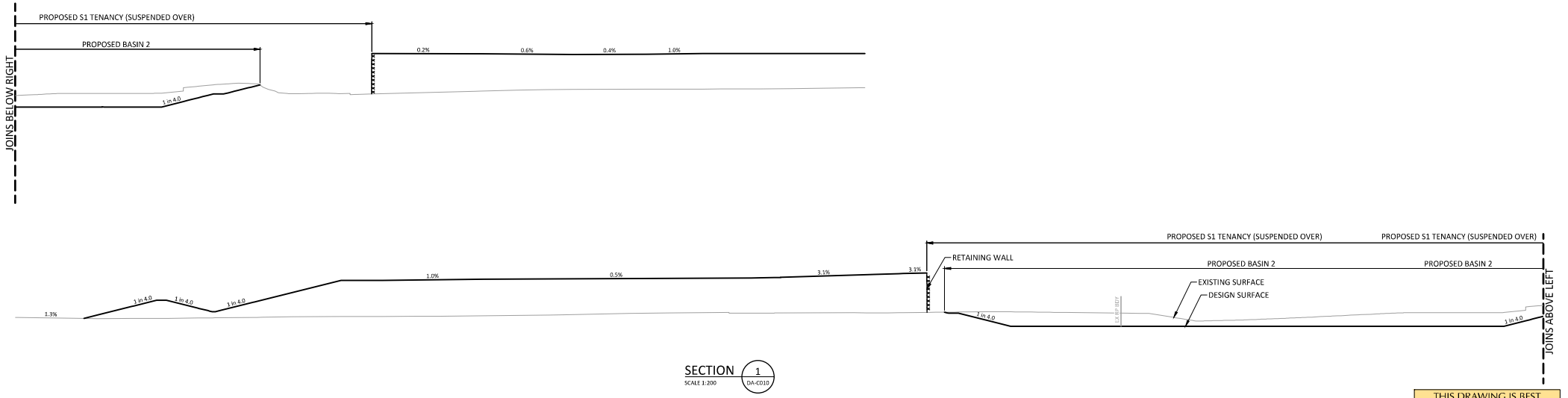


SECTION 2
SCALE 1:200 DA-C010



SECTION 1
SCALE 1:200 DA-C010

THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES — A1 UNREDUCED, A3 REDUCED

SCALES — UNREDUCED / REDUCED

0 2.0 4.0 6.0 8.0 10.0m — 1 : 200 / 1 : 400

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
C	21.08.23	RESPONSE TO RFI	ETA	ST		
B	27.04.23	ISSUE FOR DA	ETA	ST	RG	
A	26.04.23	DA DRAFT ISSUE	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED — RPEQ — DATE

CHECKED — DATE

BORNHORST +WARD
+61 (7) 3013 4699 www.bornhorstward.com.au

CLIENT: REGION GROUP AU

PROJECT: OLD PUB LANE GREENBANK

SUBJECT: EARTHWORKS SECTIONS

PROJECT No.: 21282

DRAWING No.: DA-C020

REVISION: C

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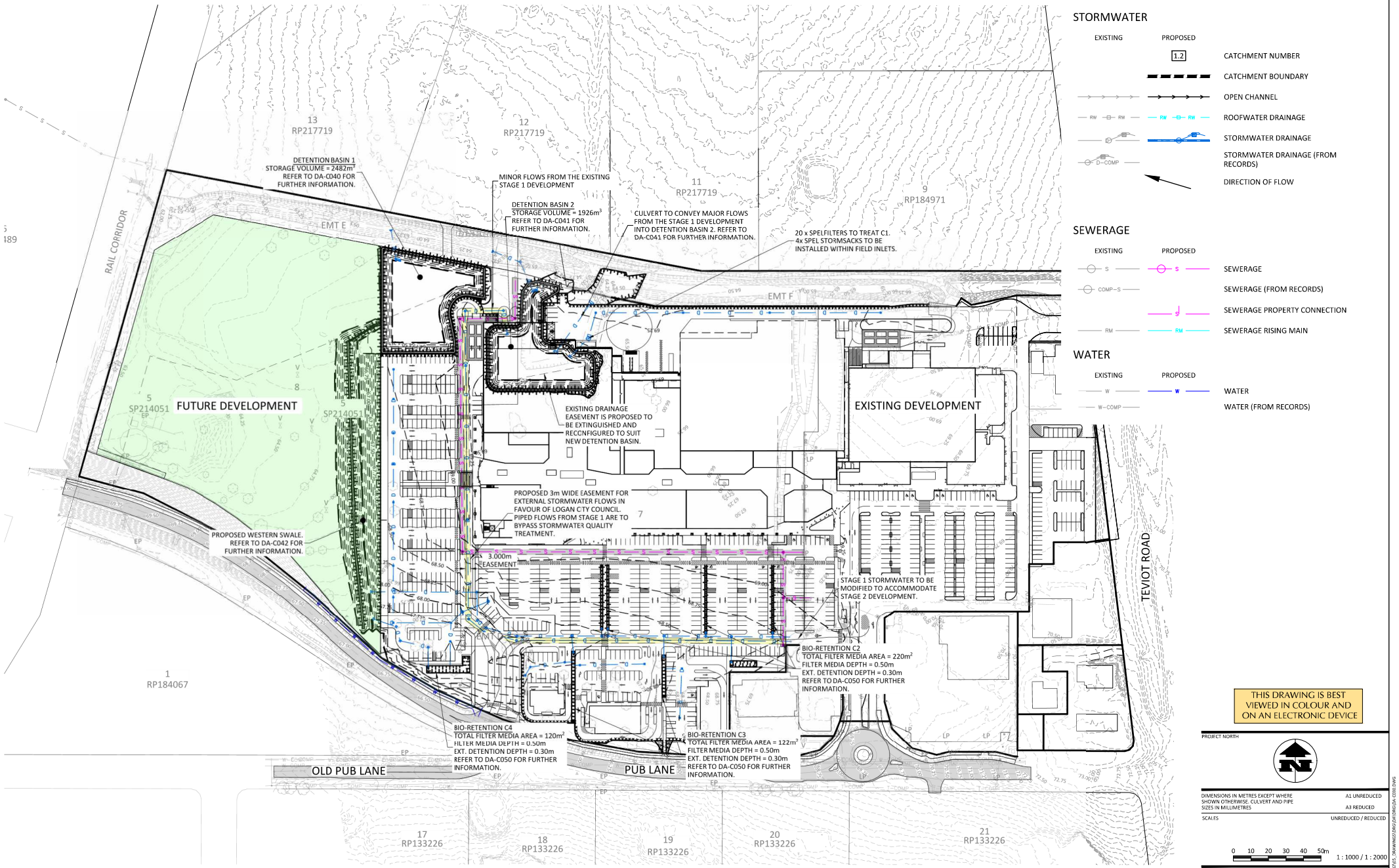
ORIGINAL SIZE A1



THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES

UNREDUCED / REDUCED

0 10 20 30 40 50m 1 : 1000 / 1 : 2000

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
C	21.08.23	RESPONSE TO RFI	ETA	ST		
B	27.04.23	ISSUE FOR DA	ETA	ST	RG	
A	26.04.23	DA DRAFT ISSUE	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
RPEQ
DATE

CHECKED
DATE

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CLIENT: REGION GROUP AU

PROJECT: OLD PUB LANE GREENBANK

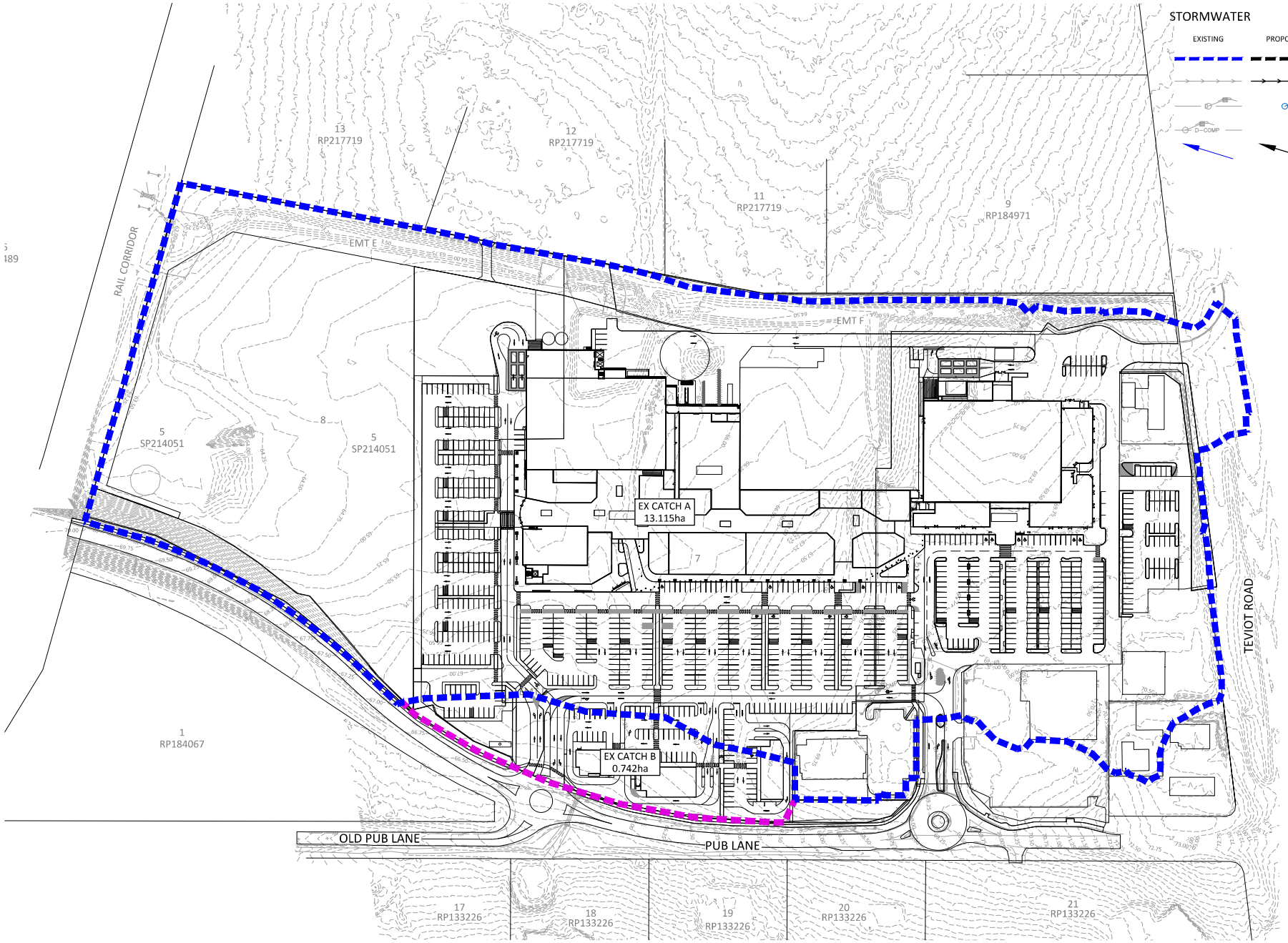
SUBJECT: SITEWORKS AND DRAINAGE LAYOUT

PROJECT No.: 21282

DRAWING No.: DA-C030

REVISION: C

ORIGINAL SIZE A1



THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES

UNREDUCED / REDUCED

0 10 20 30 40 50m

1 : 1000 / 1 : 2000

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
C	21.08.23	RESPONSE TO RFI	ST	ST		
B	27.04.23	ISSUE FOR DA	ETA	ST	RG	
A	26.04.23	DA DRAFT ISSUE	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
RPEQ
DATE

CHECKED
DATE

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CLIENT
REGION GROUP AU

PROJECT
OLD PUB LANE
GREENBANK

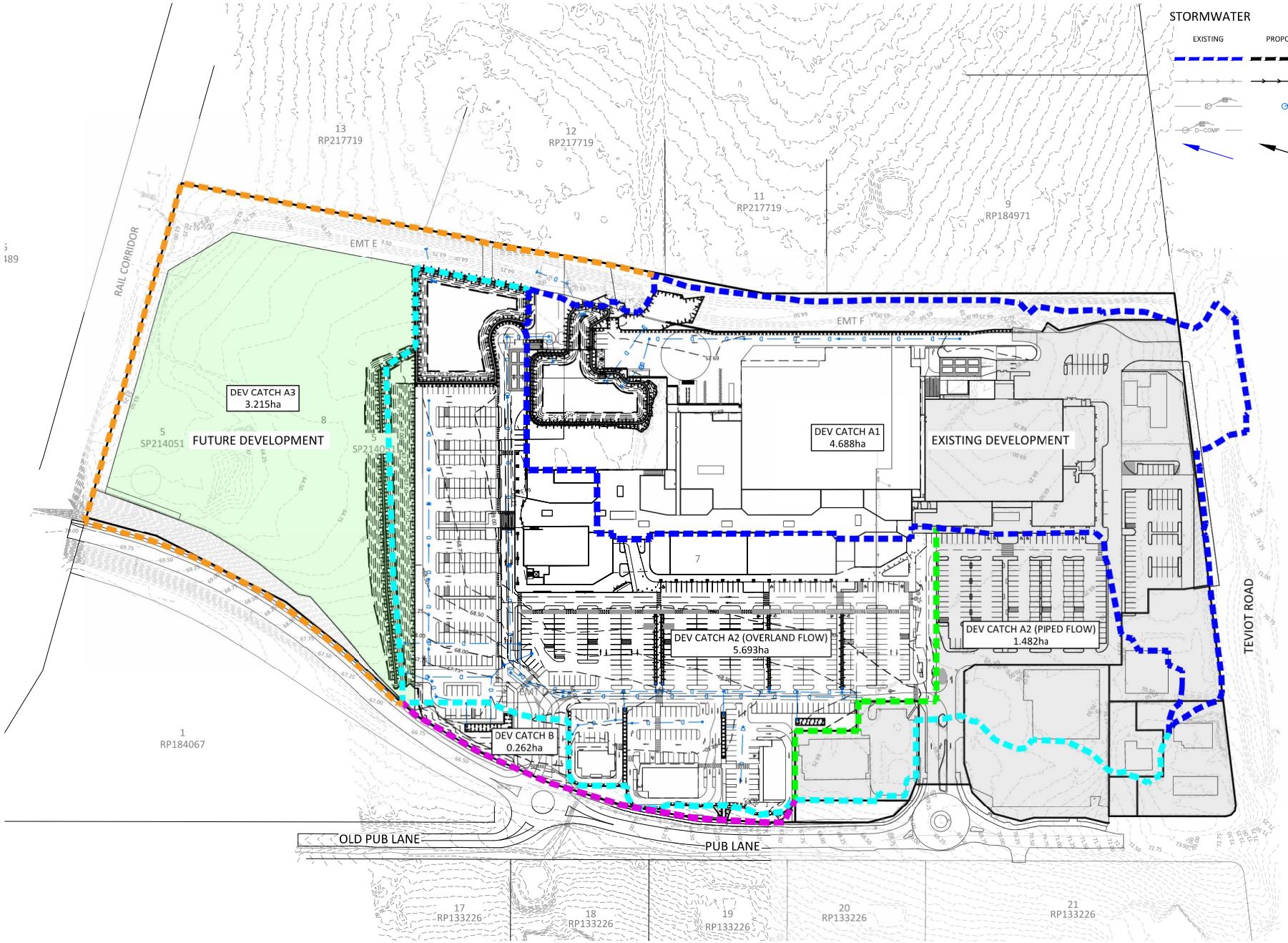
SUBJECT
EXISTING CATCHMENT PLAN

PROJECT No.
21282

DRAWING No.
DA-C035

REVISION
C

ORIGINAL SIZE A1



THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES

UNREDUCED / REDUCED

0 10 20 30 40 50m

1 : 1000 / 1 : 2000

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
C	21.08.23	RESPONSE TO RFI	ST	ST		
B	27.04.23	ISSUE FOR DA	ETA	ST	RG	
A	26.04.23	DA DRAFT ISSUE	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
RPEQ
DATE

CHECKED
DATE

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CLIENT
REGION GROUP AU

PROJECT
OLD PUB LANE
GREENBANK

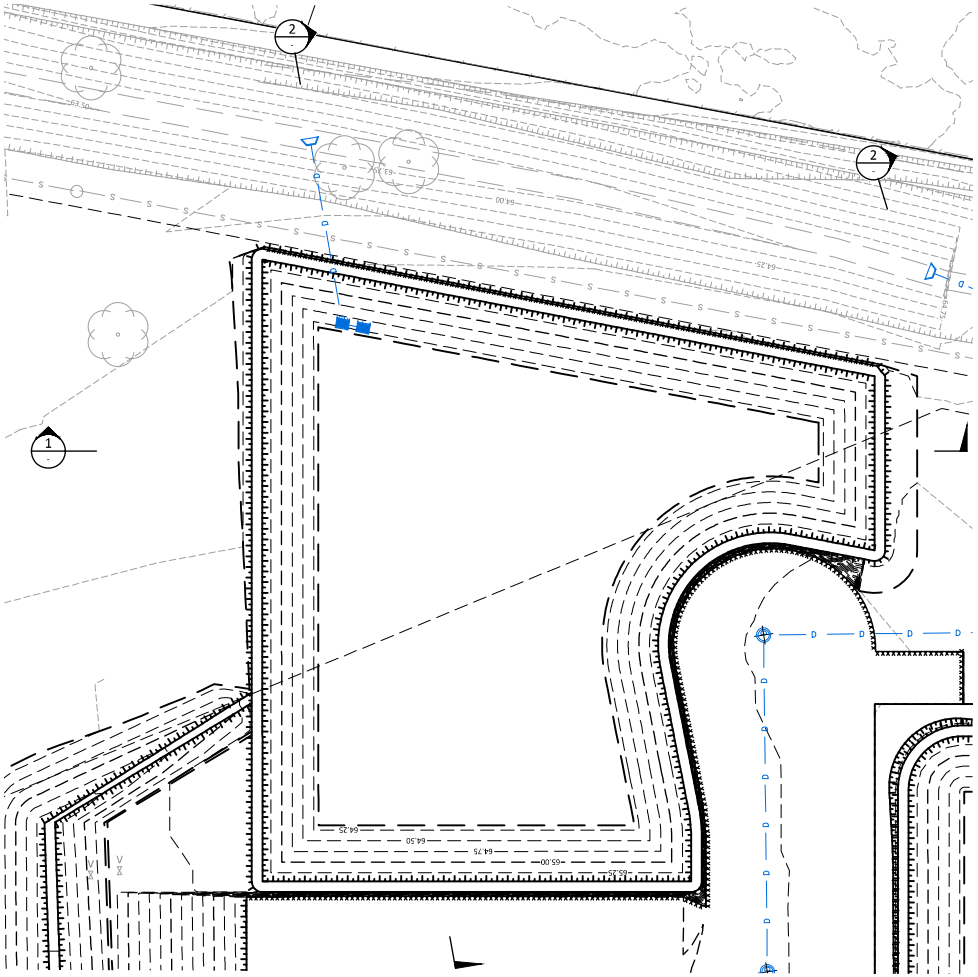
SUBJECT
DEVELOPED CATCHMENT PLAN

PROJECT No.
21282

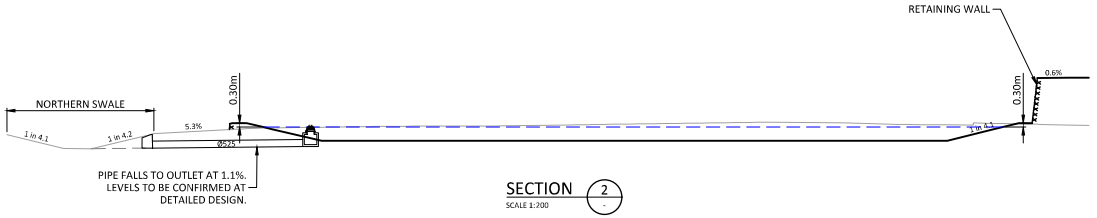
DRAWING No.
DA-C036

REVISION
C

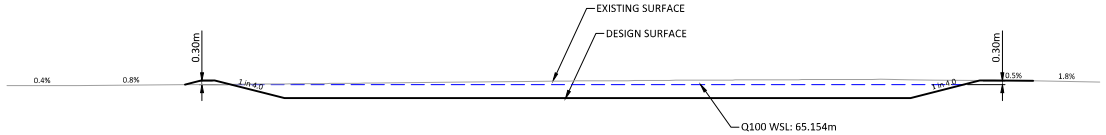
ORIGINAL SIZE A1



PLAN
SCALE 1:250



SECTION 2
SCALE 1:200



SECTION 1
SCALE 1:200

BASIN 1 CROSS SECTIONS
SCALE 1:200

THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES

UNREDUCED / REDUCED

0 2.5 5.0 7.5 10.0 12.5m

1 : 250 / 1 : 500

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
A	21.08.23	RESPONSE TO RFI	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
7729
RPEQ
DATE

CHECKED
DATE

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CLIENT
REGION GROUP AU

PROJECT
OLD PUB LANE
GREENBANK

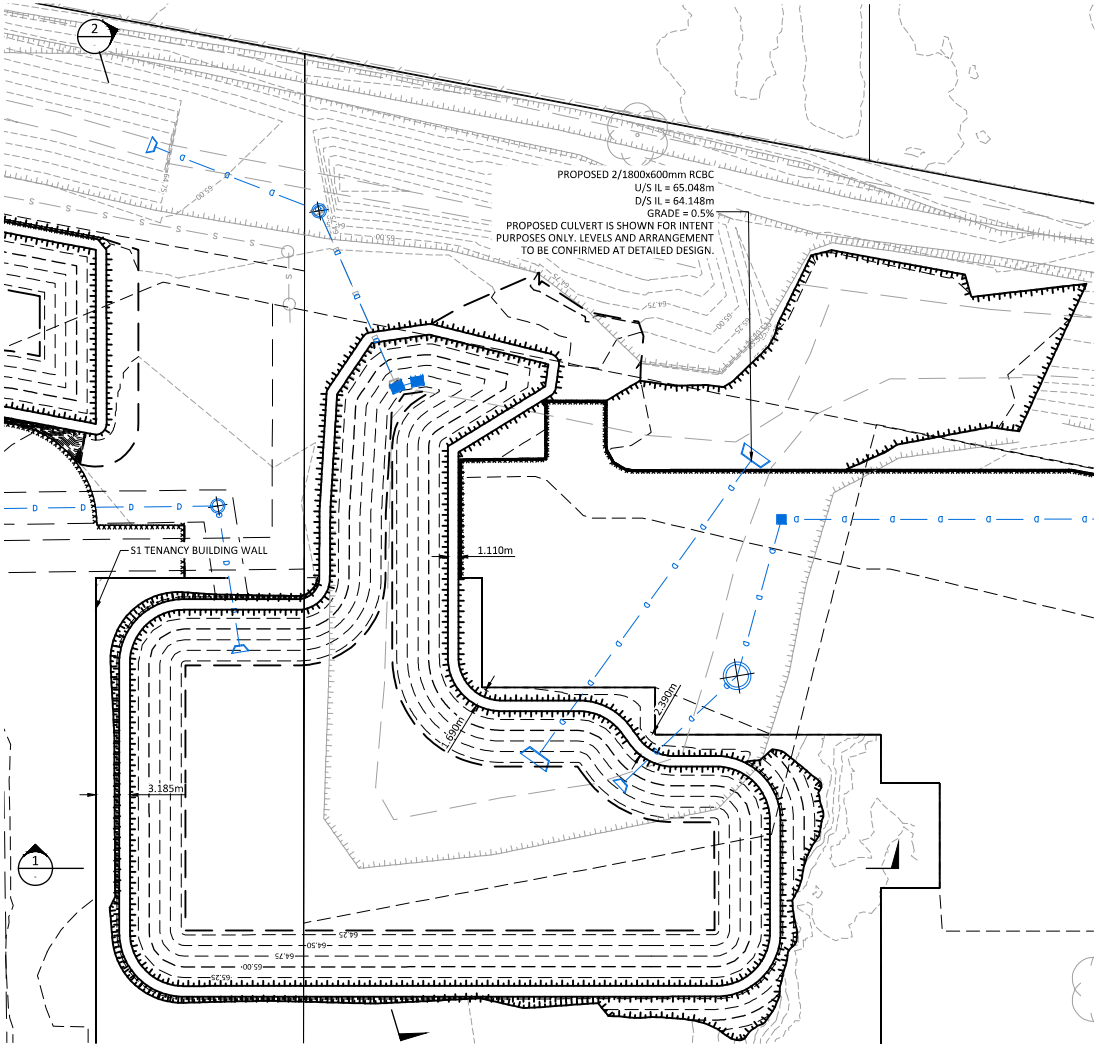
SUBJECT
STORMWATER BASIN 1
LAYOUT AND SECTIONS

PROJECT No.
21282

DRAWING No.
DA-C040

REVISION
A

ORIGINAL SIZE A1



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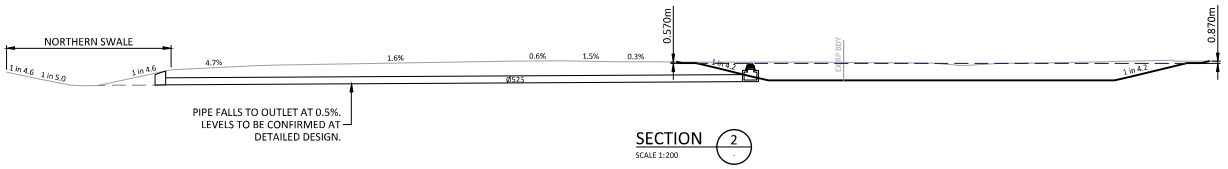
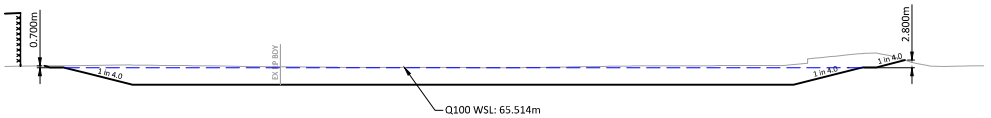
SCALE 1:250



SECTION 2
SCALE 1:200



SECTION 1
SCALE 1:200

BASIN 2 CROSS SECTIONS
SCALE 1:200

THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES — UNREDUCED / REDUCED

0 2.0 4.0 6.0 8.0 10.0m — 1 : 200 / 1 : 400

0 2.5 5.0 7.5 10.0 12.5m — 1 : 250 / 1 : 500

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
A	21.08.23	RESPONSE TO RFI	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED — DATE

CHECKED — DATE

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CLIENT: REGION GROUP AU

PROJECT: OLD PUB LANE GREENBANK

SUBJECT: STORMWATER BASIN 2 LAYOUT AND SECTIONS

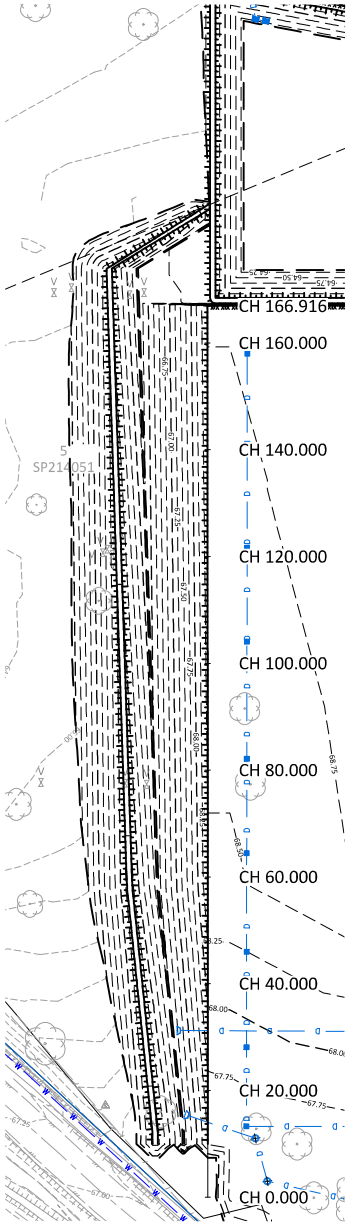
PROJECT No.: 21282

DRAWING No.: DA-C041

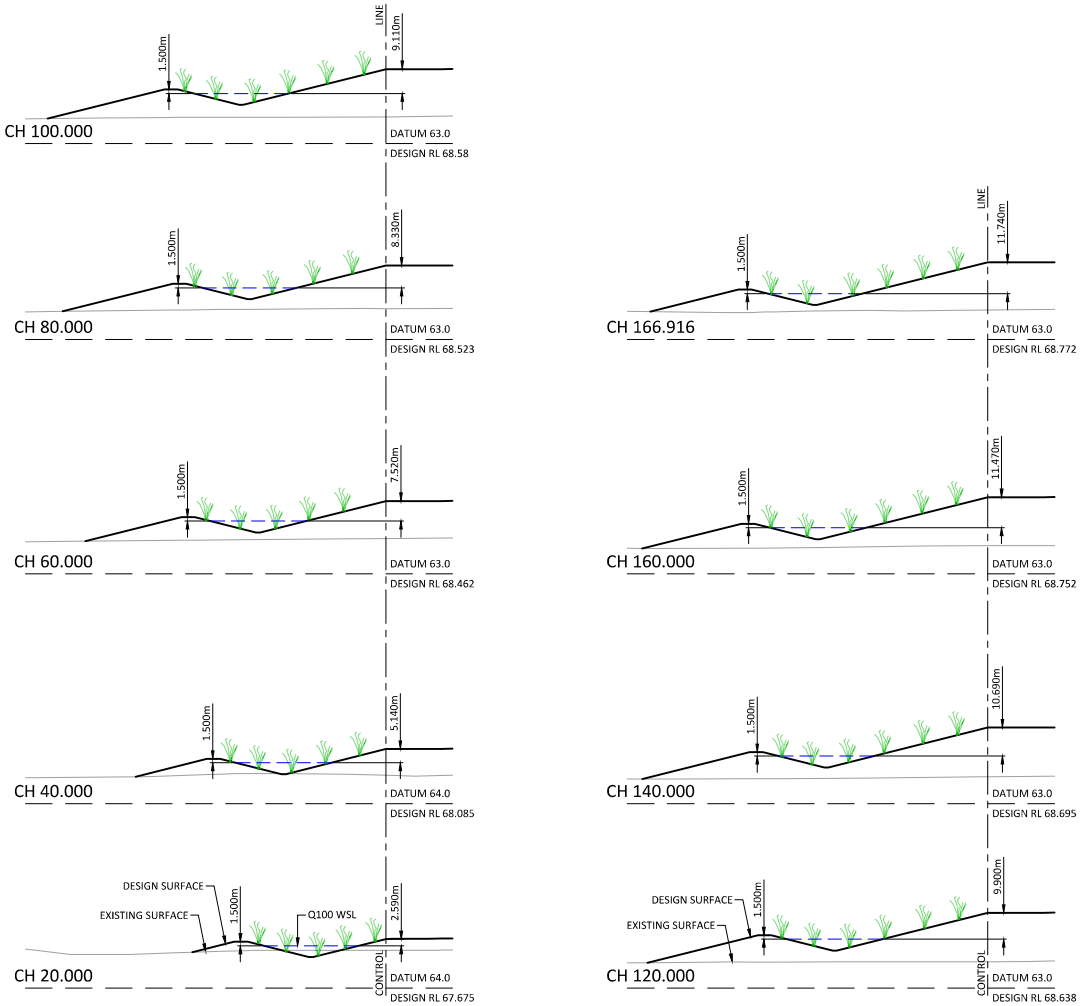
REVISION: A

ORIGINAL SIZE A1

21/08/2023 2:30:09 PM



PLAN
SCALE 1:500



SWALE CROSS SECTIONS
SCALE 1:200

THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES
A1 UNREDUCED
A3 REDUCED

SCALES
UNREDUCED / REDUCED
0 5 10 15 20 25m 1 : 500 / 1 : 1000
0 2.0 4.0 6.0 8.0 10.0m 1 : 200 / 1 : 400

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
A	21.08.23	RESPONSE TO RFI	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
7729 RPEQ
DATE

CHECKED
DATE

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CLIENT
REGION GROUP AU

PROJECT
OLD PUB LANE GREENBANK

SUBJECT
WESTERN SWALE LAYOUT AND SECTIONS

PROJECT No.
21282

DRAWING No.
DA-C042

REVISION
A

ORIGINAL SIZE A1

21/08/2023 7:30:11 PM
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APPENDIX C

EXISTING STORMWATER AND CONTOUR INFORMATION

Flood Report

During a flood or other emergency event, please visit Logan's Disaster Dashboard for the latest information.

This Flood Report provides information from Logan's planning scheme and any updated information Council has accepted from more recent flood studies.

Property Details

Address: 19-67 Pub Lane GREENBANK QLD 4124
Lot/Plan: Lot 5 SP 214051
Property Size: 99,640 m ^{2} (survey plan area)
Zone and precinct: Priority Development Area - No Precinct
Property Key: 314242
Division: 11

Flood hazard overlay in Logan Planning Scheme 2015	**NO**	This property is not mapped on the Flood hazard overlay map in the Logan Planning Scheme 2015. If more recent information about the flood hazard is available, it should be used to inform development decisions. This is to ensure risks associated with flood hazard are avoided or mitigated to protect people and property. See further details below.
Flood Level Information	**NO**	There is no flood level information for this property included in this report. This does not mean the property is not potentially impacted by floods. Please see further details below or contact Council's River and Catchment Engineering Program using the details in the Further Information section below.
Updated flood mapping based on more recent flood studies	**NO**	There is no updated flood mapping for this property at this time. This may change in future. Please contact Council's River and Catchment Engineering Program using the details in the Further Information section below or check this report in future.

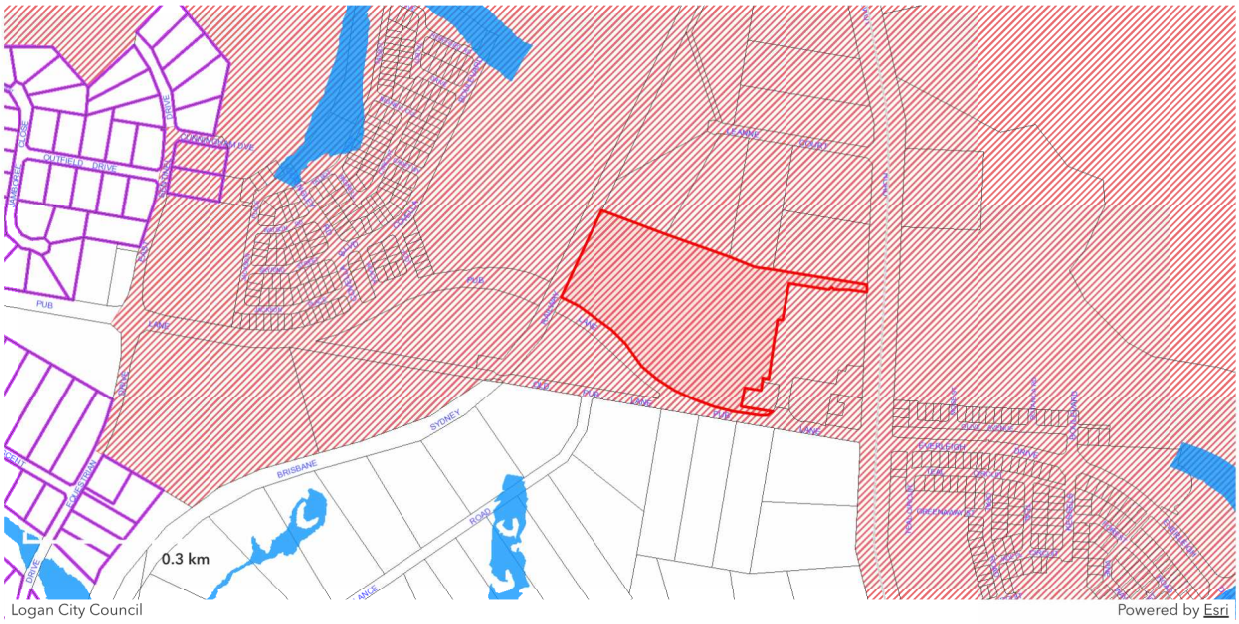
Planning Scheme Flood hazard overlay map

The selected property is shown on the extract below of the Flood hazard overlay map in the Logan Planning Scheme 2015.

Various provisions of the Logan Planning Scheme 2015 which refer to premises affected by the 'flood hazard overlay' apply to the part(s) of the property affected by the Flood hazard overlay map. The map may not reflect the most recent information about flood hazard.

If more recent information is available about the flood hazard for this property, that should be used to inform development decisions to ensure risks associated with flood hazard are avoided or mitigated to protect people and property. Please refer to the Updated flood mapping section below.

Note: this property is in a Priority Development Area. The Logan Planning Scheme does not apply and the extract below is for information only. Please contact Economic Development Queensland for advice on planning and development decisions.



Further Information

Please refer to the Flood Risk Fact Sheet or contact Council using the details below.

Planning and development enquiries	Contact Council on 07 3412 5269 or email development@logan.qld.gov.au Before lodging a development application, pre-lodgement advice is recommended.
Building information	Contact Council on 07 3412 3412 or email council@logan.qld.gov.au. You can also contact a private building certifier.
Flood studies and modelling information	Contact Council on 07 3412 3412 or email council@logan.qld.gov.au. Flood studies are available from the Flood page on Council's website.
Properties in Priority Development areas	Contact Economic Development Queensland.

Please note:

1. This report can be used for the purposes of development assessment but should **not** be relied upon as part of a property transaction.
2. This report does not represent the highest possible flood level that might affect the property, as floods are highly unpredictable and variable.
3. A property may also be affected by other sources of potential inundation.
4. The flood levels are sourced from Council's accepted flood studies and flood modelling and are measured in metres Australian Height Datum (AHD), where mean sea level is approximately zero (0) metres AHD. Ground level information for the property is provided as context for the flood levels.
5. The flood mapping and levels in this report are based on data that was obtained through flood studies undertaken at a particular time and date and which are subject to change. For example, if the method for calculating flood levels is updated, industry guidelines are amended, or more recent information becomes available, this may result in changes to the information in this report.
6. If flood level information is not available (shown as 'N/A'), you will need to contact Council using the details in the table above.
7. This report provides limited information for development assessment purposes and is not a substitute for independent professional advice. You should engage the services of a Registered Professional Engineer of Queensland (RPEQ) to obtain site specific information regarding the flood risk to your property and any the implications for any proposed building or development.
8. Although Logan City Council takes reasonable care in producing this report, it does not guarantee the information is accurate, complete, or current. Logan City Council does not accept any responsibility for any loss or damage (however it was caused) in connection with the use of or reliance on the information in this report.

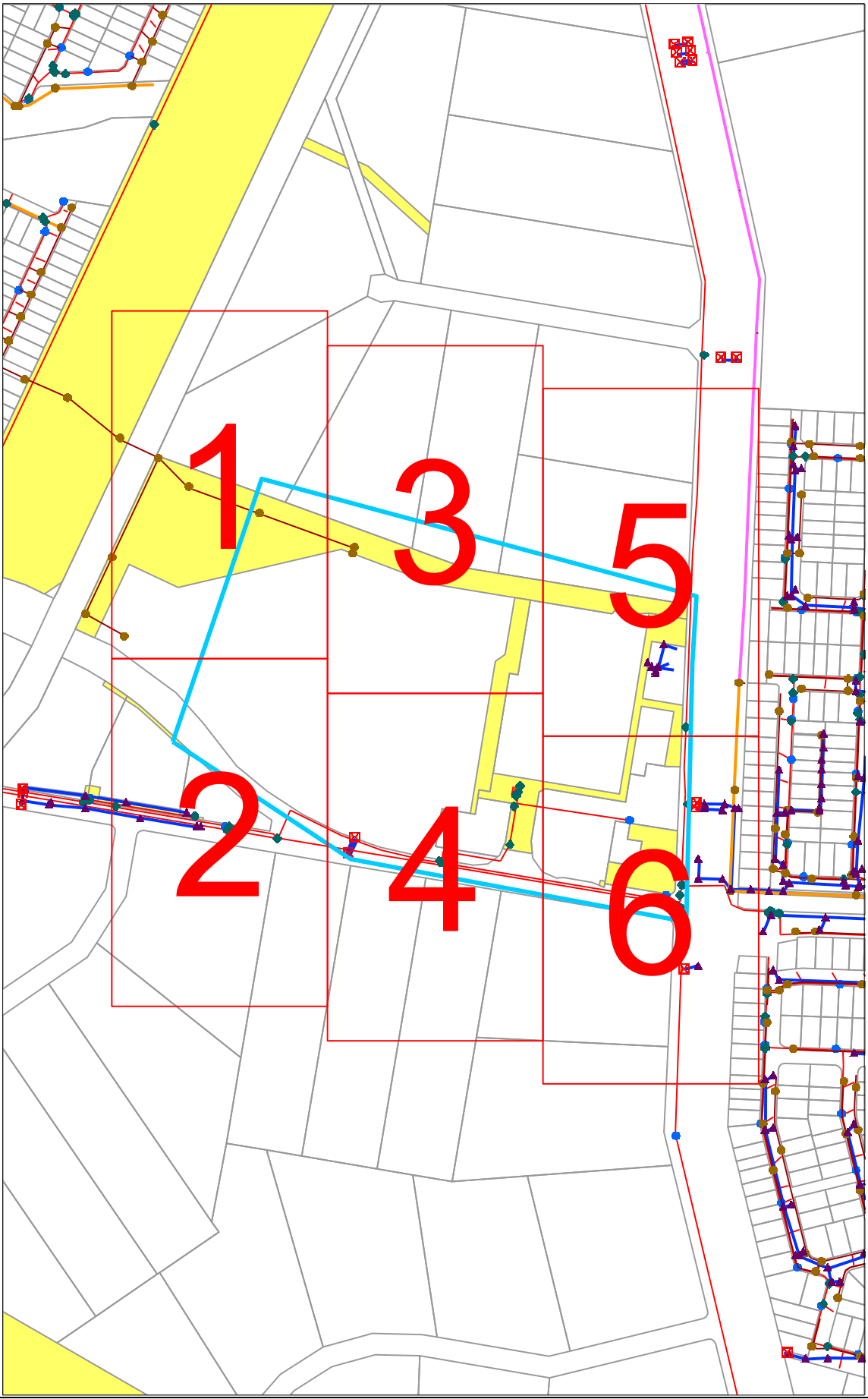
Logan City Council
PO Box 3226 Logan Central QLD 4114
Generated: Tuesday, 25 April 2023 8:23 PM

Phone: (07) 3412 5269
Email: council@logan.qld.gov.au
Web: logan.qld.gov.au

Overview Map

Sequence No: 223738366

17 Pub Lane Greenbank



LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

N

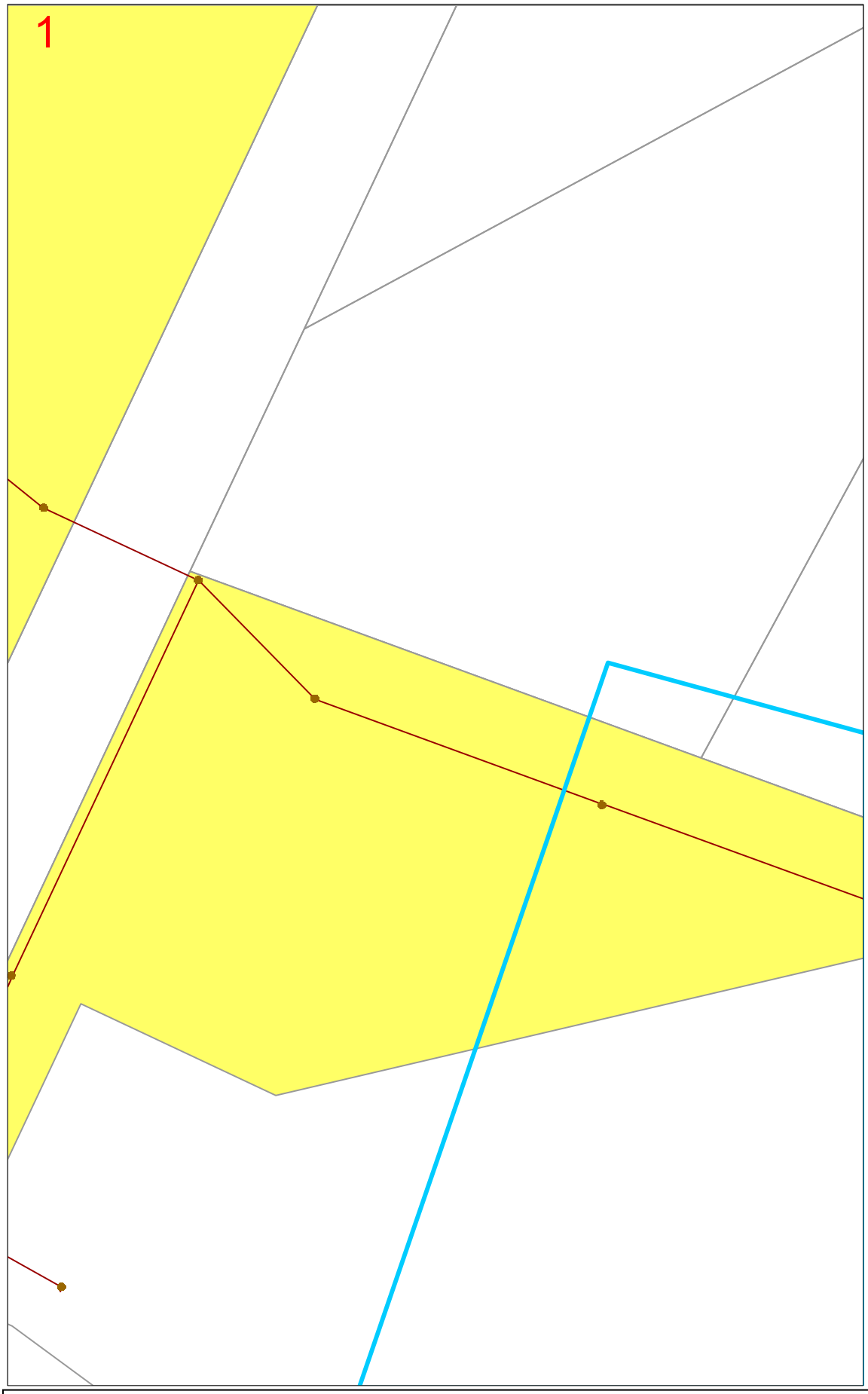
1:4000

0 0.05km

Map 1

Sequence No: 223738366

17 Pub Lane Greenbank



LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

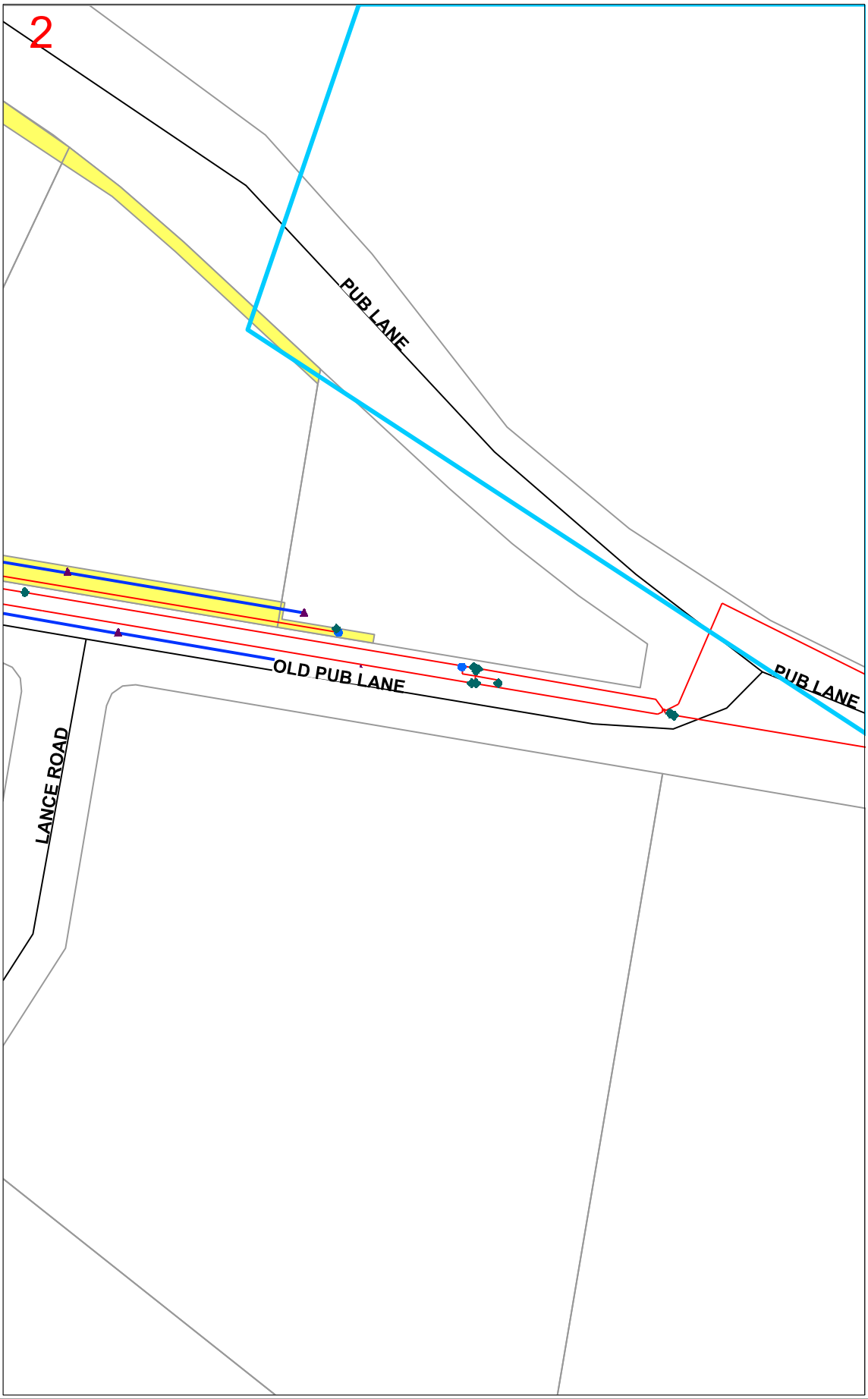
N

1:1000

Map 2

Sequence No: 223738366

17 Pub Lane Greenbank



LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

N

1:1000

Map 3

Sequence No: 223738366

17 Pub Lane Greenbank

LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

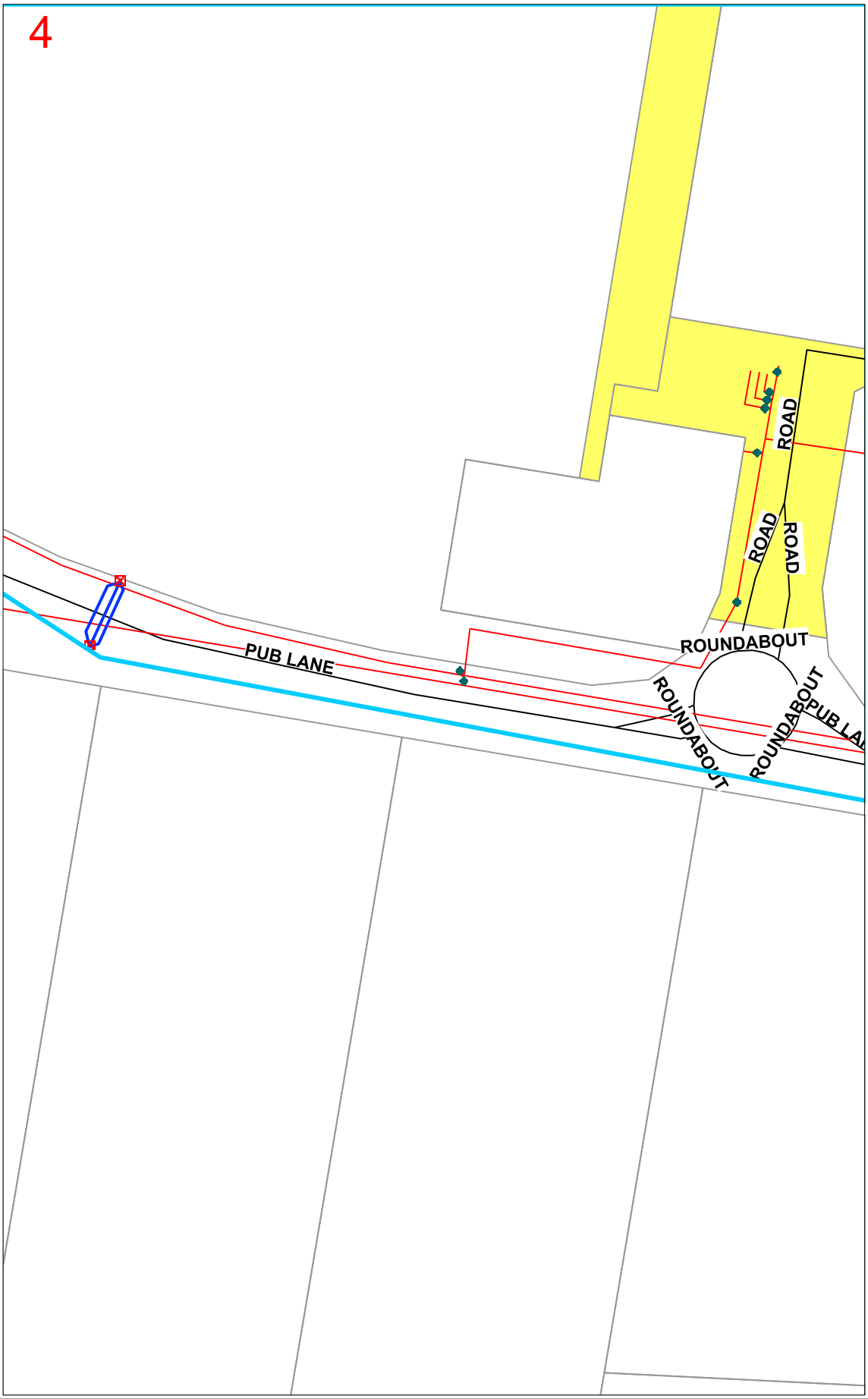
N

1:1000

Map 4

Sequence No: 223738366

17 Pub Lane Greenbank



LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

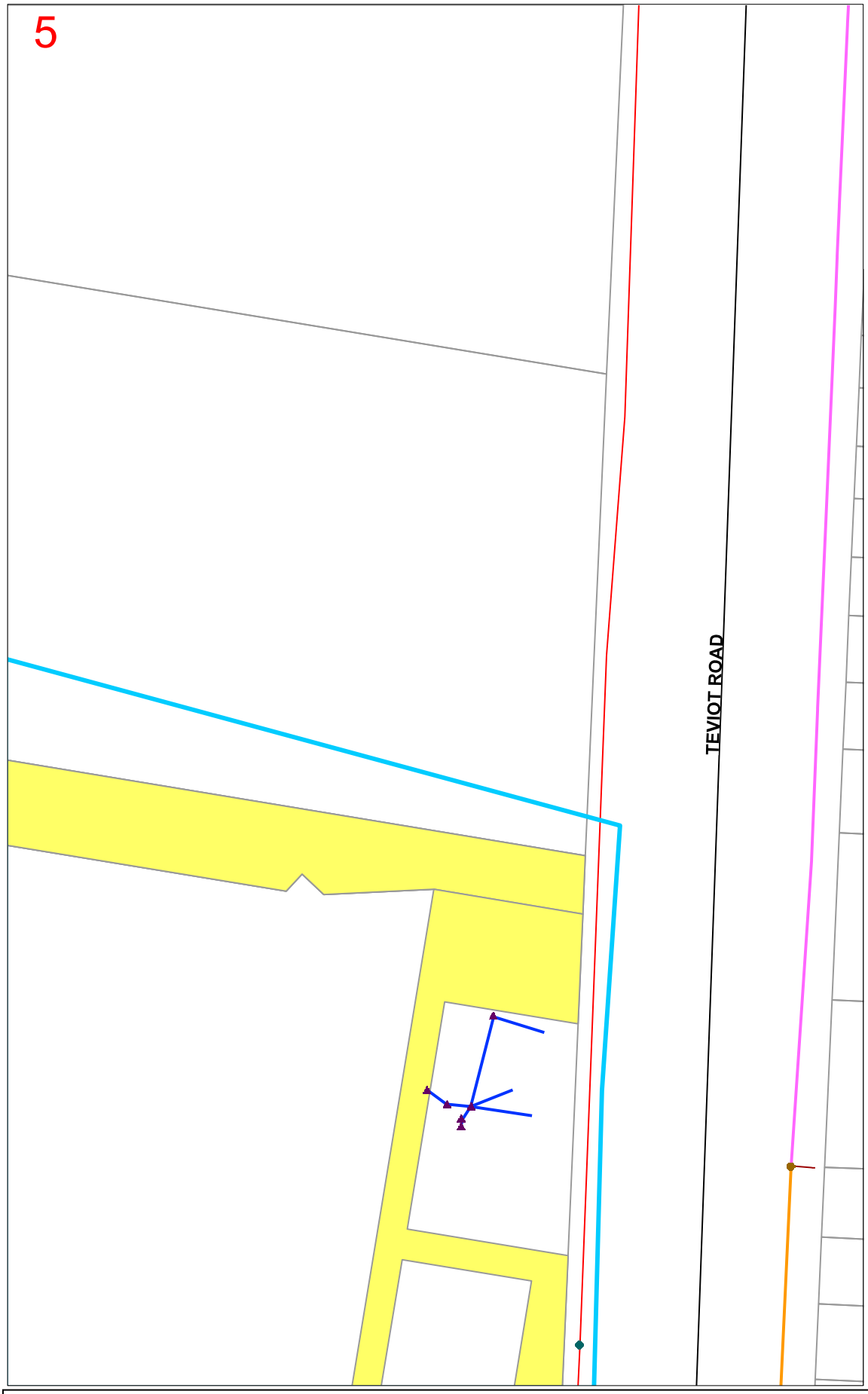
N

1:1000

Map 5

Sequence No: 223738366

17 Pub Lane Greenbank



LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

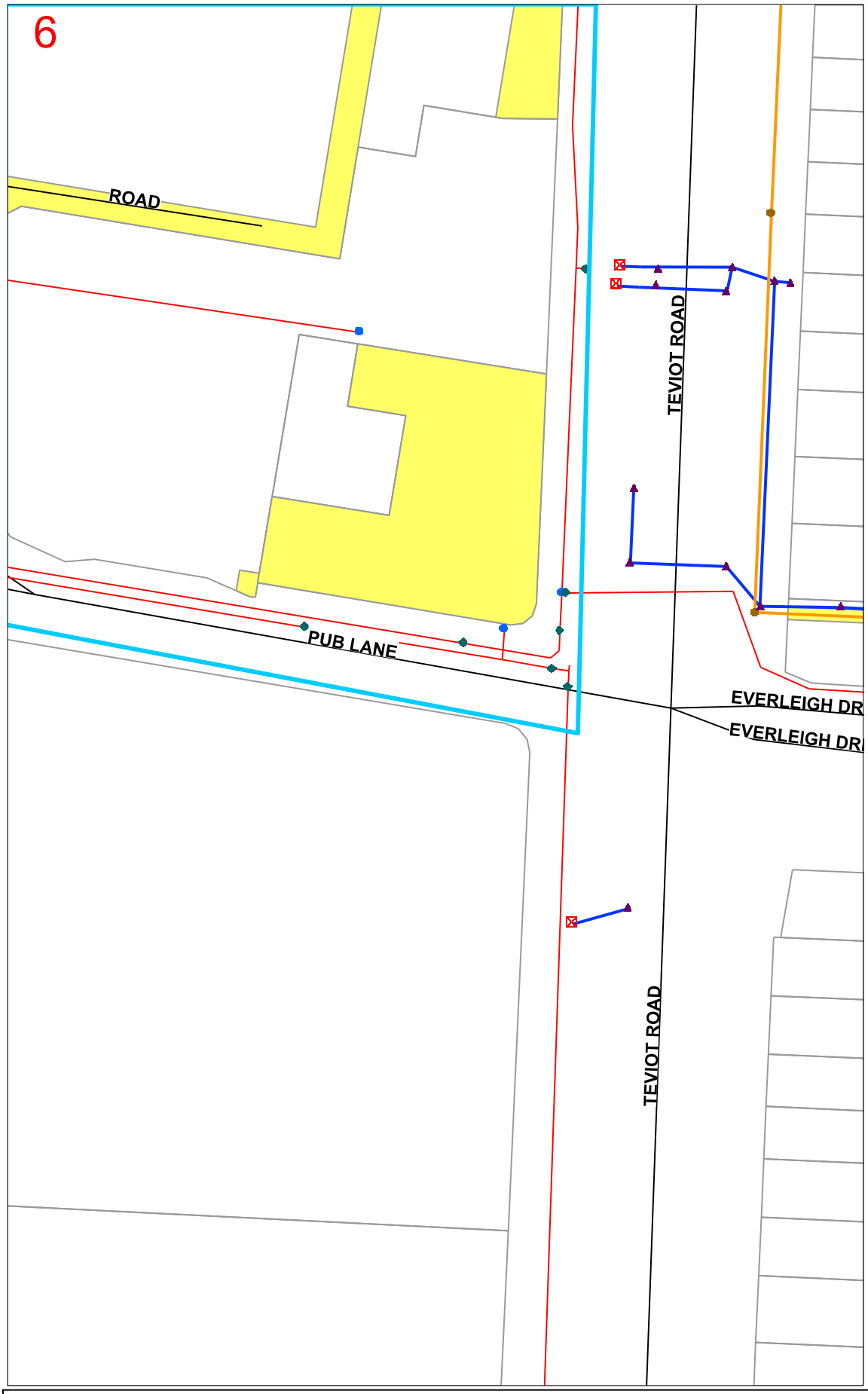
N

1:1000

Map 6

Sequence No: 223738366

17 Pub Lane Greenbank



LEGEND:

- Affected BYDA Work Area
- 1 Detail Map

Sewer Assets

- Sewerage Pump Station - Existing
- Sewerage Pump Station - Retired
- Sewerage Manhole - Existing
- Sewerage Manhole - Retired
- Sewerage Pipe - Existing
- Sewerage Pipe - Retired
- Sewerage Trunk Main - Existing
- Sewerage Trunk Main - Retired
- Sewerage Rising Main - Existing
- Sewerage Rising Main - Retired

Water Assets

- Hydrant - Existing
- Hydrant - Retired
- Valve - Existing
- Valve - Retired
- Water Supply Line - Existing
- Water Supply Line - Retired

Stormwater Assets

- Manholes, Gullies and Drainways
- Telemetry Gauge Station
- Stormwater Headwall
- Telemetry Air Line
- Stormwater Pipes and Culverts

Parcel Types

- Easement
- Base Lot (Type L)
- Water Body (Type W)

N

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APPENDIX D

RATIONAL METHOD CALCULATIONS

INITIAL PEAK FLOW ESTIMATE

Written by BB 31/10/08

Updated by DJK 25/05/20

BORNHORST + WARD

Job Number: **21282**

Job Name: **Greenbank Shopping Centre**
Reporting Point 1

Designed: ST

Checked:

IFD Location: Greenbank

TOTAL RUNOFF COEFF.

	Sub Catchment Area (Ha)		Fraction Impervious		Runoff Coeficients		Calculated C10	
No.	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
1	13.115	13.596	0%	65%	0.70	0.77		
2	0.000	0.000	0%	0%	0.00	0.00		
3	0.000	0.000	0%	0%	0.00	0.00		
4	0.000	0.000	0%	0%	0.00	0.00		
5	0.000	0.000	0%	0%	0.00	0.00		
	13.115	**13.596**					**0.70**	**0.77**

Raw IFD data has been obtained from the Bureau of Meteorology (BOM) website.

EXISTING TIME OF CONCENTRATION

	Std Inlet Time	0
SHEET FLOW	Site Slope (%)	2.1
	Flow Length (m)	200
	Horton's "n"	0.035
	Travel Time (min)	18.88
CHANNEL FLOW	Travel Length (m)	500
	Fall (m)	6.75
	Travel Time (min)	6
	Multiplier	3
	Travel Time (min)	18
	Total Time (Tc)	**36.9**

DEVELOPED TIME OF CONCENTRATION

	Std Inlet Time	5
PIPE FLOW	Travel Length (m)	270
	Fall (m)	2
	Travel Time (min)	5
	Multiplier	1
	Travel Time (min)	5
CHANNEL FLOW	Travel Length (m)	315
	Fall (m)	3
	Travel Time (min)	5
	Multiplier	3
	Travel Time (min)	15
	Total Time (Tc)	**25.0**

PEAK RUNOFF CALCULATIONS

		Rainfall Intensity (mm/hr)		Coeficient of Runoff		Peak Runoff Rates (m^3/s)	
AEP Event %	ARI Event yr	Existing	Proposed	Existing	Proposed	Existing	Proposed
63%	1	42	54	0.56	0.62	**0.863**	**1.253**
39%	2	48	62	0.60	0.65	**1.049**	**1.523**
18%	5	68	86	0.67	0.73	**1.636**	**2.369**
10%	10	81	102	0.70	0.77	**2.053**	**2.964**
5%	20	93	118	0.74	0.81	**2.496**	**3.589**
2%	50	110	138	0.81	0.89	**3.226**	**4.614**
1%	100	123	153	0.84	0.92	**3.759**	**5.356**

PEAK FLOWS FOR FREQUENT EVENTS

ARI Event	% of Q1	Peak discharge (m^/s)	
yr		Existing	Proposed
1mth	25%	**0.216**	**0.313**
2mth	40%	**0.345**	**0.501**
3mth	50%	**0.431**	**0.626**
4mth	60%	**0.518**	**0.752**
6mth	75%	**0.647**	**0.940**
9mth	90%	**0.777**	**1.128**
12mth	100%	**0.863**	**1.253**

INITIAL PEAK FLOW ESTIMATE

Written by BB 31/10/08

Updated by DJK 25/05/20

BORNHORST + WARD

Job Number: **21282**

Job Name: **Greenbank Shopping Centre**
Reporting Point 2

Designed: ST

Checked:

IFD Location: Greenbank

TOTAL RUNOFF COEFF.

	Sub Catchment Area (Ha)		Fraction Impervious		Runoff Coeficients		Calculated C10	
No.	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
1	0.742	0.262	0%	45%	0.70	0.70		
2	0.000	0.000	0%	0%	0.00	0.00		
3	0.000	0.000	0%	0%	0.00	0.00		
4	0.000	0.000	0%	0%	0.00	0.00		
5	0.000	0.000	0%	0%	0.00	0.00		
	0.742	**0.262**					**0.70**	**0.70**

Raw IFD data has been obtained from the Bureau of Meteorology (BOM) website.

EXISTING TIME OF CONCENTRATION

	Std Inlet Time	0.00
SHEET FLOW	Site Slope (%)	4
	Flow Length (m)	60
	Horton's "n"	0.05
	Travel Time (min)	15.87
CHANNEL/PIPE FLOW	Travel Length (m)	0
	Fall (m)	0
	Travel Time (min)	0
	Multiplier	0
	Travel Time (min)	0
	Total Time (Tc)	**15.9**

DEVELOPED TIME OF CONCENTRATION

	Std Inlet Time	0
SHEET FLOW	Site Slope (%)	5
	Flow Length (m)	30
	Horton's "n"	0.035
	Travel Time (min)	8.43
CHANNEL/PIPE FLOW	Travel Length (m)	0
	Fall (m)	0
	Travel Time (min)	0
	Multiplier	0
	Travel Time (min)	0
	Total Time (Tc)	**8.4**

PEAK RUNOFF CALCULATIONS

		Rainfall Intensity (mm/hr)		Coeficient of Runoff		Peak Runoff Rates (m^3/s)	
AEP Event %	ARI Event yr	Existing	Proposed	Existing	Proposed	Existing	Proposed
63%	1	68	89	0.56	0.56	**0.079**	**0.036**
39%	2	78	102	0.60	0.59	**0.096**	**0.044**
18%	5	108	142	0.67	0.66	**0.149**	**0.068**
10%	10	129	168	0.70	0.70	**0.185**	**0.085**
5%	20	148	194	0.74	0.73	**0.224**	**0.103**
2%	50	173	227	0.81	0.80	**0.287**	**0.132**
1%	100	192	252	0.84	0.84	**0.332**	**0.154**

PEAK FLOWS FOR FREQUENT EVENTS

ARI Event	% of Q1	Peak discharge (m^/s)	
yr		Existing	Proposed
1mth	25%	**0.020**	**0.009**
2mth	40%	**0.032**	**0.015**
3mth	50%	**0.039**	**0.018**
4mth	60%	**0.047**	**0.022**
6mth	75%	**0.059**	**0.027**
9mth	90%	**0.071**	**0.033**
12mth	100%	**0.079**	**0.036**

APPENDIX E

XPSTORM OUTPUTS

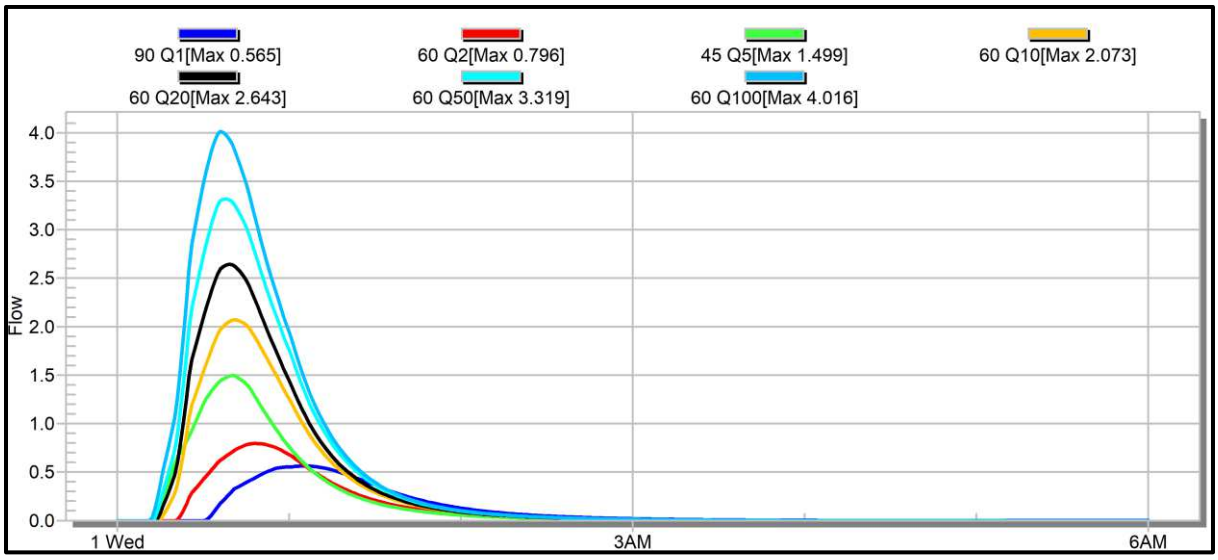


FIGURE 1: CATCHMENT A – EXISTING SCENARIO RUNOFF (m^3/s)

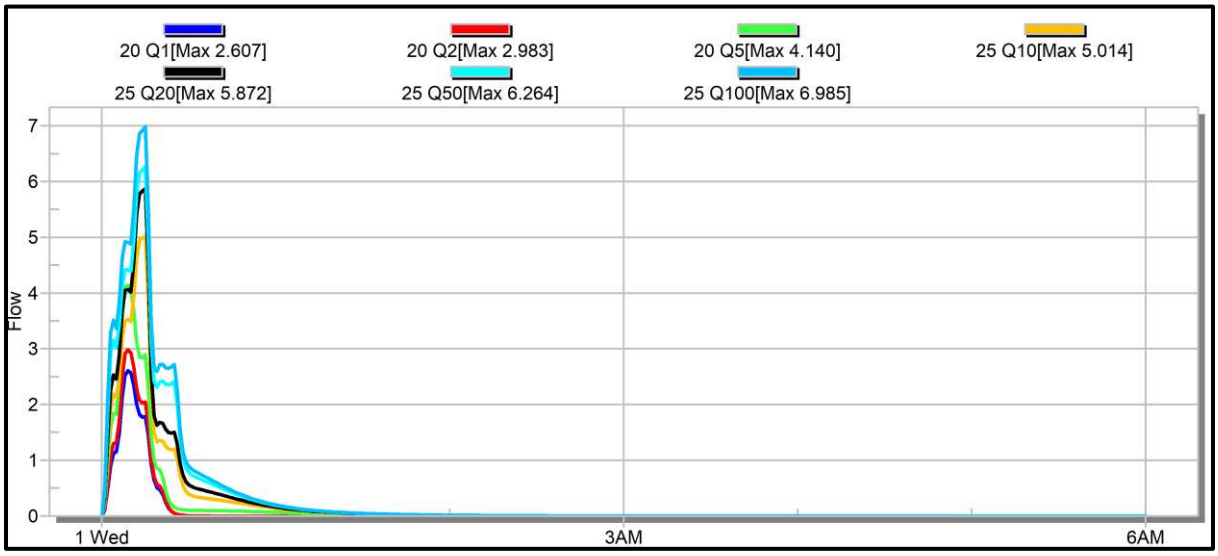


FIGURE 2: CATCHMENT A – DEVELOPED UNMITIGATED SCENARIO RUNOFF (m^3/s)

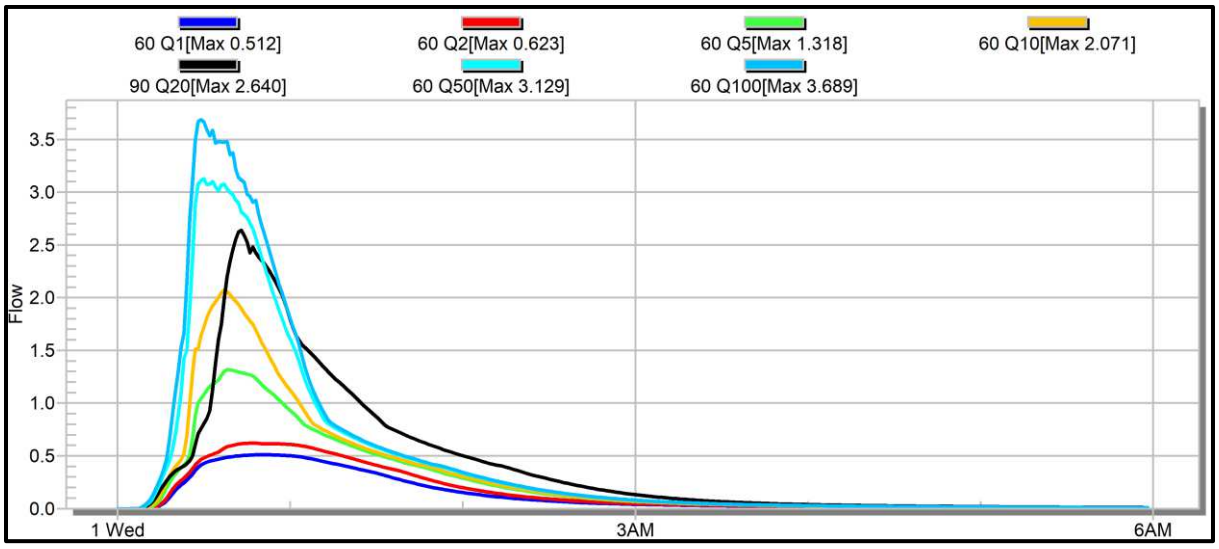


FIGURE 3: CATCHMENT A – DEVELOPED MITIGATED SCENARIO RUNOFF (m^3/s)

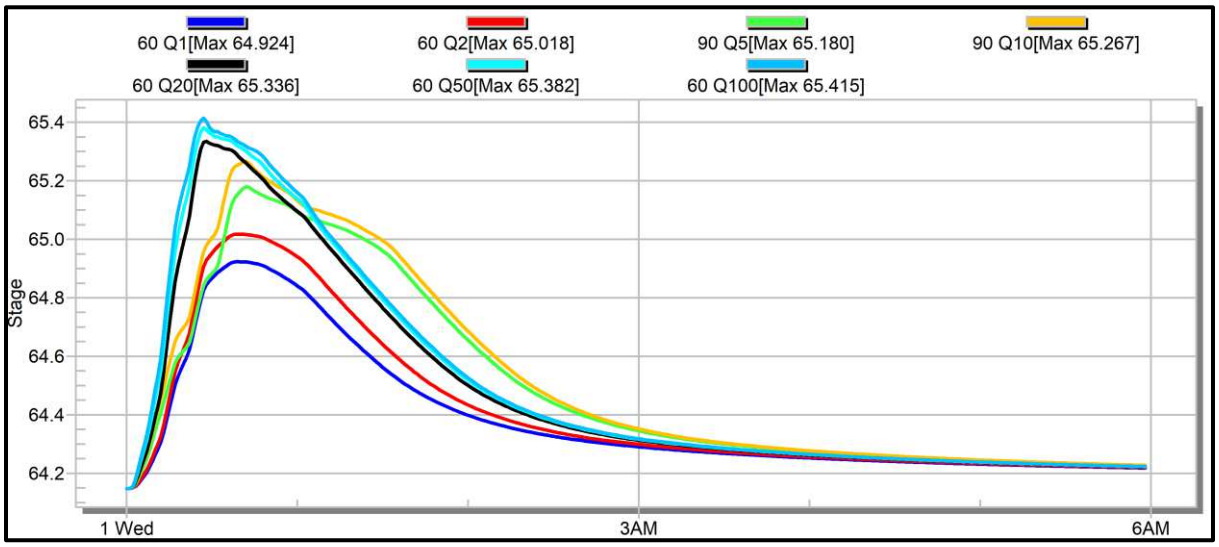


FIGURE 4: CATCHMENT A – DEVELOPED MITIGATED SCENARIO BASIN 1 STAGING (m)

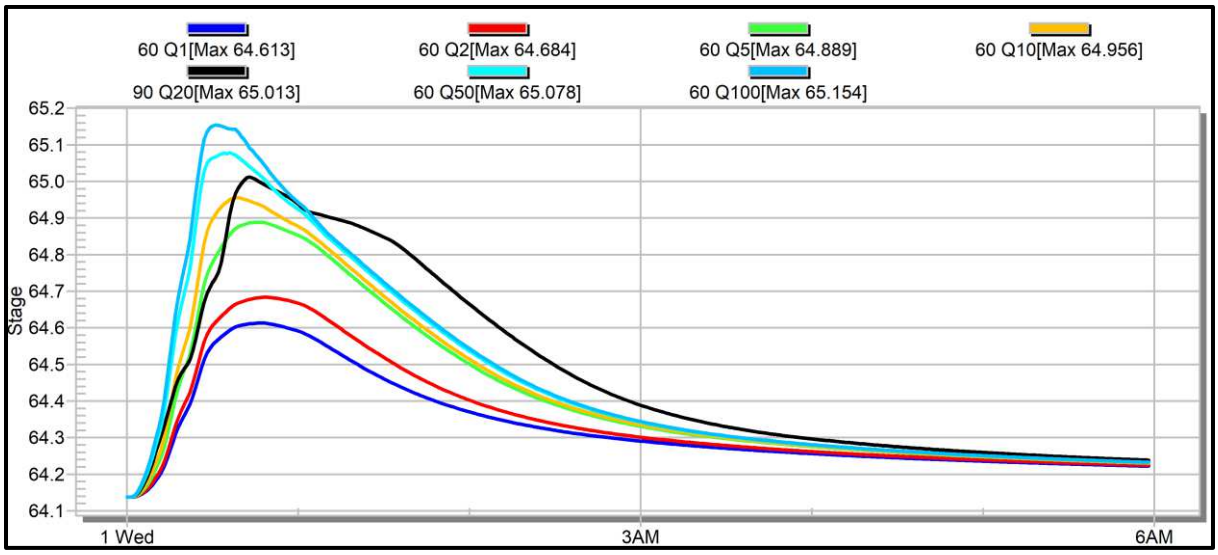


FIGURE 5: CATCHMENT A – DEVELOPED MITIGATED SCENARIO BASIN 2 STAGING (m)

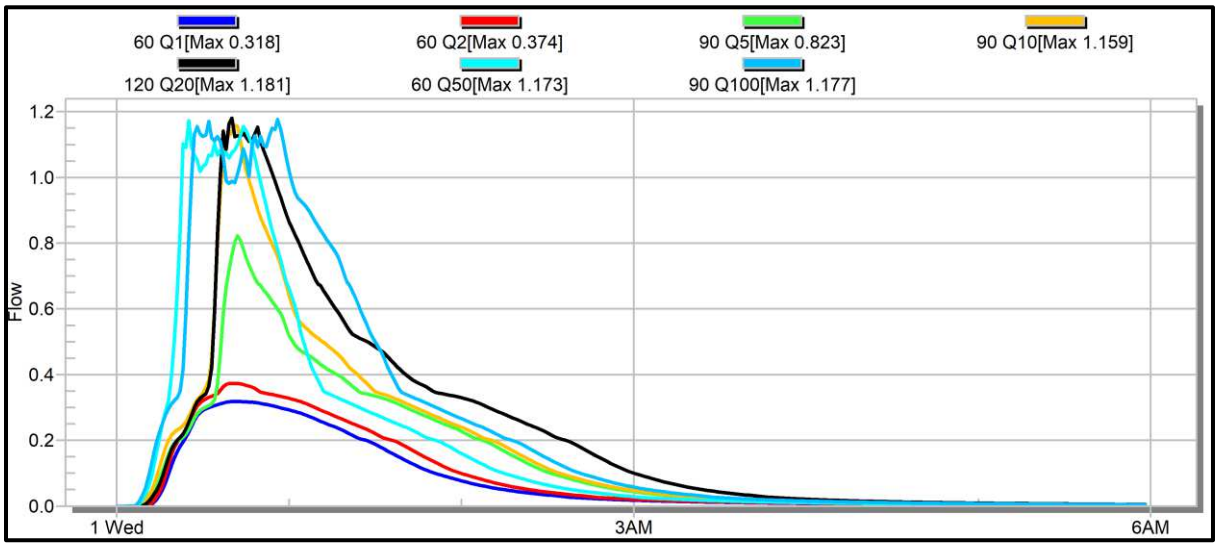


FIGURE 6: CATCHMENT A – DEVELOPED MITIGATED SCENARIO BASIN 1 DISCHARGE VIA 525mm DIA. PIPE (m^3/s)

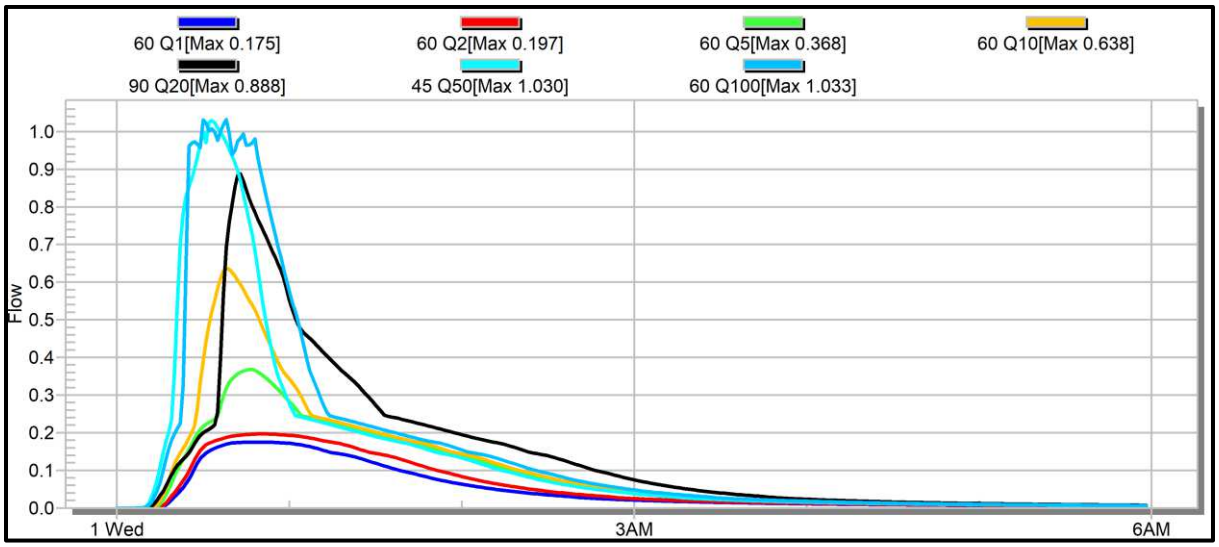
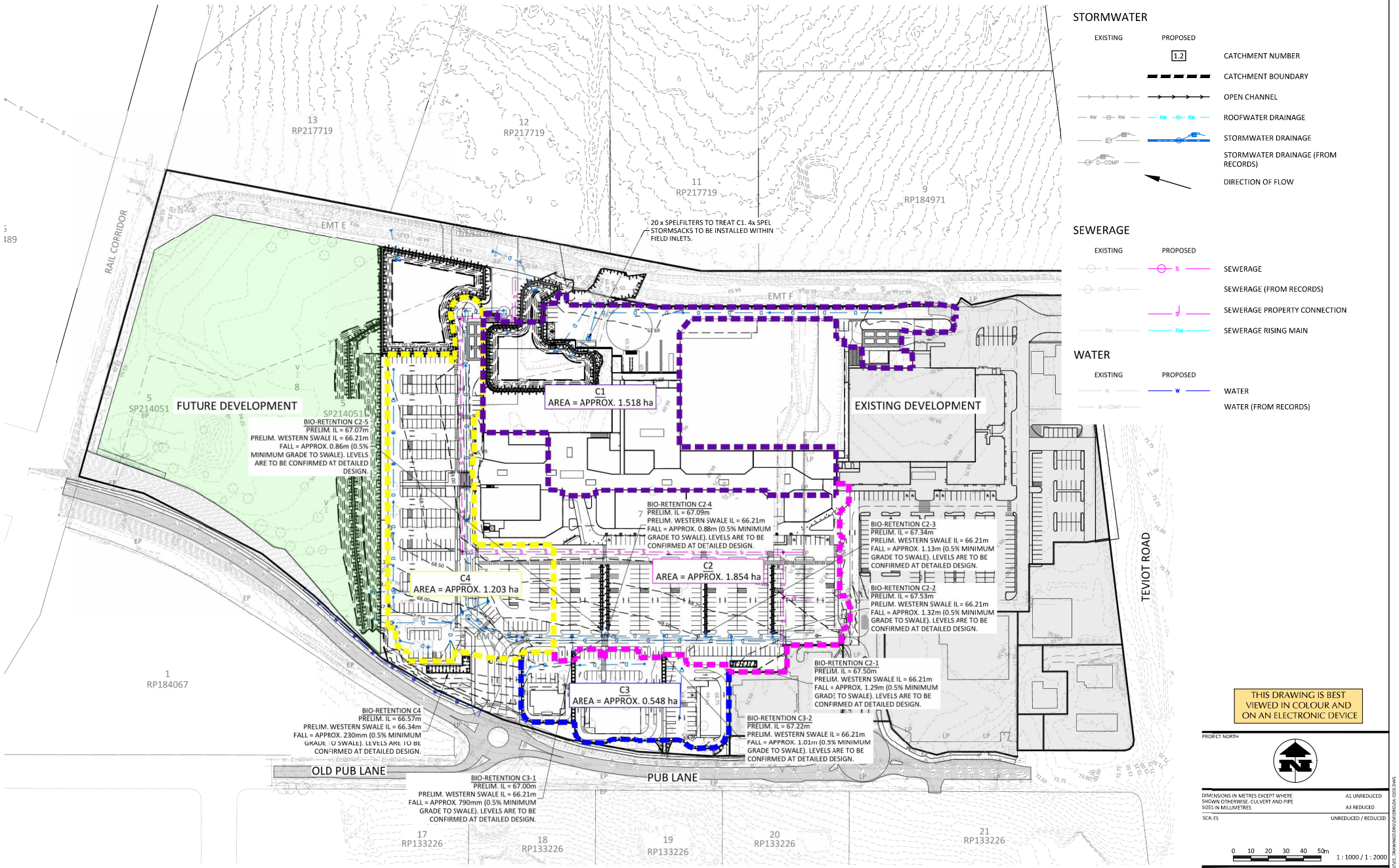


FIGURE 7: CATCHMENT A – DEVELOPED MITIGATED SCENARIO BASIN 2 DISCHARGE VIA 525mm DIA. PIPE (m^3/s)

APPENDIX F

MUSIC DATA



THIS DRAWING IS BEST VIEWED IN COLOUR AND ON AN ELECTRONIC DEVICE

PROJECT NORTH

DIMENSIONS IN METRES EXCEPT WHERE SHOWN OTHERWISE. CULVERT AND PIPE SIZES IN MILLIMETRES

A1 UNREDUCED
A3 REDUCED

SCALES

UNREDUCED / REDUCED

0 10 20 30 40 50m

1 : 1000 / 1 : 2000

STATUS

DEVELOPMENT APPLICATION

SCAN QR CODE TO CONFIRM CURRENT DRAWING REVISION
http://docs.bornhorstward.com.au/revision/

REV	DATE	DESCRIPTION	DWN	DES	CHK	APP
A	21.08.23	RESPONSE TO RFI	ETA	ST		

ASSOCIATED CONSULTANTS

APPROVED
RPEQ
DATE

CHECKED
DATE

BORNHORST +WARD
+61 (7) 3013 4699 www.bornhorstward.com.au

CLIENT: REGION GROUP AU

PROJECT: OLD PUB LANE GREENBANK

SUBJECT: STORMWATER QUALITY TREATMENT LAYOUT

PROJECT No.: 21282

DRAWING No.: DA-C050

REVISION: A

ORIGINAL SIZE A1

21/08/2023 2:30:13 PM

Table 1: Pollutants Typically Generated During the Construction Phase

Pollutant	Source
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building
Hydrocarbons	Fuel and oil spills, leaks from construction equipment
Toxic materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters (e.g. from tile works)
pH altering substances	Acid sulphate soils, cement slurry and washwaters

Table 2: Recommended MUSIC Rainfall-Runoff Generation Parameters

Parameter	Urban Residential	Commercial	Forested
Rainfall Threshold (mm)	1	1	1
Soil Storage Capacity (mm)	500	18	120
Initial Storage (% capacity)	10	10	10
Field Capacity (mm)	200	80	80
Infiltration Capacity Coefficient a	211	243	200
Infiltration Capacity Exponent b	5	0.6	1.0
Initial Depth (mm)	50	50	50
Daily Recharge Rate (%)	28	0	25
Daily Baseflow Rate (%)	27	31	3
Daily Deep Seepage Rate (%)	0	0	0

Table 3: Music Base and Storm flow Concentration Parameters

FLOW TYPE	SURFACE TYPE	TSS log¹⁰ values		TP log¹⁰ values		TN log¹⁰ values	
		Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
	Urban residential						
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
	Commercial						
Baseflow parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Roads	0.78	0.39	-0.60	0.50	0.32	0.30
	Ground level	0.78	0.39	-0.60	0.50	0.32	0.30
Stormflow parameters	Roof	1.30	0.38	-0.89	0.34	0.37	0.34
	Roads	2.43	0.38	-0.30	0.34	0.37	0.34
	Ground level	2.16	0.38	-0.39	0.34	0.37	0.34

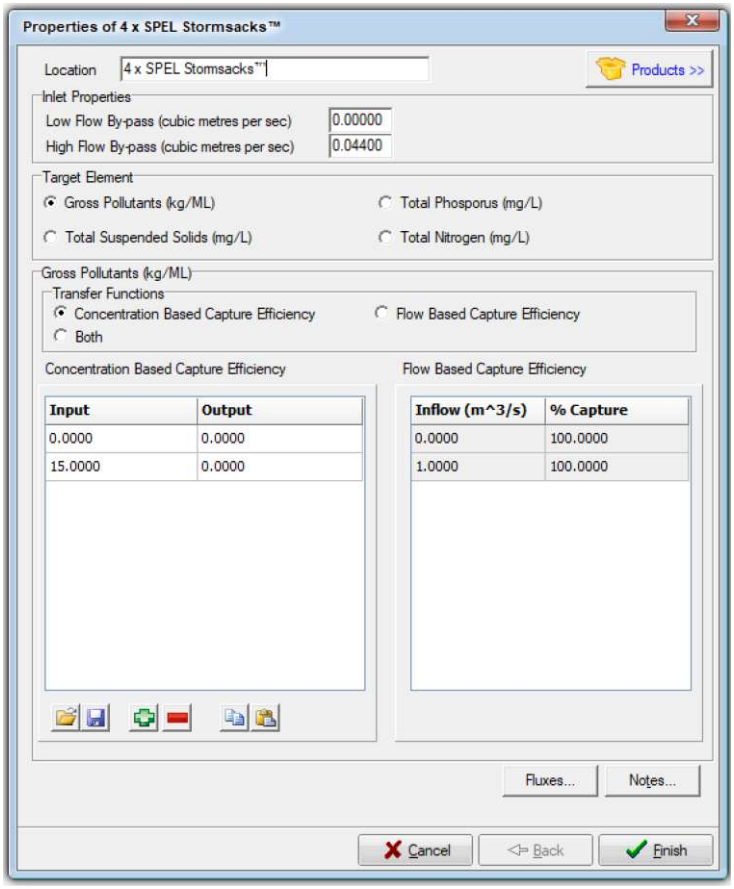


Figure 1: SPEL Stormsacks C1 Parameters

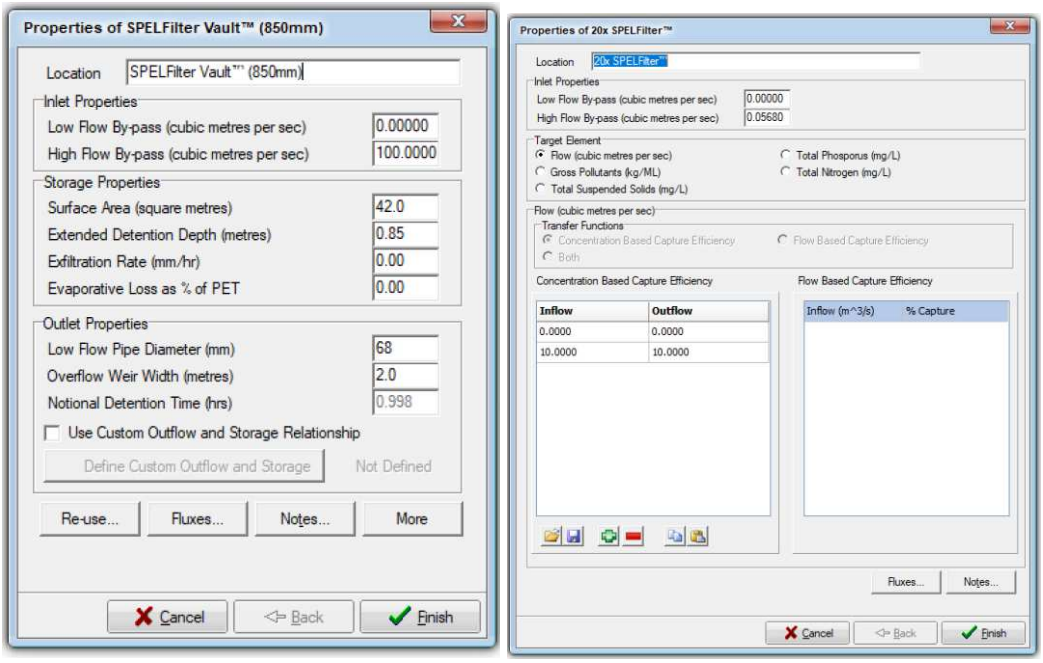


Figure 2: SPELFilters C1 Parameters

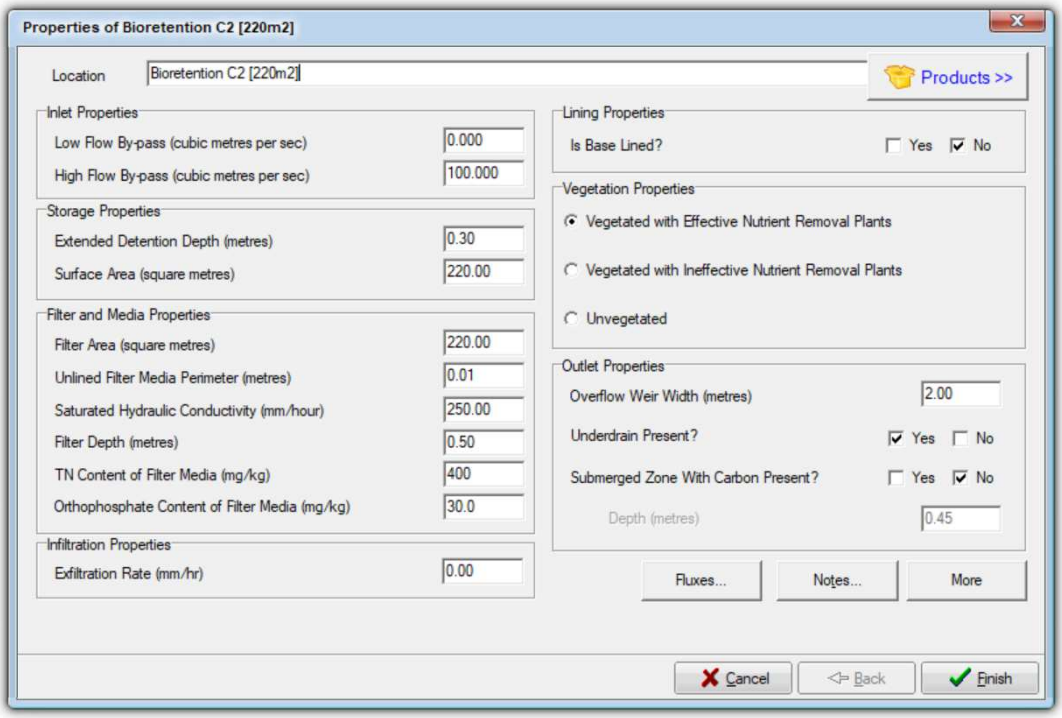


Figure 3: Bio-retention C2 Parameters

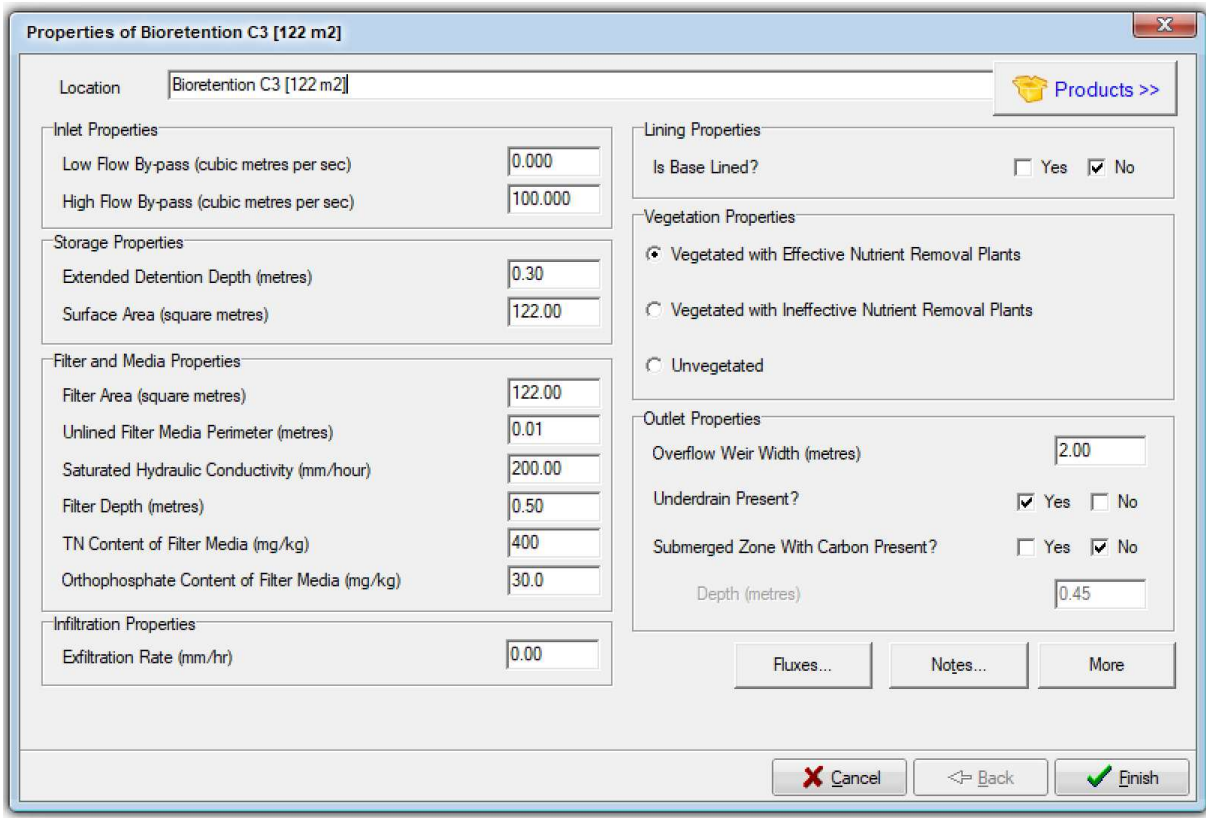


Figure 4: Bio-retention C3 Parameters

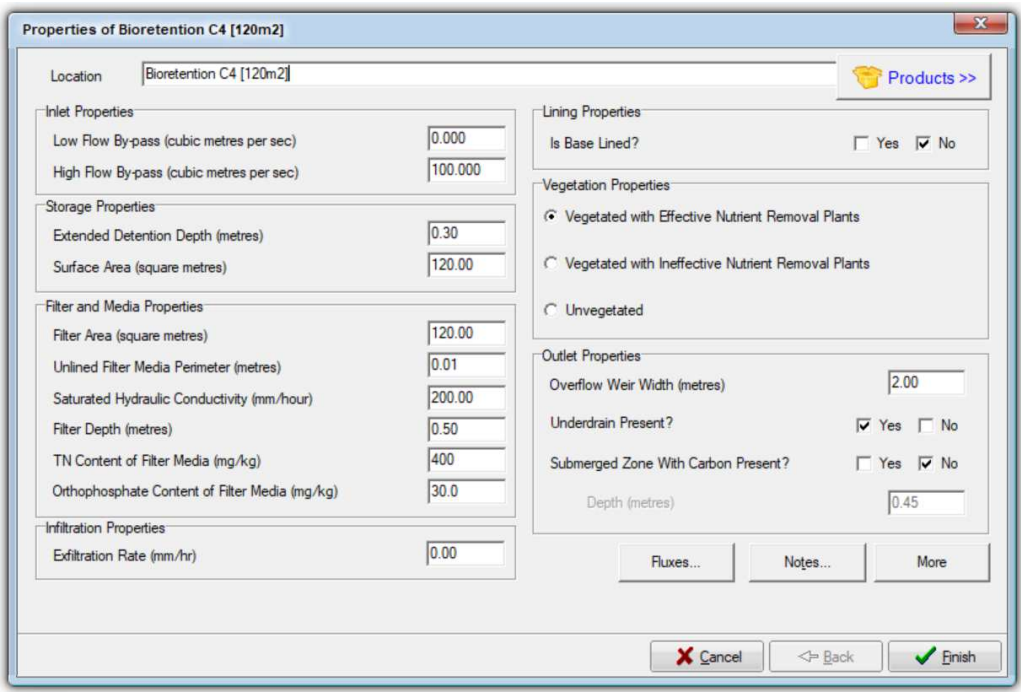


Figure 5: Bio-retention C4 Parameters

APPENDIX G

COUNCIL CODES

FILLING AND EXCAVATION CODE
Performance Criteria and Acceptable Solutions

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
Protection of natural processes and ecosystems				
PO1 The discharge of sediments and pollutants from filling or excavation does not adversely affect a waterway or the stormwater network.	**AO1** The discharge of sediments and pollutants to a waterway or stormwater network complies with part 3.3—Filling and excavation standards in planning scheme policy 5—Infrastructure.	✓	Erosion and sediment control will be utilised to minimise impacts on the downstream waterways. The discharge of sediments and pollutants to a waterway or stormwater network will comply with part 3.3—Filling and excavation standards in planning scheme policy 5—Infrastructure.	
PO2 Topsoil and spoil stockpiled on the premises do not adversely affect natural processes and ecosystems.	**AO2** Topsoil and spoil is stockpiled to comply with part 3.3–Filling and excavation standards in planning scheme policy 5–Infrastructure.	✓	Topsoil and spoil stockpiled on the development site will not adversely affect the natural processes and ecosystems and will comply with the filling and excavation standards set in planning scheme policy 5 – Infrastructure.	
PO3 Filling is carried out using stable, solid and clean earth, free of organic and putrescible waste, rubbish and refuse material.	**AO3** Filling complies with part 3.3–Filling and excavation standards in planning scheme policy 5–Infrastructure.	✓	Cut and fill earthworks are required onsite. Fill material used will be inspected to ensure compliance with the standards set in the planning scheme policy 5 – Infrastructure. Fill material used will comply with the standards set in the planning scheme policy 5 – Infrastructure.	
Protection of existing and planned infrastructure				
PO4 Filling or excavation works do not adversely affect infrastructure, including any services.	**AO4** Filling or excavation works comply with part 3.3–Filling and excavation standards in planning scheme policy 5–Infrastructure.	✓	Filling or excavation works will not adversely affect any existing infrastructure or services and will comply with part 3.3–Filling and excavation standards in planning scheme policy 5–Infrastructure.	
Protection and enhancement of personal health and safety and premises				
PO5 Filling or excavation works do not adversely affect personal health and safety.	**AO5** Filling or excavation works comply with part 3.3–Filling and excavation standards in planning scheme policy 5–Infrastructure.	✓	Filling or excavation works will not adversely affect personal health and safety and the filling or excavation works comply with part 3.3–Filling and excavation standards in planning scheme	

Solution: ✓ = Acceptable Solution
A/S = Alternative Solution
N/A = Not Applicable to this Proposal

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
			policy 5–Infrastructure.	
Surface water flow				
PO6 Surface water drainage does not cause any of the following: (a) ponding on any premises; or (b) a hazard or adversely affect personal health and safety and premises; or (c) diversion or concentration of flow from or onto adjoining premises or infrastructure.	**AO6** Surface water drainage complies with part 3.3–Filling or excavation standards in planning scheme policy 5–Infrastructure.		Surface water will not cause: Ponding; Present a hazard or adversely affect personal health and safety and premises; or Divert or concentrate flow from or onto an adjoining premises or infrastructure. Surface water drainage will comply with part 3.3–Filling or excavation standards in planning scheme policy 5 Infrastructure.	
Batters				
PO7 A batter: (a) does not adversely affect the natural physical processes and ecosystems; (b) protects existing and planned infrastructure; (c) is safe, stable and easily maintained; (d) is landscaped to enhance visual amenity.	**AO7** A batter is designed and constructed to comply with the standards specified in section 3.3.6–Batters and retaining walls in planning scheme policy 5–Infrastructure.	✓	Batters will be required as a part of the development. Batters will: Not adversely affect the natural physical processes and ecosystems; Be safe, stable and easily maintained; Protect existing and planned infrastructure; and Be landscaped to enhanced visual amenity.	
Retaining walls				
PO8 A retaining wall: (a) is not constructed of timber and are not located on existing or proposed lot boundaries, or movement networks;	**AO8** A retaining wall is designed and constructed to comply with the standards specified in section 3.3.6.2–Retaining walls in planning scheme policy 5–Infrastructure.	✓	Retaining walls will be required as a part of the development. Any retaining walls will be designed and constructed to comply with the standards specified in section 3.3.6.2–Retaining walls in planning scheme policy 5–Infrastructure.	

Solution: ✓ = Acceptable Solution
A/S = Alternative Solution
N/A = Not Applicable to this Proposal

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
(b) does not adversely affect the natural physical processes and ecosystems; (c) is located to avoid conflict with adjoining premises; (d) is located such that existing and planned infrastructure is not adversely affected; (e) protects the visual amenity of adjoining premises or a public open space; (f) is located within the premises that is being filled; (g) is located within the premises that is cut and is designed to take any surcharge loading allowable on the uphill lot; (h) is safe and stable; (i) enables easy access for maintenance.				
Filling of a dam				
PO9 The filling of a dam: (a) does not adversely affect the natural physical processes and ecosystems; (b) creates a safe and stable surface; (c) is integrated into the landscape.	**AO9** The filling of a dam complies with part 3.3–Filling and excavation standards in planning scheme policy 5–Infrastructure.	**N/A**	There will be no filling of dams as a part of this development proposal.	

Solution: ✓ = Acceptable Solution
A/S = Alternative Solution
N/A = Not Applicable to this Proposal

INFRASTRUCTURE CODE
Performance Criteria and Acceptable Solutions

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
Provision, design, construction and location of infrastructure				
PO1 Development is demonstrated to be capable of being serviced by necessary infrastructure.	**AO1** Reports, plans and drawings are provided in accordance with part 2 of planning scheme policy 5–Infrastructure.	✓	The development is capable of being serviced by the necessary infrastructure in accordance with part 2 of the planning scheme policy 5-Infastructure. Refer to the Bornhorst and Ward Serviceability Report for service connection locations.	
PO2 Development: (a) provides necessary infrastructure to service the development; (b) provides that the design, construction and location of necessary infrastructure: (i) protects existing and planned infrastructure networks; (ii) services proposed development; (iii) integrates with existing and planned infrastructure networks; (iv) delivers a standard of service that is efficient and equitable; (v) minimises the cost to the community for the life of the infrastructure by providing a suitable design life, ease of maintenance and ease of replacement; (vi) protects personal health, safety and premises; (vii) protects environmental values.	**AO2** Development: (a) in a water supply service area connects to the water network in accordance with the SEQ Water Supply and Sewerage Design and Construction Code; (b) not in a water supply service area provides a tank with a minimum storage capacity of 45,000 litres; (c) in a sewerage supply service area connects to the waste water network in accordance with the SEQ Water Supply and Sewerage Design and Construction Code; (d) not in a sewerage supply service area complies with part 1 of the Queensland Plumbing and Wastewater Code; (e) provides stormwater infrastructure in accordance with part 3.6 of planning scheme policy 5–Infrastructure; (f) provides a movement network infrastructure in accordance with part 3.4 of planning scheme policy 5–Infrastructure; (g) provides parks in accordance with part 3.12 of planning scheme policy 5–Infrastructure;	✓	The development is in a water and sewerage supply service area and is capable of being serviced by the necessary infrastructure in accordance with part 2 of the planning scheme policy 5-Infastructure and the SEQ Water Supply and Sewerage Design and Construction Code. Refer to the Bornhorst and Ward Serviceability Report for service connection locations The development provides stormwater infrastructure in accordance with part 3.6 of planning scheme policy 5-Infrastructure. Refer to the Bornhorst and Ward Stormwater Management Plan for further information. The development provides a movement network infrastructure in accordance with part 3.4 of planning scheme plicy 5- Infrastructure. Refer to the Bornhorst and Ward Serviceability report.	

Solution: ✓ = Acceptable Solution
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PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
	(h) provides road lighting in accordance with part 3.5 of planning scheme policy 5– Infrastructure; (i) provides electricity reticulation in accordance with part 3.8 of planning scheme policy 5– Infrastructure; (j) provides gas and telecommunications reticulation in accordance with part 3.9 of planning scheme policy 5–Infrastructure. Editor's note—The delivery of any part of a networ k identified in the plans for trunk infrastructure is governed b y Part 4— Priority infrastructure plan.			
Fire fighting				
PO4 Development in a water service area accessed by common private title provides: (a) fire hydrant infrastructure; (b) unimpeded access for emergency services vehicles. Editor's note—'The term common private title refers to areas such as access roads in community title developments or strata title unit access, which are private and under group or body corporate control.	**AO4** Development in a water service area accessed by common private title complies with the Acceptable outcomes of the SPP code: Fire services in developments accessed by common private title in Appendix 1 of the state planning policy.	A/S	Water reticulation with required fire hydrants will be provided as part of the development.	
PO5 Development not in a water service area provides sufficient water storage with adequate pressure, volume and flow to service development for fire fighting purposes.	**AO5** Development: (a) is connected to a reticulated water supply scheme that has sufficient flow and pressure characteristics for fire fighting purposes at all times with a minimum pressure and flow of 10 litres per second at 200kPa; or	N/A	The development lies within a water service area.	

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PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
	has an on-site water storage in accordance with (b) Table 9.4.3.3.2—Water storage for fire fighting, dedicated or retained for fire fighting purposes that is made of fire resistant materials and is: (i) a separate tank; or (ii) a reserve section in the bottom part of the main water supply tankwater tank . Editor's note—The requirement in AO5 is; –in addition to the requirement for potable water supply/storage in AO2 in Table 9.4.3.3.2–Infrastructure code: self-assessable and assessable development; – reflected in AO5 in Table 8.2.3.3.1–Bushfire hazard overlay code: self-assessable and assessable development.			
Disposal of trade waste				
PO6 The disposal of trade waste in a sewerage supply service area does not adversely affect the sewerage network.	**AO6** The disposal of trade waste in a sewerage supply service area complies with the sewer admission standards in section 3.2.6–Sewer admission standards in planning scheme policy 3–Environmental management.	N/A		
Roof water drainage and surface water drainage				
PO7 Development provides stormwater infrastructure for the drainage of the premises so as not to cause any of the following: (a) ponding of stormwater on the premises; (b) a hazard to personal health and safety; (c) damage to premises;	**AO7** Development complies with the standards for stormwater infrastructure specified in part 3.6 of planning scheme policy 5–Infrastructure.	✓	Stormwater infrastructure proposed for the development will be sized to capture the minor storm in underground drainage, and safely transfer up to the major storm as overland flow. Refer to the Bornhorst and Ward Stormwater Management Plan for further information. The Development complies with the standards for stormwater infrastructure specified in part 3.6 of planning scheme policy 5–Infrastructure. Refer to section 3.1 of the attached Engineering Report	

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PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
(d) an increased risk of flooding to premises within the catchment.			and the B+W Stormwater Management Plan for further information.	
Natural flow of surface water				
PO8 Development provides that the natural flow of surface water is: (a) not altered so as to cause a risk to personal health and safety or damage to property; (b) not increased in intensity, velocity or frequency; (c) not concentrated onto adjoining premises.	**AO8** Development complies with the standards for stormwater infrastructure specified in part 3.6 of planning scheme policy 5–Infrastructure.	✓	Overland flows will be maintained as per existing site conditions. Refer to the Bornhorst and Ward Stormwater Mangaement Plan for further information. The Development complies with the standards for stormwater infrastructure specified in part 3.6 of planning scheme policy 5–Infrastructure. Refer to section 3.1 of the attached Engineering Report and the B+W Stormwater Management Plan for further information.	
Water sensitive urban design				
PO9 Development which provides stormwater infrastructure incorporates water sensitive urban design principles having regard to: (a) protecting existing natural features and ecological processes; (b) protecting the natural hydrologic behaviour of catchments; (c) protecting the existing natural flow and water quality regimes of waterways; (d) protecting water quality of surface and ground waters; (e) minimising demand on the water network;	**AO9** Development complies with the standards for stormwater infrastructure specified in part 3.6 of planning scheme policy 5–Infrastructure.	✓	The Development complies with the standards for stormwater infrastructure specified in part 3.6 of planning scheme policy 5–Infrastructure. Refer to section 3.1 of the attached Engineering Report and the B+W Stormwater Management Plan for further information.	

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(f) minimising sewage discharges to the natural Environment (g) integrating water into the landscape to enhance visual and ecological values.				
Movement network				
PO10 The projected traffic levels for a use do not adversely affect the planned standards of service for a road or intersection.	**AO10** Development does not cause or contribute to projected traffic levels: (a) exceeding the maximum vehicle trips per day in Table 3.4.1.4.2 in planning scheme policy 5–Infrastructure; or (b) exceeding the maximum control delays through intersections in peak periods in Table 3.4.1.4.3 in planning scheme policy 5—Infrastructure.	**A/S**	Please refer to the Traffic Impact Assessment for further information.	
Integrated movement concept report				
PO11 Development which generates more than 3,000 vehicle trips per average weekday is designed to integrate the movement network to minimise the transportation costs required to service the use.	**AO11** Development which generates more than 3,000 vehicle trips per average weekday provides an integrated movement concept report which integrates the planning of the movement network in accordance with part 2 and 3 of planning scheme policy 5–Infrastructure.	**A/S**	Please refer to the Traffic Impact Assessment for further information.	
Land use and transport integration				

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INFRASTRUCTURE CODE
Performance Criteria and Acceptable Solutions

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS	SOLUTIONS[1]	COMMENTS	COUNCIL USE ONLY
PO12 Development within 400 metres of existing or future public passenger transport facilities where the total site area is 5000m^2 or more: (a) supports a road hierarchy which facilitates efficient, safe and accessible bus services connecting to existing and future public passenger transport facilities; (b) enhances connectivity between existing and future public passenger transport facilities and other transport modes; (c) optimises the walkable catchment to existing and future public passenger transport facilities; (d) provides for direct and safe access to and use of existing or future public passenger transport facilities. Note—SPP code: Land use and transport integration in Appendix 4 of the state planning policy provides guidance to achieve this outcome.	**AO12** No acceptable outcome provided.	**A/S**	Please refer to the Traffic Impact Assessment for further information.	

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