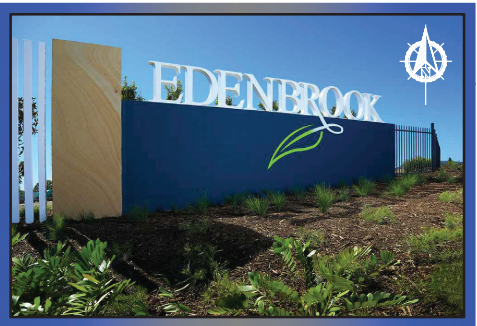


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**ROCKHAMPTON REGIONAL COUNCIL**

**AMENDED PLANS APPROVED**

**20 March 2018**

**DATE**

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**Dated: 23 January 2018**

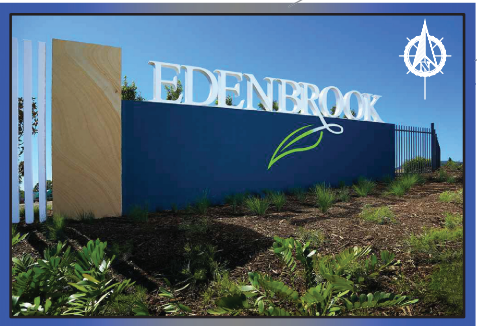
**NGGA**  
civil engineers  
ACN 063 548 390  
PH: 4927 3220  
EMAIL: mail@ngga.com.au

**FIGURE 1096-ROL1:** Property Description  
16/02/18 Rev 2

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**LEGEND EASEMENTS:**

- SEWER EASEMENT
- SEWER & STORM WATER (ROOF WATER)
- STORM WATER



**ROCKHAMPTON REGIONAL COUNCIL**

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**NGGA**

**civil engineers**

ACN 063 548 390  
PH: 4927 3220

**FIGURE 1096-ROL2: Proposal Plan**  
15/02/18 Rev 2





1. REFERENCES STORM WATER MANAGEMENT & HEALTHY WATERWAY REQUIREMENTS

The site based storm water management plan has been based on the following publications and guidelines:

- Healthy Waters Music Modeling Guidelines (HWMMG).
- State Planning Policy April 2016 (SPP)
- Queensland Urban Drainage Manual (QUDM)
- Water Sensitive Urban Design (WSUD)
- Storm water quality improvement devices are referred to as SQUID's.

2. OPPORTUNITIES, CONSTRAINTS & PRECEDENTS

The type of development complies with the Council standards for Residential subdivisional works. This development is the continuation of a staged development.

The principal pollutants likely to be generated from the site development will be hydrocarbons, metals, sediment and nutrients such as nitrogen and phosphorus fixed to the sediments.

- This development is part of a staged development. Existing downstream stages have either been constructed, are being constructed or approved for construction. Part of this stage connects to a downstream drainage system in a stage currently before Council for approval. The downstream stage includes storm water improvement devices (SQUID's);
- The existing stages include underground storm water drainage collection systems that have been sized for a 1 in 10 year design storm and incorporate in-line SQUIDs sized for the ultimate catchment area(s);
- Road and allotment layout and sizing, soil types and functionality requirements precludes the practical and feasible use of above ground in-line and end of line SQUIDs (vegetated swales; bioretention beds; wetlands) installed in the road verge area;
- Current best practice policies in Queensland generally acknowledge that other than for small selected infill developments or specific isolated areas such as the central area of large roundabouts, the use of above ground SQUIDs (vegetated swales; bioretention beds) located within the road reserves, generally in the road verge area, are not a long term successful option and are high long term maintenance;
- Council can adopt and set storm water quality targets different to the those recommended in the State Planning Policy if considered more appropriate to the the site and available opportunities and constraints; and
- The storm water management strategy proposed for these current stages is the continuation of the same adopted and approved by Council for the existing constructed stages. Outlet/area 2 has already been included in the treatment provided for the constructed downstream stages.

3. RECEIVING WATERS

The nominated receiving waterway is Ramsay Creek. Although some infiltration of storm water is likely to occur at the site, use of groundwater does not occur downstream of the site. Consequently, only surface water Environmental Values (EVs) and water quality objectives (WQOs) have been identified.

4. PROPOSED STORM WATER TREATMENT

After consideration of the available opportunities & constraints, the treatment train will be the same as has been adopted and approved by Council for the downstream stages:

- In line SQUIDs within the pipe drainage system for gross pollutant, sediment and nutrient removal.

In accordance with SPP Appendix 3's AO1.1b, this is considered current best practice reflecting land use constraints in this case.

5. PROPOSED STORM WATER TREATMENT EVALUATION & SIZING

The evaluation & sizing of the components proposed and/or adopted for the treatment train has been carried out using the MUSIC Version 6 computer package and 6 minute rainfall for the period from 1 January 1970 to 31 December 2000. The pollutant types and concentrations evaluated for removal are -

- gross pollutants (GP);
- sediments and dissolved solids, Total Suspended Solids (TSS);
- total dissolved nitrogen (TN); and
- total dissolved phosphorus (TP).

All catchments have been modeled as 'Urban Residential' split catchments. The split catchment surface types & associated runoff generation parameters; pollutant concentrations and generation parameters applicable to these type of catchments and surface compositions recommended in Healthy Waters Music Modeling Guidelines have been adopted. Details of these areas are shown in Table 1.

Inline proprietary product SQUID HUMECEPTORS or equivalent have been nominated. The size of the unit(s) has been determined using the manufacturers software package based on a minimum 80% TSS removal rate and associated nitrogen and phosphorus removed being that component 'fixed' to the suspended solids.

6. PERFORMANCE EVALUATION

Details of the catchments applicable to this stage are summarised in Table 1. Details of the SPP suggested target water quality objectives (WQO) for storm water discharging from the site to the receiving waters based on nutrient load reduction are summarised in Table 2. Details of performance of the treatment train measured at the nominated receiving water for the whole of the upstream catchments are summarised in Tables 3 to 5. Tables 3 and 4 provide a comparison between the pre and post development scenario. Table 5 provides details of the post development pollutant load reductions for the proposed treatment train and evaluation in relation to target objectives in Table 2

7. CERTIFICATION

An assessment has been carried out of the impact from this proposed development stage on storm water quality (comparison between pre and post development loads) and the effectiveness of the proposed site water quality management in meeting the suggested SPP water quality standards for storm water management and healthy waterways. Details of the nominated standards, comparison between pre and post development pollutant loads & evaluation of the effectiveness of the proposals in meeting the standards have been provided. This is a stage update to the previously approved management for the whole development. Within the limits imposed by the available opportunities and constraints and existing precedents, the proposed storm water management should provide -

- Treatment comparable to the Council approved proposals for existing constructed stages;
- An acceptable water quality management strategy that is the best achievable, cost effective and within community and sensible expectations.



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TABLE 1: DESIGN AREAS (ha) (COLOUR CODED TO MATCH PLAN VIEW)				
Outlet	Total	Roof	Roads	Ground level
1	4.067	0.660	0.779	2.628
2	0.315	0.150		0.165
Total	4.382 (100%)	0.810 (18%)	0.779 (18%)	2.793 (64%)

TABLE 2: TARGET WATER QUALITY OBJECTIVES (WQO)	
	Load Reduction (ref QWQG)
Indicator	% Reduction
Total Suspended Solids (TSS)	85
Total Nitrogen (TN)	45
Total Phosphorus (TP)	60
Litter, Gross Pollutants (GP)	90

TABLE 3: PERFORMANCE EVALUATION - POLLUTANT MEAN CONCs (mg/L)						
	TSS		TN		TP	
PRE & POST COMPARISON	PRE	POST	PRE	POST	PRE	POST
At Nominated Receiving Waters combined wet & dry flows	8.18	3.25	0.299	0.601	0.031	0.081

TABLE 4: PERFORMANCE EVALUATION - POLLUTANT MEAN ANNUAL LOAD (kg/yr)						
	TSS		TN		TP	
PRE & POST COMPARISON	PRE	POST	PRE	POST	PRE	POST
At Nominated Receiving Waters combined wet & dry flows	2230	534	24.30	23.30	4.47	3.17

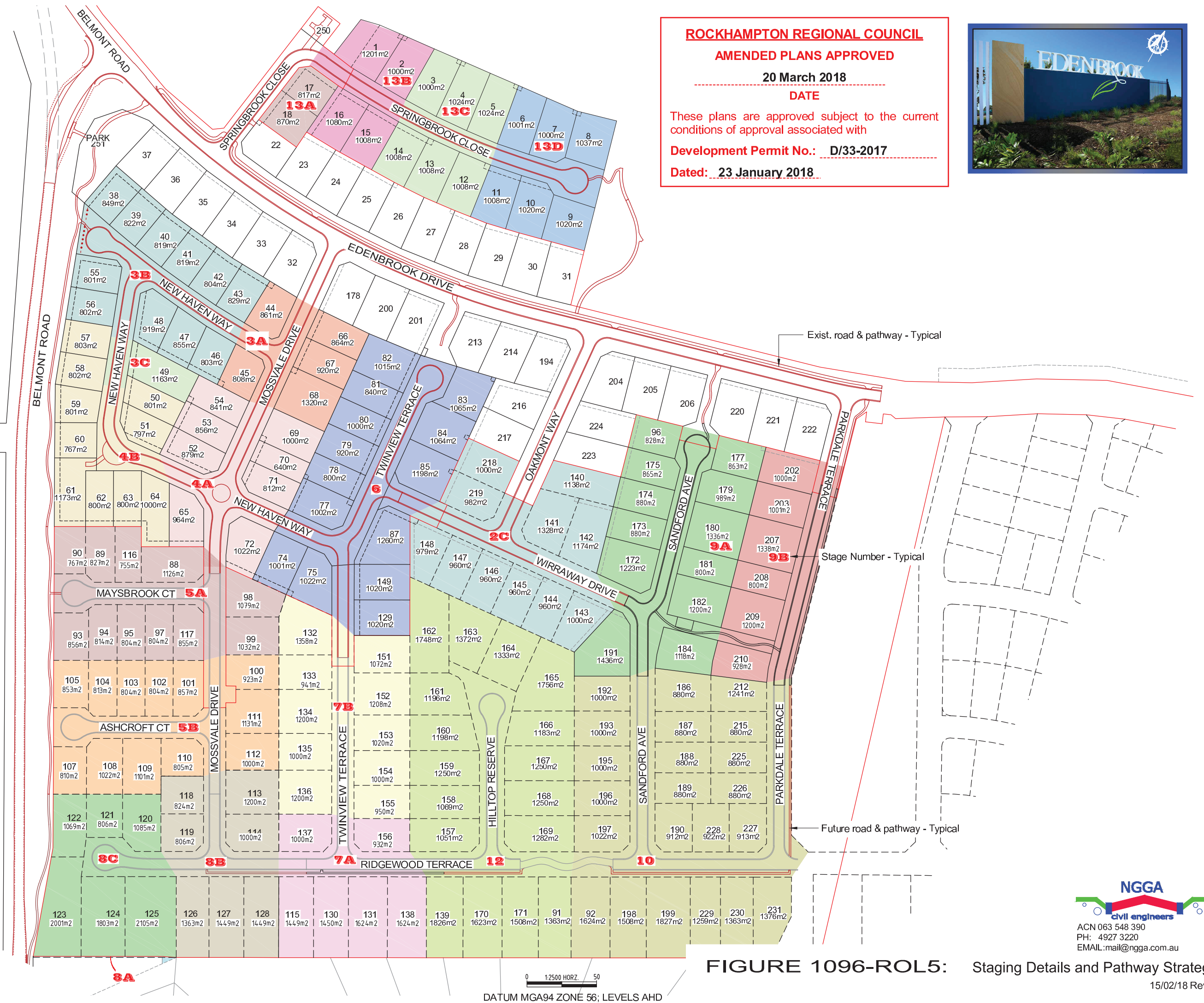
TABLE 5: PERFORMANCE EVALUATION - POLLUTANT REDUCTION (%)				
	TSS	TN	TP	GP
At Nominated Receiving Waters combined wet & dry flows	85	40	40	>90
	Complies with Table 2 frequency requirements.			

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DATUM MGA94 ZONE 56; LEVEL

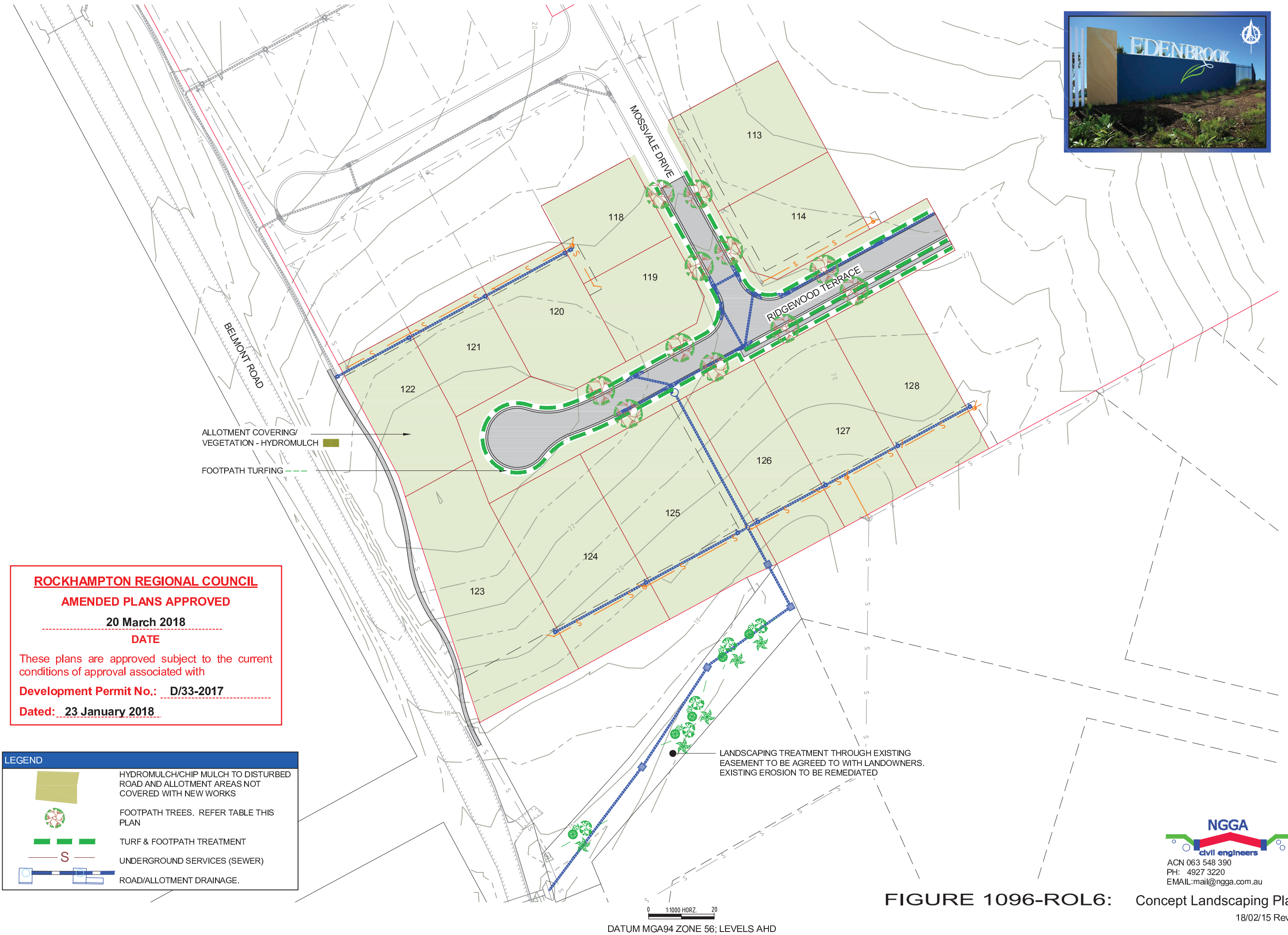
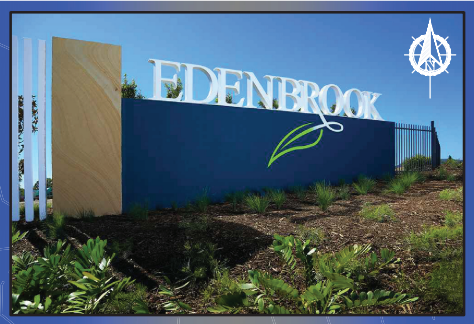
FIGURE 1096-ROL4: Storm Water Management - Water Quality



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**FIGURE 1096-ROL6: Concept Landscaping Plan**  
18/02/15 Rev 2



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LEGEND EASEMENTS:

SEWER EASEMENT

SEWER & STORM WATER (ROOF WATER)

STORM WATER

BUILDING LOCATION ENVELOPE SETBACKS

- FRONT BOUNDARY - 6.0m UNO
- REDUCED FRONT BOUNDARY SETBACK - 4.0m UNO
- SIDE BOUNDARY - 1.5m (REFER NOTE 1. (II) )
- REAR BOUNDARY - 2.0m UNO

ANNOTATED AREAS SHOWN WITHIN EACH LOT DENOTES THE RESPECTIVE BUILDING LOCATION ENVELOPE AREA FOR EACH LOT .

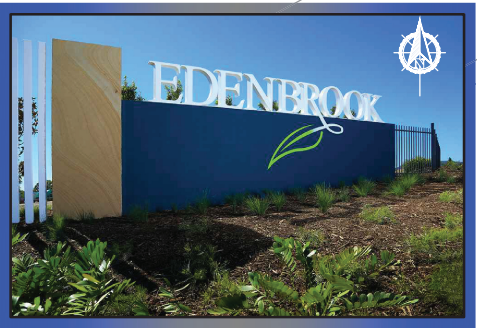
ALL SERVICES ARE CLEAR OF THE BUILDING LOCATION ENVELOPES

NOTES

- ALL SETBACKS TO BUILDINGS OR STRUCTURES ARE TO BE IN ACCORDANCE WITH THE QDC MP 1.2, EXCEPT FOR THE FOLLOWING:-
  - ROAD, SIDE, REAR AND / OR ACCESS EASEMENT BOUNDARY SETBACK FOR STRUCTURES ARE AS DEPICTED ON THE PLAN
  - SIDE BOUNDARY SETBACKS TO THE OUTERMOST PROJECTION ARE:
    - WHERE THE HEIGHT OF THAT PART IS 4.5M OR LESS - 1.5M
    - WHERE THE HEIGHT OF THAT PART IS GREATER THAN 4.5M BUT NOT MORE THAN 8.5M - 2.0M
- SITES WITH A GRADIENT GREATER THAN 15% WILL HAVE SPECIAL DESIGN NEEDS
- SWIMMING POOLS ARE PERMITTED TO BE LOCATED WITHIN THE ROAD AND SIDE / REAR BOUNDARY SETBACK IN ACCORDANCE WITH QDC MP 1.2 REQUIREMENT

DEVELOPMENT CONDITIONS

- MAXIMUM BUILDING HEIGHT FOR ANY DWELLING IS 7m ABOVE GROUND LEVEL TO THE EAVES AND 9m TO THE HIGHEST POINT ON THE ROOF.
- NO PART OF THE DWELLING INCLUDING EAVES, MAY BE CONSTRUCTED OUTSIDE THE BUILDING LOCATION ENVELOPE.



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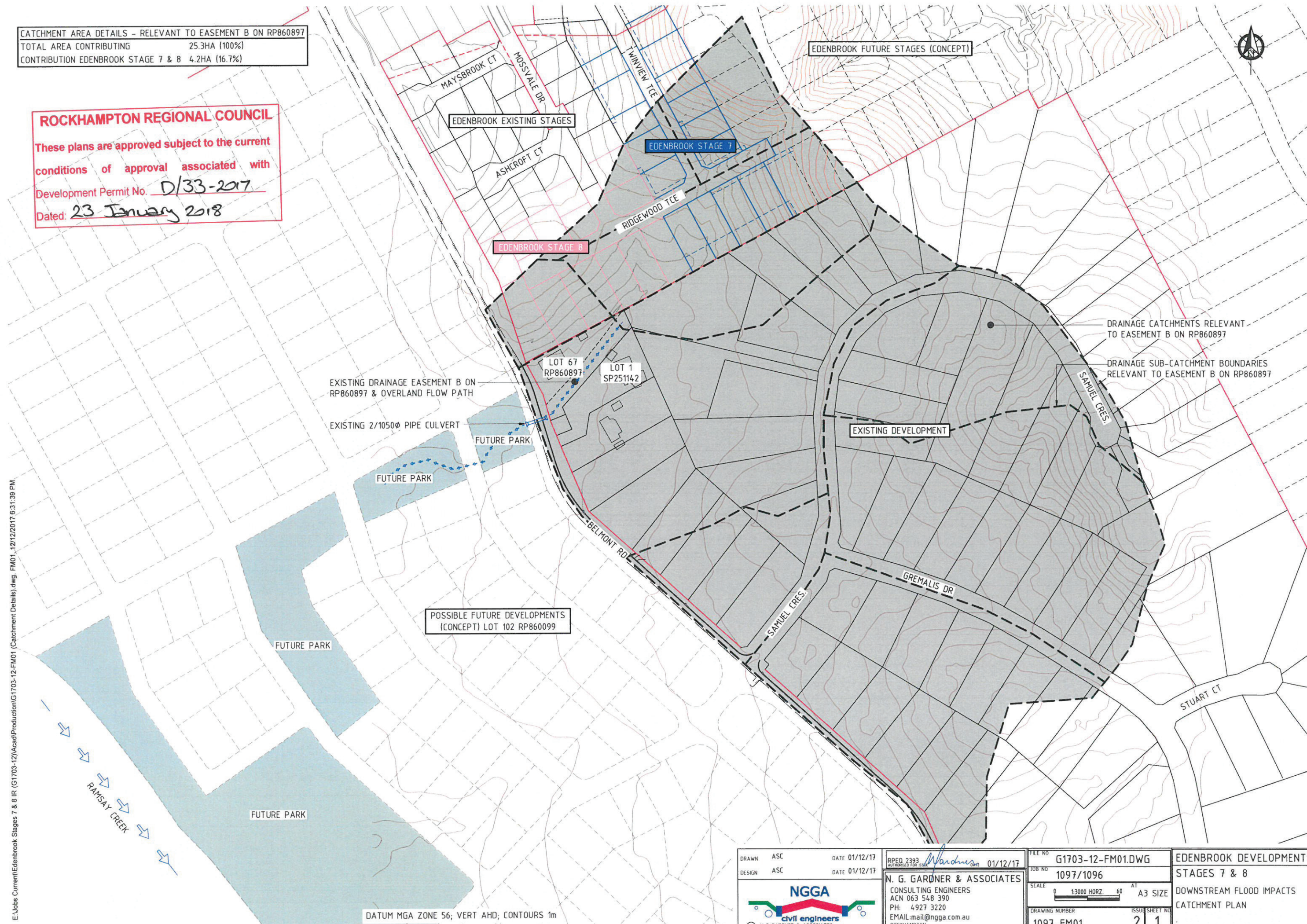
FIGURE 1096-ROL7: Building Setback Details



CATCHMENT AREA DETAILS - RELEVANT TO EASEMENT B ON RP860897  
TOTAL AREA CONTRIBUTING 25.3HA (100%)  
CONTRIBUTION EDENBROOK STAGE 7 & 8 4.2HA (16.7%)

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DESIGN: ASC DATE 01/12/17



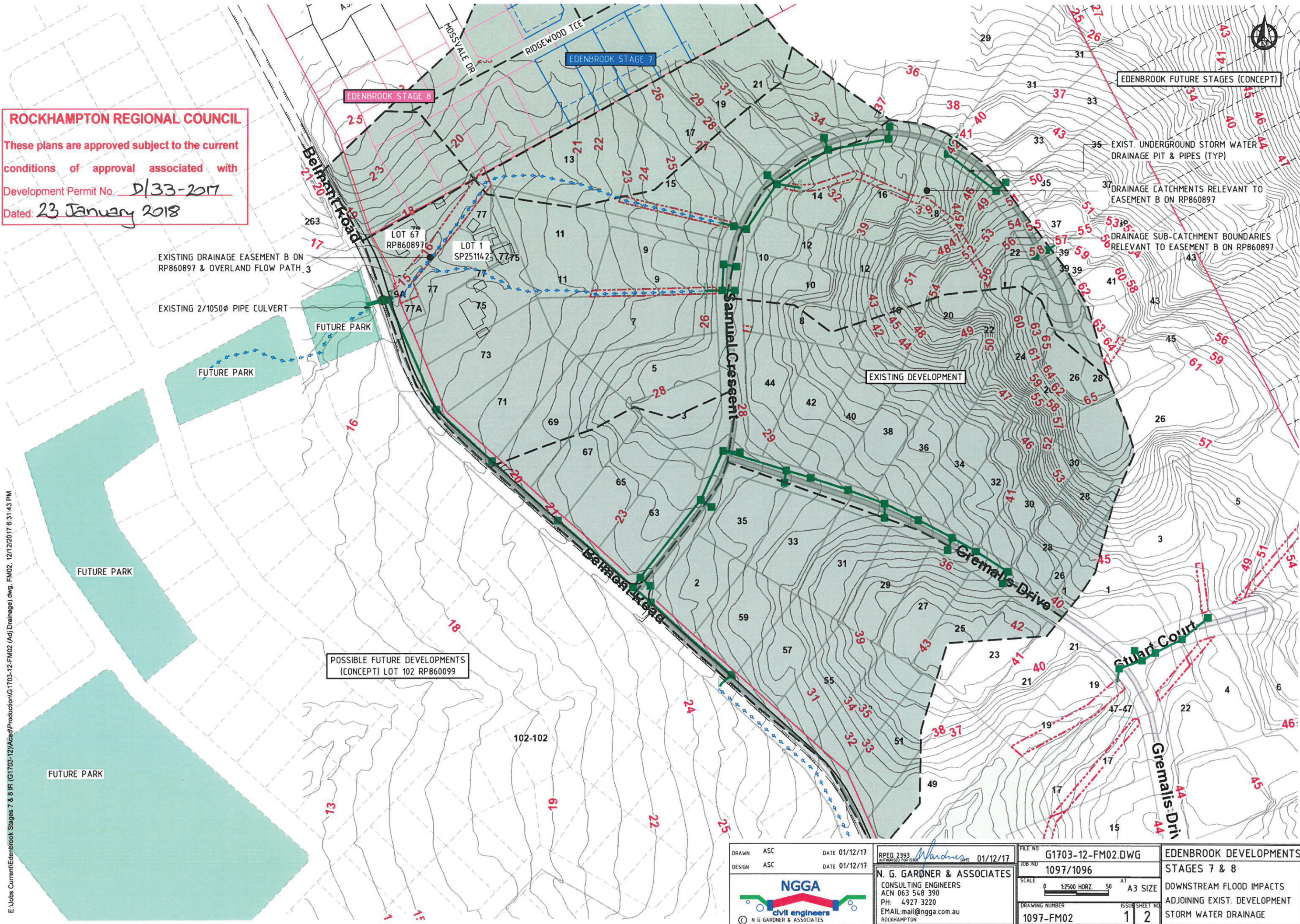
RPEQ 2393  
N. G. GARDNER & ASSOCIATES  
CONSULTING ENGINEERS  
ACN 063 548 390  
PH: 4927 3220  
EMAIL: mail@ngga.com.au  
ROCKHAMPTON

FILE NO: G1703-12-FM01.DWG  
JOB NO: 1097/1096  
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ISSUE SHEET NO: 2 1


EDENBROOK DEVELOPMENTS  
STAGES 7 & 8  
DOWNSTREAM FLOOD IMPACTS  
CATCHMENT PLAN



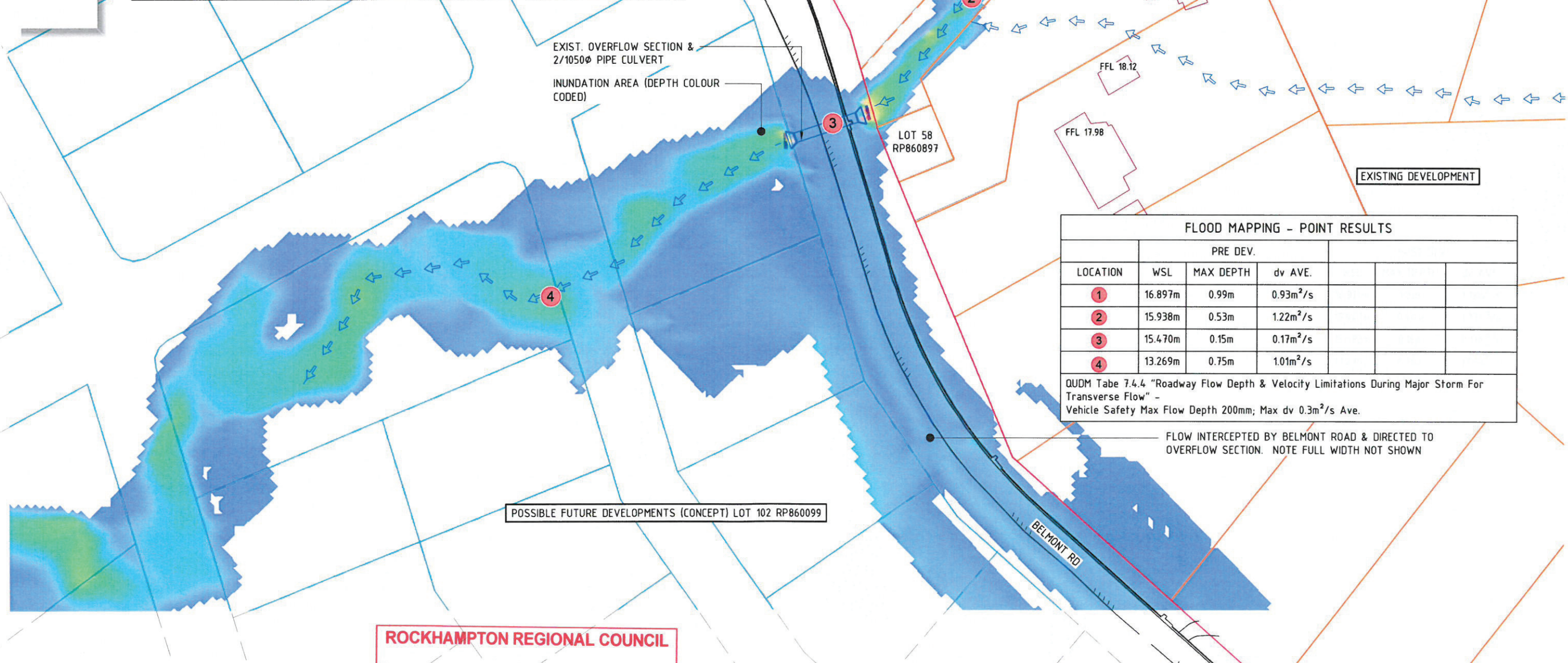
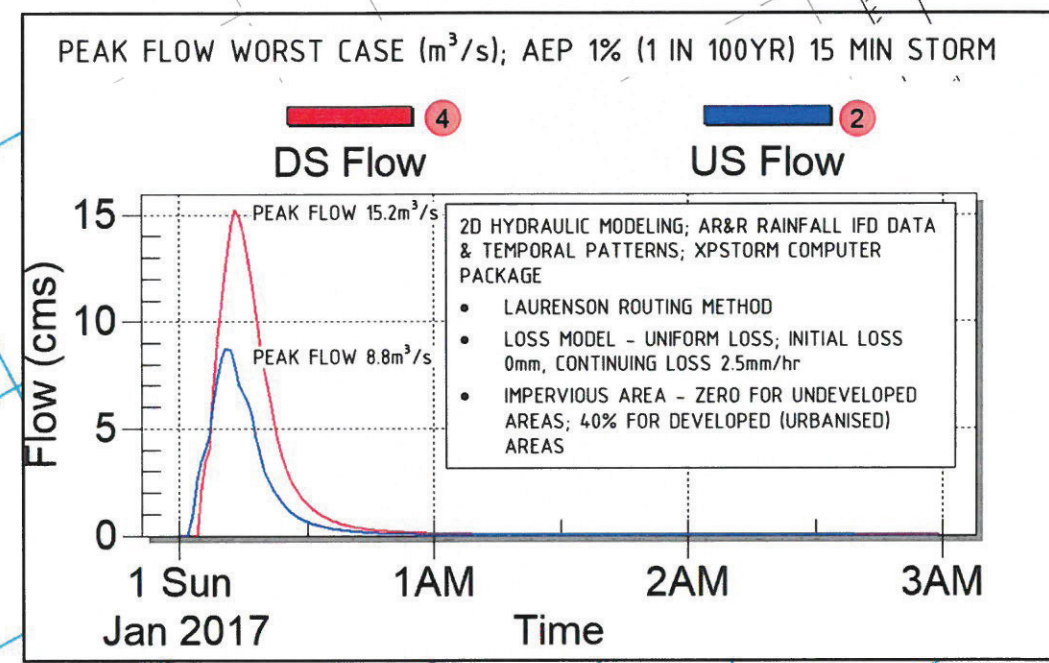
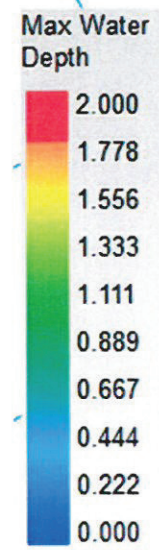
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DESIGN	ASC	DATE	01/12/17	CONSULTING ENGINEERS		JOB NO	1097/1096	STAGES 7 & 8
 N. G. GARDNER & ASSOCIATES CONSULTING ENGINEERS ACN 063 548 390 PH: 4927 3220 EMAIL: mail@ngga.com.au ROCKHAMPTON				SCALE		AT	A3 SIZE	DOWNSTREAM FLOOD IMPACTS
				0 12500 HORZ 50				ADJOINING EXIST. DEVELOPMENT
				DRAWING NUMBER		ISSUE SHEET NO		STORM WATER DRAINAGE
				1097-FM02		1	2	





FLOOD MAPPING - POINT RESULTS					
LOCATION	PRE DEV.				
	WSL	MAX DEPTH	dv AVE.		
1	16.897m	0.99m	0.93m <sup>2</sup> /s		
2	15.938m	0.53m	1.22m <sup>2</sup> /s		
3	15.470m	0.15m	0.17m <sup>2</sup> /s		
4	13.269m	0.75m	1.01m <sup>2</sup> /s		

QUDM Tab 7.4.4 "Roadway Flow Depth & Velocity Limitations During Major Storm For Transverse Flow" - Vehicle Safety Max Flow Depth 200mm; Max dv 0.3m<sup>2</sup>/s Ave.

**ROCKHAMPTON REGIONAL COUNCIL**

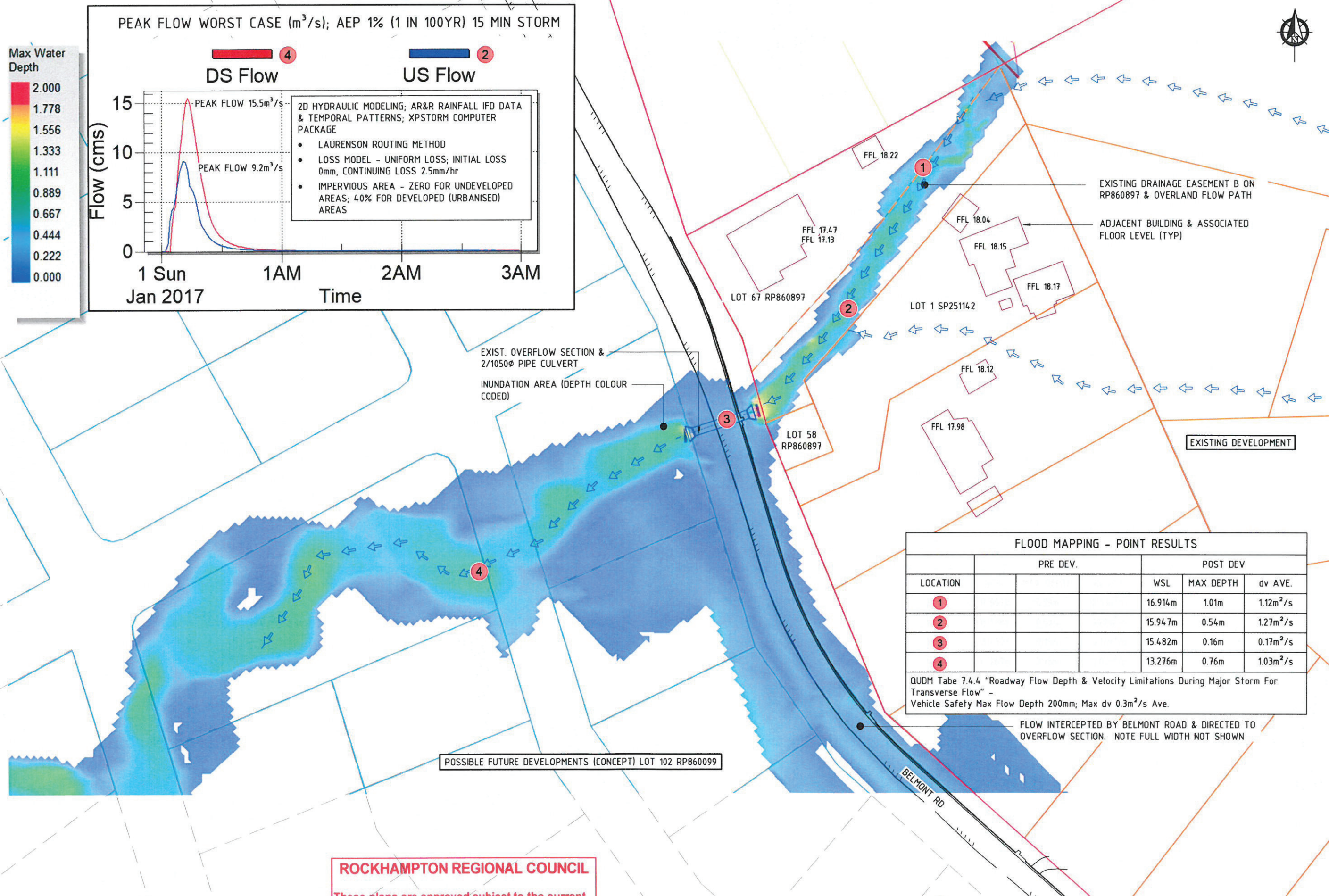
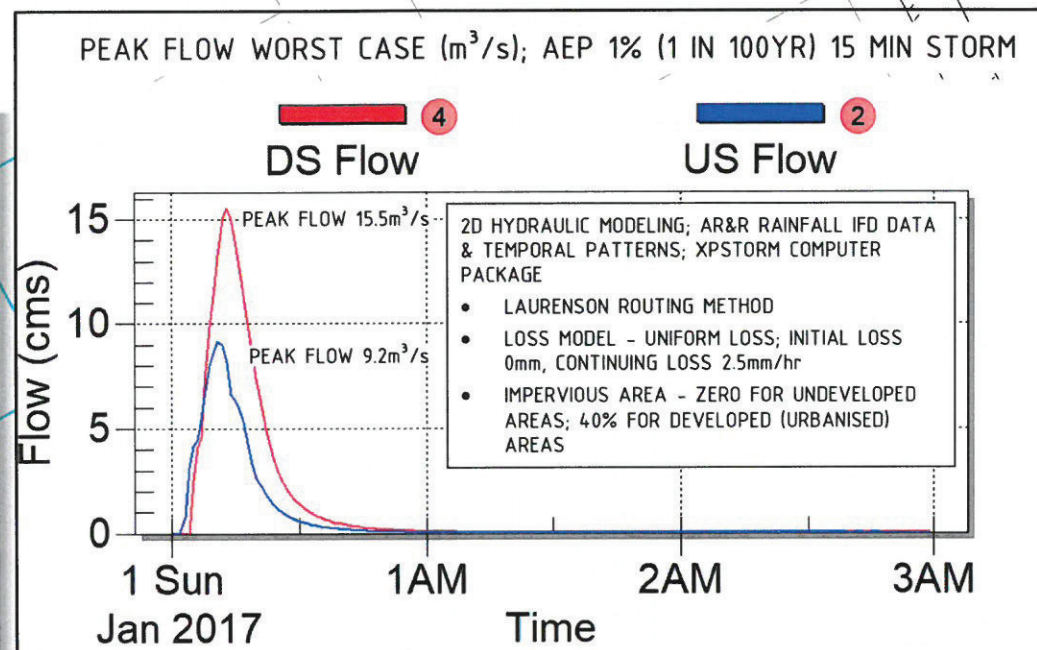
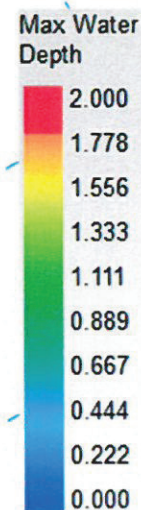
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DESIGN: ASC	DATE: 01/12/17	01/12/17	JOB NO: 1097/1096	STAGES 7 & 8
		N. G. GARDNER & ASSOCIATES CONSULTING ENGINEERS ACN 063 548 390 PH: 4927 3220 EMAIL: mail@ngga.com.au ROCKHAMPTON		DOWNSTREAM FLOOD IMPACTS
		SCALE: 0 1:1000 HORZ. 20 AT A3 SIZE		1 IN 100YR FLOOD MAPPING
		DRAWING NUMBER: 1097-FM03		PRE EDENBROOK STAGE 7 & 8
		ISSUE SHEET NO: 2 3		



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FLOOD MAPPING - POINT RESULTS						
LOCATION	PRE DEV.			POST DEV		
				WSL	MAX DEPTH	dv AVE.
1				16.914m	1.01m	1.12m <sup>2</sup> /s
2				15.947m	0.54m	1.27m <sup>2</sup> /s
3				15.482m	0.16m	0.17m <sup>2</sup> /s
4				13.276m	0.76m	1.03m <sup>2</sup> /s

QUDM Tab 7.4.4 "Roadway Flow Depth & Velocity Limitations During Major Storm For Transverse Flow" - Vehicle Safety Max Flow Depth 200mm; Max dv 0.3m<sup>2</sup>/s Ave.

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Dated: 23 January 2018

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DESIGN: ASC	DATE: 01/12/17	01/12/17	JOB NO: 1097/1096	STAGES 7 & 8	
N. G. GARDNER & ASSOCIATES		CONSULTING ENGINEERS	SCALE: 0 1:1000 HORZ. 20 AT A3 SIZE	DOWNSTREAM FLOOD IMPACTS	
ACN 063 548 390		PH: 4927 3220	DRAWING NUMBER: 1097-FM04	1 IN 100YR FLOOD MAPPING	
EMAIL: mail@ngga.com.au		ISSUE SHEET NO: 2 4		POST EDENBROOK STAGE 7 & 8	
ROCKHAMPTON					



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EDENBROOK STAGE 8

EDENBROOK STAGE 7

PROPOSED ROADS & UNDERGROUND  
DRAINAGE STAGES 7 & 8

INDICATIVE STAGE 8 STORM WATER  
DRAINAGE CONNECTION

INDICATIVE STAGE 8 ALLOTMENT  
REAR OF ALLOTMENT DRAINAGE

EXIST. DWELLING (TYP)

PROPOSED FIELD INLET (TYP)

EXISTING DRAINAGE EASEMENT B ON  
RP860897 & OVERLAND FLOW PATH

UNDER GROUND PIPE DRAINAGE  
CONNECTION FROM STAGES 7 & 8

EXISTING 2/1050Ø PIPE CULVERT

EXIST. UNDERGROUND STORM WATER  
DRAINAGE PIT & PIPES (TYP)

POSSIBLE FUTURE DEVELOPMENTS (CONCEPT) LOT 102 RP860099

LOT 67 RP860897

LOT 1 SP251142

LOT 58  
RP860897

EXISTING DEVELOPMENT

DRAWN ASC DATE 01/12/17  
DESIGN ASC DATE 01/12/17



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N. G. GARDNER & ASSOCIATES  
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FILE NO G1703-12-FM02.DWG  
JOB NO 1097/1096  
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DRAWING NUMBER 1097-FM05  
ISSUE SHEET NO 2 5

EDENBROOK DEVELOPMENTS  
STAGES 7 & 8  
DOWNSTREAM FLOOD IMPACTS  
EDENBROOK STAGES 7 & 8 STORM  
WATER DRAINAGE CONNECTION