

APPENDIX E - STORMWATER MANAGEMENT PLAN

Kehoe Myers Consulting Engineers

STORMWATER MANAGEMENT PLAN

CRONIN ROAD HIGHFIELDS - SUBDIVISION

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1 INTRODUCTION

Kehoe Myers Consulting Engineers has been engaged by Tahmer Pty Ltd to prepare an Engineering Infrastructure Report as part of the planning documentation in support of the Development Application with the Toowoomba Regional Council (TRC) for the Reconfiguration of a Lot Development Application (DA) at 104 Cronin Road, Highfields.

The proposed development is for a residential subdivision at Cronin Road, Highfields. Works will include the construction of new roads and services to the proposed lots. Earthworks to provide level building pads, stormwater, sewerage, water reticulation, power and telecommunications services will also be constructed.

This report seeks to address onsite stormwater management for the proposed development. The following items will be addressed in this report:

- Hydraulic analysis to assess the required mitigation to ensure a case of ‘non-worsening’ or not incurring an actionable nuisance is achieved.
- Compliance with TRC’s pollutant reduction policy and the State Planning Policy (SPP).

From the below analysis, it was determined that stormwater discharge conditions from the site can be maintained within the capacity of the existing road drainage infrastructure. As such, it is seen that the proposed development can achieve a case of ‘non-worsening’ or no ‘actionable nuisance’ at the lawful points of discharge.

As a result of this analysis, it is then shown that the proposed development complies with the guidelines set by both the TRC and Queensland Urban Drainage Manual (QUDM). The report below details the achievement of these lawful points of discharge requirements.

Additionally, the developed site was assessed for water quality requirements as per the TRC Planning Scheme and the Queensland State Planning Policy. As detailed in this report, site stormwater quality is not required as the development does not trigger water quality requirements listed under the State Planning Policy (SPP).

2 SITE DESCRIPTION

The proposed development is located on a 41,030 m² site located at Cronin Road, Highfields. The real property description is Lot 109 on D349. A Locality Plan highlighting the proposed development site is shown below.

Refer to **FIGURE 1** below for site location with respect to adjoining roads and lots.



FIGURE 1 AERIAL PHOTOGRAPH OF THE PROPOSED DEVELOPMENT SITE (QUEENSLAND GLOBE 2025)

2.1 EXISTING SITE CONDITIONS

From the available contour data of the subject, the site is currently seen to be a generally open and gently graded allotment. The current allotment is seen to feature an existing dwelling and multiple sheds, with extensive open grass areas and sparse vegetation. The site is seen to fall from North to South. The average gradient of the subject site is approximately 2%.

A current aerial image of the proposed development site is shown below in **FIGURE 2**.



FIGURE 2 SITE AERIAL IMAGE AND CONTOURS (TR MAPS 2025)

2.2 PROPOSED DEVELOPMENT

The proposed development layout has been developed in association with the Client. From this liaison, the proposed site layout was created, and a conceptual engineering design was undertaken to provide access and a stormwater network for the proposed development.

A snapshot of the approved Site Layout of the development is shown below in **FIGURE 3** and a full plan of the proposed site is attached in **APPENDIX A**. Further to the development of the allotment layout, preliminary services were developed for the proposed site, and a concept services layout plan is attached in **APPENDIX B**.



FIGURE 3 PROPOSED LOT LAYOUT (KEHOE MYERS DRAWING: C2425076-PR01)

3 HYDROLOGY

To enable the hydraulic analysis of the stormwater management system, the development site has been assessed for both the pre-development and post-development cases. This analysis has been undertaken to check that the development achieves a case of ‘non-worsening’ or not incurring an actionable nuisance at the lawful point of discharge.

3.1 EXISTING SITE INFRASTRUCTURE

As shown below in **FIGURE 4**, the road network adjacent to the development site contains a pit and pipe network. The drainage infrastructure network within Cronin Road drains South along Cronin Road and Westward through an existing culvert, through to the existing basin constructed as part of ‘The Avenues’ development.



FIGURE 4 EXISTING STORMWATER NETWORK (TRC INFRASTRUCTURE MAPS 2025)

3.2 PRE-DEVELOPMENT CATCHMENTS

Existing catchments to the existing Cronin Road culvert crossing and the existing detention basin have been obtained from the Reis Road Catchment Strategy and the approved Stormwater Management Plan, forming part of Council Operational Works Approval OW/2016/3161.

The uncontained overland flows from neighbouring properties to the North form an external upstream catchment contributing runoff to the subject site. Internally, the development site currently discharges as overland flow across the Southern boundary and into the neighbouring properties, eventually discharging to the Cronin Road kerb and channel and under the existing culvert crossing to the existing detention basin.

A snapshot of the pre-development catchments derived from the existing approvals is included in **FIGURE 5** below and attached in **APPENDIX C**.

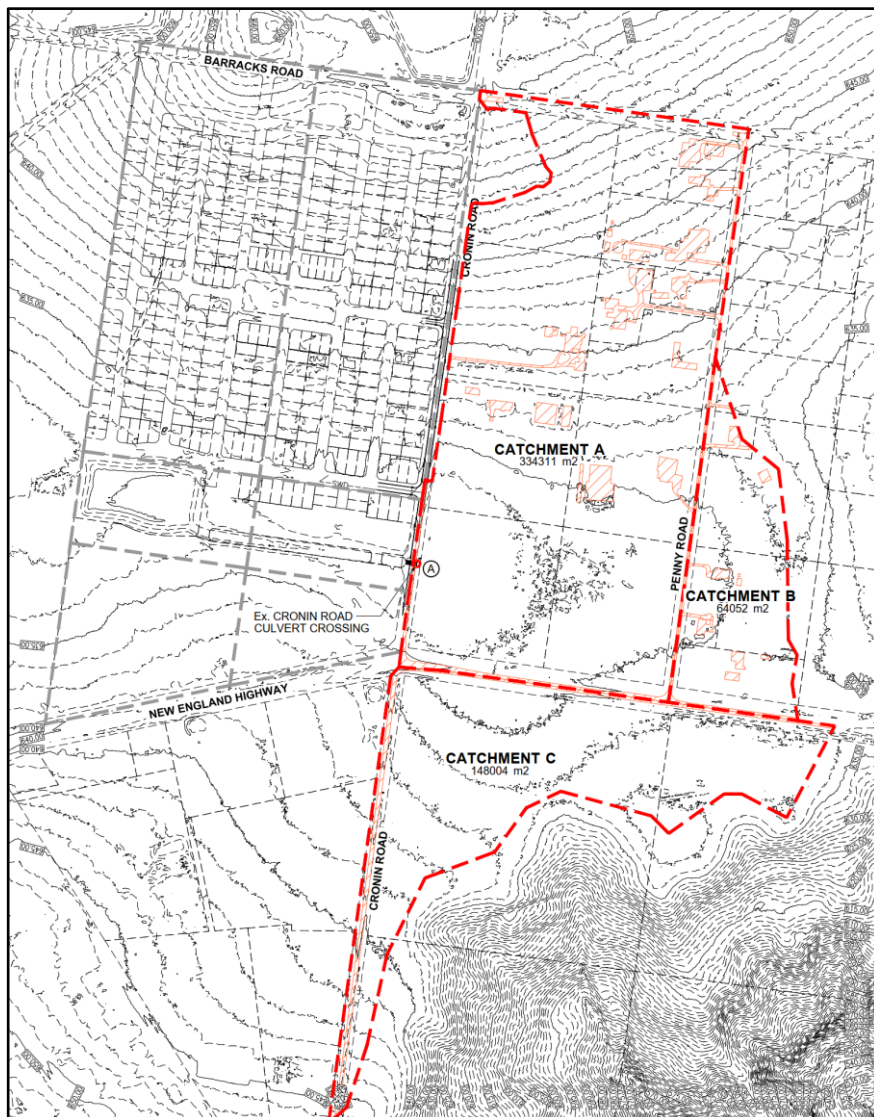


FIGURE 5 PRE-DEVELOPED STORMWATER CATCHMENT PLAN

From the detailed assessment of the existing catchment to the culvert, the design attributes have been determined and are presented in **Table 1** below.

TABLE 1 PRE-DEVELOPED SUB-CATCHMENT PROPERTIES

CATCHMENT NAME	AREA (HA)	IMPERVIOUS TC (MIN)	PERVIOUS TC (MIN)	FRACTION IMPERVIOUS (%)
A	33.4311	7.6	39.4	7.3
B	6.4052	11.4	15.2	8.0
C	14.8004	19.5	28.8	4.4

3.3 POST-DEVELOPMENT CATCHMENTS

It is anticipated that minor earthworks will be required to form the new road and achieve compliant surface drainage grades for the proposed development. The Southern portion of the site will be raised to direct site runoff from proposed lots onto the new road.

The proposed stormwater system consists of overland flows as well as an underground pit and pipe network. These details are documented in the Preliminary Services Layout attached in **APPENDIX B**.

From the proposed site plan, the conceptual stormwater catchment has been determined and is presented in **FIGURE 6** below and attached in **APPENDIX C**.

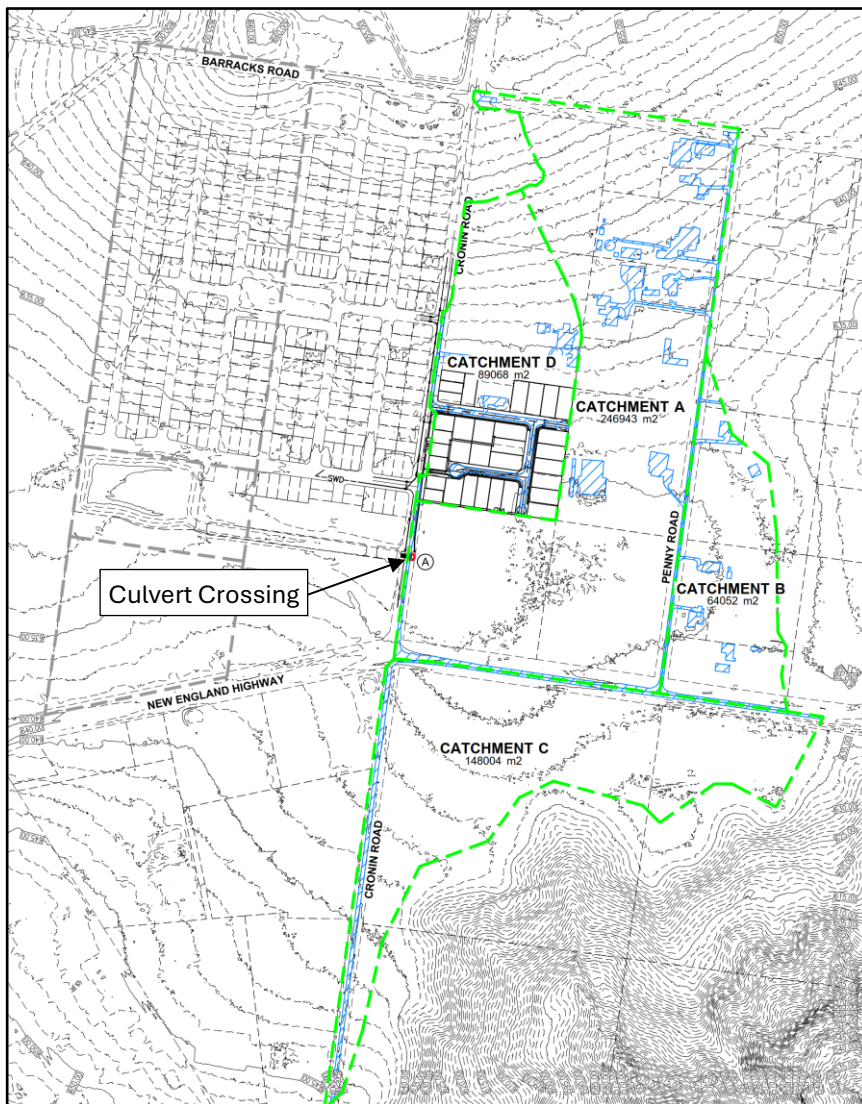


FIGURE 6 POST-DEVELOPED STORMWATER CATCHMENT PLAN

From the detailed assessment of the post-development catchments, the design attributes have been determined and are presented in **Table 2** below.

TABLE 2 POST-DEVELOPED SUB-CATCHMENT PROPERTIES

CATCHMENT NAME	AREA (HA)	IMPERVIOUS TC (MIN)	PERVIOUS TC (MIN)	FRACTION IMPERVIOUS (%)
A	24.6943	7.6	40.6	8.2
B	6.4052	11.4	15.2	8.0
C	14.8004	19.5	28.8	4.4
D	8.9068	5.0	20.6	23.2

3.4 DISCHARGE REPORTING LOCATIONS

From the site assessment of all stormwater flows, the critical discharge location was identified as the Cronin Road culvert crossing. This location was selected to assess pre-development against post-development flows.

A. Cronin Road Culvert

4 PEAK FLOW COMPARISONS

Stormwater analysis for this report has been undertaken using *DRAINS*. *DRAINS* is an engineering software package for designing urban stormwater drainage systems. The “Extended Rational Method” hydrology loss model was used to convert Australian Rainfall and Runoff (AR&R) Temporal Patterns and rainfall data into runoff Hydrographs.

As per the approved Stormwater Management Report for The Avenues of Highfields – Stages 1& 2 (Council Ref: OW/2016/3161), the culvert was sized to provide flood immunity during a 10% AEP storm event. Accordingly, analyses have been conducted within the catchments to determine pre- and post-development flows for the 39% AEP (0.5EY) to the 10% AEP rainfall events. A range of rainfall event durations was analysed from the 5- to 120-minute storm duration. pre- and post-development median peak flow results are provided in TABLE 3 below.

TABLE 3 MEDIAN PEAK STORMWATER FLOWS (m³/s) – DISCHARGE NODE A

DEVELOPMENT STAGE	39% AEP (0.5EY) (m ³ /s)	18% AEP (0.2EY) (m ³ /s)	10% AEP (m ³ /s)
Pre-developed	3.004	4.212	5.182
Post-developed	3.155	4.479	5.496
Increase	0.151	0.267	0.314

As per **Table 3** above, the peak discharge to the Cronin Road culvert crossing increases post-development. Due to the increase, the capacity of the existing culvert was assessed. The culvert crossing is 2/2700x600 RCBCs on 1% grade. Cronin Road at the culvert location has a 1-way 1% crossfall. The culverts are oriented perpendicular to the roadway. A screenshot of the culvert design from the approved OW/2016/3161 drawing no GS109-ST1-D09/F is given below.

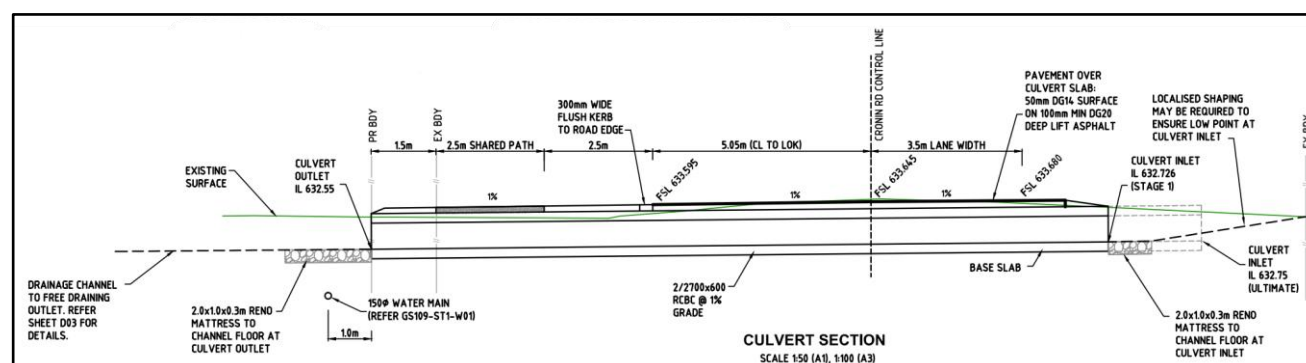


FIGURE 7 EXISTING CULVERT DESIGN DETAILS (GENENG SOLUTIONS)

4.1 DRAINS MODEL VALIDATION

From the QUDM guidelines, it is recommended that computer models are calibrated to flow data or “be ‘compared’ with the peak discharge derived for the same catchment using the Rational Method” (QUDM 2013).

As this report utilises the “Extended Rational Method” hydrology loss model, all ‘peak discharge’ catchment flows are derived directly from the Rational Method, and as such, a direct ‘comparison’ back to the ‘Rational Method’ can be assumed.

4.2 HY-8 CULVERT ANALYSIS

To assess the culvert crossing, an analysis was performed using HY-8 software. Input parameters for the analysis were obtained from the approved drawings detailed as part of OW/2016/3161 and are presented in **FIGURE 8** below. The design flow input was obtained from the DRAINS analysis for the 10% AEP storm as per **SECTION 4** and presented in **TABLE 3**. Following this analysis, the results are presented in **FIGURE 9** below.

The screenshot displays the HY-8 software interface for 'Crossing 1'. It is divided into two main panels: 'Crossing Properties' and 'Culvert Properties'.

Crossing Properties:

- Discharge Data:** Discharge Method: Minimum, Design, and Maximum; Minimum Flow: 0.000 cms; Design Flow: 5.496 cms; Maximum Flow: 12.000 cms.
- Tailwater Data:** Channel Type: Trapezoidal Channel; Bottom Width: 10.000 m; Side Slope (H:V): 4.000 :1; Channel Slope: 0.0034 m/m; Manning's n (channel): 0.030; Channel Invert Elevation: 632.550 m; Rating Curve: View...
- Roadway Data:** Roadway Profile Shape: Constant Roadway Elevation; First Roadway Station: 0.000 m; Crest Length: 10.000 m; Crest Elevation: 633.690 m; Roadway Surface: Paved; Top Width: 9.000 m.

Culvert Properties:

- Culvert 1:** Add Culvert, Duplicate Culvert, Delete Culvert.
- Culvert Data:** Name: Culvert 1; Shape: Concrete Box; Material: Concrete; Span: 2700.000 mm; Rise: 600.000 mm; Embedment D...: 0.000 mm; Manning's n: 0.012; Culvert Type: Straight; Inlet Configura...: Square Edge (90°) Headwall (K_e=0...; Inlet Depressio...: No.
- Site Data:** Site Data Input Option: Culvert Invert Data; Inlet Station: 0.000 m; Inlet Elevation: 632.750 m; Outlet Station: 20.000 m; Outlet Elevation: 632.550 m; Number of Barrels: 2; Computed Culvert SL...: 0.010000 m/m.

Buttons at the bottom include: Help, Click on any icon for help on a specific, Low Flow, AOP, Energy Dissipation, Analyze Crossing, OK, and Cancel.

FIGURE 8 - HY8 CULVERT ANALYSIS INPUTS

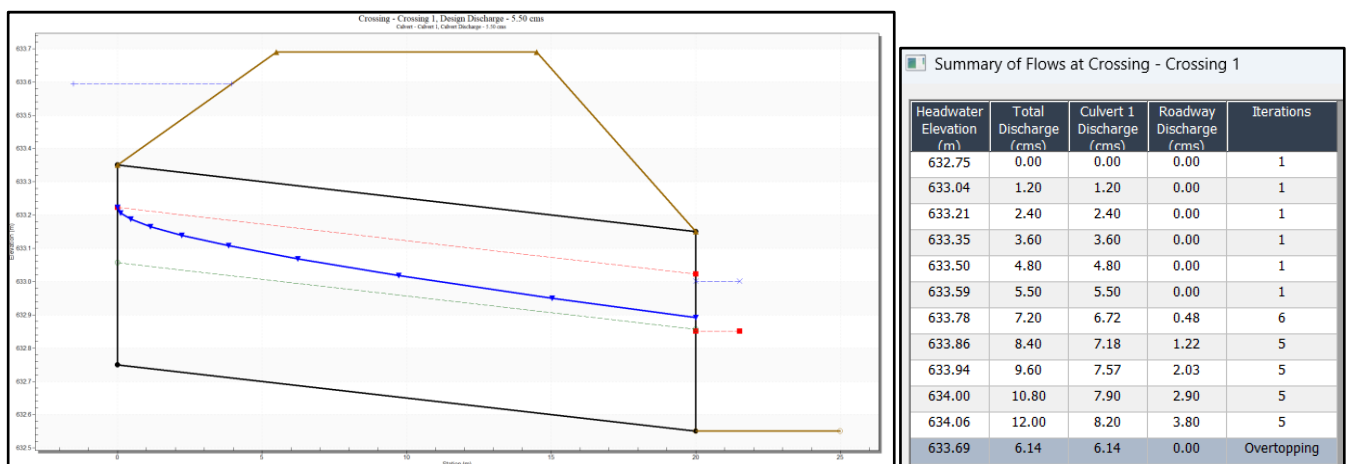


FIGURE 9 - HY8 CULVERT ANALYSIS RESULTS

As seen in **FIGURE 9** above, the developed flows to the culvert in the 10% AEP storm are within the capacity of the existing culvert(s). This demonstrates that the existing culverts have the capacity to convey all developed flows. Therefore, flows up to and including the 10% AEP remain safe and within the capacity of the existing culvert, with no overtopping of Cronin Road.

5 STORMWATER QUALITY MANAGEMENT

5.1 STORMWATER QUALITY LEGISLATION

The State Planning Policy (SPP), released in July 2017, provides guidelines on the requirement for stormwater quality treatment. Further advice on stormwater quality is provided in Toowoomba Regional Council's Planning Scheme Policy.

SPP states that the pollutant reduction design objectives for the Western Queensland climatic region are applicable to:

- A material change of use for an urban purpose that involves premises 2,500 m² or greater in size and;
 - will result in six or more dwellings; or
 - an impervious area greater than 25 percent of the net developable area; or
- Reconfiguring a lot for an urban purpose that involves premises 2,500 m² or greater in size and will result in six or more lots; or
- Operational Works for an urban purpose that involves disturbing a land area 2,500 m² or greater in size.

The development is located within the Western Queensland climatic region. In addition to the above, Appendix B Note 14 indicates that for areas within Western Queensland, the pollutant reduction design objectives only apply to population centres greater than 25,000.

From the 2021 Census, Highfields is a population centre with 8,568 people, which is less than 25,000 persons, so compliance with the SPP requires only "best management practices".

5.2 CONSTRUCTION PHASE STORMWATER QUALITY MANAGEMENT

While the development will ultimately comply with the objectives of State Planning Policy - July 2017, Water Quality, Section 1, it is also required to comply with the requirements of Appendix 2 Table A: Construction Phase – Stormwater Management Design Objectives during the construction works.

Pollutants typically generated during the construction phase include:

- Litter
- Sediment
- Hydrocarbons
- Toxic Materials
- pH Altering Substances

During the detailed design and construction phase, an erosion and sediment control plan will be prepared for the site. The erosion and sediment control plan will be based on the ICEA document '*Best Practice Erosion and Sediment Control*', International Erosional Control Association (Australasia), to achieve compliance under the *Environmental Protection Act 1994*.

The erosion and sediment control plan shall address the following:

- Use and location of sediment control devices including; sediment fencing and sediment traps for stormwater entry pits.
- Erosion control measures during earthworks, including any staging or sequencing of the works.

6 CONCLUSION

This report summarises the stormwater management practices proposed to manage the stormwater quantity and quality generated by the proposed development.

The development results in an increase in flows generated from the site. A capacity check at the existing culvert confirms that design storm flows are within acceptable limits. Overall, stormwater runoff from the site will be directed to the Cronin Road culvert crossing via a pit and pipe network, rather than through private neighbouring land as it is currently in the existing condition. As such, the proposed development is not expected to incur actionable nuisance flows with quantifiable loss to downstream properties.

As the town of Highfields is a population centre of less than 25,000 and is situated within the Western Queensland Climatic region, the development does not trigger the State Planning Policy criterion for stormwater quality management and is considered to be a low-risk development with respect to the quality of stormwater drainage.

As such, it is therefore seen that the proposed development will be able to meet both the stormwater quantity and quality objectives as detailed within the Queensland State Planning Policy and the Toowoomba Regional Council's Planning Scheme.

7 REFERENCES

Text References

Toowoomba Regional Council, Toowoomba Regional Planning Scheme

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Institute of Public Works Engineering Australasia, Queensland 2017, Queensland Urban Drainage Manual –Fourth Edition, 2016, Institute of Public Works Engineering Australasia, Queensland

Queensland Government 2017, State Planning Policy, July 2017, Department of Infrastructure, Local Government Planning, Brisbane, Australia

Water by Design 2010, MUSIC Modelling Guidelines, SEQ Healthy Waterways Partnership, Brisbane Qld, ISBN 978-0-9806278-4-8

Software Used

12d Model

DRAINS by Watercom Pty Ltd

HY-8 Culvert Analysis

8 APPENDICES

APPENDIX A. PROPOSED LOT LAYOUT (*KEHOE MYERS* DRAWING: C2425076-PR01)



NOTE:
+ ALL SHOWN SERVICES ARE FROM ON SITE VISUAL INSPECTIONS AND EXISTING RECORDS ONLY. CONTRACTOR TO CONFIRM LOCATION AND DEPTH OF ALL INGROUND SERVICES PRIOR TO ANY EXCAVATION.

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P2	01.07.26	FOR INFORMATION	

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SCALE 1:500 @ A1
SCALE 1:1,000 @ A3

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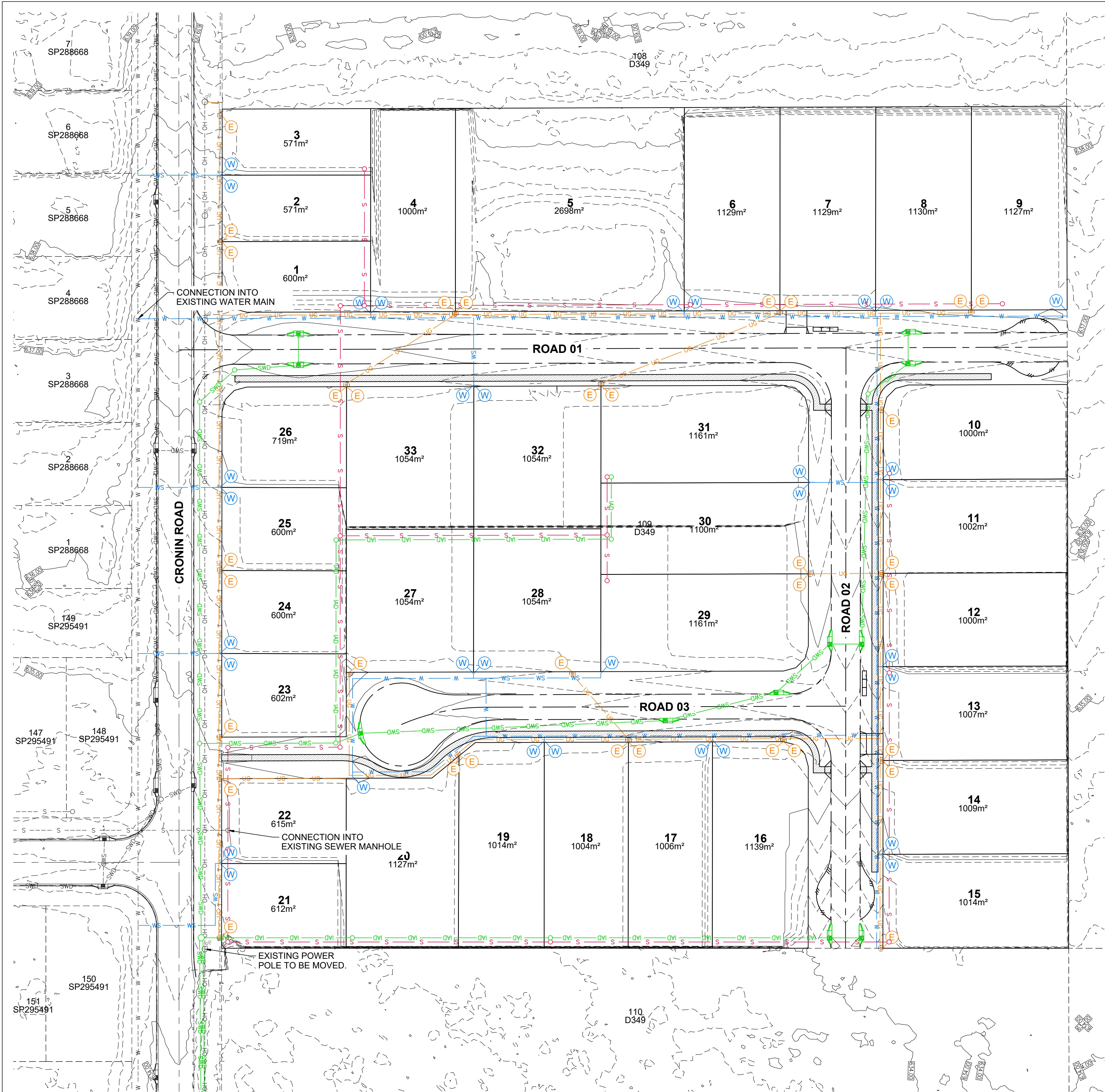
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DRAWN	NJ	PROJECT NUMBER	C2425076
CHECKED	FJS	DRAWING NUMBER	PR01
APPROVED		ISSUE	P2
DATE			

PRELIMINARY LOT LAYOUT
SCALE:- 1:500 @ A1, 1:1000 @ A3

APPENDIX B.

PROPOSED SERVICES LAYOUT (*KEHOE MYERS* DRAWING: C2425076-PR02)



NOTE:
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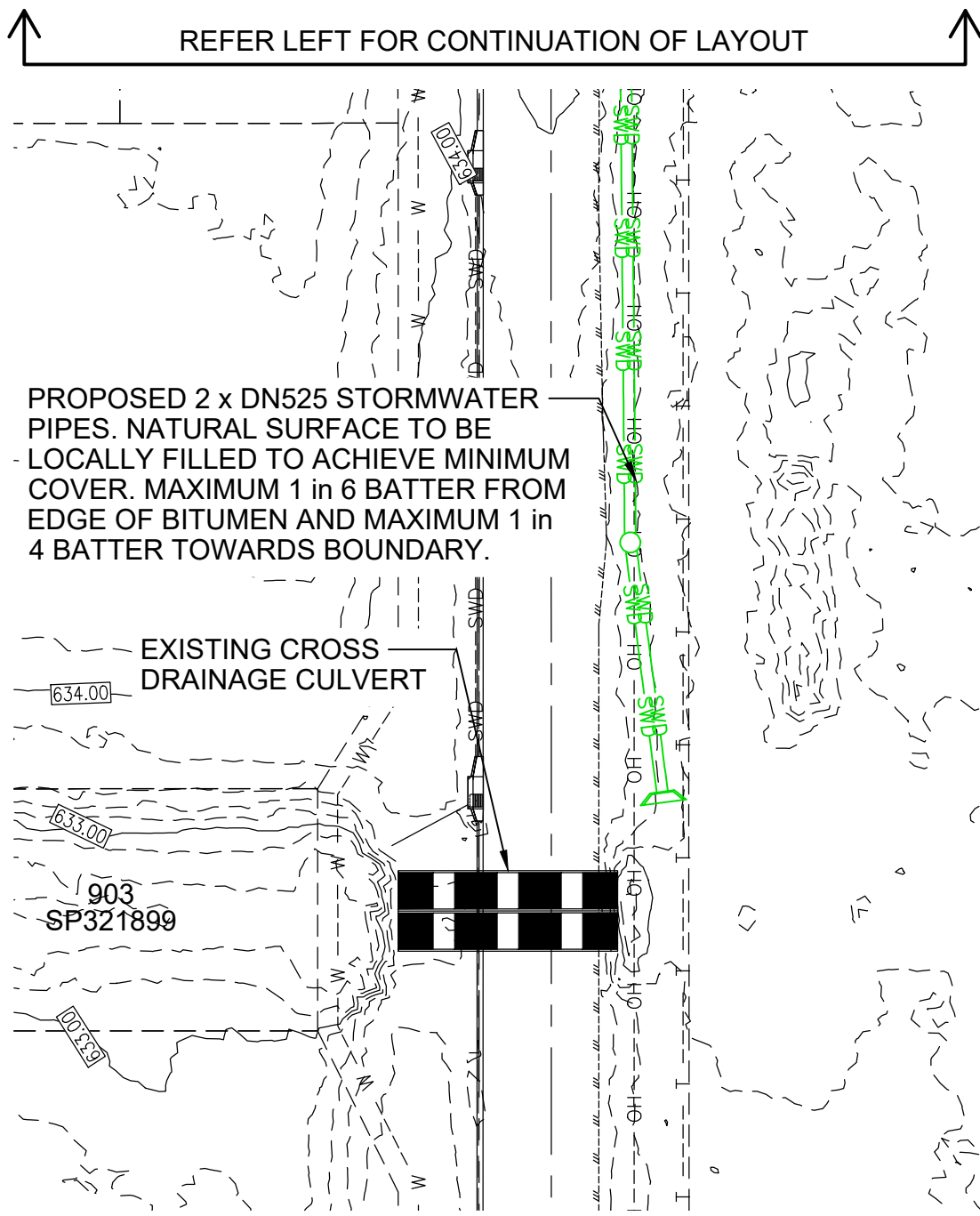
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SURVEYOR_INFORMATION

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SCALE 1:1,000 @ A3



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SERVICES LEGEND	
PROPOSED WORKS	
	PROPOSED LAYBACK KERB AND CHANNEL.
	PROPOSED STORMWATER DRAINAGE PIPE, MANHOLE, GULLY AND HEADWALL
	PROPOSED INTERALLOTMENT DRAINAGE PIPE AND MANHOLE
	PROPOSED SEWER MAIN AND MANHOLE
	PROPOSED WATER MAIN
	PROPOSED WATER METER AND SERVICE (BY OTHERS)
	PROPOSED UNDERGROUND ELECTRICAL LINE
	PROPOSED ELECTRICAL PILLAR BOX
	MAJOR DESIGN SURFACE CONTOUR (1.0m INTERVALS)
	MINOR EXISTING SURFACE CONTOUR (0.2m INTERVALS)
EXISTING WORKS	
	EXISTING BITUMEN EDGE
	EXISTING KERB AND CHANNEL.
	EXISTING STORMWATER DRAINAGE PIPE
	EXISTING OPEN DRAIN AND DIRECTION
	EXISTING SEWER MAIN AND MANHOLE
	EXISTING WATER MAIN
	EXISTING OVERHEAD ELECTRICAL LINES AND POWER POLES
	EXISTING TELECOMMUNICATION LINES

PRELIMINARY SERVICES LAYOUT
SCALE:- 1:500 @ A1, 1:1000 @ A3

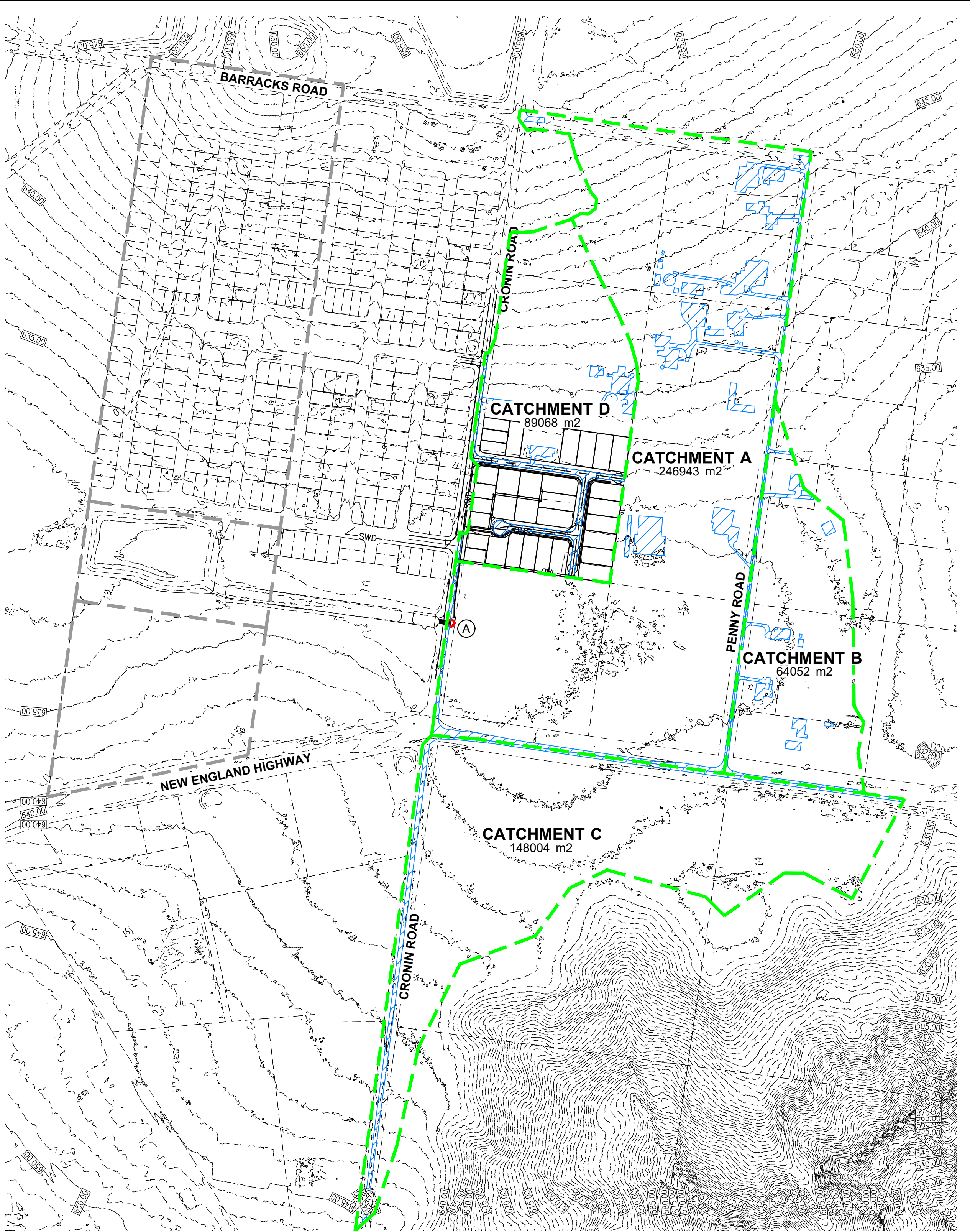
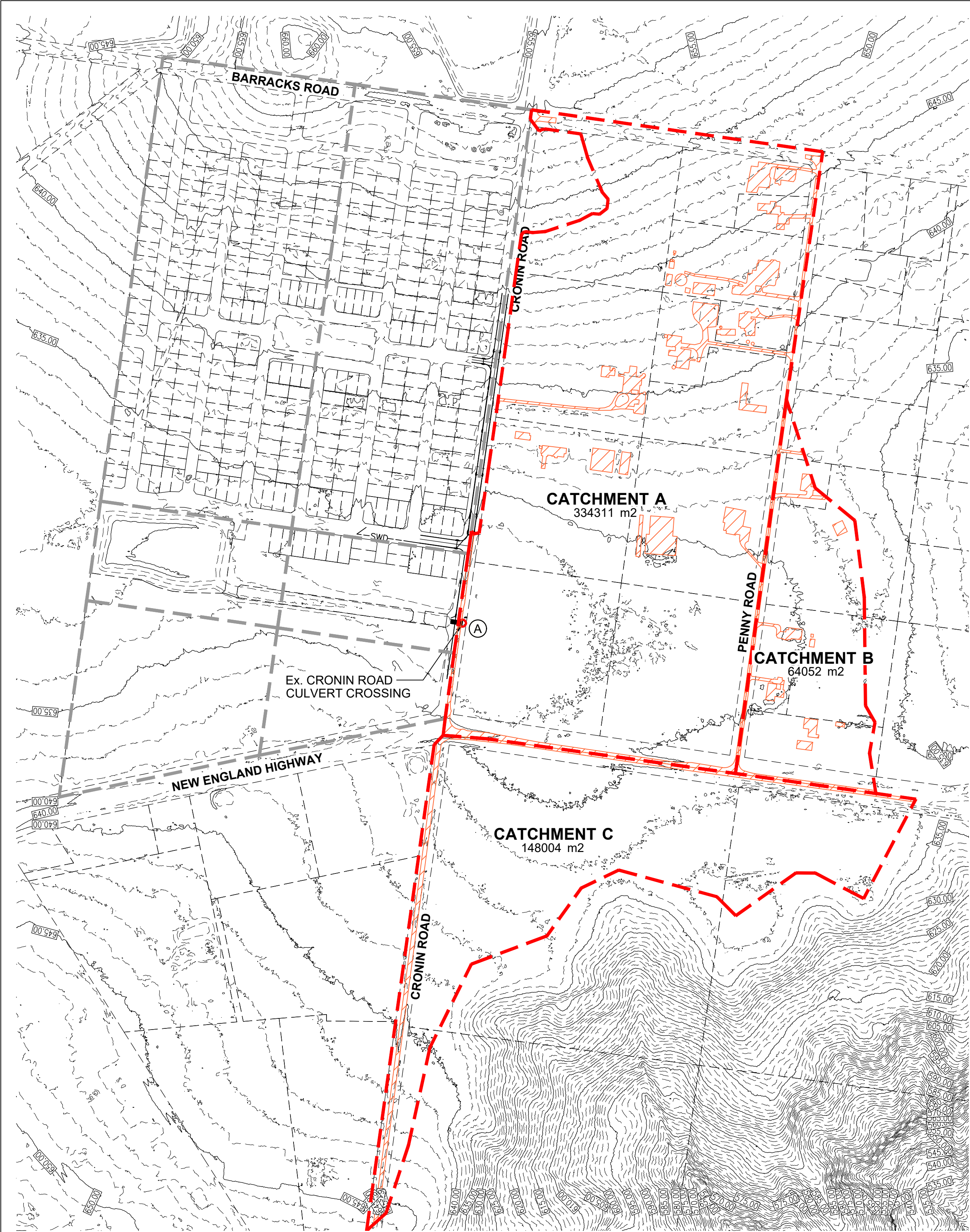
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DRAWING TITLE
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DRAWN	MDP	PROJECT NUMBER	C2425076
CHECKED	FJB	DRAWING NUMBER	PR02
APPROVED		ISSUE	P1

APPENDIX C. STORMWATER CATCHMENT LAYOUTS (KEHOE MYERS DRAWING: C2425076-SWM01)



**PRELIMINARY STORMWATER
CATCHMENT LAYOUTS**

SCALE:- 1:4,000 @ A1, 1:8,000 @ A3

STORMWATER CATCHMENT LEGEND

	PRE-DEVELOPED CATCHMENT BOUNDARY
	POST-DEVELOPED CATCHMENT BOUNDARY
	PRE-DEVELOPED NON-PERVIOUS AREAS
	POST DEVELOPED NON-PERVIOUS AREAS
	PROPOSED STORMWATER DRAINAGE PIPE, MANHOLE AND GULLY
	PROPOSED KERB INVERT
	EXISTING STORMWATER PIPE, MANHOLE AND GULLY
	DISCHARGE NODE

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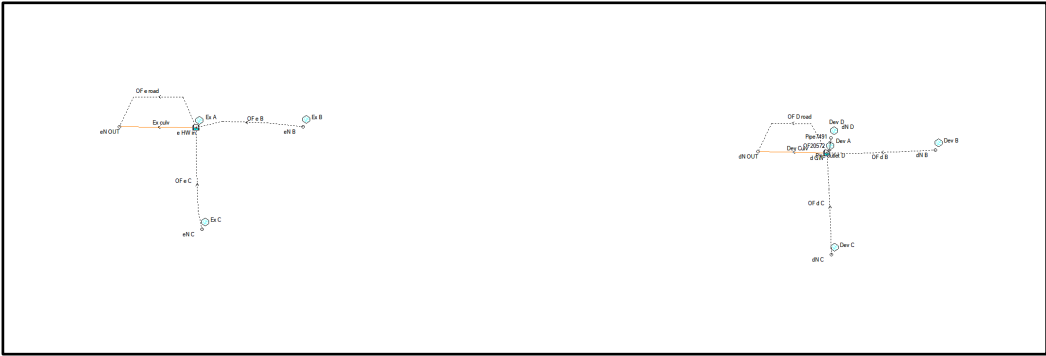
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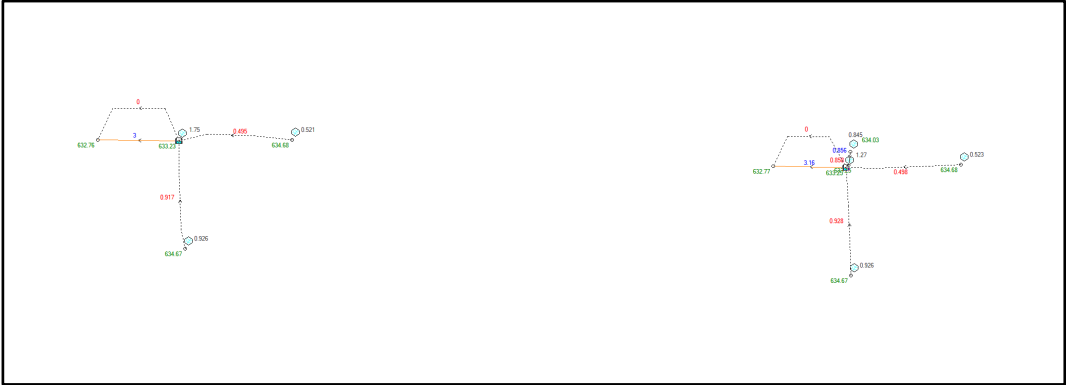
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CATCHMENT LAYOUTS

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CHECKED	FJS	DRAWING NUMBER	SWM01
APPROVED		ISSUE	P1

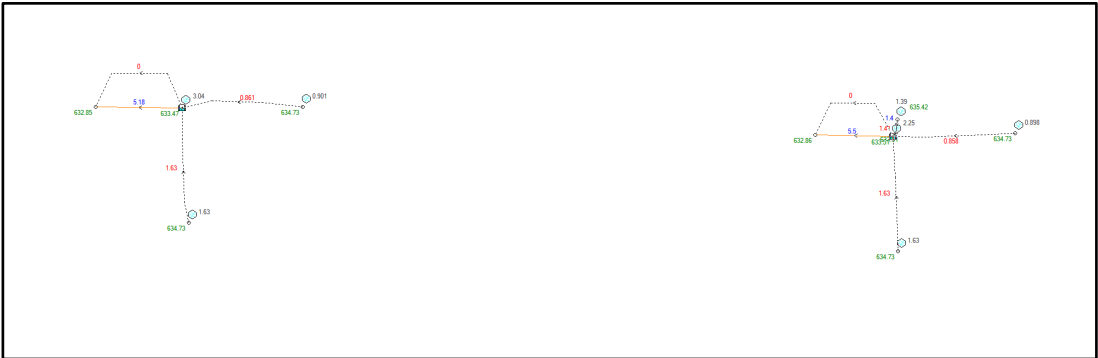
APPENDIX D. DRAINS MODEL RESULTS



DRAINS Layout Pre and Post Developed Scenario's



DRAINS 0.5EY Model Run



DRAINS 10%AEP Model Run