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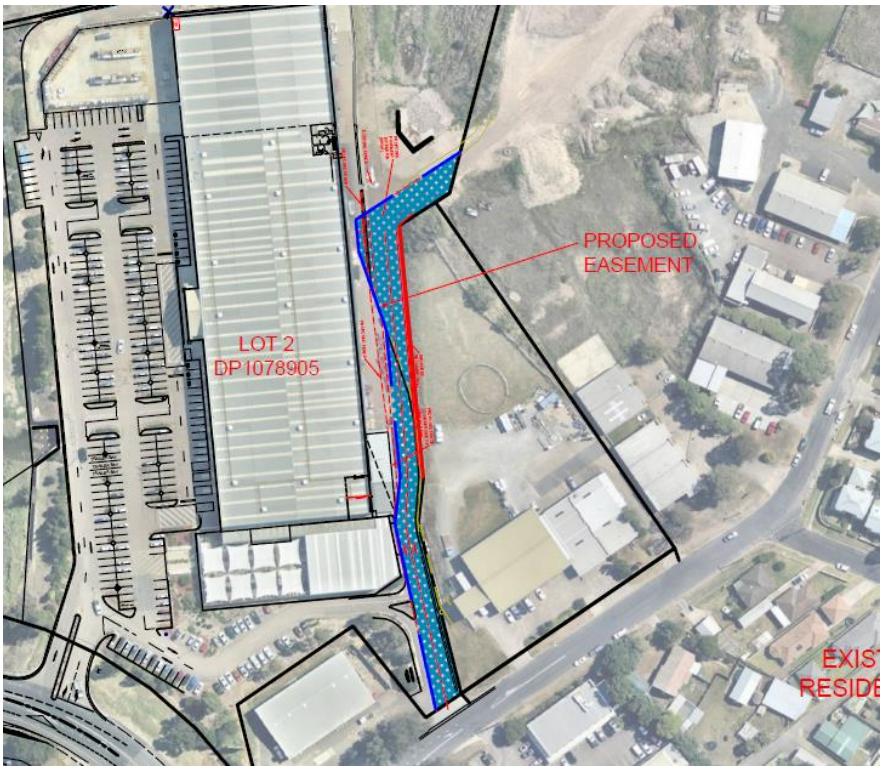
Water Cycle Management Plan

Right of Access Modifications

At

2A Johnson Street
MAITLAND



For

BWP Management
Level 7, 1 Southbank Boulevard
SOUTHBANK VIC 3205

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2. INTRODUCTION AND BACKGROUND

2.1. Purpose

The purpose of this water cycle management report is to provide the stormwater drainage system design and stormwater quality treatment design parameters and demonstrate that the proposed stormwater system will meet the requirements of Maitland City Council stormwater targets.

The principal objectives of this review are to provide:

- A summary of stormwater design parameters.
- A summary of Australia Standards used and the local council's stormwater requirements.
- A summary of stormwater design strategy.
- A maintenance schedule of each stormwater drainage components proposed for this development.

2.2. Site Description

The development site is described as Lot 2 in DP1078905. This lot is addressed as 2A Johnson Street, Maitland. The location of the site is shown in Figure 2.1.

Figure 2.1: Site Location (Nearmap, SIX Maps November 2021)

The proposed development seeks to modify the rear access to the new warehouse developments located to the north at 22 Johnson Street Maitland. The warehouse development currently has access from the north at Johnson Street, and the proposed development serves as an upgrade to the existing unsealed access between the lower south-eastern end of Johnson Street and the existing Bunnings development to the south.

The total development area is 952 m^2. The development's pavement area represents 100% of the stormwater catchment.

2.3. Proposed Development

The proposed development works includes:

- Resurfacing of existing unsealed driveways to concrete pavement driveway. Total pavement area = 952 m^2.

Figure 2.2 shows the overall site plan for the development.

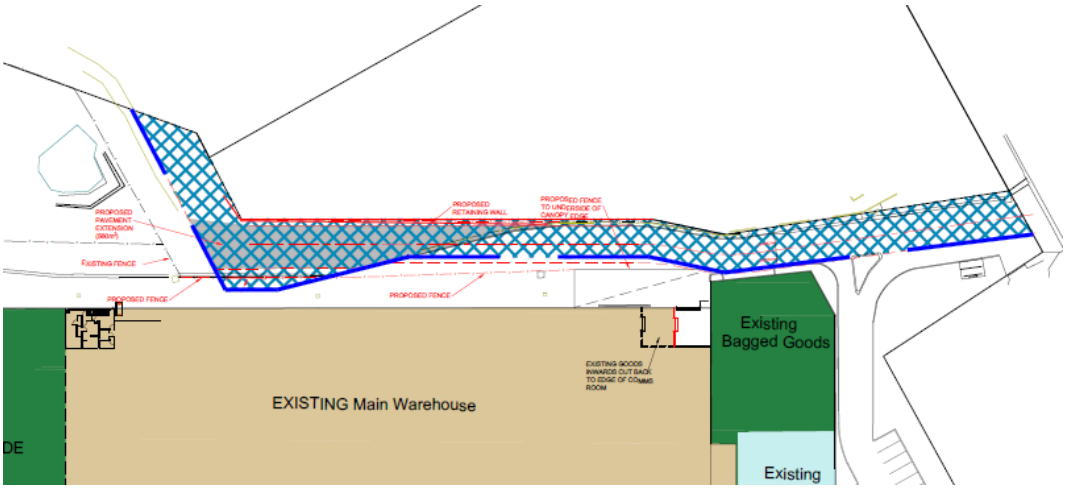


Figure 2.2: Proposed Development Site Architectural Layout

3. DESIGN STANDARDS & COUNCIL REQUIREMENTS

3.1. Australian Standards

The design has been based on the following design standards:

- AS/NZS 3500.3 Plumbing and Drainage, Part 3: Stormwater Drainage

3.2. Stormwater Requirements

The stormwater requirements for the development site have been determined by the Maitland City Council Manual of Engineering Standards.

3.2.1. Stormwater Retention Requirements

Stormwater retention measure are not required for this site as there is not intent to capture or reuse any stormwater falling on the site.

3.2.2. Stormwater Quantity Requirements

Maitland City Council require provision of on-site detention (OSD) in accordance with Council's Manual of Engineering Standards as follows:

- Stormwater drainage systems shall be designed to achieve the detention of stormwater flows that mimics natural, pre-developed flows for all storm events up to and including the 100-year ARI event.

3.2.3. Stormwater Quality Requirements

Maitland City Council require retention of stormwater flows to achieve target water quality standards. The following shall be used as targets for pollutant retention goals:

- Suspended solids retention requirement (TSS) – 80%
- Gross pollutants retention requirement (GP) – 70%
- Total phosphorus retention requirement (TP) – 45%
- Total nitrogen retention requirement (TN) – 45%

4. HYDRAULIC ANALYSIS

The OSD basin designed for the development site serves the dual purpose of meeting both the stormwater quality and quantity requirements outlined in Section 3. The content of this section discusses the method and results of the analyses used in the design of this system.

4.1. On-Site Detention Parameters

The above-ground on-site detention basin controls both water quality and quantity exiting the site. Water quantity control is required such that outflow from the site is limited to pre-development conditions in all rainfall events up to and including the 1% AEP event. The total site area draining to the OSD basin is 952 m^2, and all rainfall on impervious areas are directed to the OSD basin prior to discharge from the site.

The on-site detention tank characteristics are listed below:

- Detention basin is formed by new and existing concrete pavement. Discharge control pit level is designed as 10.05 with top water level 10.25. Detention area at top water level is designed as 245.50 m^2. Detention volume at top water level is designed as 15.10 m^3.
- Discharge control pit at low-level outlet contains orifice place restricting post-development flows to pre-development discharge in the 20% AEP rainfall event.
- Discharge control pit discharges into adjacent sealed junction pit, which connects to existing drainage.
- Overflows in extreme rainfall events overflow to adjacent pits and to the infiltration basin to the west of the proposed development.

A summary diagram of the detention basin layout is shown in Figure 4.1 below.

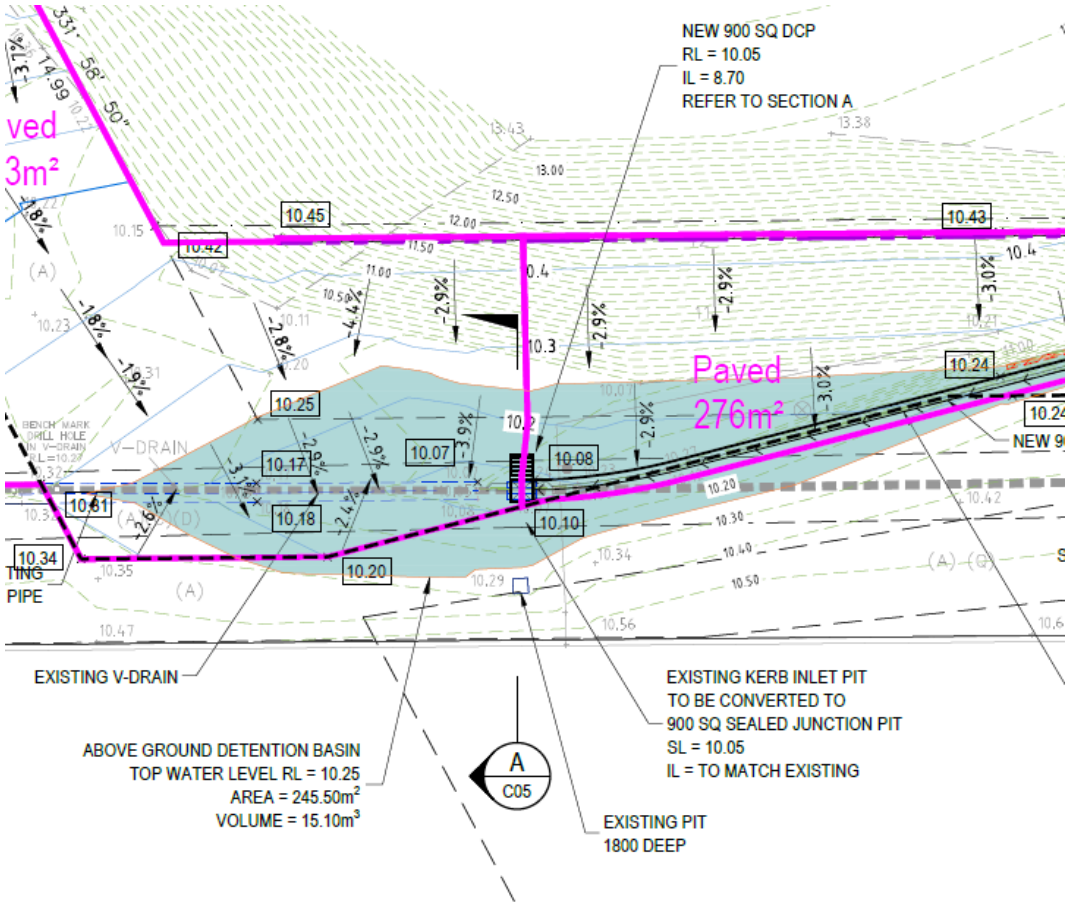


Figure 4.1: Designed Detention Basin for the Proposed Development

4.2. Detention Calculations

The designed detention volume for the proposed development has been determined using basic volumetric calculations. These calculations are based on a time of concentration of 5 minutes and determine the volume of detention required to detain the 5% AEP, 5-minute duration rainfall event while restricting the outflows to the 20% AEP, 5-minute rainfall event. Checks are also conducted to ensure that outflows in the 1% AEP rainfall event are less than or equal to outflows in the pre-development state.

Full calculations are provided in Appendix B.

5. WATER QUALITY ANALYSIS

5.1. General

The water quality for the site has been designed in accordance with Council's Manual of Engineering Standards objectives which require that the proposed development have pollutant load reductions as shown in Table 5.1.

To determine compliance with this requirement, a full analysis of the water quality of the stormwater discharge leaving the site was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software modelling package.

Pollutant	Percentage Reduction
Gross Pollutants (GP)	70%
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	45%
Total Nitrogen (TN)	45%

Table 5.1: Maitland City Council Pollutant Reduction Targets

The analysis has considered the use of the following Stormwater Quality Improvement Devices (SQIDs) to improve the stormwater discharge leaving the site:

- On-site detention basin

5.2. MUSIC Input Parameters

The input parameters representing the urban catchment areas across the site have been adopted from the default MUSIC parameters. The site has been divided into sub-catchments that drain into the various treatment nodes of the treatment train. Figure 5.1 and Table 5.2 provide an arrangement and summary of the input values used for source nodes in the MUSIC model.

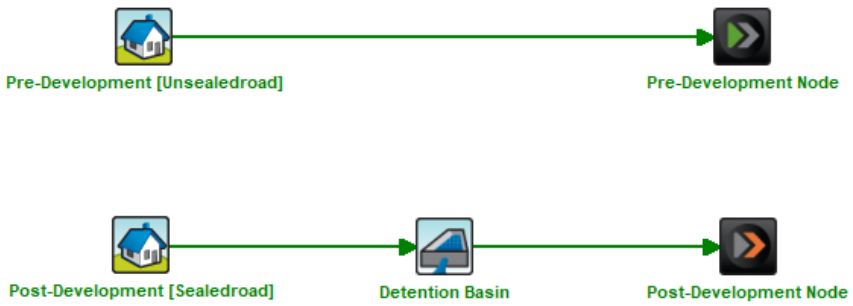


Figure 5.1: MUSIC Model Arrangement of the Treatment Train Designed for the Proposed Development

Data Type		Catchment Type		
		Unsealed Road	Sealed Road	Landscaped Area
Area Parameters				
Impervious Area (%)		100	100	0
Pervious Area (%)		0	0	100
Rainfall Runoff Parameters				
Rainfall Threshold (mm/day)		1.00	1.00	1.40
Soil Storage Capacity (mm)		120	120	105
Initial Storage (%)		25	25	30
Field Capacity (mm)		80	80	70
Infiltration Capacity Coefficient		200	200	150
Infiltration Capacity Exponent		1.00	1.00	3.50
Total Suspended Solids (log mg/L)				
Base Flow	Mean	1.200	1.200	1.200
	Std Dev	0.170	0.170	0.170
Storm Flow	Mean	3.000	2.430	2.150
	Std Dev	0.320	0.320	0.320
Total Phosphorus (log mg/L)				
Base Flow	Mean	-0.850	-0.850	-0.850
	Std Dev	0.190	0.190	0.190
Storm Flow	Mean	-0.300	-0.300	-0.600
	Std Dev	0.250	0.250	0.250
Total Nitrogen (log mg/L)				
Base Flow	Mean	0.110	0.110	0.110
	Std Dev	0.120	0.120	0.120
Storm Flow	Mean	0.340	0.340	0.300
	Std Dev	0.190	0.190	0.190

Table 5.2: MUSIC Model Input Parameters

5.3. Analysis Results

The pollutant reduction results for the designed treatment train are summarised in Table 5.3.

	Pollutants Generated (kg/yr)	Residual Pollutants (kg/yr)	% Reduction Target	% Reduction Achieved
Total Suspended Solids	246	17.8	80	92.8
Total Phosphorus	0.407	0.0962	45	76.3
Total Nitrogen	1.66	1.13	45	32.0
Gross Pollutants	19.9	0.13	70	99.3

Table 5.3: Design Treatment Train Effectiveness as Reported by MUSIC Model

The above table demonstrates that Council's pollutant reduction targets have been met for the development, except for retention of total nitrogen. While this does not strictly meet the requirements of Maitland City Council, the development has significantly reduced the pollutant load being discharged from the site. Concession is sought for the general improvement in water quality that occurs downstream of the development.

6. MAINTENANCE SCHEDULE

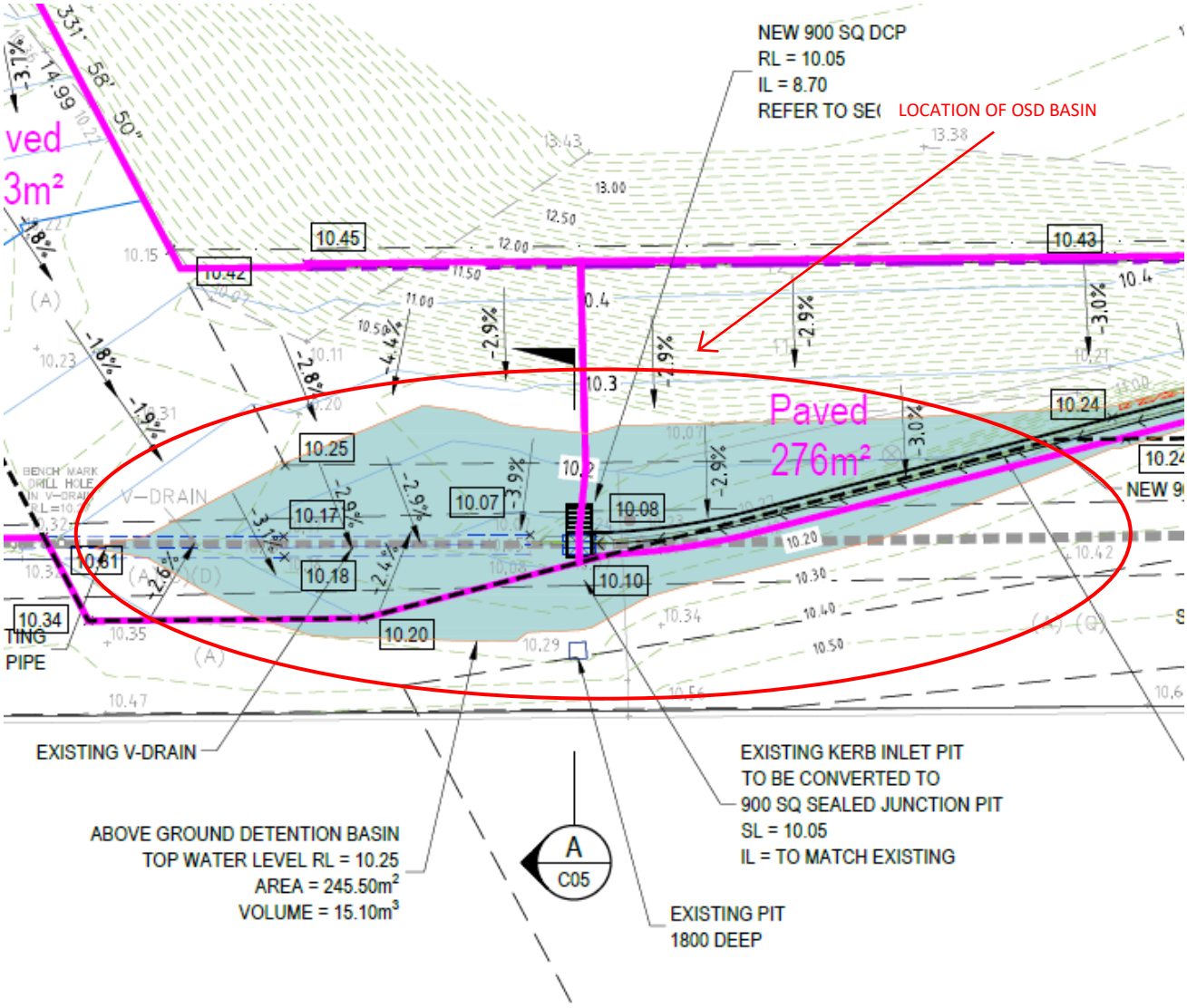
6.1. Stormwater Drainage System Maintenance

To ensure the system functions efficiently long term, regular maintenance must be carried out on the stormwater system and water quality treatment devices. The maintenance of the on-site detention systems will be undertaken during regular inspections and a maintenance schedule is included in Appendix A.

APPENDIX A – Stormwater System Maintenance Schedule

Proposed Development
2A Johnson St, Maitland

Stormwater System	
Stormwater Drainage Plan	
Location identified on plan	The location of the on-site detention tank for the proposed development is circled in red, below.



On-Site Detention Basin			
Maintenance Action	**Frequency**	**Responsibility**	**Procedure**
Check system operational performance	End of first month after installation and annually	Maintenance Contractor	• Inspect and check all components of the OSD basin system are operating normally. Replace or repair if required.
Inspect system and grates for damage and/ or blockage	Quarterly and/or after storm	Maintenance Contractor	• Check the system and grates for corrosion, damage and/or blockage (especially corner and welds). Replace or repair if required.
Inspect all pits, internal, external and overflow structure	Quarterly and/or after storm	Maintenance Contractor	• Check all pits and remove debris as required.
Clean system	Annually	Maintenance Contractor	• Clean the system by removing sediment, debris and blockage as required.

APPENDIX B – Detention Calculation Sheet

On-Site Stormwater Detention Design Summary Sheet

Pre-Development

Catchment Areas

Roof Area ($A_{r)}$)	0	m^2
Paved Area (A_p)	0	m^2
Landscaped Area (A_v)	952	m^2
Total Area	952	m^2

C_r	1
C_p	0.9
C_v	0.5

Stormwater Flows

Duration	5	min
Rainfall Intensity ($^5I_5$)	132	mm/hour
Stormwater Flow (Q^5_{undev})	17.45	L/s

Post-Development

Catchment Areas to Detention

Roof Area ($A_{r)}$)	0	m^2
Paved Area (A_p)	896	m^2
Landscaped Area (A_v)	0	m^2
Total Area to Detention	896	m^2

C_r	1
C_p	0.9
C_v	0.5

Catchment Areas Bypassing Detention

Roof Area ($A_{r)}$)	0	m^2
Paved Area (A_p)	56	m^2
Landscaped Area (A_v)	0	m^2
Total Bypass Area	56	m^2

C_r	1
C_p	0.9
C_v	0.5

Total Area	952	m^2

Stormwater Flows

Duration	5	min
Rainfall Intensity ($^{20}I_5$)	188	mm/hour
Stormwater Flow (Q^{20}_{dev})	44.74	L/s

Stormwater Detention Requirements

Storage Volume Required	8.19	m^3
Bypass Flow (Q^{20}_{dev})	2.63	L/s
Permissible Site Discharge (PSD)	14.82	L/s

Orifice Plate Controlled Discharge

Head (H)	1.55	m
Orifice Diameter (mm)	74.3	mm
Outlet Pipe Diameter (mm)	450	mm

100y Rainfall Event Check

Rainfall Intensity ($^{100}I_5$)	262	mm/hour
Stormwater Flow (Q^{100}_{undev})	35	L/s
Stormwater Flow (Q^{100}_{dev})	59	L/s
Stormwater Flow (Q^{100}_{bypass})	4	L/s

$Q^{100}_{dev} - Q^{20}_{dev}$ + PSD + Bypass	<=	Q^{100}_{undev}
32.43	<=	35

OK