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DEVELOPMENT APPROVAL

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SITE BASED STORMWATER MANAGEMENT PLAN

144 Grampian Drive, Deebing Heights

Commissioned By
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REPORT CONTROL SHEET

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Report Title:	Site Based Stormwater Management Plan
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1 INTRODUCTION

1.1 Overview and Background

A development application for a material change of use is planned to be lodged over a multi-residential lot which is to be established as part of a wider reconfiguration of lot development (1 into 178) at 144 Grampian Drive, Deebling Heights (Lot 196 on S3157). The site is located within Ipswich City Council and has a total area of approximately 0.59ha. Figure 1.1 below provides an aerial locality of the site and adjacent areas.



Figure 1.1: Subject Site bound by Grampian Drive to the west (QLD Globe)

The proposed development involves a material change of use to a childcare centre. Refer to Appendix A for proposed development plan.

The existing site generally falls to the east towards a tributary of Deebling Creek on a grade of approximately 3%. Ipswich City Council's as constructed information indicates that no municipal stormwater infrastructure is present within the subject site.

ICC's Property Specific Flood Report states that the overall site is not known to have been affected by the 1974 nor 2011 flood.

A Flood Investigation Report was prepared by JFP Urban Consultants to address Conditions outlined within approval package 7787/2008/MAMC/A. The report identified localised flooding conditions associated with the tributary to the east of the

site and minimum lot levels to be achieved as part of the initial subdivision works. Refer below extract for minimum required lot levels applicable to subject site.

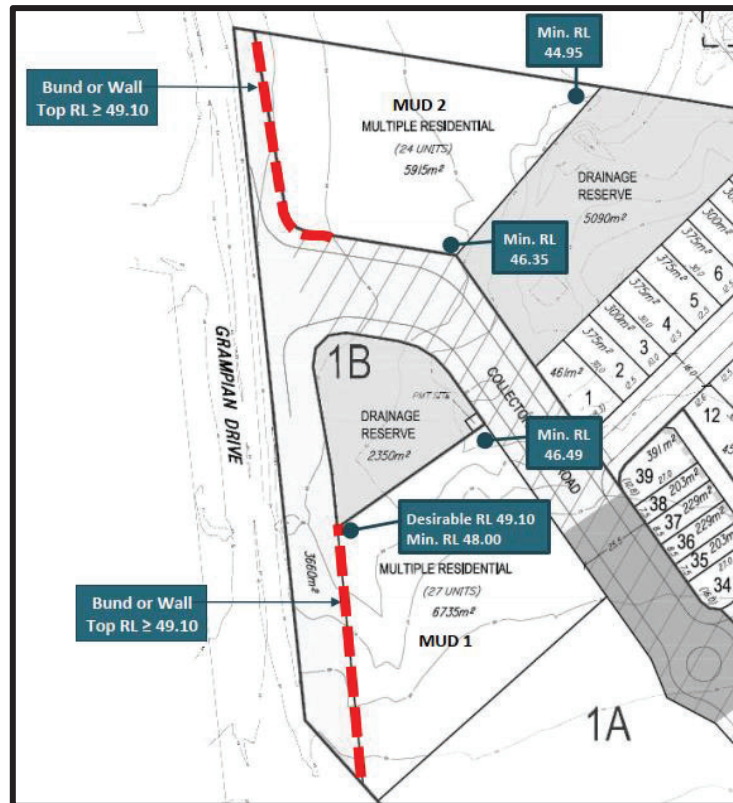


Figure 1.2: Minimum Required Lot Levels (Figure 9 - JFP FIR)

1.2 Objectives and Scope

Milanovic Neale Consulting Engineers have been commissioned by Otiosum Ltd ATF to undertake an assessment of stormwater quality and quantity impacts associated with the proposed development. Stormwater management strategies are also to be identified for the proposed development as required.

The scope of works undertaken for this project is summarized below:

1. Assessment of the development against State and Local Government legislation to identify water quality management measures to be adopted for the proposed development.
2. Undertake conceptual design of water quality improvement devices (if required) using best practice measures in accordance with State and Local Government legislation.
3. Assessment of the pre and post development stormwater discharge and undertake preliminary design and commentary of any mitigation devices required to control site discharge if required.

2 DATA

2.1 State and Local Government Policies

The *State Planning Policy – July 2017, Ipswich City Council – Ipswich Planning Scheme – Implementation guideline No.24* has been used as a guide to establish the required stormwater objectives and requirements for the development in conjunction with the *Queensland Urban drainage Manual (QUDM)*.

2.2 Initial ROL Documentation

The site-based stormwater quality management plan dated September 2018 which was prepared for the initial subdivision works by JFP Urban Consultants has been referenced to establish required stormwater treatment and detention measures to be implemented as part of the proposed development works.

A review of documentation associated with the flood investigation works undertaken on the tributary to the east of the development site by JFP Urban Consultants was also undertaken. This enable minimum lot levels to be identified with the aim of determining whether additional filling works would be necessary to accommodate the required stormwater treatment and detention measures.

2.3 Level and Modelling Data

Design contour information for the subject site and adjacent properties was obtained from bulk earthworks design plans associated with the initial subdivision works by JFP Urban Consultants.

3 OPPORTUNITIES AND CONSTRAINTS

3.1 Site Opportunities

Currently there are no stormwater quality measures on site, thus there are some opportunities to improve the quality of the stormwater leaving the site before discharge through stormwater treatment devices.

3.2 Site Constraints

The proposed development is likely required to incorporate detention measures to achieve a non-worsening of peak site runoff volumes post development as the existing site primarily consists of vegetation.

4 WATER QUALITY MANAGEMENT

This section of the report will provide an assessment of the development against State and Local Government legislation to identify water quality management measures to be adopted for the proposed development.

4.1 Risk Category

The *State Planning Policy – July 2017* identifies developments as high risk with respect to stormwater quality if any of the following criteria are triggered:

1. Material change of use urban purposes that involves a land area greater than 2,500m² that:
 - a. Will result in an impervious area greater than 25 percent of the net developable area; or
 - b. Will result in six or more dwellings, or
2. Reconfiguring a Lot for urban purposes that involves a land area greater than 2,500m² and will result in 6 or more Lots: or
3. Operational work for urban purposes that involves disturbing more than 2,500m² of land;

With respect to the above, the policy can be applied to the proposed development due to point 1a and 3 being triggered.

Ipswich City Council's Implementation Guideline No.24, Table 4.1 – Threshold for Stormwater Quality and Flow Management identifies further stormwater quality criteria on the following page.

**Table 4.1: Ipswich City Council
(Implementation Guideline No.24)**

Development Type	Threshold
Material change of use for urban purposes	a) Includes newly constructed road (previously unformed road) exceeding 30m in total length. b) Greater than 2500m² of land. c) 6 or more additional dwellings (attached or unattached). d) Located within an identified sensitive receiver area. e) Consists of 300m² or more uncovered impervious car park area including parking bays and circulation driveways for high pollutant generators such as Business Use - Fast Food Premises and Business Use - Service Station. f) Consists of 600m² or more uncovered impervious car park area including parking bays and circulation driveways for all other uses.
Reconfiguration of a lot for urban purposes	a) Includes newly constructed road exceeding 30m in total length. b) Would result in 6 or more residential allotments or that provides for 6 or more dwellings. c) Involves greater than 2500m² of land and will result in six or more lots. d) Located within an identified sensitive receiver area. e) Is associated with operational work disturbing greater than 2500m² of land.
Operational works for urban purposes	a) Disturbing greater than 2500m² of land. b) Located within an identified sensitive receiver area.

In relation to the above guideline, the development is classified as 'high risk' as with respect to water quality as criteria a, b and c for material change of use for urban purposes and criteria a for operational works for urban purposes is triggered.

4.2 Water Quality Objectives

4.2.1 Construction Phase

The *Urban Stormwater Quality Guidelines 2010* identify that eroded soils and litter are major pollutant sources during construction activity. There is also potential for hydro-modification of streams due to increased run-off coefficients when subsoils are exposed, for longer term major developments. Water sensitive urban design principles and reducing erosion during construction are fundamental to achieving water quality objectives in relevant waterways.

It is therefore proposed to prepare an erosion and sediment management plan during the operational works phase of the development which will incorporate a range of control measures to be implemented during the construction phase of the project.

4.2.2 Operational Phase

4.2.2.1 Voluntary Water Quality Nutrient Offset Payment

The Ipswich City Council Planning Scheme makes a provision for the developer to provide a voluntary payment in lieu of providing on site water quality treatment but Council have requested that MUSIC modelling works specific to the development be undertaken to determine required stormwater treatment measures.

4.2.2.2 Design Objectives

Stormwater quality management design objectives for the operational phase of the development are identified in the following table in accordance with the *Urban Stormwater Quality Guidelines 2010*. These objectives provide an emphasis on the reduction of mean annual loadings associated with suspended sediments and nutrients.

Table 4.2: Stormwater Quality Objectives

Region	Minimum Reductions in Mean Annual Loads from Unmitigated Development (%)			
	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Gross Pollutants > 5mm (GP)
South East Queensland	80	60	45	90

4.3 Water Quality Treatment

4.3.1 Model Selection

To determine on site pollutant generation, discharge concentrations of target pollutants and the effectiveness of Stormwater Quality Improvement Devices the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been used to model the development proposal.

4.3.2 MUSIC Model Configuration

The following sections identify the modelling parameters used in the configuration of the MUSIC Model adopted for the development. The following figure provides a screenshot of the MUSIC model schematic for reference. Refer Appendix D for associated MUSIC model summary report and Appendix A for catchment plan.

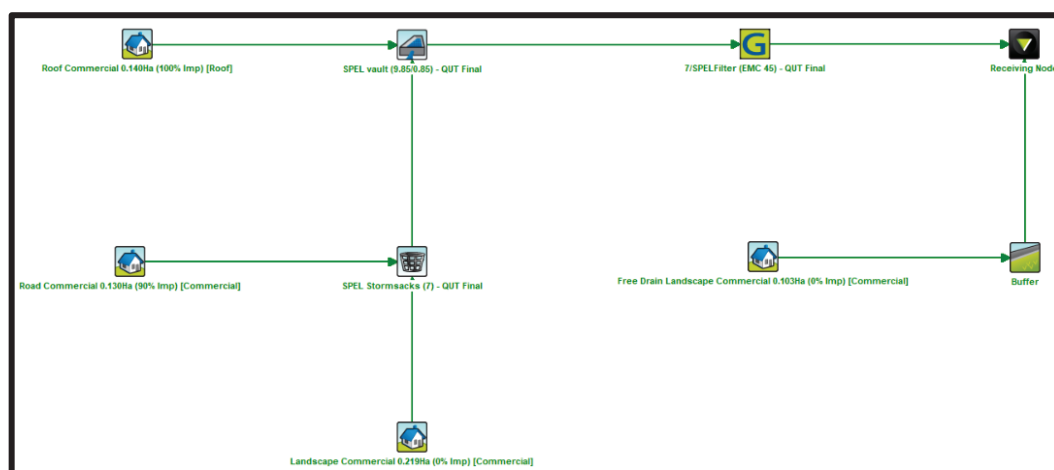


Figure 4.1: MUSIC Model Layout

4.3.2.1 Meteorological and Time Step

Meteorological Data used in the MUSIC model has been identified in accordance with the *MUSIC Modelling Guidelines 2010*, incorporating the following parameters:

Rainfall Period: 01/01/1990 12:00 AM to 30/12/1999 11:54 PM

Rainfall Station: 40004 AMBERLEY

A model time step of 6 minutes has also been adopted as recommended in Section 3.2 of the *MUSIC Modelling Guidelines 2010*.

4.3.2.2 Catchment Properties

The MUSIC model for the development adopts a split catchment approach, whereby the site has been broken down into a number of catchments with site specific land uses and their respective areas, in accordance with Table 3.6 in the MUSIC Modelling Guidelines. Table 4.3 provides a summary of the catchment data used in the MUSIC analysis.

Table 4.3: MUSIC Catchment Parameters

Catchment Name	Area (ha)	Fraction Impervious (%)	MUSIC Source Node
Roof	0.140	100	Commercial
Hardstand	0.130	100	
Vegetation	0.219	0	
Vegetation Free Drain	0.103	0	

4.3.2.3 Rainfall Runoff Parameters

The following table provides a summary of the rainfall runoff parameters adopted for the source nodes used in the MUSIC analysis which has been extracted from Table 3.7 of the *MUSIC Modelling Guidelines 2010*.

Table 4.4: MUSIC Source Node Base and Storm Flow Concentration Parameters

Land Use	Parameter	Total Suspended Solids (Log ₁₀ mg/L)		Total Phosphorus (Log ₁₀ mg/L)		Total Nitrogen (Log ₁₀ mg/L)	
Roof	Mean	N/A	1.30	N/A	-0.89	N/A	0.37
	Std Deviation	N/A	0.38	N/A	0.34	N/A	0.34
Road	Mean	0.78	2.43	-0.60	-0.30	0.32	0.37
	Std Deviation	0.39	0.38	0.50	0.34	0.30	0.34
Ground	Mean	0.78	2.16	-0.6	0.5	0.32	0.3
	Std Deviation	0.39	0.38	-0.39	0.34	0.37	0.34

4.3.2.4 Pollutant Export Parameters

The following table provides a summary of the pollutant export parameters for split catchment surface types which have been adopted for the source nodes used in the MUSIC analysis. This information has been extracted from Table 3.8 of the *MUSIC Modelling Guidelines 2010*.

Table 4.5: MUSIC Catchment Parameters

Parameter	Quantity
Rainfall Threshold (mm)	1
Soil Storage Capacity (mm)	18
Initial Storage (%)	10
Field Capacity (mm)	80
Infiltration Capacity Coefficient a	243
Infiltration Capacity Coefficient b	0.6
Daily Recharge Rate (%)	0
Daily Base-Flow Rate (%)	31
Daily Seepage Rate (%)	0

4.3.3 Developed Unmitigated Conditions

MUSIC Modelling has been performed to determine the pollutant export and corresponding concentrations from the development site under the proposed conditions. The mean annual loads that have been estimated for proposed unmitigated conditions are given in Table 4.6 below, also shown are the mean annual load percentage reductions required to meet current State Planning Policy objectives.

Table 4.6: MUSIC Unmitigated Mean Annual Loads (kg/yr)

Pollutant	Unmitigated Mean Annual Load (kg/yr)	Reduction required to meet Council Requirements (%)
Total Suspended Solids (TSS)	568	80
Total Phosphorous (TP)	1.27	60
Total Nitrogen (TN)	8.81	45
Gross Pollutants (GP)	47.9	90

Refer Appendix D for MUSIC summary report.

4.3.4 Developed Mitigated Conditions

The scale of the development is large enough to support the implementation of effective water quality design measures. Therefore, a consideration of a variety of best management measures has been given with a focus on water quality treatment measures and reducing polluted runoff volumes from the site.

Key elements of the proposed stormwater management plan are as follows:

- Runoff associated with proposed development areas are to be initially captured and treated via 10No. at source pollutant filters (SPEL Stormsack or similar approved) and piped to an underground detention tank (see section 5).
- The underground detention tank is to be fitted with 7No. SPEL Filter cartridges or similar approved to treat development runoff before discharging to the existing natural gully to the site's eastern boundary.
- Vegetated areas to the east of the proposed car parking area to bypass proposed treatment measures and sheet flow towards the existing natural gully adjacent to the site's eastern boundary.

The table below demonstrates that the required pollutant reductions have been achieved through the implementation of the proposed stormwater treatment train.

Table 4.7: MUSIC Model Removal Efficiencies

Pollutant	Unmitigated Mean Annual Load (kg/yr)	Mitigated Mean Annual Load (kg/yr)	Reduction required to meet Council Requirements (%)	Removal Efficiency Achieved (%)
Total Suspended Solids (TSS)	568	116	80	80
Total Phosphorous (TP)	1.27	0.49	60	62
Total Nitrogen (TN)	8.81	4.42	45	50
Gross Pollutants (GP)	47.9	0	90	100

5 WATER QUANTITY MANAGEMENT

This section of the report will provide an assessment of the pre and post development stormwater discharge and undertake preliminary design and commentary of any mitigation devices required to control site discharge.

5.1 Existing Conditions

This section of the report will analyse and comment on the existing site stormwater discharge conditions. The modelling software InfoWorks ICM, utilising the RAFTS routing model, will be used to generate the hydrographs and peak flows from the site for all storm events up to and including the 1% AEP storm event.

5.2 Existing Hydrologic Model

5.2.1 Catchment Definition

An examination of the existing site land topography and land use was undertaken to quantify the number of sub catchment areas applicable for the site. A single sub catchment was identified to represent the vacant, vegetated lot.

Refer Table 5.1 below for existing site catchment details within Appendix A. Manning's 'n' numbers were adopted for specific surface areas and the catchment slope has been determined following review of approved bulk earthworks design plans associated with the initial subdivision works by JFP Urban Consultants.

Table 5.1: Catchment Data Summary Table

Catchment	Area (ha)	Impervious (%)	Slope (%)	Pervious Manning's 'n'	Impervious Manning's 'n'
Existing	0.592	0	2	0.050	0.015

5.2.2 Rainfall Parameters and Losses

As indicated in Section 2.2 above, Rainfall data for the subject site has been extracted from AR&R 2016 through the IFD tool on the Bureau of Meteorology website.

The uniform loss method was adopted to account for rainfall losses throughout the existing catchment. Based on experience and guidance provided in *Australian Rainfall and Runoff - A Guide to Flood Estimation*, initial and continuing loss coefficients adopted for the impervious and pervious sub catchments have been tabulated below. It is noted that an initial loss coefficient equal to approximately 70% of the rural loss value provided in the ARR Data Hub has been considered with reference to *Book 5 of Australian Rainfall and Runoff* (ARR 2019).

Table 5.2: Initial and Continuing Loss Parameters

Parameter	Value (mm)
Initial Loss (Pervious)	14.8
Initial Loss (Impervious)	1.0
Continuing Loss (Pervious)	0.8
Continuing Loss (Impervious)	0.0

Temporal pattern applicable to East Coast North has been adopted in accordance with the *Australian Rainfall and Runoff 2016, A Guide to Flood Estimation*.

5.2.3 Existing Hydrological Results

The following table provides a summary of the peak discharge from the existing site that was estimated by the RAFTS Routing Method for all storm events up to and including the 1% AEP storm event based on the median peak discharge for all ensembles for each AEP.

Table 5.3: Existing Site Peak Discharges

Storm Event	ICM Peak Median Runoff (m ³ /s)
39% AEP	0.052
18% AEP	0.078
10% AEP	0.104
5% AEP	0.133
2% AEP	0.168
1% AEP	0.197

5.2.4 Runoff Comparison

QUDM Section 4.1.3 recommends hydrologic models are calibrated with actual flow data rather than to an alternate runoff routing model. In the absence of such data, Section 4.1.3 continues to state that as an alternative, model results may be compared with the results to a Rational Method peak discharge for catchments less than 500ha.

Based on the methods outlined in *QUDM*, the following parameters were used to estimate the peak runoff from the upstream catchment affecting the site. Refer Appendix C for detailed rational method calculation summary.

Table 5.4: Rational Method Parameters

Site Area (ha)	Runoff Coefficient (C10)	Time of Concentration (mins)
0.592	0.70	25

The following table provides a comparison of the results of both the Rational Method and ICM Model results for peak discharges up to and including the 1% AEP storm event.

Table 5.5: Existing Site Peak Discharge Comparison

Storm Event	ICM Peak Median Runoff (m ³ /s)	Rational Method Peak Runoff (m ³ /s)	Difference	
			+/-	%
39% AEP	0.052	0.065	0.013	20
18% AEP	0.078	0.093	0.015	16
10% AEP	0.104	0.114	0.010	8
5% AEP	0.133	0.138	0.005	3
2% AEP	0.168	0.179	0.011	6
1% AEP	0.197	0.207	0.010	5

As can be seen above, the RAFTS Routing Method established from the ICM model generates peak flows that are generally within 16% of what is estimated by the Rational Method. Hence the scenario that has been modelled and applied to the site is considered suitable.

5.3 Developed Conditions

This section of the report will analyse and comment on the developed site stormwater discharge conditions. The modelling software InfoWorks ICM, utilising the RAFTS routing model, will be used to generate the hydrographs and peak flows from the site for all storm events up to and including the 1% AEP storm event.

5.4 Developed Unmitigated Model

5.4.1 Catchment Definition

An examination of the developed site land topography and land use was undertaken to establish the quantity of sub catchments applicable to the proposed development. A total of 3 sub catchments were identified in accordance with proposed development works.

Refer Table 5.6 below for developed site catchment details and C5211-CD07-REVA within Appendix A. Manning's 'n' numbers were adopted for specific surface areas and the catchment slope has been determined in accordance with prelim bulk earthworks design by MNCE.

Table 5.6: Catchment Data Summary Table

Catchment	Area (ha)	Impervious (%)	Slope (%)	Pervious Manning's 'n'	Impervious Manning's 'n'
Roof	0.140	100	17	N/A	0.012
Hardstand	0.130	90	2	0.050	0.015
Vegetation	0.322	0	2	0.050	N/A

5.4.2 Rainfall Parameters and Losses

Rainfall Parameters and Losses have been adopted in accordance with Section 5.2.2 of this report.

5.4.3 Developed Hydrological Results

The following table provides a summary of the peak discharge from the developed site that was estimated by the RAFTS Routing Method for all storm events up to and including the 1% AEP storm event based on the median peak discharge for all ensembles for each AEP.

Table 5.7: Developed Site Peak Discharges

Storm Event	ICM Peak Median Runoff (m ³ /s)
39% AEP	0.083
18% AEP	0.114
10% AEP	0.134
5% AEP	0.163
2% AEP	0.213
1% AEP	0.247

5.4.4 Runoff Comparison

As noted in Section 5.2.4 of this report, a comparison between the ICM model discharge and Rational Method peak discharge is recommended to be undertaken by *QUDM*.

Based on the methods outlined in *QUDM*, the following parameters were used to estimate the peak runoff from the upstream catchment affecting the site. Refer Appendix C for detailed rational method calculation summary.

Table 5.8: Rational Method Parameters

Site Area (ha)	Runoff Coefficient (C10)	Time of Concentration (mins)
0.592	0.79	18

The following table provides a comparison of the results of both the Rational Method and ICM Model results for peak discharges up to and including the 1% AEP storm event.

Table 5.9: Developed Site Peak Discharge Comparison

Storm Event	ICM Peak Median Runoff (m ³ /s)	Rational Method Peak Runoff (m ³ /s)	Difference	
			+/-	%
39% AEP	0.083	0.088	0.005	5
18% AEP	0.114	0.125	0.011	9
10% AEP	0.134	0.153	0.019	12
5% AEP	0.163	0.185	0.022	12
2% AEP	0.213	0.235	0.022	9
1% AEP	0.247	0.267	0.020	8

As can be seen above, the Laurenson Routing Method established from the ICM model generates peak flows that are within 12% of what is estimated by the Rational Method, Hence the scenario that has been modelled and applied to the site is considered suitable.

5.5 Potential Impacts of Development

The following table provides a summary of the peak runoff from the overall site under both existing and developed scenarios.

Table 5.10: Runoff Comparison

Storm Event	Existing Peak Runoff (m ³ /s)	Developed Peak Runoff (m ³ /s)	Difference	
			+/-	%
39% AEP	0.052	0.083	0.031	37
18% AEP	0.078	0.114	0.036	32
10% AEP	0.104	0.134	0.030	22
5% AEP	0.133	0.163	0.030	18
2% AEP	0.168	0.213	0.045	21
1% AEP	0.197	0.247	0.050	20

The proposed development has altered site runoff regimes and increased the proportion of the site that is impervious, consequently the runoff characteristics from the site will be altered as a result of the development. As demonstrated above, the development has increased runoff volumes and peak flow rates in comparison to the existing conditions. As a result, if left unmitigated, the developed runoff could potentially have an adverse effect on downstream properties and/or stormwater infrastructure.

It is therefore proposed that an on-site detention system be constructed within the site to mitigate increased peak discharges to below pre-development levels, to demonstrate a non-worsening of peak stormwater runoff is achieved.

5.6 Proposed Mitigated Conditions

This section of the report will specify the mitigation device(s) required to detain the post development flow rate to match existing site runoff conditions. The modelling software InfoWorks ICM, utilising the RAFTS routing model, will be used to generate the hydrographs and peak flows from the mitigated site in conjunction with the design of an on-site detention device for all storm events up to and including the 1% AEP storm event.

5.7 Developed Mitigated Model

Proposed development flows associated are to be discharged to an underground detention tank within the proposed car parking area to the east of the site. Detained flows are to be discharged to the existing natural gully which runs adjacent to the site's eastern boundary. Vegetated areas to the east of the existing car parking area are to bypass the detention tank and free drain towards the gully as sheet flow.

All storm events up to and including the 1% AEP storm event have been modelled in InfoWorks ICM. A retarding basin has been included in the proposed model to account for the detention of the proposed development areas.

The following parameters were used to define a stage storage discharge relationship for the basin:

- Maximum Storage Depth of 1m
- Total Storage Volume of 130m³
- 1 x 170 mm low flow outlet at basin invert
- 1 x 160 mm mid flow outlet at basin invert + 0.45m
- 2 x 150 mm high flow outlet at basin invert + 0.65m

Refer to Appendix B for InfoWorks ICM hydrographs and stage storage discharge relationship.

The table below is a summary of the peak discharge flows from the site with the proposed detention system implemented:

Table 5.11: Mitigated Runoff Comparison

Storm Event	Existing Peak Runoff (m ³ /s)	Mitigated Peak Runoff (m ³ /s)	Difference	
			+/-	%
39% AEP	0.052	0.051	0.001	2
18% AEP	0.078	0.078	0.000	0
10% AEP	0.104	0.094	0.010	9
5% AEP	0.133	0.122	0.011	8
2% AEP	0.168	0.155	0.013	8
1% AEP	0.197	0.193	0.004	2

All storm events have been mitigated to below pre-developed levels; as such the proposal satisfies Council's condition of a non-worsening effect in regards to peak stormwater runoff.

6 INTERPRETATION AND CONCLUSIONS

The proposed development is to obtain a lawful point of discharge via the natural gully runs adjacent to the site's eastern boundary. Flows associated with proposed development areas are to discharge to a 130m³ underground detention tank located within the proposed car parking area. Vegetated areas to the east of the car park are to bypass this infrastructure and free drain towards the existing natural gully.

The proposed detention basin and associated outlet configuration demonstrate a non-worsening of peak stormwater runoff leaving the site in comparison to existing conditions.

The proposed development, if unmitigated, would have a negative effect on runoff water quality from the site. Best practices in water quality design have been implemented to improve the quality of the stormwater runoff generated on the site.

The Ipswich City Council Planning Scheme makes a provision for the developer to provide a voluntary payment in lieu of providing on site water quality treatment but Council have advised that as site is a large lot green field development, on-site treatment of road flows is required.

The predicted pollutant export load concentrations for the mitigated conditions as determined by the MUSIC model show that the proposed water quality treatment measures comply with Council's mean annual load reduction requirements for total suspended solids (TSS), total phosphorous (TP), total nitrogen (TN) and gross pollutants (GP).

Key elements of the proposed stormwater management plan are as follows:

- Runoff associated with proposed development areas are to be initially captured and treated via 10No. at source pollutant filters (SPEL Stormsack or similar approved) and piped to an underground detention tank (see section 5).
- The underground detention tank is to be fitted with 7No. SPEL Filter cartridges or similar approved to treat development runoff before discharging to the existing natural gully to the site's eastern boundary.
- Vegetated areas to the east of the proposed car parking area to bypass proposed treatment measures and sheet flow towards the existing natural gully adjacent to the site's eastern boundary.

Refer Appendix A for the proposed stormwater management layout.

APPENDIX A: Proposed Development Layout



NOT FOR CONSTRUCTION

EROSION & SEDIMENT CONTROL TRENCHING OPERATIONS

THE CONTRACTOR SHALL FOLLOW THE PROCEDURES BELOW TO MINIMIZE SCOURING OF TRENCHES DURING RAINFALL EVENTS THAT OCCUR THROUGH THE CONSTRUCTION PHASE.

- 1 OPEN ONLY AS MUCH GROUND AS REQUIRED TO UNDERTAKE THE WORK AT HAND.
- 2 WHEREVER POSSIBLE CONSTRUCT LINES FROM UPS TREAM TO DOWNSTREAM.
- 3 IN PLACE BEDROCK MATERIAL, A CONCRETE OR CAST-IN-PLACE CONCRETE

EROSION & SEDIMENT CONTROL GENERAL NOTES

1 THE SEQUENCE OF OPERATIONS SHALL BE AS FOLLOWS:

- a DELINEATION OF BUFFER AREAS AND DRAINAGE RESERVES.
 - b LOCATION OF TOPSOIL TO COMPLEXES AND ERECTION OF DOWNHILL EROSION CONTROL STRUCTURES.
 - c CONSTRUCTION OF DIVERSION WORKS NECESSARY TO MINIMISE RUNOFF FROM ENTERING THE SITE.
 - d CONSTRUCTION OF TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES (e.g. Silt FENCES).
 - e LAND CLEARING AND TOPSOIL STRIPPING.
 - f CONSTRUCTION OF 3 MONTH DRAINAGE FACILITIES.
 - g LAND SHAPING.
 - h CONSTRUCTION OF ROADS AND ACCESSWAYS, NOT ALLATION OF ROADS.
 - i FINAL REHABILITATION AND LANDSCAPING MAINTENANCE WORKS.
- 2 ALL SILT FENCES ARE TO BE INSTALLED PARALLEL, TO CONTOURS UNLESS SHOWN OTHERWISE.
- 3 SILT FENCES ARE TO BE INSTALLED DOWNHILL AND DIVERSION BANKS ARE TO BE INSTALLED UPHILL.
- 4 TOPSOIL TO COMPLEXES ARE TO BE MULCHED OR TEMPORARILY VEGETATED IF THEY ARE TO REMAIN FOR MORE THAN 30 DAYS.
- 5 MOVEMENT OF CONSTRUCTION EQUIPMENT SHALL BE LIMITED TO THE DOWNHILL SIDE OF THE DIVERSION BANKS.
- 6 CONSTRUCTION AREAS TO BE USED SHOULD FOLLOW FINAL THRESHOLD AREAS TO BE DISTURBED AND BE USED PROGRESSIVELY.
- 7 ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE MAINTAINED THROUGHOUT THE PROJECT AND TO BE REMOVED TO ALLOW PROGRESSIVE REHABILITATION OF THE SITE.

EROSION STAGING NOTE:

THE EROSION MEASURES SHOWN ON THIS DRAWING ARE TO BE ADJUSTED THROUGHOUT THE COURSE OF CONSTRUCTION TO SUIT INTERIM STAGING OF THE BUILDING WORKS. ANY TEMPORARY SITE WORKS SHALL BE MANAGED IN A WAY NOT TO CAUSE ANY NUISANCE DRAINAGE IMPACTS TO ADJOINING OR DOWNSTREAM PROPERTIES. CONTACT CONSULTING ENGINEER FOR FURTHER DETAILS AS REQUIRED.

SAFE ACCESS NOTE:

CONTRACTOR TO CLOSE FOOTPATH AND BARRICADE STABILISED ENTRY/EXIT.
PROVIDE SAFE PEDESTRIAN ACCESS IN ACCORDANCE WITH THE MANUAL FOR
UNIFORM TO BASIC CONTROL DEVICES

EXISTING SERVICES NOTE:

THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS
CONSTRUCTED INFORMATION OR FIELD SURVEY, IF MADE AVAILABLE TO
THE TIME OF DESIGN. THE LOCATION OF UNDERGROUND SERVICES ARE NOT
GUARANTEED. ALSO IN ACCORDANCE WITH A.S.C. 20.01, THE AGENCY

STANDARDS FOR CLASSIFICATION OF SUBSURFACE UTILITY INFORMATION (SUL). POT HOLE HAS BEEN UNDER TAKEN TO VERIFY EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UNDERTAKE FURTHER SURVEY AND POT HOLE AS REQUIRED, TO CONFIRM THE NATURE AND LOCATION OF THESE SERVICES AND VERIFY THE DESIGN.

REAL PROPERTY DESCRIPTION

(SCALE BEFORE REDUCTION)

(SCALE BEFORE REDUCTION)

CONTACT DETAILS

mailto:info@nace.com.au
www.nace.com.au

**CIVIL
STRUCTURAL**

**TRAFFIC
PROJECT MANAGEMENT**

MILANOVIC NEAL
CONSULTING ENGINEERS

A	PRELIMINARY ISSUE	12.05.22	SH

DRAWING No.	C5211 - CE01	REV.	A
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EROSION AND SEDIMENT CONTROL LAYOUT PLAN

144 GRAMPIAN DRIVE, DEEBING
HEIGHTS

OTIOSUM PTY LTD

mailto:info@nace.com.au
www.nace.com.au

**CIVIL
STRUCTURAL**

A	PRELIMINARY ISSUE	12.05.22	SH

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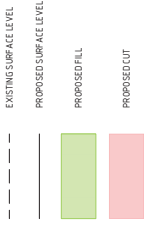
DO NOT SCALE

REAL PROPERTY DESCRIPTION
LOT 803 ON RP##

NOT FOR CONSTRUCTION



LEGEND



WORKPLACE HEALTH AND SAFETY NOTE:
ALL WORKS UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH THE
REQUIREMENTS OF THE QUEENSLAND WORK HEALTH AND SAFETY ACT 2011.
CONTACT THE NEAREST OFFICE OF THE DIVISION OF WORKPLACE HEALTH AND
SAFETY FOR INFORMATION. PHONE NO. 1300 362 128.

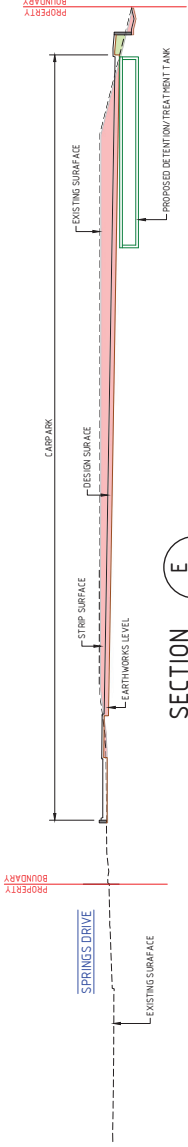
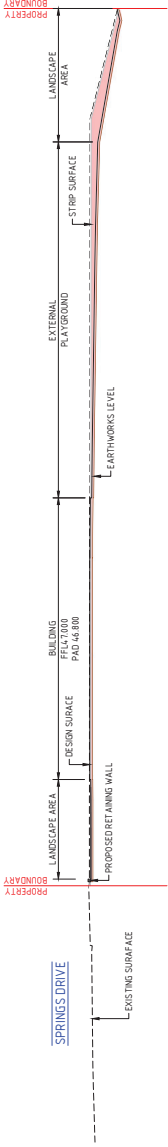
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THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS
CONSTRUCTED INFORMATION. NO POT HOLEING HAS BEEN UNDERTAKEN TO VERIFY
EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTORS
RESPONSIBILITY TO UNDERTAKE POT HOLEING TO VERIFY THE DESIGN.

EXISTING SERVICES WERE PREPARED BASED ON SERVICE AUTHORITY AS
CONSTRUCTED INFORMATION OF FIELD SURVEY, IF MADE AVAILABLE TO PONKE AT
THE TIME OF DESIGN. THE LOCATION OF UNDERGROUND SERVICES ARE NOT WITH
THEIR RESPECTIVE CLASS IN ACCORDANCE WITH AS 4848.2019. THE AUSTRALIAN
STANDARDS FOR CLASSIFICATION OF SUB-SURFACE UTILITY INFORMATION (SUI)
DO NOT PUT IT HAS BEEN UNDER TAKEN TO VERIFY EXISTING SERVICE LOCATIONS
AND DEPTHS. IT IS THE CONTRACTORS RESPONSIBILITY TO UNDERTAKE FURTHER
SURVEY AND POT HOLEING AS REQUIRED, TO CONFIRM THE NATURE AND LOCATION
OF THESE SERVICES AND VERIFY THE DESIGN.



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NOT FOR CONSTRUCTION



LEGEND

EXISTING SURFACE LEVEL

PROPOSED SURFACE LEVEL

1000

WORKPLACE HEALTH AND SAFETY NOTE:

ALL WORKS UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORK HEALTH AND SAFETY ACT 2011. CONTACT THE NEAREST OFFICE OF THE DIVISION OF WORKPLACE HEALTH AND SAFETY FOR INFORMATION. PHONE No. 1300 362 128.

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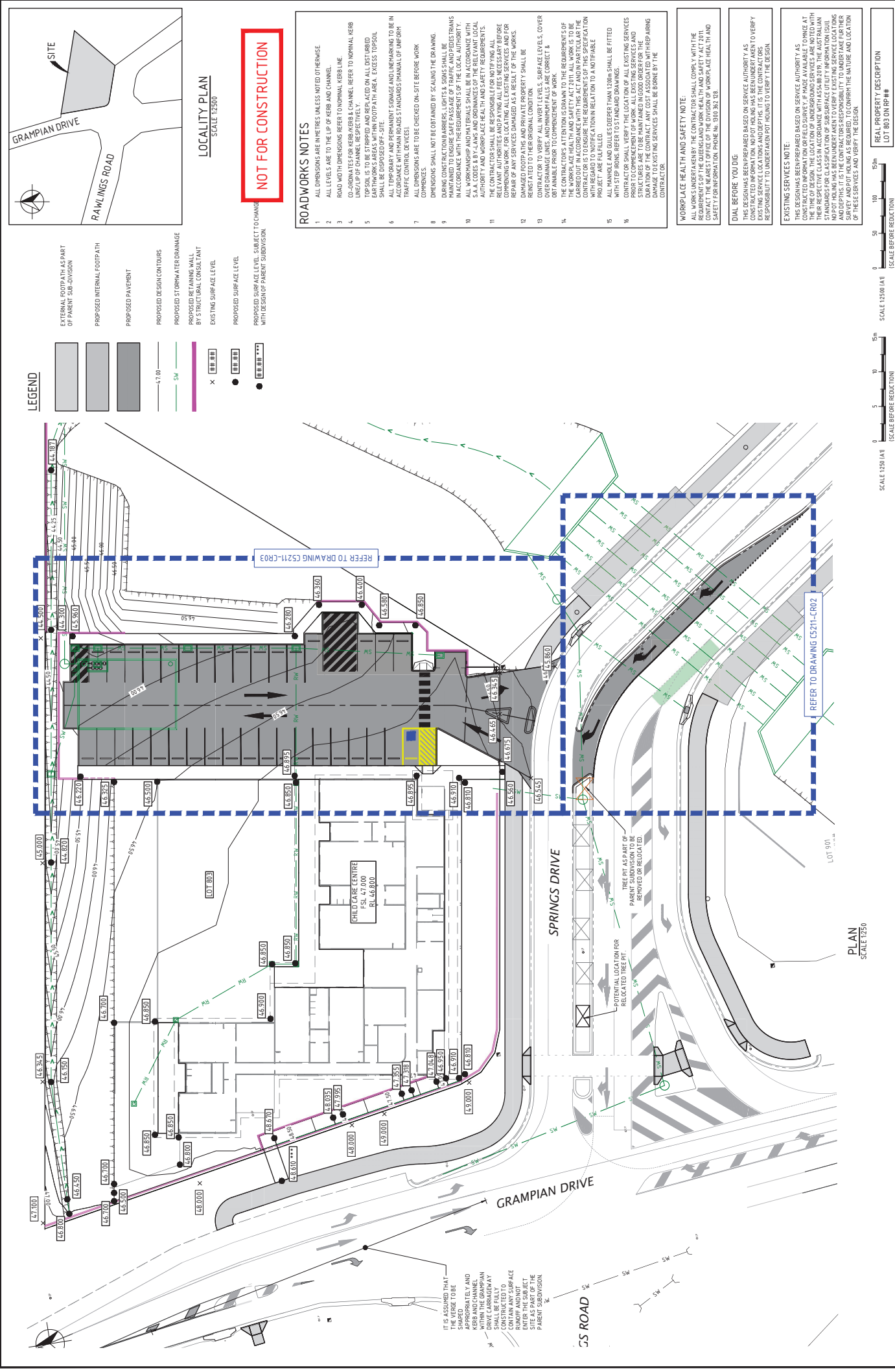
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RESPONSIBILITY TO UNDERTAKE POT HOLEING TO VERIFY THE DESIGN.

EXISTING SERVICES NOTE:

THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS
CONSTRUCTED INFORMATION OR FIELD SURVEY, IF MADE AVAILABLE TO PNCE AT
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THEIR RESPECTIVE CLASS IN ACCORDANCE WITH AS 5400:2019. THE AUSTRALIAN
STANDARDS FOR CLASSIFICATION OF SUBSURFACE UTILITY INFORMATION (SUI).
NO POT HOLING HAS BEEN TAKEN TO VERIFY EXISTING SERVICE LOCATIONS
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OF THESE SERVICES, AND VERIFY THE DESIGN.



 MILANOVIC NEALE CONSULTING ENGINEERS		 CIVIL STRUCTURAL PROJECT MANAGEMENT			
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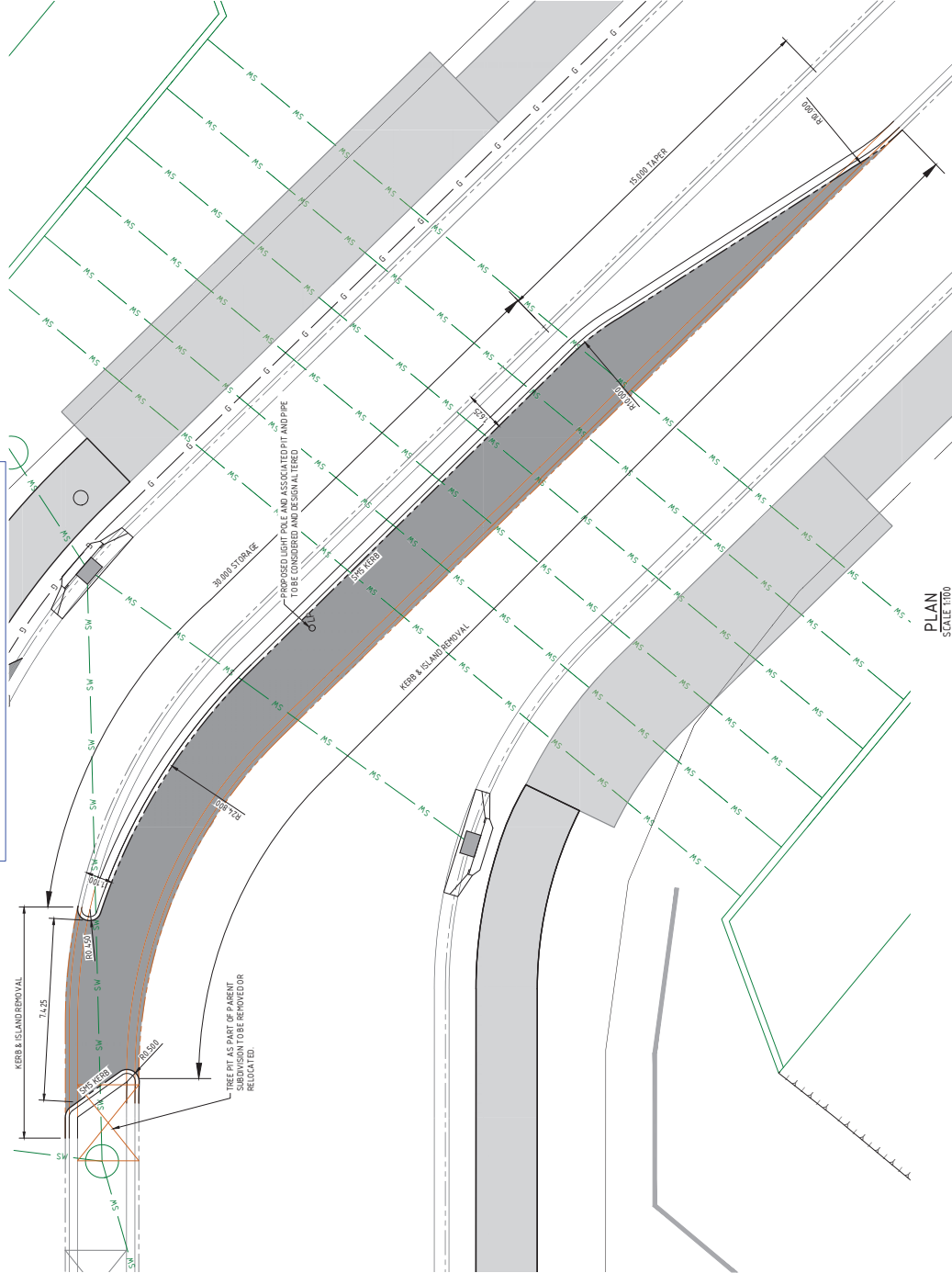


NOT FOR CONSTRUCTION

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1801

FOR CONTINUATION REFER TO DRAWING C5211-CR03



WORKPLACE HEALTH AND SAFETY NOTE:
ALL WORKS UNDER A KENBY THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORK HEALTH AND SAFETY ACT 2011. CONTACT THE NEAREST OFFICE OF THE DIVISION OF WORKPLACE HEALTH AND SAFETY FOR INFORMATION. PHONE NO. 1300 362 278

DIAL BEFORE YOU DIG:
THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS
CONSTRUCTED INFORMATION. NO POT HOLE HAS BEEN UNDERTAKEN TO VERIFY
EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTORS
RESPONSIBILITY TO UNDERTAKE POT HOLE TO VERIFY THE DESIGN.

EXISTING SERVICES NOTE:
THIS DESIGN WAS PREPARED BASED ON SERVICE AUTHORITY AS
CONSTRUCTED INFORMATION ON FIELD SURVEY IF MADE AVAILABLE TO PM/AT
THE TIME OF DESIGN. THE LOCATION OF UNDERGROUND SERVICES ARE NOTED WITH
THEIR RESPECTIVE CLASS IN ACCORDANCE WITH AS 3608:2019. THE AUSTRALIAN
STANDARDS FOR CLASSIFICATION OF SUBSURFACE UTILITY INFORMATION (SUI)
POLE HOLES HAS BEEN ADOPTED TO VERIFY EXISTING SERVICE LOCATIONS
AND DEPTHS. THE INFORMATION PROVIDED IS BASED ON THE RESULTS OF THE
SURVEY, AND PHOTOGRAPHS ARE REQUIRED, TO CORROBORATE THE NATURE AND LOCATION
OF THESE SERVICES, AND VERIFY THE DESIGN.

SCALE 1:100 (A1)
(SCALE BEFORE REDUCTION)

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NOT FOR CONSTRUCTION

PAVEMENT MARKING LEGEND

DESCRIPTION	WIDTH	CODE
EDGE LINES		EL CL
CONTINUITY LINES		SA
STRAIGHT ARROW		TA
CURVE ARROW		ELM
EXISTING LINE/MARKING		



GIVE WAY SIGN

R1-2A

WORKPLACE HEALTH AND SAFETY NOTE:

ALL WORKS UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORK HEALTH AND SAFETY ACT 2011. CONTACT THE NEAREST OFFICE OF THE DIVISION OF WORKPLACE HEALTH AND SAFETY FOR INFORMATION. PHONE No. 1300 362 128.

DIAL BEFORE YOU DIG:

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EXISTING SERVICES NOTE:

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REAL PROPERTY DESCRIPTION

SCALE BEFORE REDUCTION

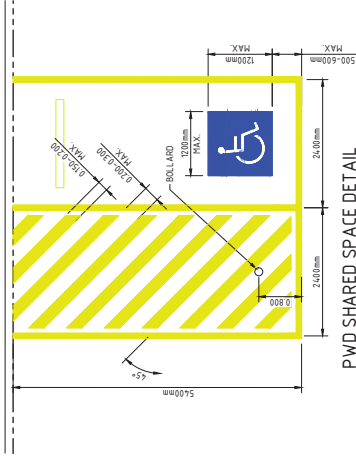
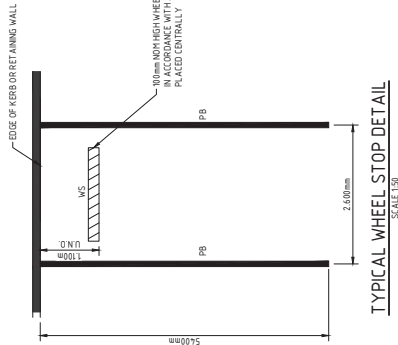
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DO NOT SCALE FROM DRAWING
ALL SCALES ARE AS SHOWN (A1)

NOT FOR CONSTRUCTION

PAVEMENT MARKING LEGEND

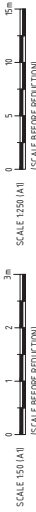
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TURN ARROW	TA 400mm
CHEVRONS	CHV 600mm STRIPE AND GAP
PARKING BAY	PB 100
PEDESTRIAN CROSSING	PX 600mm STRIPE AND GAP
GIVE WAY SIGN	RL2A 1500



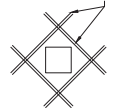
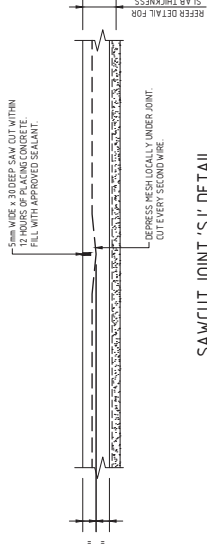
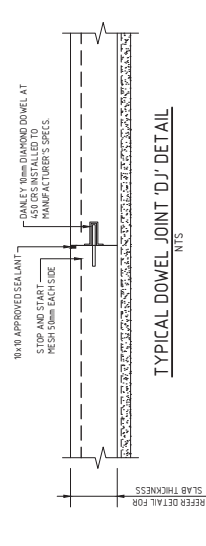
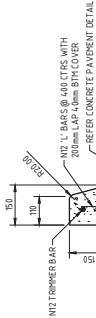
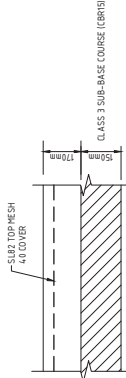
WORKPLACE HEALTH AND SAFETY NOTE:
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DIAL BEFORE YOU DIG:

EXISTING SERVICES NOTE:
CONSTRUCTED INFORMATION FIELD SURVEY, IF MADE AVAILABLE TO OWNER AT THE TIME OF DESIGN. THE LOCATION OF UNDERGROUND SERVICES ARE NOTED WITHIN THE RESPECTIVE CLASS IN ACCORDANCE WITH AS 48:2019, THE AUSTRALIAN STANDARD FOR THE LOCATION OF SUBSURFACE UTILITIES. SERVICES IDENTIFIED BY THE CONTRACTOR ARE BEING NOTED FOR EXISTING SERVICES. THE CONTRACTOR ACCEPTS RESPONSIBILITY TO UNCOVER TAKE FOR THE SURVEY AND POT-Holing AS REQUIRED TO CONFIRM THE NATURE AND LOCATION OF THE SERVICES AND VERIFY THE DESIGN.

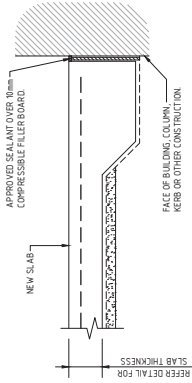
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NOT FOR CONSTRUCTION



TRIMMERS ARE NOT TO EXTEND
ACROSS PROPOSED JOINTS.

2-N12 2.0m LONG TRIMMERS TO RE-ENTRANT CORNERS, PITS, COLUMNS AND THE LIKE.



PAVEMENT CONSTRUCTION NOTES

1. UNIFORM 500 GPH OR THEREABOUTS DEBITERIOUS MATERIAL AT SUBGRADE AND TOP OF EACH LAYER AND DISPOSED WITHIN PAVED AREA WITH A MINIMUM 50 FT. RADIUS.
2. MATERIAL EXCAVATED FROM CUT AREAS SHALL NOT BE USED AS FILLING UNLESS THE CERTIFYING ENGINEER'S APPROVAL.
3. ALL EXCAVATIONS SHALL BE PROTECTED BY SHIELDING IN ACCORDANCE WITH 2010b MAXIMUM LOOSE THICKNESS LAYERS TO 95% MOISTURE COMPACTION.
4. ALL COMPACTIONS BE SUBJECT TO TESTING IN ACCORDANCE WITH AASHTO T-99.
5. ALL WORK ARE TO BE GRADDED TO PROVIDE DRAINAGE DURING CONSTRUCTION.
6. SUBGRADE IS TO BE COMPACTED AT OPTIMUM MOISTURE CONTENT TO 95% OF THE SPEC. FOR THE TOP 300mm (150mm x 150mm x 150mm) BELOW THE TOP 300mm.
7. ALL TRENCHES IN ROADWAYS ARE TO BE BACKFILLED TO BOX LEVEL USING APPROVED MATERIAL WITH A MINIMUM CR-1.5 BACKFILL COMPACTION UNTIL THE TOP DENSITY IS NOT LESS THAN 95% OF THE MATERIAL'S DENSITY. MOISTURE COMPACTION COMPACTION TESTS EVERY 500 MM OR PART THEREOF. ONE IN FIVE TESTS TO BE LOCATED BESIDE A MANHOLE OR GULLY.
8. ALL TRENCHES IN DRIVEWAYS AND SIDEWALKS TO BE LOCATED SUCH AS SUBGRADE, GULLY, GUTTER, AND PAVEMENT DRAINAGE.

CONCRETE NOTES

- 1 ALL CONCRETE SUPPLY & WORK SHALL MEET THE REQUIREMENTS OF ACI 308.1R-90.
- 2 CONCRETE GRADE SHALL BE #30.
- 3 AGGREGATE FOR CONCRETE SHALL BE CLEAN AND FREE OF CLAY.
- 4 ALL ADMIXTURES TO THE CONCRETE SHALL BE PERMITTED WITHOUT THE PRIOR APPROVAL OF THE SUPERINTENDENT.
- 5 ALL CONCRETE SHALL BE PLACED IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 207 OF A-330.00.
- 6 CONCRETE SURFACE SHALL BE BROOM-FINISH.
- 7 CONCRETE SHALL NOT BE PLACED WHEN HOT, DRY AND/OR CONDITIONS PREVAIL.
- 8 CONCRETE TO BE PLACED IN TEMPERATURES OF 10° TO 25° C (50° TO 75° F) SHALL BE PROTECTED FROM FREEZING AND CURING IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 207 OF A-330.00.
- 9 CONCRETE PAVEMENTS SHALL BE JOINTED AS DETAIL GOES ON THE DRAWINGS. ALL SHRINKAGE JOINTS SHALL BE PLACED IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 207 OF A-330.00. JOINTS SHALL BE SEALED WITH A PURPOSE MADE PROSTHETIC "SEALANT" JOINT SEALANT SHALL NOT BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
- 10 ALL CONCRETE SHALL BE PLACED IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 207 OF A-330.00. JOINTS SHALL BE SEALED WITH THE MANUFACTURER'S SPECIFICATIONS.
- 11 JOINT PREPARATION - BEFORE FRESH CONCRETE IS PLACED AT A CONSTRUCTION JOINT, FORMS AND CLEAN THE HARDENED CONCRETE SURFACE SHALL BE REMOVED. ALL JOINTS HOWEVER MADE SHALL BE PROVIDED WITH A GROOVE TO ACCOMMODATE A SEALING MATERIAL.
- 12 DIMENSIONAL TOLERANCES SHALL BE AS FOLLOWS:
 (a) ± 1/4" (6.35 mm) for all dimensions
 (b) ± 1/2" (12.7 mm) for all dimensions
 (c) ± 3/4" (19.0 mm) for all dimensions
 (d) ± 1" (25.4 mm) for all dimensions
 (e) ± 1 1/2" (38.1 mm) for all dimensions
 (f) ± 2" (50.8 mm) for all dimensions
 (g) ± 2 1/2" (63.5 mm) for all dimensions
 (h) ± 3" (76.2 mm) for all dimensions
 (i) ± 3 1/2" (88.9 mm) for all dimensions
 (j) ± 4" (101.6 mm) for all dimensions
 (k) ± 4 1/2" (114.3 mm) for all dimensions
 (l) ± 5" (127.0 mm) for all dimensions
 (m) ± 5 1/2" (139.7 mm) for all dimensions
 (n) ± 6" (152.4 mm) for all dimensions
 (o) ± 6 1/2" (165.1 mm) for all dimensions
 (p) ± 7" (177.8 mm) for all dimensions
 (q) ± 7 1/2" (190.5 mm) for all dimensions
 (r) ± 8" (203.2 mm) for all dimensions
 (s) ± 8 1/2" (215.9 mm) for all dimensions
 (t) ± 9" (228.6 mm) for all dimensions
 (u) ± 9 1/2" (241.3 mm) for all dimensions
 (v) ± 10" (254.0 mm) for all dimensions
 (w) ± 10 1/2" (266.7 mm) for all dimensions
 (x) ± 11" (279.4 mm) for all dimensions
 (y) ± 11 1/2" (292.1 mm) for all dimensions
 (z) ± 12" (304.8 mm) for all dimensions
 (aa) ± 12 1/2" (317.5 mm) for all dimensions
 (ab) ± 13" (330.2 mm) for all dimensions
 (ac) ± 13 1/2" (342.9 mm) for all dimensions
 (ad) ± 14" (355.6 mm) for all dimensions
 (ae) ± 14 1/2" (368.3 mm) for all dimensions
 (af) ± 15" (381.0 mm) for all dimensions
 (ag) ± 15 1/2" (393.7 mm) for all dimensions
 (ah) ± 16" (406.4 mm) for all dimensions
 (ai) ± 16 1/2" (419.1 mm) for all dimensions
 (aj) ± 17" (431.8 mm) for all dimensions
 (ak) ± 17 1/2" (444.5 mm) for all dimensions
 (al) ± 18" (457.2 mm) for all dimensions
 (am) ± 18 1/2" (469.9 mm) for all dimensions
 (an) ± 19" (482.6 mm) for all dimensions
 (ao) ± 19 1/2" (495.3 mm) for all dimensions
 (ap) ± 20" (508.0 mm) for all dimensions
 (aq) ± 20 1/2" (520.7 mm) for all dimensions
 (ar) ± 21" (533.4 mm) for all dimensions
 (as) ± 21 1/2" (546.1 mm) for all dimensions
 (at) ± 22" (558.8 mm) for all dimensions
 (au) ± 22 1/2" (571.5 mm) for all dimensions
 (av) ± 23" (584.2 mm) for all dimensions
 (aw) ± 23 1/2" (596.9 mm) for all dimensions
 (ax) ± 24" (609.6 mm) for all dimensions
 (ay) ± 24 1/2" (622.3 mm) for all dimensions
 (az) ± 25" (635.0 mm) for all dimensions
 (ba) ± 25 1/2" (647.7 mm) for all dimensions
 (bb) ± 26" (660.4 mm) for all dimensions
 (bc) ± 26 1/2" (673.1 mm) for all dimensions
 (bd) ± 27" (685.8 mm) for all dimensions
 (be) ± 27 1/2" (698.5 mm) for all dimensions
 (bf) ± 28" (711.2 mm) for all dimensions
 (bg) ± 28 1/2" (723.9 mm) for all dimensions
 (bh) ± 29" (736.6 mm) for all dimensions
 (bi) ± 29 1/2" (749.3 mm) for all dimensions
 (bj) ± 30" (762.0 mm) for all dimensions
 (bk) ± 30 1/2" (774.7 mm) for all dimensions
 (bl) ± 31" (787.4 mm) for all dimensions
 (bm) ± 31 1/2" (800.1 mm) for all dimensions
 (bn) ± 32" (812.8 mm) for all dimensions
 (bo) ± 32 1/2" (825.5 mm) for all dimensions
 (bp) ± 33" (838.2 mm) for all dimensions
 (bq) ± 33 1/2" (850.9 mm) for all dimensions
 (br) ± 34" (863.6 mm) for all dimensions
 (bs) ± 34 1/2" (876.3 mm) for all dimensions
 (bt) ± 35" (889.0 mm) for all dimensions
 (bu) ± 35 1/2" (901.7 mm) for all dimensions
 (bv) ± 36" (914.4 mm) for all dimensions
 (bw) ± 36 1/2" (927.1 mm) for all dimensions
 (bx) ± 37" (939.8 mm) for all dimensions
 (by) ± 37 1/2" (952.5 mm) for all dimensions
 (bz) ± 38" (965.2 mm) for all dimensions
 (ca) ± 38 1/2" (977.9 mm) for all dimensions
 (cb) ± 39" (990.6 mm) for all dimensions
 (cc) ± 39 1/2" (1003.3 mm) for all dimensions
 (cd) ± 40" (1016.0 mm) for all dimensions
 (ce) ± 40 1/2" (1028.7 mm) for all dimensions
 (cf) ± 41" (1041.4 mm) for all dimensions
 (cg) ± 41 1/2" (1054.1 mm) for all dimensions
 (ch) ± 42" (1066.8 mm) for all dimensions
 (ci) ± 42 1/2" (1079.5 mm) for all dimensions
 (cj) ± 43" (1092.2 mm) for all dimensions
 (ck) ± 43 1/2" (1104.9 mm) for all dimensions
 (cl) ± 44" (1117.6 mm) for all dimensions
 (cm) ± 44 1/2" (1130.3 mm) for all dimensions
 (cn) ± 45" (1143.0 mm) for all dimensions
 (co) ± 45 1/2" (1155.7 mm) for all dimensions
 (cp) ± 46" (1168.4 mm) for all dimensions
 (cq) ± 46 1/2" (1181.1 mm) for all dimensions
 (cr) ± 47" (1193.8 mm) for all dimensions
 (cs) ± 47 1/2" (1206.5 mm) for all dimensions
 (ct) ± 48" (1219.2 mm) for all dimensions
 (cu) ± 48 1/2" (1231.9 mm) for all dimensions
 (cv) ± 49" (1244.6 mm) for all dimensions
 (cw) ± 49 1/2" (1257.3 mm) for all dimensions
 (cx) ± 50" (1270.0 mm) for all dimensions
 (cy) ± 50 1/2" (1282.7 mm) for all dimensions
 (cz) ± 51" (1295.4 mm) for all dimensions
 (da) ± 51 1/2" (1308.1 mm) for all dimensions
 (db) ± 52" (1320.8 mm) for all dimensions
 (dc) ± 52 1/2" (1333.5 mm) for all dimensions
 (dd) ± 53" (1346.2 mm) for all dimensions
 (de) ± 53 1/2" (1358.9 mm) for all dimensions
 (df) ± 54" (1371.6 mm) for all dimensions
 (dg) ± 54 1/2" (1384.3 mm) for all dimensions
 (dh) ± 55" (1397.0 mm) for all dimensions
 (di) ± 55 1/2" (1409.7 mm) for all dimensions
 (dj) ± 56" (1422.4 mm) for all dimensions
 (dk) ± 56 1/2" (1435.1 mm) for all dimensions
 (dl) ± 57" (1447.8 mm) for all dimensions
 (dm) ± 57 1/2" (1460.5 mm) for all dimensions
 (dn) ± 58" (1473.2 mm) for all dimensions
 (do) ± 58 1/2" (1485.9 mm) for all dimensions
 (dp) ± 59" (1498.6 mm) for all dimensions
 (dq) ± 59 1/2" (1511.3 mm) for all dimensions
 (dr) ± 60" (1524.0 mm) for all dimensions
 (ds) ± 60 1/2" (1536.7 mm) for all dimensions
 (dt) ± 61" (1549.4 mm) for all dimensions
 (du) ± 61 1/2" (1562.1 mm) for all dimensions
 (dv) ± 62" (1574.8 mm) for all dimensions
 (dw) ± 62 1/2" (1587.5 mm) for all dimensions
 (dx) ± 63" (1600.2 mm) for all dimensions
 (dy) ± 63 1/2" (1612.9 mm) for all dimensions
 (dz) ± 64" (1625.6 mm) for all dimensions
 (ea) ± 64 1/2" (1638.3 mm) for all dimensions
 (eb) ± 65" (1651.0 mm) for all dimensions
 (ec) ± 65 1/2" (1663.7 mm) for all dimensions
 (ed) ± 66" (1676.4 mm) for all dimensions
 (ee) ± 66 1/2" (1689.1 mm) for all dimensions
 (ef) ± 67" (1701.8 mm) for all dimensions
 (eg) ± 67 1/2" (1714.5 mm) for all dimensions
 (eh) ± 68" (1727.2 mm) for all dimensions
 (ei) ± 68 1/2" (1739.9 mm) for all dimensions
 (ej) ± 69" (1752.6 mm) for all dimensions
 (ek) ± 69 1/2" (1765.3 mm)

JOINTING NOTES

- 1 ALL DOWELS TO BE CONSTRUCTED AT MINIMUM SPACINGS SPECIFIED.
- 2 DOWELS TO BE CONSTRUCTED PERPENDICULAR TO JOINT.
- 3 CONTRACTOR TO ENSURE MINIMUM 5mm COVER TO OUTER MOST REINFORCING BAR.
- 4 REFER SITE CONDITIONS FOR LOCATIONS OF ISOLATION JOINTS (I/J'S).
- 5 SPACING OF DOWEL JOINTS (CONCRETE POURS) TO BE NO GREATER THAN 24.0m.
- 6 SAWN JOINTS TO BE SPACED IN BETWEEN CONCRETE POURS AT NORMAL 6.0m - 7.0m Spacing.
- 7 CONTRACTOR TO PROVIDE THIMBLER BARS TO ALL SERVICES PITS, RE-ENTRANT CORNERS, AND AS DIRECTED ON-SITE.

WORKPLACE HEALTH AND SAFETY NOTE:
ALL WORKS UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORK HEALTH AND SAFETY ACT 2011. CONTACT THE NEAREST OFFICE OF THE DIVISION OF WORKPLACE HEALTH AND SAFETY FOR INFORMATION. PHONE No. 1300 362 28.

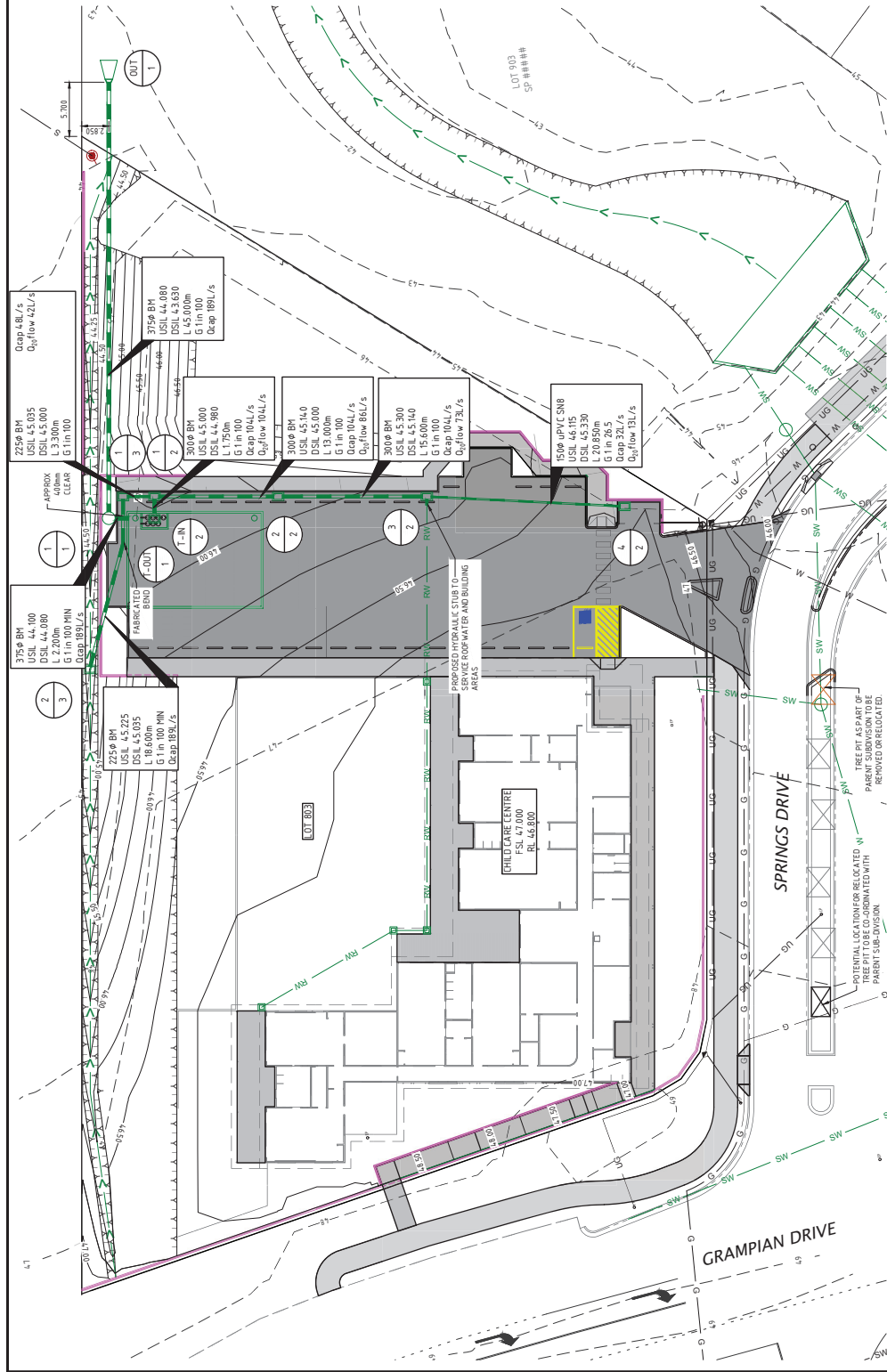
DIAL BEFORE YOU DIG:

EXISTING SERVICES NOTE:

THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS CONSTRUCTED INFORMATION OF FIELD SURVEY, IF MADE AVAILABLE TO NMIC AT THE TIME OF THE DESIGN. THE DESIGN IS BASED ON THE INFORMATION PROVIDED BY THE RESPECTIVE CLASSIFICATION WITH ASSURANCE OF THE AUSTRALIAN STANDARD FOR CLASSIFICATION OF SUB-SURFACE UTILITY INFORMATION (SUI). NO POT HOLE HAS BEEN UNDERTAKEN TO VERIFY EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UNDERTAKE FURTHER SURVEY AND POT HOLE AS REQUIRED, TO CONFIRM THE NATURE AND LOCATION OF THESE SERVICES AND VERIFY THE DESIGN.

REAL PROPERTY DESCRIPTION
LOT 803 ON RP##

[illegible]



NOT FOR CONSTRUCTION

- 1 LEVELS TO AND
- 2 ALL DIMENSIONS ARE IN FEET/INCHES NOTED OTHERWISE.
- 3 ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON-SITE BEFORE
- 4 WORK COMMENCES.
- 5 DIMENSIONS SHALL NOT BE OBTAINED BY SCALING THE DRAWINGS.
- 6 ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE LOCAL
- 7 AUTHORITIES CONCERNING SPECIFICATIONS AND STANDARDS.
- 8 ALL WORK SHALL BE IN ACCORDANCE WITH THE RELEVANT LOCAL
- 9 A CODES & REGULATIONS AND REQUIREMENTS.
- 10 THE AUTHORITY AND WORKSAFE HEALTH AND SAFETY REQUIREMENTS.
- 11 THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING ALL
- 12 NEARBY PROPERTY OWNERS AND ADJACENT PROPERTY OWNERS OF THE
- 13 COMMENCING WORK FOR LOGS AND ALL EXISTING SERVICES AND FOR
- 14 REPAIR OF ANY SERVICES DAMAGED AS A RESULT OF THE WORKS.
- 15 FOOTPATHS AND PRIVATE PROPERTY SHALL BE REINSTATED TO THEIR
- 16 ORIGINAL CONDITION.
- 17 THE CONTRACTOR'S ATTENTION IS DRAWN TO THE REQUIREMENTS OF
- 18 THE WORKSAFE HEALTH AND SAFETY ACT 2001. ALL WORK IS TO BE
- 19 CARRIED OUT IN ACCORDANCE WITH THIS ACT AND IN PARTICULAR THE
- 20 REQUIREMENTS OF THE ACT RELATIVE TO THE NOTIFICATION OF NEIGHBOURS
- 21 WITH REGARD TO NOTIFICATION IN RELATION TO A NOTIFIABLE
- 22 PROJECTS ARE TO BE FILLED.
- 23 THE PROJECTS ARE TO BE FILLED IN ACCORDANCE WITH COUNCIL
- 24 STANDARD PRACTICES.
- 25 ALL WORK SHALL BE DONE WITHIN THE ZONE OF INFLUENCE OF
- 26 STRICTLY LOCAL LOADINGS UNLESS BRIDGING OF THE ROAD IS PROVIDED.
- 27 ANY BRIDGING IS TO BE DESIGNED BY A TRULY QUALIFIED ENGINEER
- 28 AND SHALL BE IN ACCORDANCE WITH THE RELEVANT LOCAL AUTHORITY
- 29 REQUIREMENTS.
- 30 ALL WORK SHALL NOT PROJECT INSIDE THE SHAFT OF THE
- 31 PIPE AND PIPES SHALL NOT PROJECT INSIDE THE SHAFT OF THE
- 32 PIPE.
- 33 ALL ROAD-WATER OUTLETS TO KERNB TO BE MADE WITH FULL HEIGHT
- 34 AND IN ACCORDANCE WITH THE RELEVANT LOCAL AUTHORITY STANDARD
- 35 DRAWINGS.

CONTRACTOR TO REMOVE ANY REDUNDANT DRAINAGE OUTLETS FROM THE KERB & CHANNEL INCLUDING ANY ASSOCIATED PIPE WORK ACROSS THE FOOTWAY AND REINSTATE THE KERB AND CHANNEL AND THE FOOTWAY.

WORKPLACE HEALTH AND SAFETY NOTE:
ALL WORKS UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORK HEALTH AND SAFETY ACT 2011. CONTACT THE NEAREST OFFICE OF THE DIVISION OF WORKPLACE HEALTH AND SAFETY FOR INFORMATION. PHONE NO. 1300 362 128.

DIAL BEFORE YOU DIG:
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CONSTRUCTED INFORMATION. NO POT HOLE HAS BEEN UNDERTAKEN TO VERIFY
EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTORS
RESPONSIBILITY TO UNDERTAKE POT HOLEING TO VERIFY THE DESIGN.

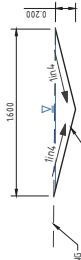
EXISTING SERVICES NOTE: THIS DESIGN WAS PREPARED BASED ON SERVICE AUTHORITY AS CONSTRUCTED INFORMATION FIELD SURVEY. IF MADE AVAILABLE TO PINCE AT THE TIME OF DESIGN, THE LOCATION OF UNDERGROUND SERVICES ARE NOTED WITHIN THE DESIGN. THE LOCATION OF UNDERGROUND UTILITIES ARE NOTED WITHIN THE DESIGN FOR CLASSIFICATION OF SUBSURFACE INFORMATION (SU). NOT PLOT HAVING BEEN RESPONSIBLE TO VERIFY EXISTING SERVICE LOCATIONS AND DEPTHS IT IS THE CONTRACTORS RESPONSIBILITY TO UNDISTURB FURTHER SURVEY AND PLOT HAVING AS REQUIRED TO CONFIRM THE NATURE AND LOCATION OF THESE SERVICES AND VERIFY THE DESIGN.

REAL PROPERTY DESCRIPTION
LOT 803 ON RP##

STORMWATER DRAINAGE STRUCTURE SETOUT TABLE			
STRUCTURE No.	SURFACE LEVEL	DESCRIPTION	LID CLASS
QUT/1	44.000	PRECAST HEADWALL AND SOUP PROTECTION TO FUTURE CHANNEL	N/A
1/1	45.9260	1000P HANDHOLE TO CC STODING SO2	CLASS D
2/3	45.7575	600x900 GRATED FIED INLET TO CC STODING SO.09	CLASS D
1/3	45.5550	600x900 GRATED FIED INLET TO CC STODING SO.09 TYPE TURBOE INLET	CLASS D
1/2	45.7000	600x900 GRATED FIED INLET TO CC STODING SO.09	CLASS D
2/2	45.8800	600x900 GRATED FIED INLET TO CC STODING SO.09	CLASS D
3/2	46.8800	600x900 GRATED FIED INLET TO CC STODING SO.09	CLASS D
4/2	46.7675	600x900 GRATED FIED INLET TO CC STODING SO.09	CLASS D

NOTE:
ALL STORMWATER PITS TO BE FITTED WITH SPCL STORMSACK (OR APPROVED EQUIVALENT), 10 MINIMUM TO BE IMPLEMENTED ON SITE

1% AEP DESIGN Q (m ³ /s)	0.094
MANNINGS (n)	0.035
LONG SLOPE (%)	1% MIN.
VELOCITY (m/s)	0.600
DY PRODUCT (m ² /s)	0.120
FLOW DEPTH (m)	0.200

[illegible]



**MILANOVIC NEALE
CONSULTING ENGINEERS**

BUSINESS
Ph No. (07) 3255 877
Fax No. (07) 3281 663

**CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT**

SYDNEY
Ph No. 150 827 901
Ph No. 150 827 901



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W - www.mncc.com.au

144 GRAMPIAN DRIVE, DEEBING HEIGHTS

OTIOSUM PTY LTD

STORMWATER DRAINAGE LAYOUT PLAN

DRAWN	DESIGNED	DATE
JH	CA	APRIL 2022
CHECKED	APPROVED	
JHU		
DRAWING No.	REV.	B
C5211 - CD01		

NOT FOR CONSTRUCTION



STRUCTURAL DETAILS TO BE CONFIRMED
BY STRUCTURAL CONSULTANT



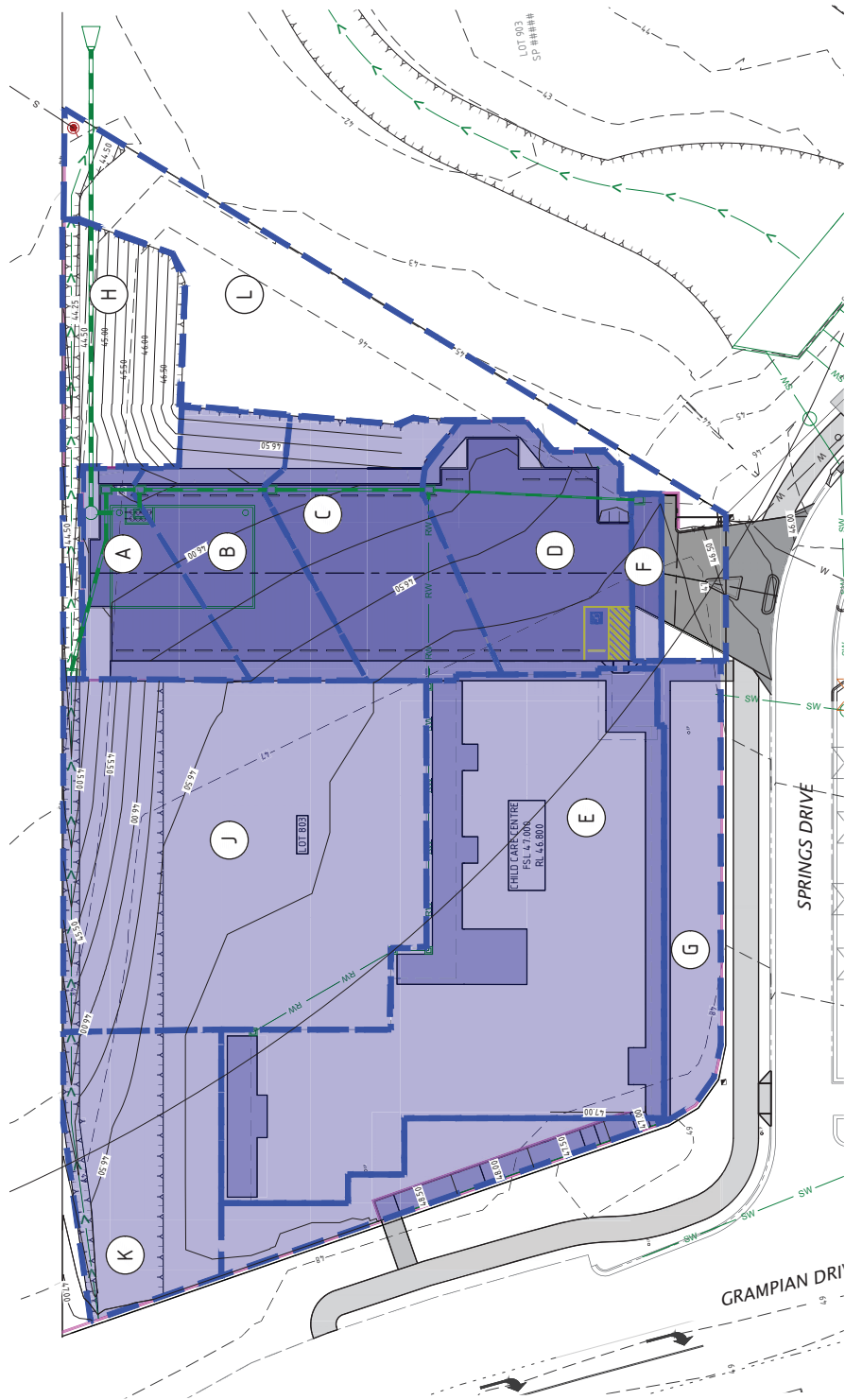
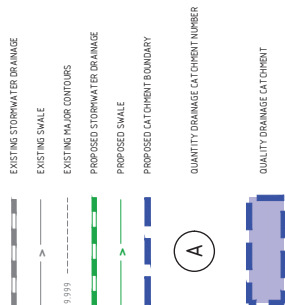
DIAL BEFORE YOU DIG:

REAL PROPERTY DESCRIPTION



DO NOT SCALE FROM DRAWING
ALL SCALES ARE AS SHOWN (A1)

LEGEND



PLAN
SCALE 1:250

CATCHMENT NAME	AREA (HA)	C_{50}	l_{50} mm/hr	Q_{50} m^3/s	C_{100}	l_{100} mm/hr	Q_{100} m^3/s
A	0.021	0.88	136	0.007	1	178	0.010
B	0.022	0.88	136	0.011	1	178	0.016
C	0.038	0.88	136	0.013	1	178	0.019
D	0.041	0.88	136	0.014	1	178	0.020
E	0.138	0.90	136	0.047	1	178	0.068
F	0.005	0.88	136	0.002	1	178	0.002
G	0.046	0.70	136	0.012	1	178	0.023
H	0.029	0.70	136	0.008	1	178	0.014
J	0.122	0.70	136	0.032	1	178	0.060
K	0.039	0.70	136	0.010	1	178	0.019
L	0.069	0.70	136	0.018	1	178	0.034

$T_c = 5$ minutes

WORKPLACE HEALTH AND SAFETY NOTE:
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DIAL BEFORE YOU DIG:

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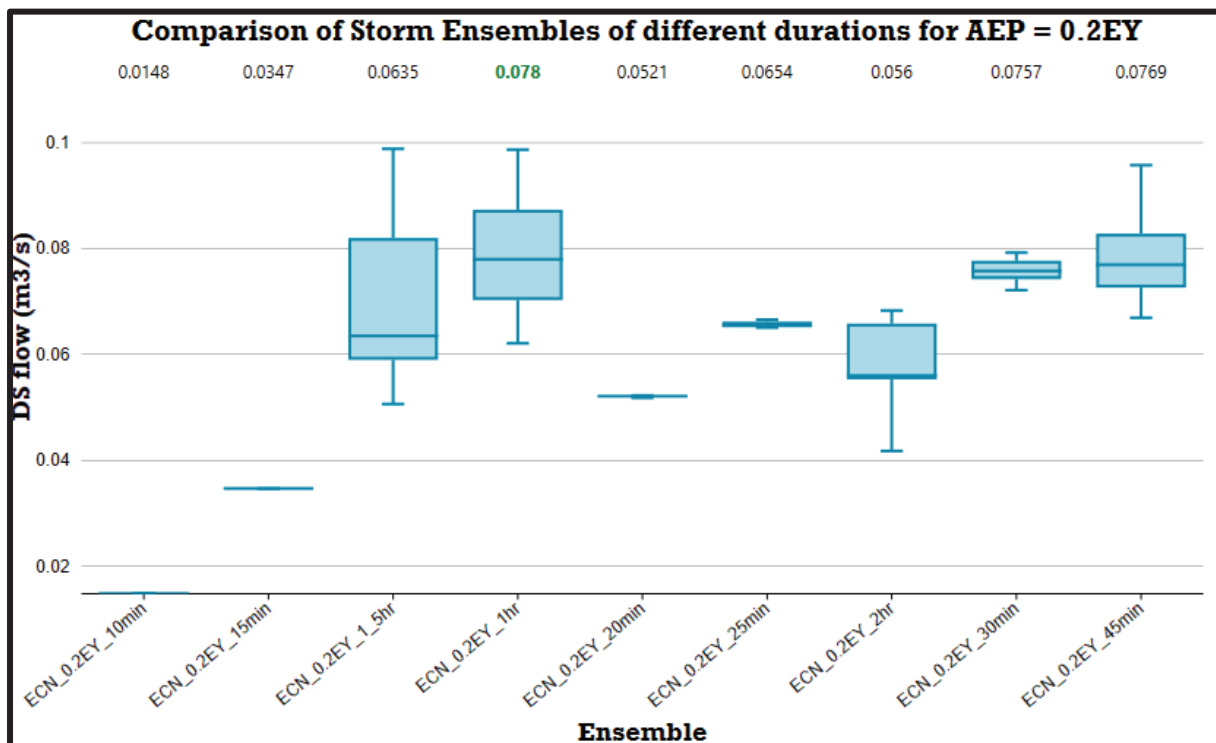
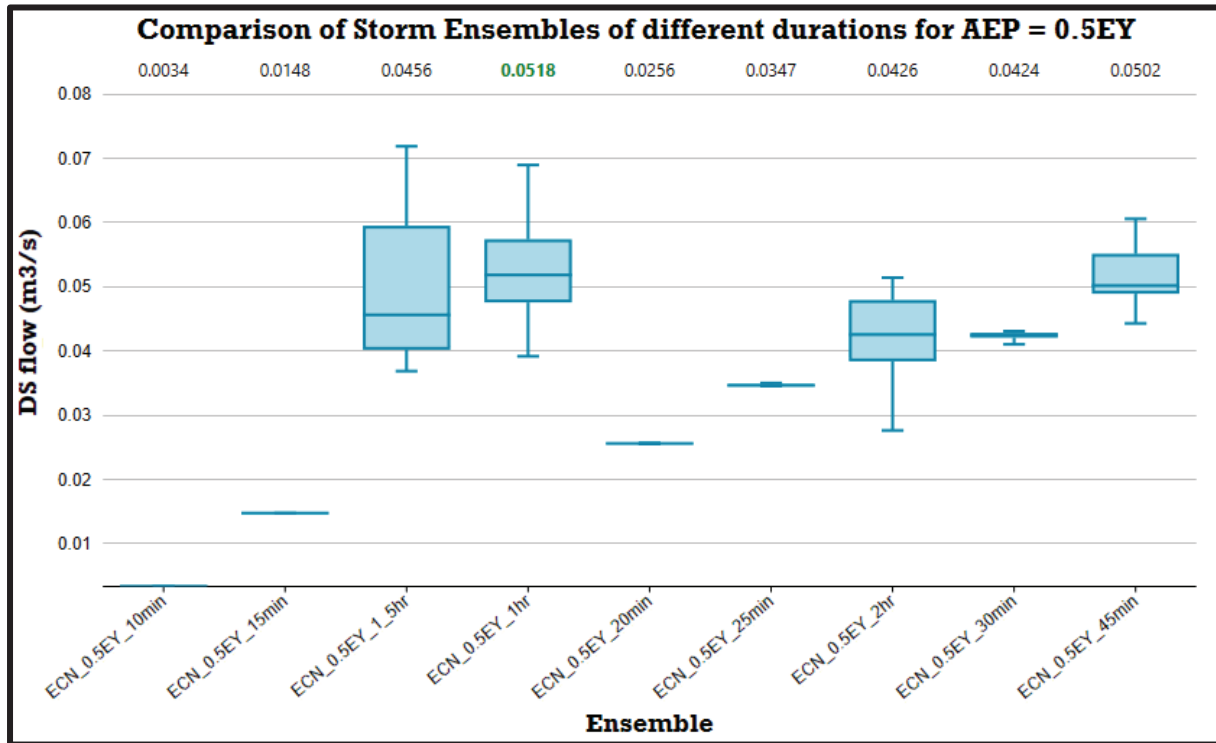
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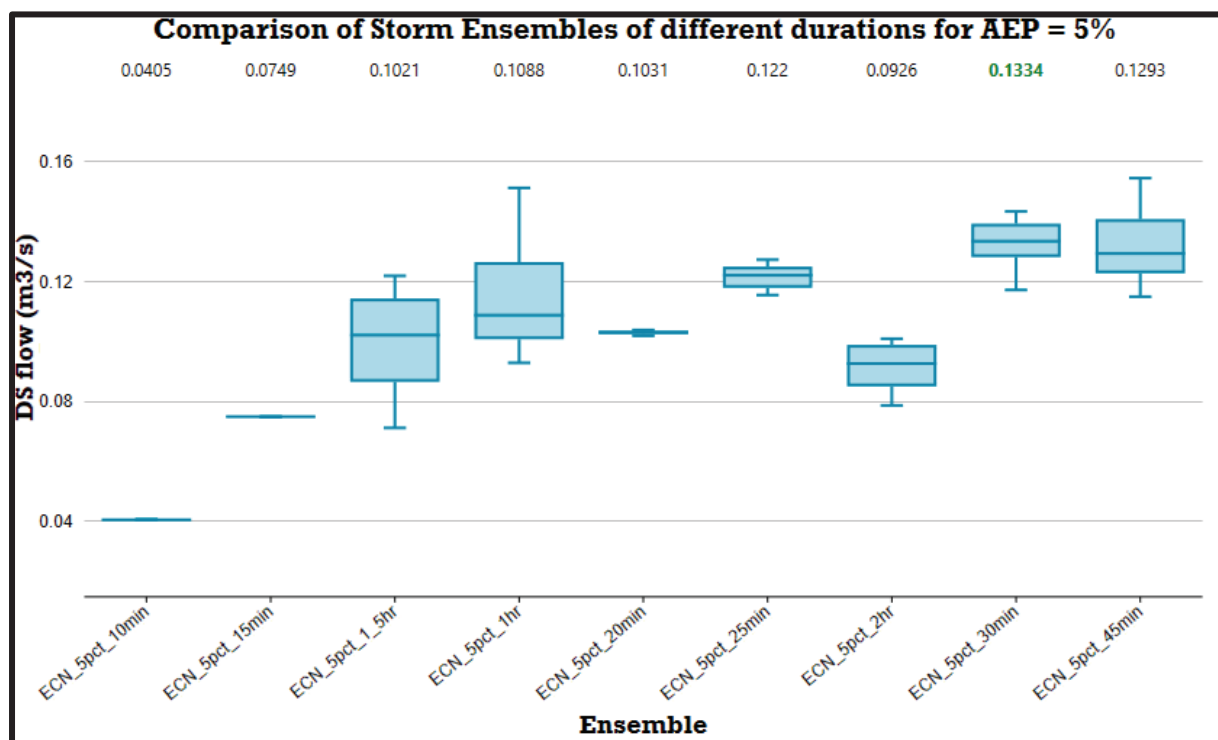
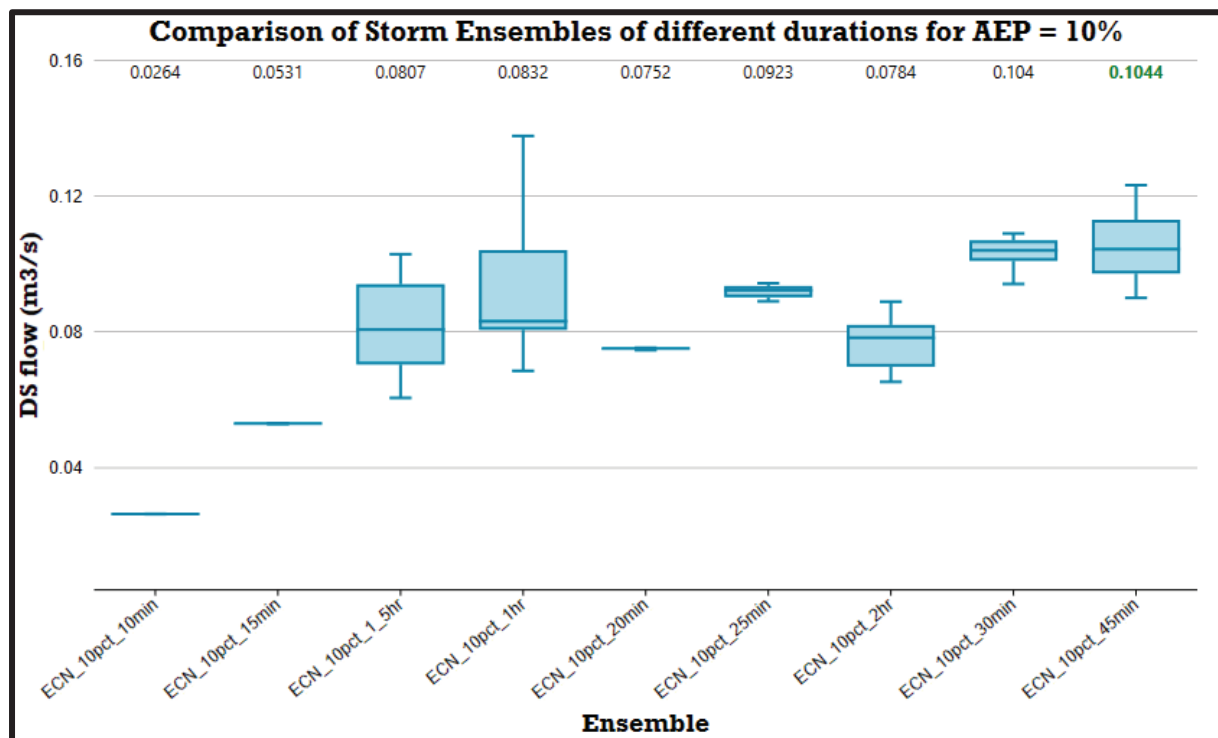
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CONSTRUCTED INFORMATION OR FIELD SURVEY. IF MADE AVAILABLE TO PM/CE AT
THE TIME OF DESIGN, THE LOCATION OF UNDERGROUND SERVICES ARE NOTED WITH
THEIR RESPECTIVE CLASS IN ACCORDANCE WITH AS 4588:09. THE AUSTRALIAN
STANDARDS FOR CLASSIFICATION OF SUBSURFACE UTILITY INFORMATION (SUI)
DO NOT APPLY. HAS BEEN UNDERTAKEN TO VERIFY EXISTING SERVICE LOCATIONS
AND POTHOLING IS THE CONTRACTOR'S RESPONSIBILITY. TO UNDERTAKE FURTHER
SURVEY AND POTHOLING AS REQUIRED, TO CONFIRM THE NATURE AND LOCATION
OF THESE SERVICES, AND VERIFY THE DESIGN.

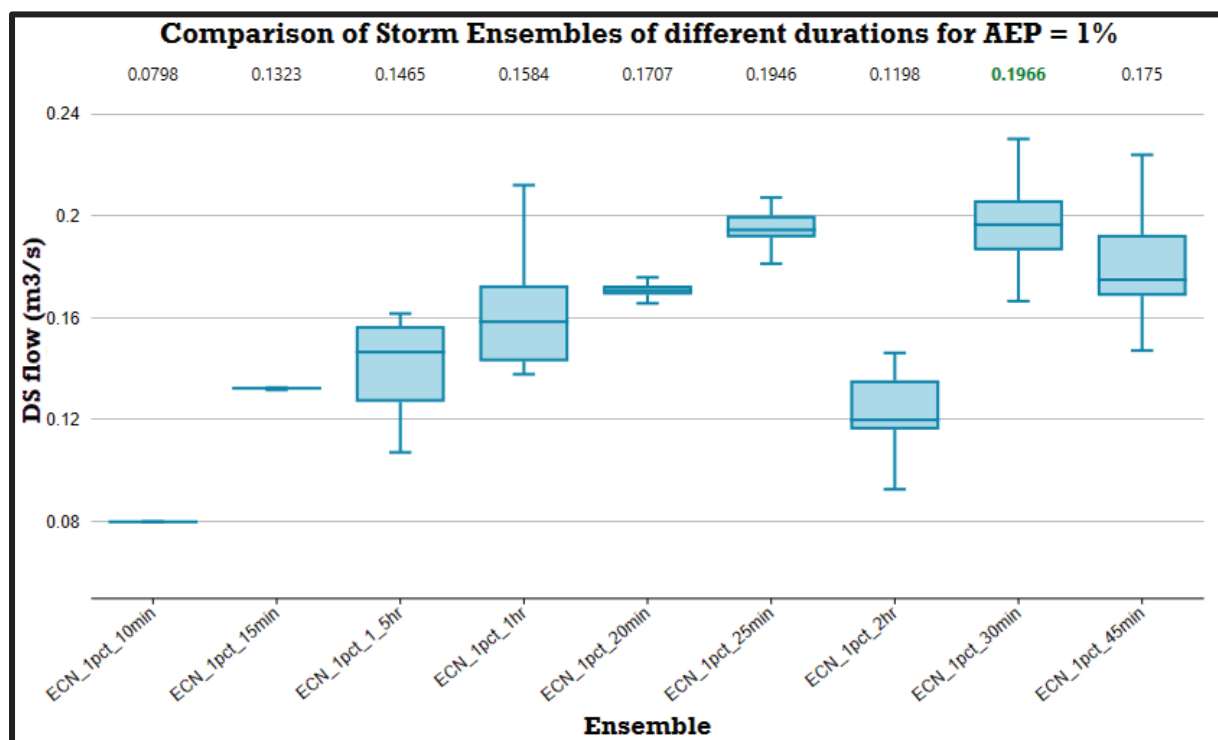
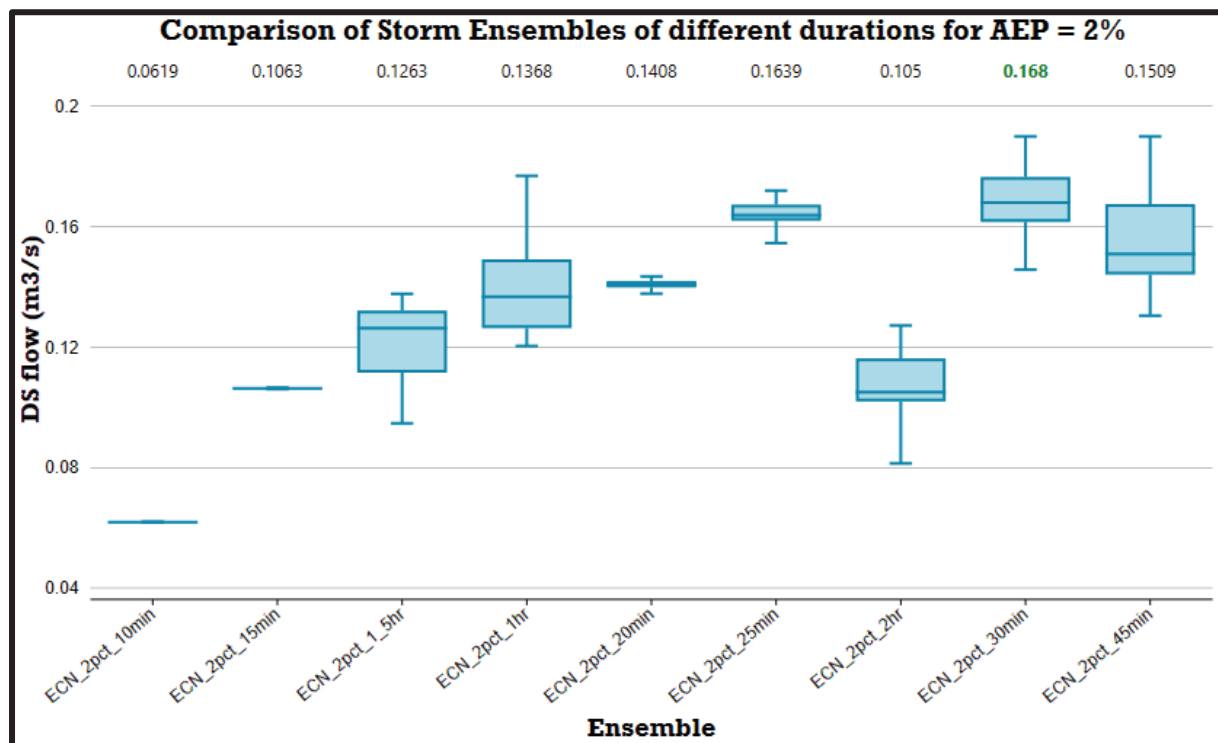
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APPENDIX B: ICM Hydrographs and Stage Storage Relationship

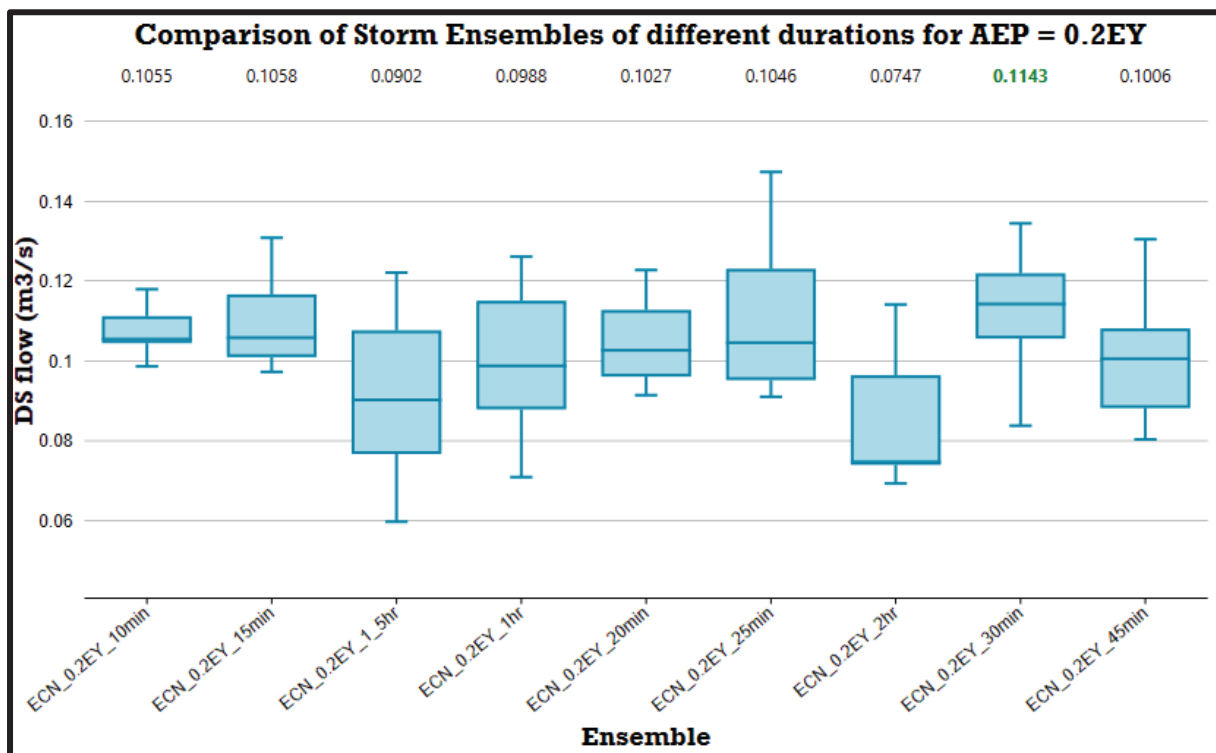
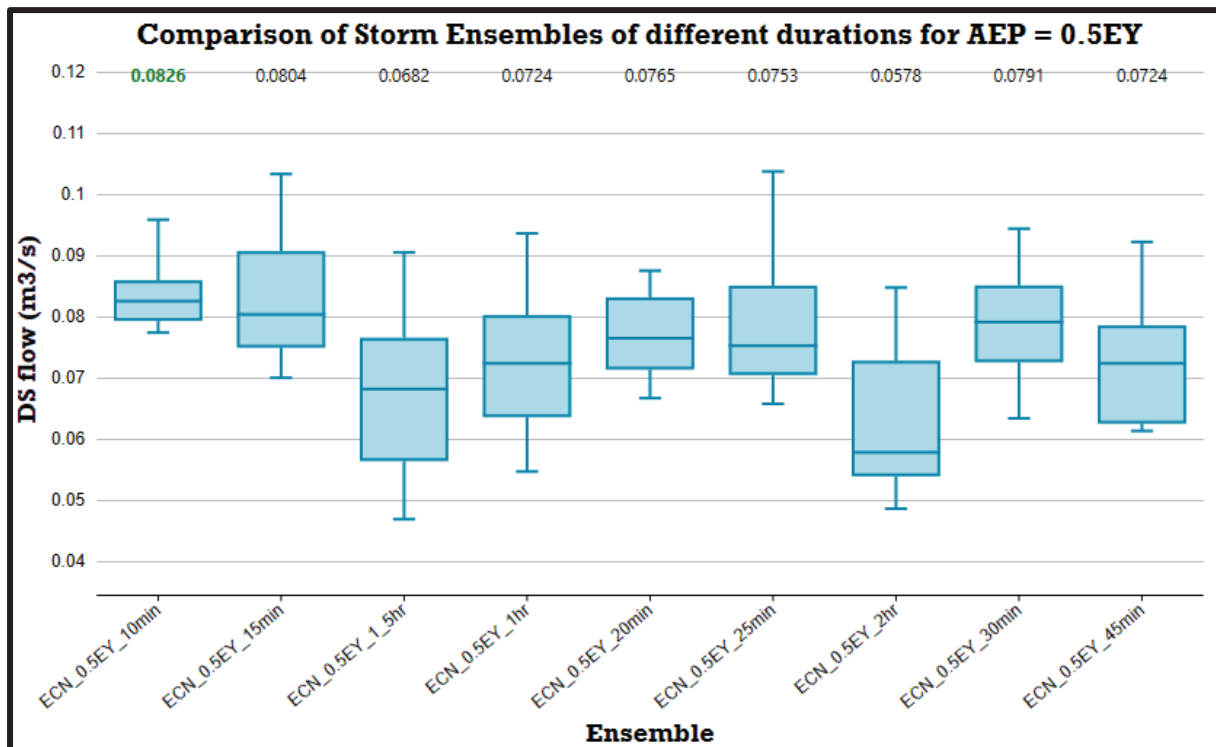
EXISTING SCENARIO

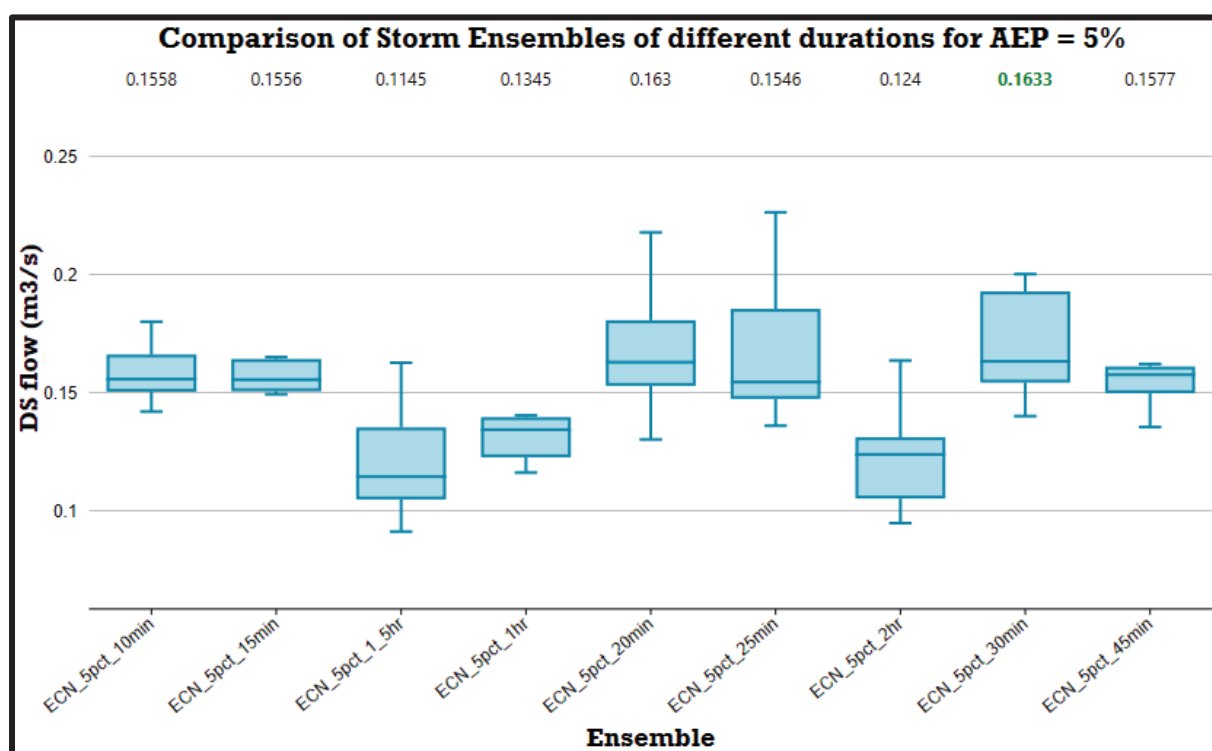
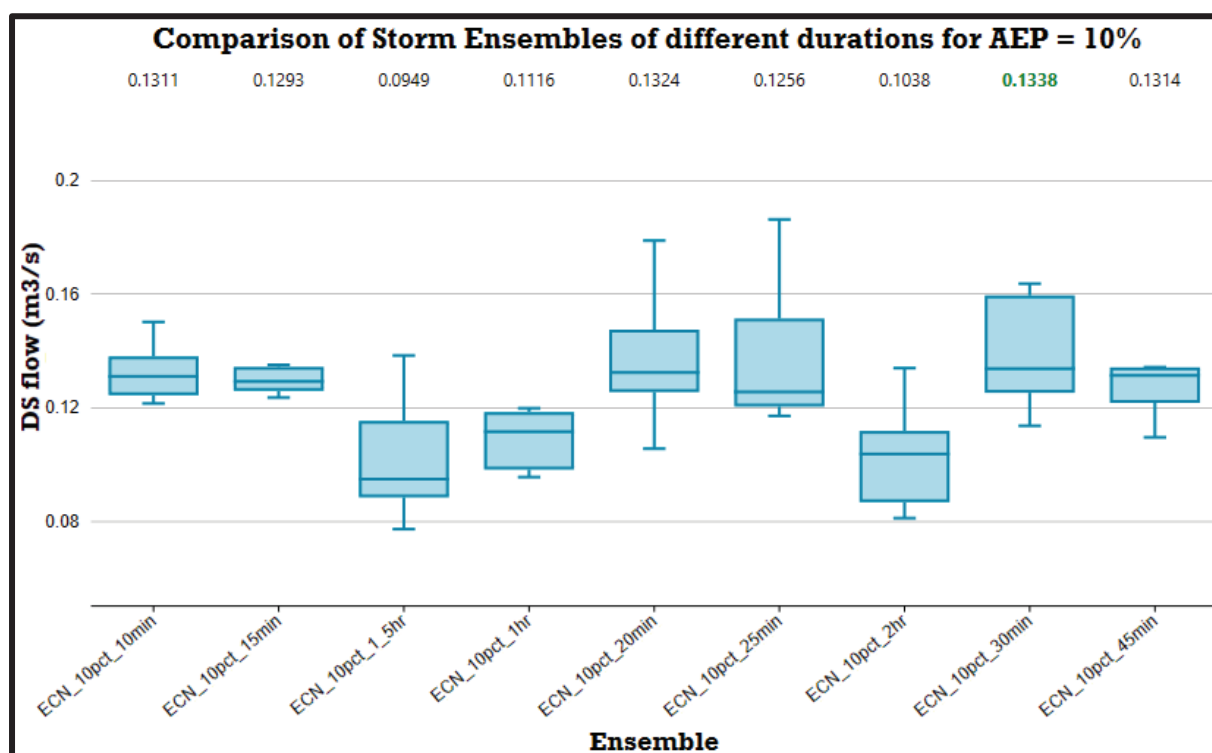


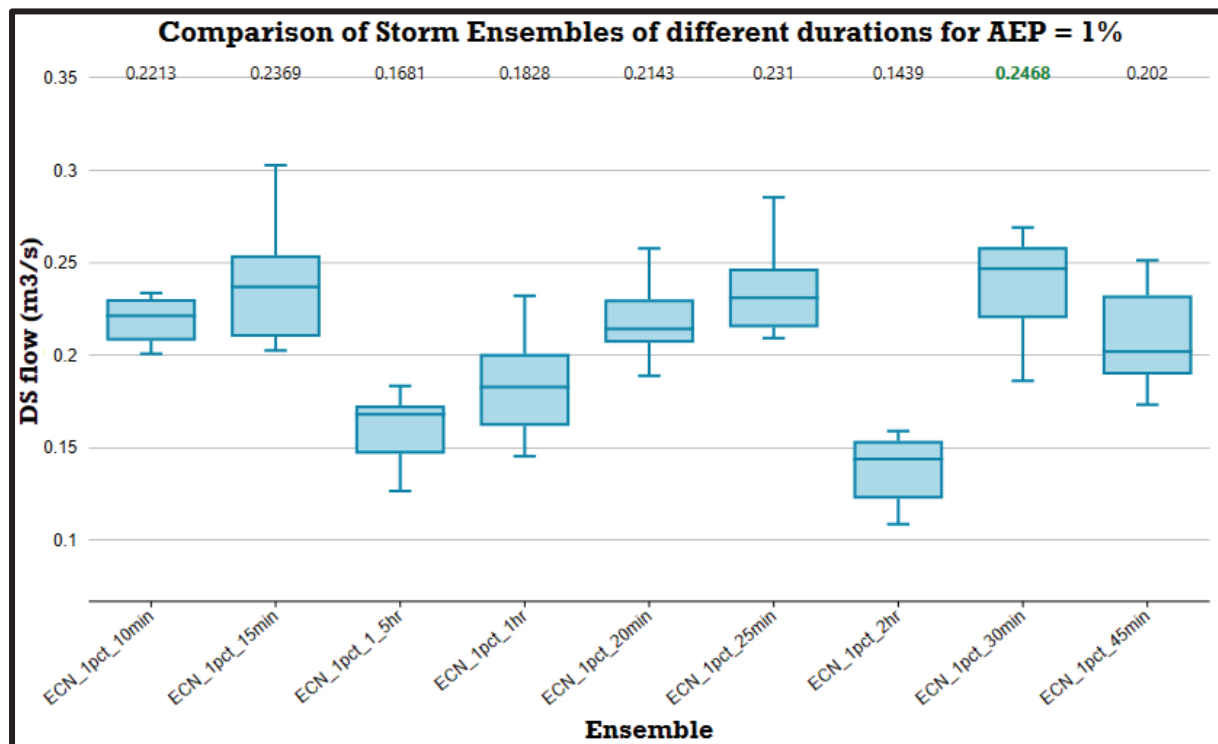
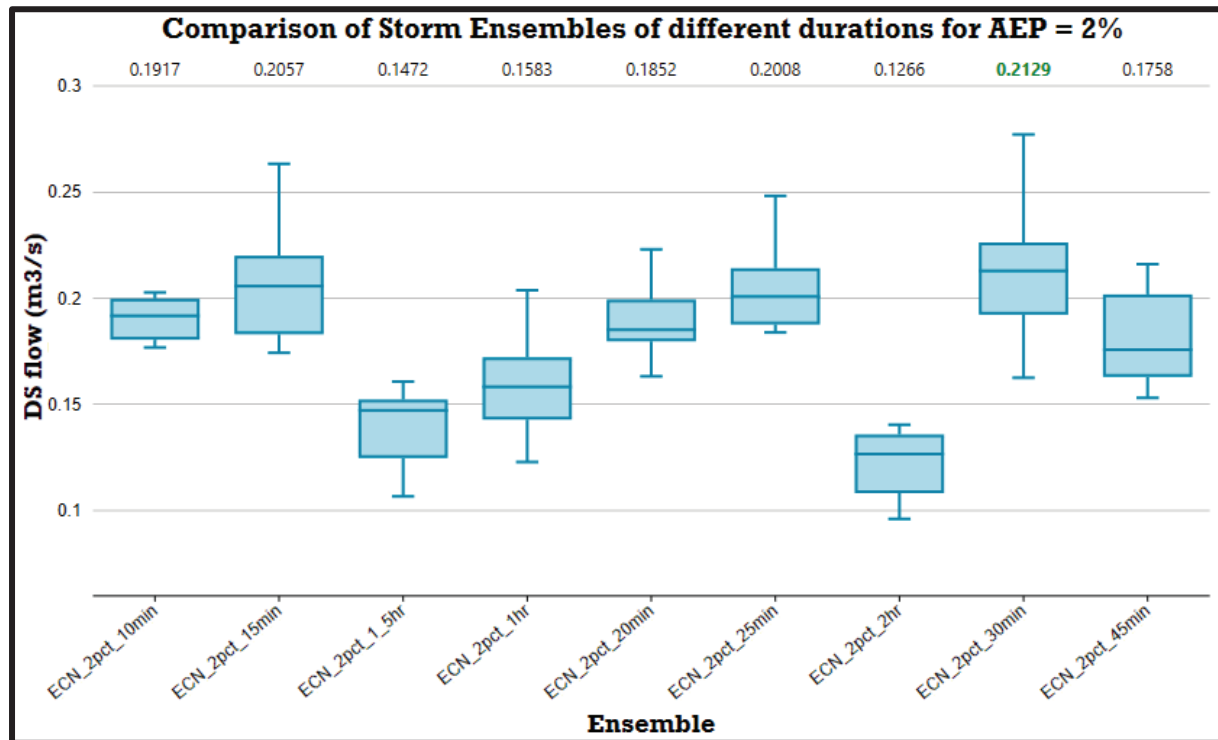




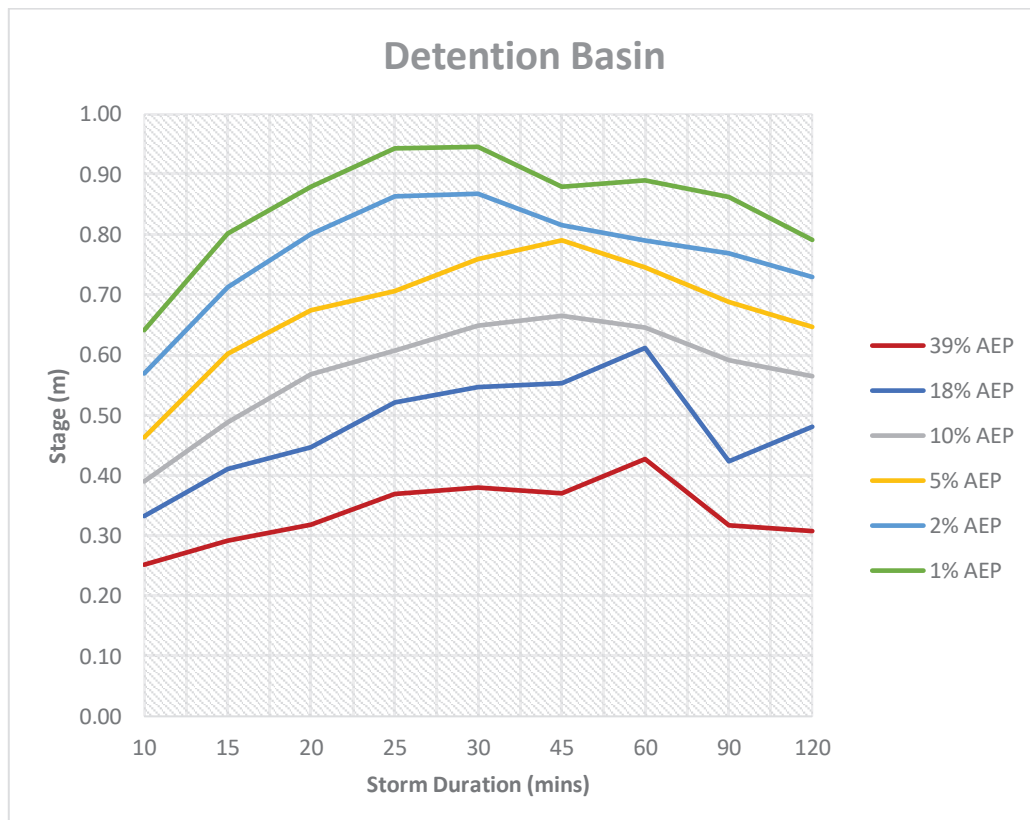
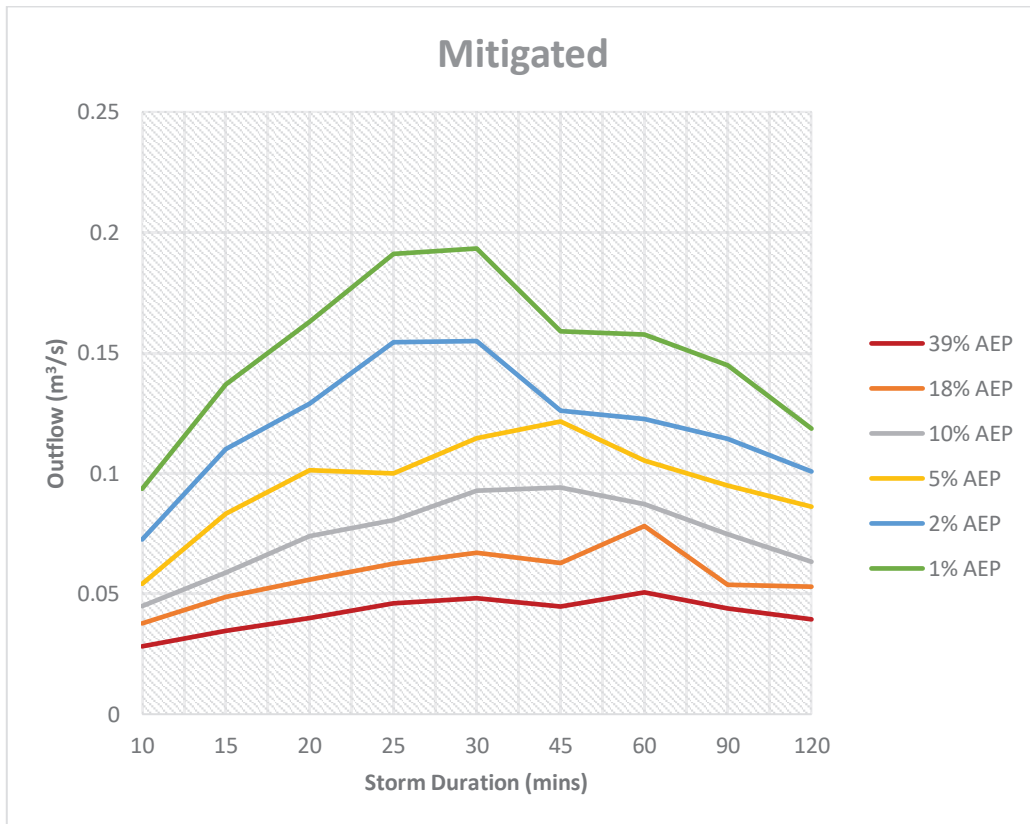
DEVELOPED SCENARIO







MITIGATED SCENARIO



APPENDIX C: Rational Method Calculation Summary

RATIONAL METHOD CALCULATIONS - EXISTING SITE

Job Reference	C5211
Site Address	144 Grampian Drive, Deebing Heights
Council	ICC

Number of Sub-Catchments	1
Minor Storm Event	10% AEP (As per QUDM Table 7.02.1)
Major Storm Event	1% AEP (As per QUDM Table 7.02.1)

Subcatchment Summary Table				
Number	Catchment Name	Catchment Description	C ₁₀	tc
1	Existing	Open Space (eg parks)	0.70	25

Site C₁₀ 0.70

Catchment Calculations (Major and Minor Storm ARI's)							
Number	Area	C10	I10	10% AEP	C100	I100	1% AEP
	ha		mm/hr	m ³ /s		mm/hr	m ³ /s
1	0.592	0.70	99	0.114	0.84	150	0.207

Total Runoff	Minor	0.114 m ³ /s
	Major	0.207 m ³ /s
Total Area		0.592 ha

Overland Flow Calculations	
Trunk SW Infrastructure	
Pipe Diameter	N/A m
Number of Pipes	
Grade	m/m
mannings	
Pipe Capacity	m ³ /s
Pipe Velocity	m/s
Capacity @ 3m/s	m ³ /s
Overland Flow	m ³ /s

Runoff Summary		
Freq.	Peak Discharge	
4 EY	0.024	m ³ /s
63% AEP	0.048	m ³ /s
39% AEP	0.065	m ³ /s
15% AEP	0.093	m ³ /s
10% AEP	0.114	m ³ /s
5% AEP	0.138	m ³ /s
2% AEP	0.179	m ³ /s
1% AEP	0.207	m ³ /s

RATIONAL METHOD CALCULATIONS - DEVELOPED SITE

Job Reference	C5211
Site Address	144 Grampian Drive, Deebling Heights
Council	ICC

Number of Sub-Catchments	3
Minor Storm Event	10% AEP (As per QUDM Table 7.02.1)
Major Storm Event	1% AEP (As per QUDM Table 7.02.1)

Subcatchment Summary Table				
Number	Catchment Name	Catchment Description	C ₁₀	tc
1	Roof	Impervious Roof	0.90	18
2	Hardstand	Significant paved areas	0.88	18
3	Vegetation	Open Space (eg parks)	0.70	18

Site C₁₀ 0.79

Catchment Calculations (Major and Minor Storm ARI's)							
Number	Area	C10	I10	10% AEP	C100	I100	1% AEP
	ha		mm/hr	m ³ /s		mm/hr	m ³ /s
1	0.140	0.90	118	0.041	1.00	178	0.069
2	0.130	0.88	118	0.037	1.00	178	0.064
3	0.322	0.70	118	0.074	0.84	178	0.134

Total Runoff	Minor	0.153 m ³ /s
	Major	0.267 m ³ /s
Total Area		0.592 ha

Overland Flow Calculations	
Trunk SW Infrastructure	
Pipe Diameter	N/A m
Number of Pipes	
Grade	m/m
mannings	
Pipe Capacity	m ³ /s
Pipe Velocity	m/s
Capacity @ 3m/s	m ³ /s
Overland Flow	m ³ /s

Runoff Summary		
Freq.	Peak Discharge	
4 EY	0.033	m ³ /s
63% AEP	0.065	m ³ /s
39% AEP	0.088	m ³ /s
15% AEP	0.125	m ³ /s
10% AEP	0.153	m ³ /s
5% AEP	0.185	m ³ /s
2% AEP	0.235	m ³ /s
1% AEP	0.267	m ³ /s

APPENDIX D: MUSIC Model Summary

Receiving Node

29/04/2022 4:17:36 PM

	Treatment Train Effectiveness				
	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	Gross Pollutants (kg/yr)
Sources	2.77	568	1.27	8.81	47.9
Residual Load	2.77	116	0.490	4.42	0.00
% Reduction	0.0	79.6	61.5	49.9	100.0