

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN  
Sheet 1 of 23**

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

**THE CSE GROUP.**  
CONSULTING ENGINEERS

## **EMMANUEL COLLEGE**

## **STORMWATER MANAGEMENT PLAN**

## **CRAWLEY STREET WARRNAMBOOL**

28/02/2024

Version: 3

For:  
Emmanuel College

Checked By: Scott Trotter  
 Date Issued: 19/02/2024  
 Date: 06 March 2024  
 MINISTER FOR PLANNING

## Document History

Rev. No.	Description of Revision	Prepared By
1	First Report	Stephen Brodie
2	Amended appendix	Stephen Brodie
3	Amended terminology	Stephen Brodie

### Disclaimer:

This report and the results shown and recommendations made herein are based upon the information, drawings, samples, tests and measurements referred to. The CSE Group, its consultants and agents accepts no liability for any damages, charges, costs or expenses in respect of or in relation to injury or death of any person or damage to any property or of other loss whatsoever arising either directly or indirectly from the use of this report, the carrying out of recommendations contained herein or the use of any goods or materials referred to.

## Table of Contents

### Report

1.0	INTRODUCTION .....	3
2.0	EXISTING CONDITIONS .....	3
3.0	DESIGN REQUIREMENTS .....	3
4.0	DESIGN & DISCUSSION .....	4
4.1	Pre-development Runoff .....	4
4.2	Coefficient of Runoff for Development .....	4
4.3	Roof Stormwater Collection .....	4
4.4	Infiltration during 1% AEP Storm Event .....	4
4.5	Storage for 1% AEP Storm Event .....	5
4.6	Discharge for 1% AEP Storm Event .....	5
4.7	Proposed Storm Water Connection Points .....	5
4.8	Overland Flow Path .....	6
4.9	Stormwater Quality Treatment .....	6
5.0	CONCLUSION & RECOMENDATIONS .....	7

### Attachments

Sheet No.	Description
SW1	Stormwater Catchment Plan
SW2	Site Soakage Test
SW3	Soak Test Calculations
SW4	Stormwater Storage & Discharge Calculation
SW5	Orifice Plate Calculations
SW6	MUSIC Results
2022.152 C-12, C-21 & C-32	Year 9 Centre Stormwater Layout Plan, Long section & Details

### References

The CSE Group Consulting Engineers  
 – 2022.152 Emmanuel College Year 9 Centre, Stormwater Management Plan, 28-09-2022

## 1.0 INTRODUCTION

A stormwater management plan was previously produced for the proposed year 9 centre off Crawley Street (CSE#2022.152). Recently, Emmanuel College was able to purchase the land known as 15 Crawley Street and are looking to apply for planning approvals for this land and the land on 13 Crawley Street for teachers and staff at the year 9 centre. This stormwater report will review the proposed stormwater management system for the Year 9 Centre and adjust it to account for the additional land that is being developed into carparks and ensure the stormwater discharge from the subject site is compliant with Council requirements and BPEM guidelines. Whilst subject to further planning approval, the stormwater infrastructure would be designed to allow for any future development such as hardstands and carparking areas. Stormwater detention is investigated for the proposed site and carpark to limit the adverse effects of stormwater on downstream properties up to the 1% AEP rainfall event. Stormwater treatment is designed to meet BPEM guidelines.

## 2.0 EXISTING CONDITIONS

The proposed site for the year 9 centre and carpark falls northeast onto Crawley Street. There is an existing Council underground drainage pipe approximately 60m east of the proposed site which runs north along Ardlie Street and discharges into Russell's Creek.

Ground contours indicate that overland flow paths from the proposed site do not reach the Russell Creek and instead become land locked in a low-lying area on the block surrounded by Conns Lane, Ardlie Street, Wentworth Street and Barbers Lane. Water sitting in this location would likely pond in a major event before infiltrating into the ground.

## 3.0 DESIGN REQUIREMENTS

It is anticipated that the proposed site will be required to meet the following conditions:

- Underground drainage to the legal point of discharge.
- On-site detention of stormwater to limit outflows to pre-development conditions in a 1% AEP rainfall event (due to the lack of overland outfall).
- All stormwater to be designed in accordance with the Infrastructure Design Manual & AS/NZS 3500.
- Meet Best Practice Environmental Guidelines:
  - 80% Reduction in Suspended Solids
  - 45% Reduction in Total Phosphorus
  - 45% Reduction in Total Nitrogen
  - 70% Reduction in Gross Pollutants
  - Maintain flows at 1.5 year ARI pre-development levels

## 4.0 REVIEW, DESIGN & DISCUSSION

The stormwater management system that was proposed for the Year 9 Centre as part of the 2022.152 SWMP incorporates a stormwater detention tank to attenuate flows from the roof area, an underground tank to attenuate flows from ground water runoff and a raingarden treatment area to treat stormwater to BPEM. With the inclusion of more impervious surface from the proposed carpark the same elements will be utilised, though their sizes will be adjusted to suit the proposed conditions.

Stormwater attenuation is designed to limit flows to pre-developed conditions in a 1% AEP rainfall event to prevent exacerbation of flooding in the land locked area to the east.

Stormwater quality improvements are designed to meet or exceed BPEM guidelines.

### 4.1 Catchments & Coefficient of Runoff for Development

The Coefficient of Runoff of the development has been calculated in accordance with the infrastructure design manual and the following:

- Landscaped Areas – 0.25
- Low Density Residential Zone > 2ha – 0.3
- Commercial Zones – 0.9
- Paved Areas – 0.95

Catchments were determined based on landform and surface finishes. Layouts of the catchments are provided in the appendix with results summarised below:

<b>Catchment No.</b>	<b>Catchment Name</b>	<b>Area (m<sup>2</sup>)</b>	<b>Runoff Coefficient</b>
5	Crawley Yard & Carpark	1234	0.95
8	West of Footpath Landscaping	324	0.25
9	North of Year 9 Centre Landscaping	1252	0.25
10	South of Gym Landscaping	351	0.25
11	Year 9 Centre & Entrance Courtyard	3538	0.95

### 4.2 Pre-development Runoff

The Rational Method is used to determine the pre-development runoff for a 1% AEP event with a **10 minute** time of concentration and a **0.3** runoff coefficient. Allowable runoff for the new development was calculated to be:

- Year 9 Centre & Crawley Street Carpark – 70.3 litres / second

### 4.3 Roof Stormwater Collection

Rainfall collected from the roof of the year 9 building has been addressed in the previous report. Please refer to the 2022.152 SWMP for further details.

### 4.4 Infiltration during 1% AEP Storm Event

The hydraulic conductivity of the soil surrounding the matrix tank was determined in a single bore hole in close proximity to the proposed soakage area. During excavation of the bore hole the following soil profile was discovered:

- Topsoil to 200mm depth
- Medium grain, brown sand to 500mm depth
- Medium to coarse grain, white sand to 780mm depth
- Bore hole refusal at 780mm

The bore hole was pre-soaked with water prior to the soakage test to ensure the test reflected the soils capacity to infiltrate water when wet. A soakage test was constructed in the coarse sand and tested using the constant head method. Test details are included on sheet SW2 and the following results were determined:

- Soak Test 1 – 180mm/hr
- Soak Test 2 – 120mm/hr
- Soak Test 3 – 82mm/hr

It should be noted that previous soil tests on the subject site show that there is a layer of sandstone over dune sands which have high infiltration rates. Previous soakage tests conducted on the site that have managed to get below the sandstone have resulted in higher rates of hydraulic conductivity. For the purposes of this report, the average hydraulic conductivity of 137mm/hr was adopted for the design of the matrix tank as per sheet SW3. The proposed 5.5m x 2.4m x 1.5m soakage pit is expected to soak 0.75 L/s.

#### 4.5 Storage for 1% AEP Storm Event

The required storage volume for the proposed development is shown on sheet SW3 to limit development flows to peak pre-development flows for a 1% AEP storm event. Storage volumes are:

- Year 9 Centre – 65.0 kilolitres

It is proposed that the previously recommended 100 kilolitre rainwater detention / retention tank be retained to limit flows from the roof (see prior 2022.152 SWMP for further details). The underground infiltration tank was upsized to a 17.8 kilolitre to limit flows from surface water. The underground tank limits discharge flows to pre-development levels through both storing excess stormwater for later release and infiltrating some stormwater into groundwater stores. The raingarden also provides some storage capacity but is primarily used to improve stormwater discharge quality. For details refer to sheet C-12.

#### 4.6 Discharge for 1% AEP Storm Event

Discharge rates are to be limited to the 1% AEP rainfall event using an orifice plate located at the outlet of the underground infiltration tank. The orifice calculation can be found on sheet SW4 and is summarised below:

- Year 9 Centre, underground tank – 150mm dia. @ bottom of tank

The orifice for the above ground tanks was previously calculated in the 2022.152 report, please refer to this report for above ground tank details.

#### 4.7 Proposed Storm Water Connection Points

Proposed discharge points for each allotment are:

- Year 9 Centre – Stormwater pit at front of 5 Crawley Street

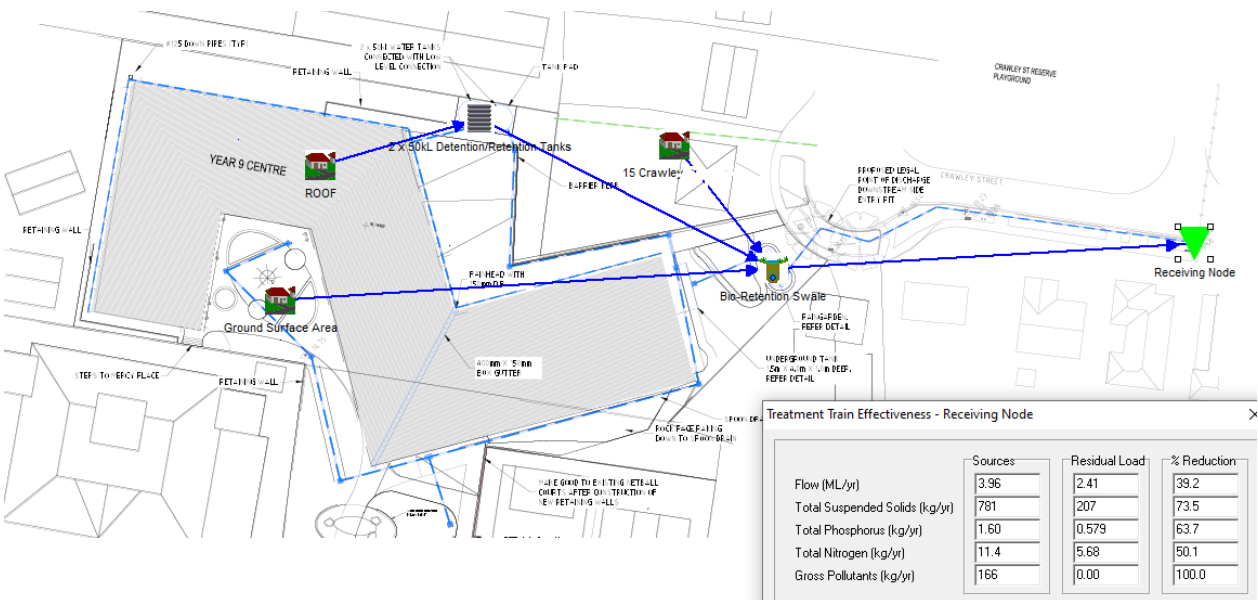
Pipe size for the connection between the raingarden and council drainage assets is 150mm uPVC.

**4.8 Overland Flow Path**

In storm events where the drainage system is exceeded, site stormwater will surcharge from the underground storage pit and head east down Crawley Street and south down Ardlie Street before ending up in the low-lying area between Conns Lane, Ardlie Street, Wentworth Street and Barbers Lane. Flows in a 1% AEP event will be limited to pre-development levels ensuring flooding in this area is not exacerbated.

**4.9 Stormwater Quality Treatment**

Upon review of the previous system (2022.152 SWMP) it was found that the proposed raingarden was able to be reduced in size and still meet BPEM. The proposed stormwater detention system & raingarden was modelled in MUSIC to determine the effectiveness of these treatments at reducing stormwater pollutants from entering the stormwater network. A summary of results is presented below as a screenshot and a table with detailed results provided in the appendix. The quality of stormwater leaving the site is expected to exceed BPEM requirements.



Source	Residual Loads	% Reduction	BPEM % Targets	
Flow (ML/yr)	3.96	2.41	39.2	-
Total Suspended Solids (kg/yr)	781	207	73.5	80
Total Phosphorus (kg/yr)	1.60	0.579	63.7	45
Total Nitrogen (kg/yr)	11.4	5.68	50.1	45
Gross Pollutants (kg/yr)	166	0.00	100.0	70

**PLANNING and ENVIRONMENT ACT**  
**Warnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
 Sheet 6 of 7

Signed: \_\_\_\_\_ for  
**MINISTER FOR PLANNING**  
 Date: 06 March 2024

## 5.0 CONCLUSION & RECOMENDATIONS

The adjusted Stormwater Management Plan for the proposed Year 9 Centre Development, requires the following works:

- Year 9 Centre (refer previous 2022.152 SWMP):
  - Connect all roof water down pipes by charged 125/150/225mm diameter stormwater pipe to a 100 kilolitre rainwater detention / retention tank.
  - Install 125mm diameter mid-level outlet in rainwater detention tank and connect to bioretention swale.
- Changes to Underground Drainage System to allow for potential future impervious surfaces:
  - Install 5m long 2m wide bioretention swale between outlet of underground drainage network and underground storage network for stormwater quality treatment.
  - Install underground 17.8 kilolitre detention / infiltration tank as per attached details.
  - Connect underground pit with 150mm diameter uPVC to legal point of discharge.

--- END OF REPORT ---



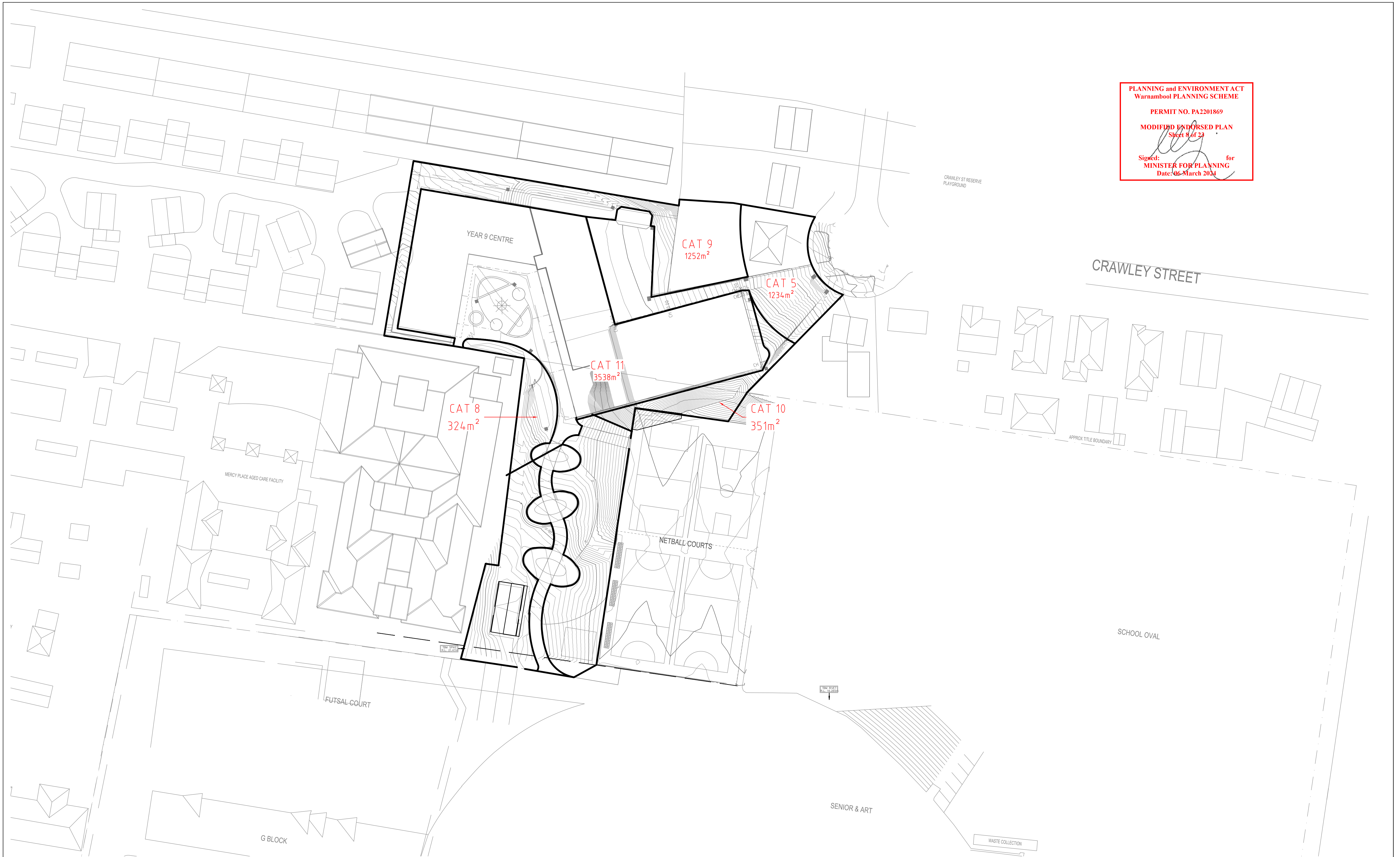


PLANNING and ENVIRONMENT ACT  
Warrnambool PLANNING SCHEME

PERMIT NO. PA2201869

MODIFIED ENDORSED PLAN  
Sheet 8 of 23

Signed:  for  
MINISTER FOR PLANNING  
Date: 06 March 2024



LAYOUT PLAN  
SCALE 1:500

REV.	DESCRIPTION	DATE
B	AMENDED PROJECT TITLE	28/02/2024
A	PRELIMINARY ISSUED FOR COMMENT	30/11/2023

APPROVED	
----------	---


APPROVED

**THE CSE GROUP.**  
CONSULTING ENGINEERS

116 Timor Street Warrnambool Vic 3280  
T. 03 5562 4930 F. 03 5562 0763  
E. engineers@thecsegroup.com.au  
thecsegroup.com.au

DESIGNED	SJB
DRAWN	MC
SCALE	A1 1:500
DATE	OCT 2023

PROJECT TITLE	EMMANUEL COLLEGE CRAWLEY STREET, WARRNAMBOOL
DRAWING TITLE	STORMWATER CATCHMENT PLAN

  
NORTH

PROJECT NO. 2023.197

SHEET SW1	REV. B
-----------	--------



Project: 2023.197  
Address: 15 CRAWLEY STREET, W'BOOL

Date: 29/8/23

Operators: SB, mic

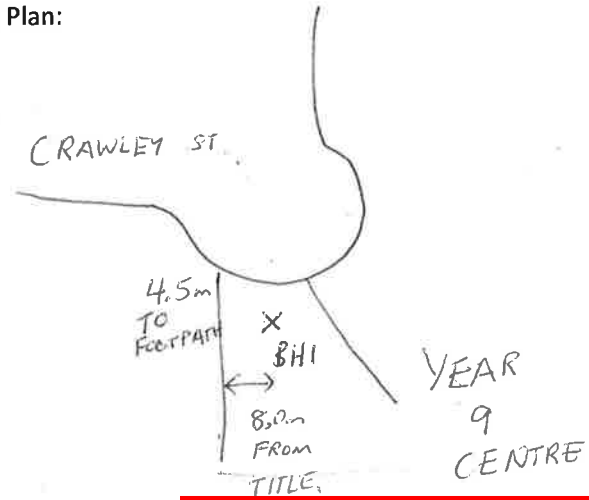
Test: **SOIL PERMEABILITY WORKSHEET**  
Auger:  Manual auger  Mechanical Auger  
Method:  Constant Head  Falling Head  
Comments:

Recent Weather: FAIR, SOME DRIZZLE  
Site Conditions: SUNNY

**Soak Well Properties**

Diameter Auger Hole: 0.055 m  
Diameter Tube: 0.035 m  
Diameter inner tube: 0.009 m  
Hole Depth at Start of Test D<sub>s</sub>: 780 mm  
Apparatus Depth D<sub>a</sub>: 250 mm  
Hole depth at end of test D<sub>e</sub>: \_\_\_\_\_ mm  
Test Depth (=D<sub>e</sub>-D<sub>a</sub>): 530 mm

Site Plan:



**Bore Hole Log**

Start	End	Description
0	200	BLACK TOPSOIL
200	500	RED SAND FINE GRAW
500	780	YELLOW SAND & SANDSTONE
780		BH Refusal

**PLANNING and ENVIRONMENT ACT**  
**Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
Sheet 9 of 23

Signed: \_\_\_\_\_ for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

Test 1 SHIELD

Test 2 - SHIELD

Test 3 - SHIELD

Reading (mm)	Time (m:ss)	Interval (s)
100		
200		
300	27	
400	44	17
500	1:01	16
600	1:20	19
700	1:40	20
800	2:02	22
900	2:26	24
1000	2:50	24
1100		
1200		
1300		

Reading (mm)	Time (m:ss)	Interval (s)
100		
200	1:26	
300	1:57	31
400	2:25	28
500	2:54	29
600	3:24	30
700	3:53	29
800	4:23	30
900	4:53	30
1000	5:24	31
1100		
1200		
1300		

Reading (mm)	Time (m:ss)	Interval (s)
100		
200		
300		
400	1:54	
500	2:36	
600	3:17	
700	3:59	42
800	4:42	43
900		
1000		
1100		
1200		
1300		

100mm Interval: 20 s  
Permeability: 180 mm/h

100mm Interval: 30 s  
Permeability: 120 mm/h

100mm Interval: 42 s  
Permeability: 82 mm/h

2023.197 Emmanuel College 15 Crawley St  
15 Crawley Street, Warrnambool, 3280

**Soakage Testing**

**Soak Test 1**

**Location:** See Field Sheet **Date:** 29-Aug-23  
**Method:** CHT **By:** SB, MC  
**Site Conditions:** Grassed area. Slight fall to SE  
**Recent Weather:** Warm, fine for several days  
**Comments:** Hole presoaked for several minutes.

Soak Well Properties		Round Well
Diameter (auger hole)	0.055	m
Diameter (tube)	0.035	m
Diameter (inner tube)	0.009	m
Depth	0.530	m
Vol.	1.26	L

**PLANNING and ENVIRONMENT ACT**  
**Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
**Sheet 10 of 23**

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

**Constant Head Test**

$$k_h = Q / [ \pi r_o^2 + 2\pi r_o h ]$$

$$Q = V_c / t_c$$

**Test 1**

Water Source	Time		Reading (m)	Discharge (m <sup>3</sup> /s)	k <sub>h</sub> Soil Conductivity		Comments
	(min)	(sec)			m/sec	mm/hr	
Constant Head Assembly	0	27	0.3				
	0	44	0.4	5.29E-06	5.63E-05	202.5	
	1	1	0.5	5.29E-06	5.63E-05	202.5	
	1	20	0.6	4.73E-06	5.03E-05	181.2	
	1	40	0.7	4.49E-06	4.78E-05	172.1	
	2	2	0.8	4.08E-06	4.35E-05	156.5	
	2	26	0.9	3.74E-06	3.98E-05	143.4	
	2	50	1	3.74E-06	3.98E-05	143.4	

Average k<sub>h</sub>      172      mm/hr

**Test 2**

Water Source	Time		Reading (m)	Discharge (m <sup>3</sup> /s)	k <sub>h</sub> Soil Conductivity		Comments
	(min)	(sec)			m/sec	mm/hr	
stant Head Assembly	1	26	0.2				
	1	57	0.3	2.90E-06	3.08E-05	111.1	
	2	25	0.4	3.21E-06	3.42E-05	123.0	
	2	54	0.5	3.10E-06	3.30E-05	118.7	
	3	24	0.6	2.99E-06	3.19E-05	114.8	
	3	53	0.7	3.10E-06	3.30E-05	118.7	
	4	23	0.8	2.99E-06	3.19E-05	114.8	
	4	53	0.9	2.99E-06	3.19E-05	114.8	
	5	24	1	2.90E-06	3.08E-05	111.1	

2023.197 Emmanuel College 15 Crawley St  
15 Crawley Street, Warrnambool, 3280

**Soakage Testing**

Con							
-----	--	--	--	--	--	--	--

Average  $k_h$  116 mm/hr

**Test 3**

Water Source	Time		Reading (m)	Discharge (m <sup>3</sup> /s)	$k_h$ Soil Conductivity		Comments
	(min)	(sec)			m/sec	mm/hr	
Constant Head Assembly	1	54	0.4				
	2	36	0.5	2.14E-06	2.28E-05	82.0	
	3	17	0.6	2.19E-06	2.33E-05	84.0	
	3	59	0.7	2.14E-06	2.28E-05	82.0	
	4	42	0.8	2.09E-06	2.22E-05	80.1	

Average  $k_h$  82 mm/hr

**PLANNING and ENVIRONMENT ACT**  
**Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
Sheet 11 of 23

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

2022.152 Emmanuel College - Year Nine Centre  
140 Botanic Road, Warrnambool, 3280

**MODIFIED ENDORSED PLAN**  
Sheet 12 of 23

**Storage & Infiltration Calculation**

**Site Characteristics**

	Area (m <sup>2</sup> )	Runoff Coefficient	C x A
CAT 11 Year 9 Centre and yard	3538	0.95	3361.1
CAT 5 Crawley yard & carpark	1234	0.95	1172.3
CAT 9 North grass	1252	0.25	313
CAT 8 West of footpath grass	324	0.25	81
South east of gym	351	0.25	87.75

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

**Totals (m<sup>2</sup>)** 6699 5015 75% Impervious

**Predevelopment Runoff**

Predev. Runoff Coefficient - C	0.3
Find CA (Total Area by C)	2009.7 m <sup>2</sup>
Storm Event	1% AEP
Time of Concentration	10 mins
Locality Code	WARR Warrnambool
Intensity - I	126.0 mm/hr
Runoff Q = CAI / 3600	70.3 L/s

**WSUD Measures**

		Effective Infiltration Area (m <sup>2</sup> )	Storage Volume (m <sup>3</sup> )
<b>Rainwater Tank</b>			
Number of tanks	1		
Detention Volume	50 m <sup>3</sup>		
Retention Volume	50 m <sup>3</sup>		
% retention for private use	50%	Vol = n * (pi * D <sup>2</sup> /4 * h) * (1-percentage)	50.00
<b>Underground Matrix Pit</b>			
Length - L	5.5 m	Base Infiltration Area A <sub>int</sub> = WxLx(1-F <sub>b</sub> )	13.20
Width - W	2.4 m	Perimeter Infiltration Area = 0.5*P*D	11.85
Depth of Storage - d	1.5 m		
Infiltration Blockage Factor - F <sub>b</sub>	0%	<b>Storage Volume</b>	<b>17.82</b>
Storage Porosity P <sub>s</sub>	90%	S <sub>B</sub> = L x W x d x P <sub>s</sub> + (LxWxd <sub>bed</sub> )	
Infiltration Bed Depression d <sub>bed</sub>	0 m		
<b>Swale</b>			
Length - L	5 m	Base Infiltration Area A <sub>int</sub> = WxLx(1-F <sub>b</sub> )	10.00
Width - W	2 m	Perimeter Infiltration Area = 0.5*P*D*(1-F <sub>b</sub> )	4.20
Depth of Storage - d <sub>i</sub>	0.6 m	<b>Storage Volume - infiltration media</b>	<b>1.20</b>
Infiltration Blockage Factor - F <sub>b</sub>	0%	S <sub>i</sub> = L x W x d <sub>i</sub> x P <sub>s</sub>	
Storage Porosity P <sub>s</sub>	20%	Basin Vol. S <sub>3</sub> = L ((W d <sub>w</sub> ) + ((d <sub>w</sub> ) <sup>2</sup> /2))	2.60
Infiltration Bed Depression d <sub>w</sub>	0.2 m		
<b>TOTALS</b>		<b>39.25</b>	<b>71.62</b>

**Soil Characteristics**

Soil K <sub>n</sub>	137 mm/hr	Infiltration Rate*	7.49E-04 m <sup>3</sup> /s
	3.81E-05 m/s		0.749 L/s
Moderating Factor - U	0.5 Sandy soil		
<b>Allow Piped Outflow Q<sub>p</sub></b>	<b>70.3 L/s</b>	Equal to Predevelopment Runoff Conditions (unless no connection available)	

**1% AEP Rainfall Event**

Time (Duration) min	Rainfall Intensity mm/hr	Volume In CAID/60,000 I <sub>v</sub> (m <sup>3</sup> )	Piped flow O <sub>s</sub> (m <sup>3</sup> )	Nett Inflow Vol. I <sub>v</sub> - O <sub>p</sub> (m <sup>3</sup> )	Soakage Out [A <sub>int</sub> ] Uk <sub>s</sub> t O <sub>s</sub> (m <sup>3</sup> )	Storage Volume Required S <sub>R</sub> =I <sub>v</sub> -O <sub>s</sub> -O <sub>s</sub> (m <sup>3</sup> )	Percentage of storage provided S <sub>T</sub> / S <sub>R</sub> %	Storage area adequate
0	0	0	0	0	0	0		Yes
1	268.0	22.40	4.22	18.18	0.04	18.14	395%	Yes
2	202.0	33.77	8.44	25.33	0.09	25.24	284%	Yes
3	185.0	46.39	12.66	33.73	0.13	33.59	213%	Yes
4	173.0	57.84	16.88	40.96	0.18	40.78	176%	Yes
5	163.0	68.12	21.10	47.02	0.22	46.80	153%	Yes
10	126.0	105.32	42.20	63.11	0.45	62.67	114%	Yes
15	103.0	129.14	63.31	65.83	0.67	65.16	110%	Yes
20	86.3	144.27	84.41	59.86	0.90	58.96	121%	Yes
25	74.8	156.31	106	50.80	1.12	49.67	144%	Yes
30	66.1	165.75	127	39.14	1.35	37.79	190%	Yes
45	49.6	186.56	190	0.00	0.00	0.00		Yes
60	40.3	202.11	253	0.00	0.00	0.00		Yes
90	30.1	226.43	380	0.00	0.00	0.00		Yes
120	24.6	246.75	506	0.00	0.00	0.00		Yes
180	18.6	279.85	760	0.00	0.00	0.00		Yes
270	14.3	322.72	1139	0.00	0.00	0.00		Yes
360	12.0	361.09	1519	0.00	0.00	0.00		Yes
540	9.3	421.57	2279	0.00	0.00	0.00		Yes
720	7.8	471.22	3039	0.00	0.00	0.00		Yes
1080	6.1	547.96	4558	0.00	0.00	0.00		Yes
1440	5.0	603.02	6077	0.00	0.00	0.00		Yes
1800	4.3	643.95	7597	0.00	0.00	0.00		Yes
2160	3.7	675.24	9116	0.00	0.00	0.00		Yes
2880	3.0	717.37	12155	0.00	0.00	0.00		Yes
4320	2.1	761.90	18232	0.00	0.00	0.00		Yes
5760	1.6	779.96	24309	0.00	0.00	0.00		Yes
7200	1.3	794.40	30387	0.00	0.00	0.00		Yes
8640	1.1	801.62	36464	0.00	0.00	0.00		Yes
10080	1.0	86.40	4947	0.00	0.00	0.00		Yes



**2023.197 Emmanuel College 15 Crawley St  
15 Crawley Street, Warrnambool, 3280**

**Orifice Plate**

$Q = C_d a_o \sqrt{[2gh]}$

Rate of Discharge

$C_d$	0.63		Coefficeint of Discharge
$Q$	70	L/s	Flow Rate
	0.07	m <sup>3</sup> /s	
$h$	1.5	m	Water height above orifice
$g$	9.81	m/s	m/s gravity
$a_o$	0.020482	m <sup>2</sup>	Area of Orifice

<b>Orifice Dia.</b>	<b>0.161</b>	m
	161	mm

**PLANNING and ENVIRONMENT ACT  
Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
Sheet 13 of 23

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

Location	ROOF	Ground Surface Area	15 Crawley Carpark
ID	1	5	6
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Total Area (ha)	0.313	0.3	0.072
Area Impervious (ha)	0.313	0.224421053	0.065024211
Area Pervious (ha)	0	0.075578947	0.006975789
Field Capacity (mm)	80	80	80
Pervious Area Infiltration Capacity coefficient - a	200	200	200
Pervious Area Infiltration Capacity exponent - b	1	1	1
Impervious Area Rainfall Threshold (mm/day)	1	1	1
Pervious Area Soil Storage Capacity (mm)	120	120	120
Pervious Area Soil Initial Storage (% of Capacity)	30	30	30
Groundwater Initial Depth (mm)	10	10	10
Groundwater Daily Recharge Rate (%)	25	25	25
Groundwater Daily Baseflow Rate (%)	5	5	5
Groundwater Daily Deep Seepage Rate (%)	0	0	0
Stormflow Total Suspended Solids Mean (log mg/L)	2.2	2.2	2.2
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.32
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic
Stormflow Total Suspended Solids Serial Correlation	0	0	0
Stormflow Total Phosphorus Mean (log mg/L)	-0.45	-0.45	-0.45
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic
Stormflow Total Phosphorus Serial Correlation	0	0	0
Stormflow Total Nitrogen Mean (log mg/L)	0.42	0.42	0.42
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic
Stormflow Total Nitrogen Serial Correlation	0	0	0

Location	ROOF	Ground Surface Area	15 Crawley Carpark
Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.17
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic
Baseflow Total Suspended Solids Serial Correlation	0	0	0
Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.19
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic
Baseflow Total Phosphorus Serial Correlation	0	0	0
Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.12
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic
Baseflow Total Nitrogen Serial Correlation	0	0	0
OUT - Mean Annual Flow (ML/yr)	2	1.54	0.423
OUT - TSS Mean Annual Load (kg/yr)	418	305	85.4
OUT - TP Mean Annual Load (kg/yr)	0.843	0.622	0.174
OUT - TN Mean Annual Load (kg/yr)	5.75	4.34	1.21
OUT - Gross Pollutant Mean Annual Load (kg/yr)	82.2	66.4	17.8
No Imported Data Source nodes			

**PLANNING and ENVIRONMENT ACT  
Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**

Sheet 15 of 23

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

Location	2 x 50kL Detention/Retention Tanks	Bio-Retention Swale
ID	2	3
Node Type	RainWaterTankNode	BioRetentionNode
Lo-flow bypass rate (cum/sec)	0	0
Hi-flow bypass rate (cum/sec)	100	100
Inlet pond volume	0	
Area (sqm)	50	5
Extended detention depth (m)	1	0
Permanent pool volume (cum)	50	
Proportion vegetated	0	
Equivalent pipe diameter (mm)	125	
Overflow weir width (m)	10	2
Notional Detention Time (hrs)	0.381	
Orifice discharge coefficient	0.6	
Weir coefficient	1.7	1.7
Number of CSTR cells	2	3
Total Suspended Solids k (m/yr)	400	8000
Total Suspended Solids C* (mg/L)	12	20
Total Suspended Solids C** (mg/L)	12	
Total Phosphorus k (m/yr)	300	6000
Total Phosphorus C* (mg/L)	0.13	0.13
Total Phosphorus C** (mg/L)	0.13	
Total Nitrogen k (m/yr)	40	500
Total Nitrogen C* (mg/L)	1.4	1.4
Total Nitrogen C** (mg/L)	1.4	
Threshold hydraulic loading for C** (m/yr)	3500	
Extraction for Re-use	On	Off
Annual Re-use Demand - scaled by daily PET (ML)	0	



**PLANNING and ENVIRONMENT ACT**  
**Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
Sheet 17 of 23

**Signed:**  **for**  
**MINISTER FOR PLANNING**  
**Date: 06 March 2024**

Location	2 x 50kL Detention/Retention Tanks	Bio-Retention Swale
Constant Daily Re-use Demand (kL)	0.6	
User-defined Annual Re-use Demand (ML)	0	
Percentage of User-defined Annual Re-use Demand Jan	8.333333333	
Percentage of User-defined Annual Re-use Demand Feb	8.333333333	
Percentage of User-defined Annual Re-use Demand Mar	8.333333333	
Percentage of User-defined Annual Re-use Demand Apr	8.333333333	
Percentage of User-defined Annual Re-use Demand May	8.333333333	
Percentage of User-defined Annual Re-use Demand Jun	8.333333333	
Percentage of User-defined Annual Re-use Demand Jul	8.333333333	
Percentage of User-defined Annual Re-use Demand Aug	8.333333333	
Percentage of User-defined Annual Re-use Demand Sep	8.333333333	
Percentage of User-defined Annual Re-use Demand Oct	8.333333333	
Percentage of User-defined Annual Re-use Demand Nov	8.333333333	
Percentage of User-defined Annual Re-use Demand Dec	8.333333333	
Filter area (sqm)		10
Filter depth (m)		0.3
Filter median particle diameter (mm)		2
Saturated hydraulic conductivity (mm/hr)		360
Voids ratio		0.3
Length (m)		
Bed slope		
Base Width (m)		
Top width (m)		
Vegetation height (m)		
Proportion of upstream impervious area treated		
Seepage Rate (mm/hr)	0	360
Evap Loss as proportion of PET	0	

Location	2 x 50kL Detention/Retention Tanks	Bio-Retention Swale
Depth in metres below the drain pipe		0
IN - Mean Annual Flow (ML/yr)	2	3.74
IN - TSS Mean Annual Load (kg/yr)	418	502
IN - TP Mean Annual Load (kg/yr)	0.843	1.18
IN - TN Mean Annual Load (kg/yr)	5.75	9.55
IN - Gross Pollutant Mean Annual Load (kg/yr)	82.2	84.2
OUT - Mean Annual Flow (ML/yr)	1.78	2.41
OUT - TSS Mean Annual Load (kg/yr)	112	213
OUT - TP Mean Annual Load (kg/yr)	0.382	0.593
OUT - TN Mean Annual Load (kg/yr)	4.01	5.6
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0
No Generic treatment nodes		

**PLANNING and ENVIRONMENT ACT**  
**Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
**Sheet 18 of 23**

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

Location	Receiving Node
ID	4
Node Type	ReceivingNode
IN - Mean Annual Flow (ML/yr)	2.41
IN - TSS Mean Annual Load (kg/yr)	213
IN - TP Mean Annual Load (kg/yr)	0.593
IN - TN Mean Annual Load (kg/yr)	5.6
IN - Gross Pollutant Mean Annual Load (kg/yr)	0
OUT - Mean Annual Flow (ML/yr)	0
OUT - TSS Mean Annual Load (kg/yr)	0
OUT - TP Mean Annual Load (kg/yr)	0
OUT - TN Mean Annual Load (kg/yr)	0
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0

**PLANNING and ENVIRONMENT ACT  
Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN  
Sheet 19 of 23**

Signed:  for  
**MINISTER FOR PLANNING**  
Date: **06 March 2024**

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	1	5	2	3	6
Target node ID	2	3	3	4	3
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K					
Muskingum theta					
IN - Mean Annual Flow (ML/yr)	2	1.54	1.78	2.41	0.423
IN - TSS Mean Annual Load (kg/yr)	418	305	112	213	85.4
IN - TP Mean Annual Load (kg/yr)	0.843	0.622	0.382	0.593	0.174
IN - TN Mean Annual Load (kg/yr)	5.75	4.34	4.01	5.6	1.21
IN - Gross Pollutant Mean Annual Load (kg/yr)	82.2	66.4	0	0	17.8
OUT - Mean Annual Flow (ML/yr)	2	1.54	1.78	2.41	0.423
OUT - TSS Mean Annual Load (kg/yr)	418	305	112	213	85.4
OUT - TP Mean Annual Load (kg/yr)	0.843	0.622	0.382	0.593	0.174
OUT - TN Mean Annual Load (kg/yr)	5.75	4.34	4.01	5.6	1.21
OUT - Gross Pollutant Mean Annual Load (kg/yr)	82.2	66.4	0	0	17.8

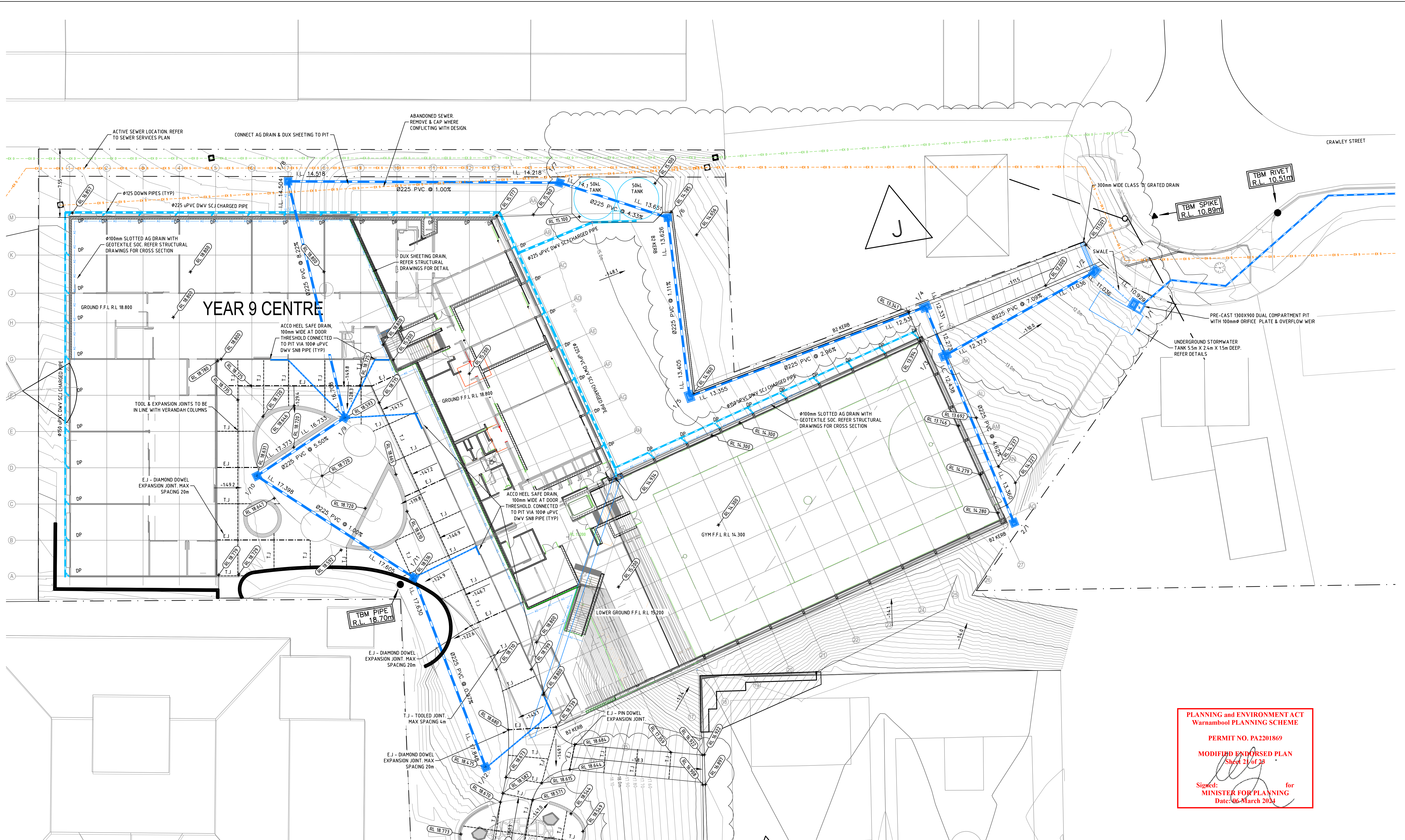
**PLANNING and ENVIRONMENT ACT**  
**Warrnambool PLANNING SCHEME**

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
Sheet 20 of 23

Signed:  for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024





**PLANNING and ENVIRONMENT ACT**  
Warrnambool PLANNING SCHEME

**PERMIT NO. PA2201869**

**MODIFIED ENDORSED PLAN**  
Sheet 21 of 28

Signed: [Signature] for  
**MINISTER FOR PLANNING**  
Date: 06 March 2024

REV.	DESCRIPTION	DATE
J	NETBALL RAMP & UNDERGROUND SW TANK ADJUSTMENT	30/11/2023
I	ADJUSTMENT TO LABELS & RELOCATION OF TANKS	25/05/2023
H	TENDER ADDENDUM	16/05/2023
G	MINOR AMENDMENTS FOR TENDER ISSUE	24/04/2023
F	TENDER ISSUE	21/04/2023
E	TENDER ISSUE	11/04/2023
D	ISSUED FOR TENDER COORDINATION	16/03/2023

APPROVED

**THE CSE GROUP.**  
CONSULTING ENGINEERS

116 Timor Street Warrnambool Vic 3280  
T. 03 5562 4930 F. 03 5562 0763  
E. engineers@thecsegroup.com.au  
thecsegroup.com.au

DESIGNED	S. Brodie
DRAWN	A. Stevenson
SCALE	1:200
DATE	APRIL 2023

**PROJECT TITLE**  
YEAR 9 CENTRE AND CARPARK  
EMMANUEL COLLEGE  
BOTANIC ROAD, WARRNAMBOOL

**DRAWING TITLE**  
BUILDING LAYOUT PLAN

**PROJECT NO.**  
2022.152

**SHEET**  
C-12

**REV.**  
J

**NORTH**

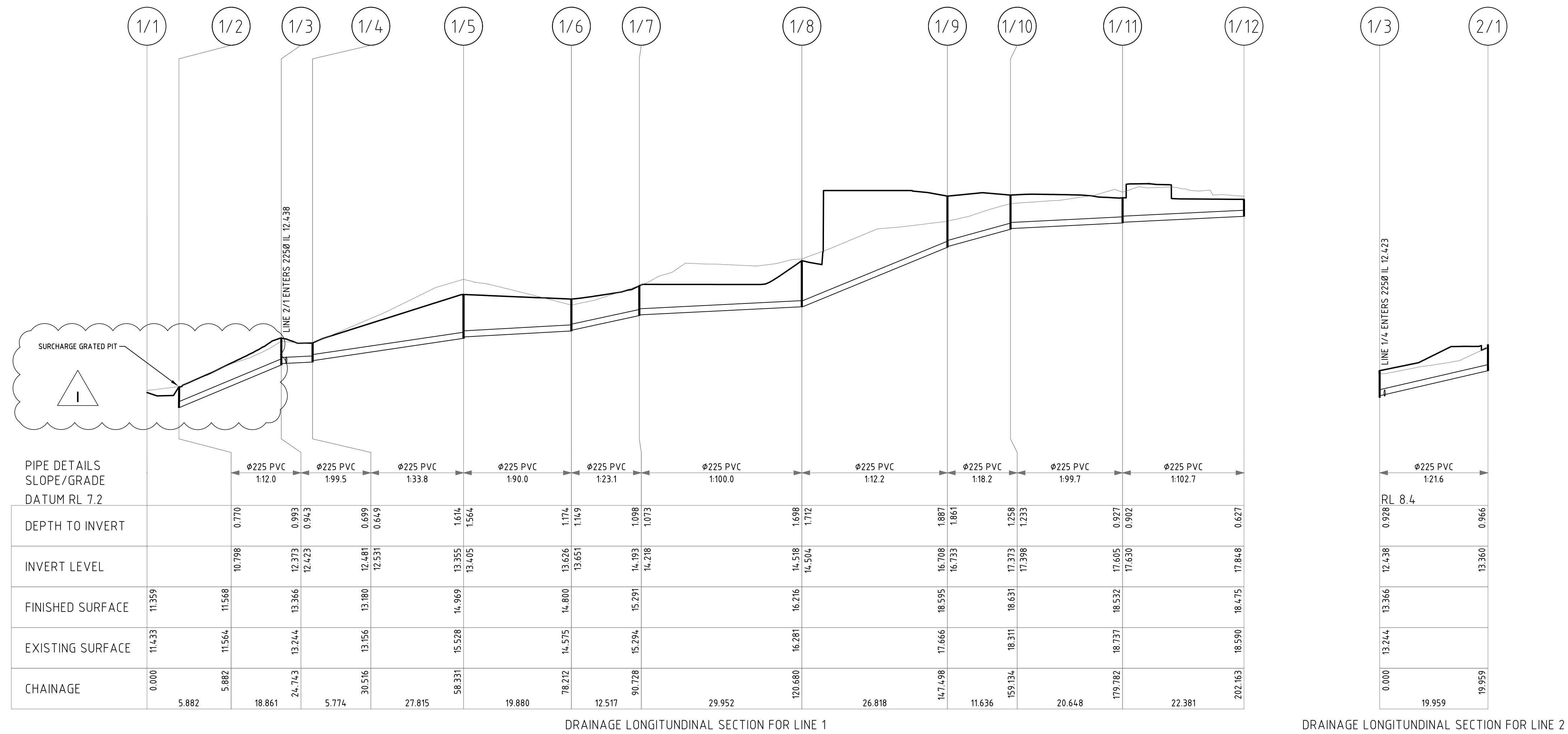


PLANNING and ENVIRONMENT ACT  
Warrnambool PLANNING SCHEME

PERMIT NO. PA2201869

MODIFIED ENDORSED PLAN  
Sheet 22 of 23

Signed: *[Signature]* for  
MINISTER FOR PLANNING  
Date: 06 March 2024



DRAINAGE LONGITUDINAL SECTION FOR LINE 1

DRAINAGE LONGITUDINAL SECTION FOR LINE 2

REV.	DESCRIPTION	DATE
I	NETBALL RAMP & UNDERGROUND SW TANK ADJUSTMENT	30/11/2023
H	TENDER ADDENDUM	16/05/2023
G	MINOR AMENDMENTS FOR TENDER ISSUE	24/04/2023
F	TENDER ISSUE	21/04/2023
E	TENDER ISSUE	11/04/2023
D	ISSUED FOR TENDER COORDINATION	16/03/2023

APPROVED

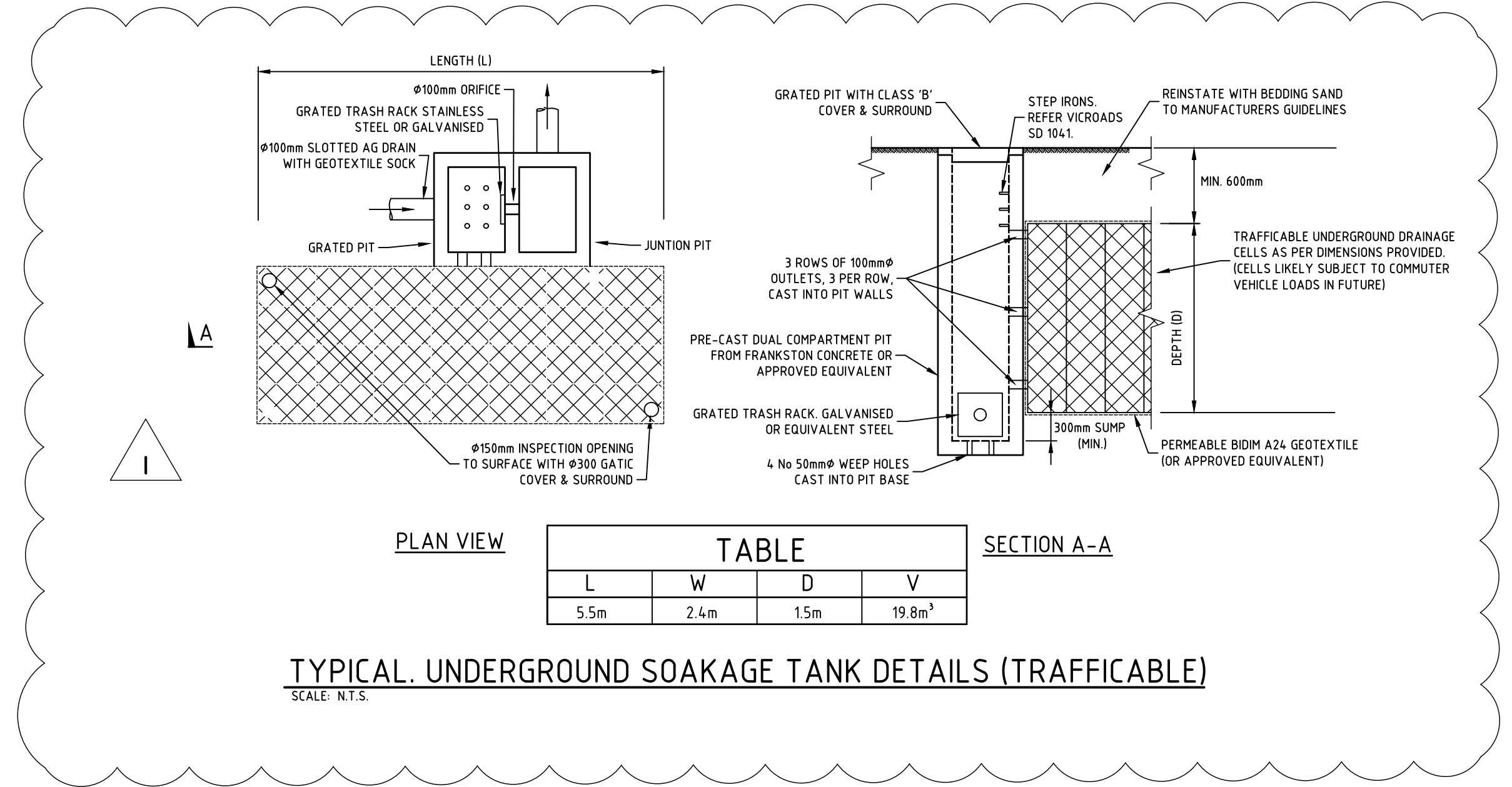
**THE CSE GROUP.**  
CONSULTING ENGINEERS

116 Timor Street Warrnambool Vic 3280  
T. 03 5562 4930 F. 03 5562 0763  
E. engineers@thecsegroup.com.au  
thecsegroup.com.au

DESIGNED	S. Brodie
DRAWN	A. Stevenson
SCALE	A1 AS SHOWN
DATE	APRIL 2023

PROJECT TITLE	YEAR 9 CENTRE AND CARPARK EMMANUEL COLLEGE BOTANIC ROAD, WARRNAMBOOL
DRAWING TITLE	DRAINAGE LONGITUDINAL SECTION

PROJECT NO.	2022.152
SHEET	C-21
REV.	I



PLAN VIEW

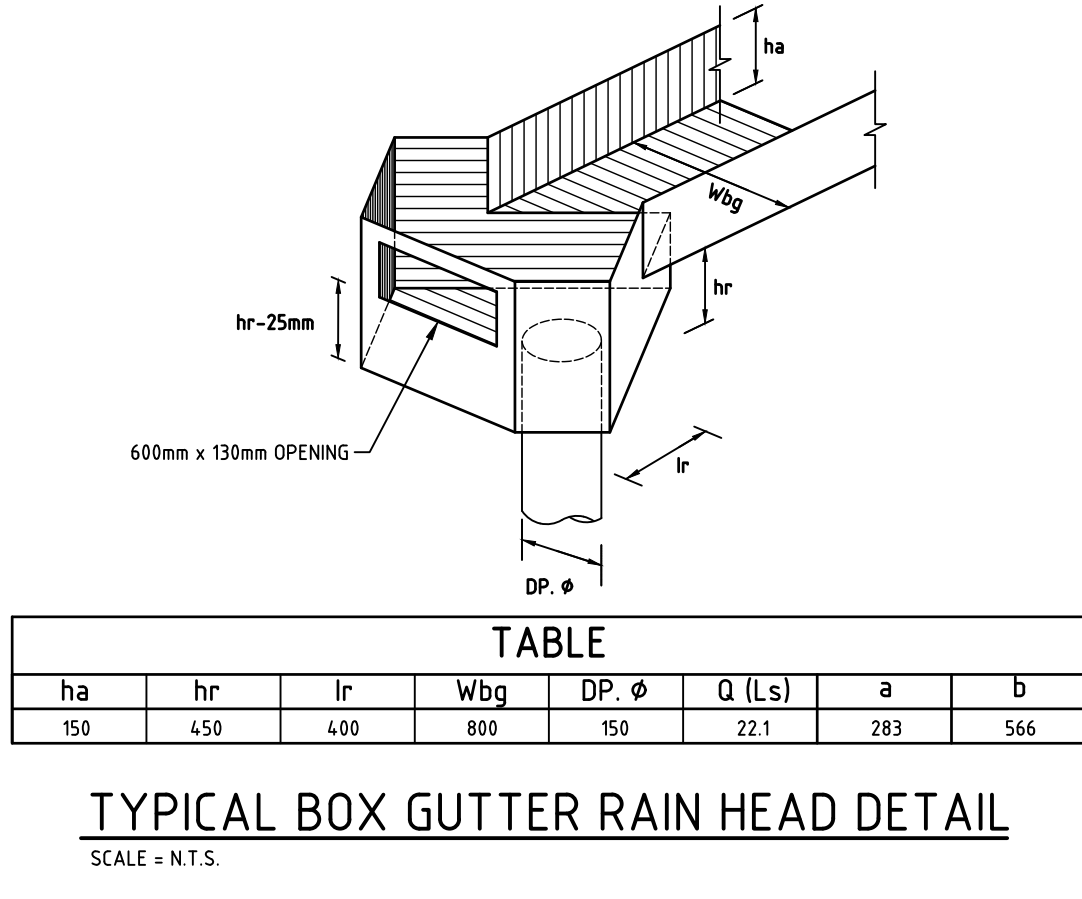
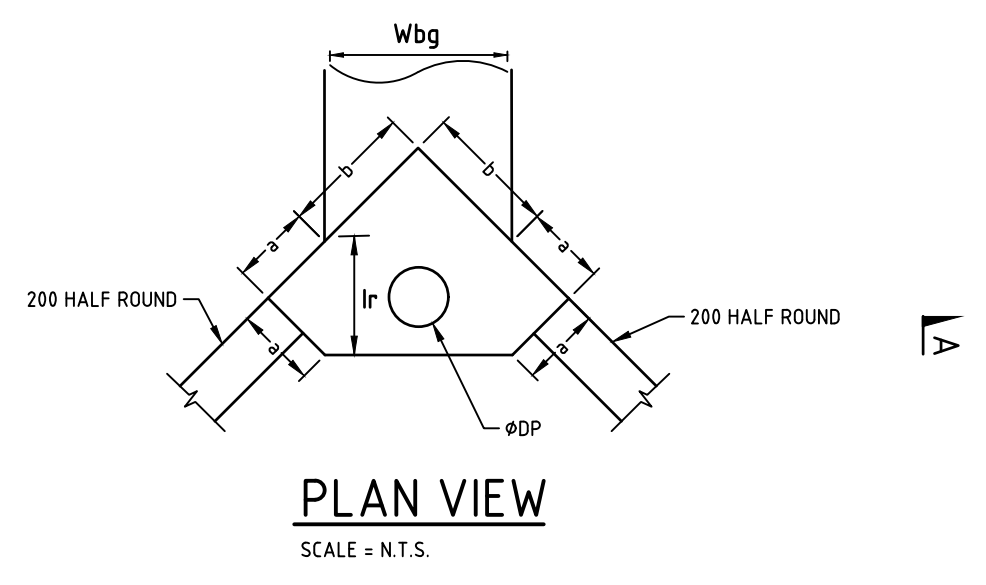
TABLE			
L	W	D	V
5.5m	2.4m	1.5m	19.8m <sup>3</sup>

SECTION A-A

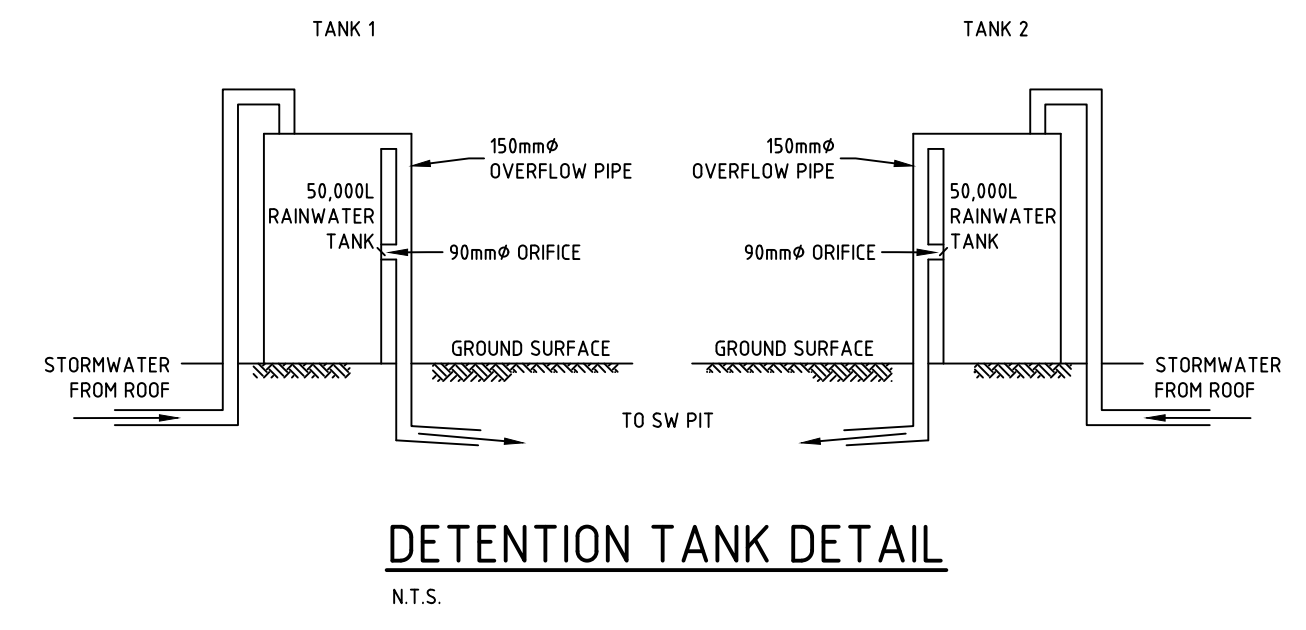
TYPICAL UNDERGROUND SOAKAGE TANK DETAILS (TRAFFICABLE)  
SCALE: N.T.S.

Pit Schedule - Surface SW

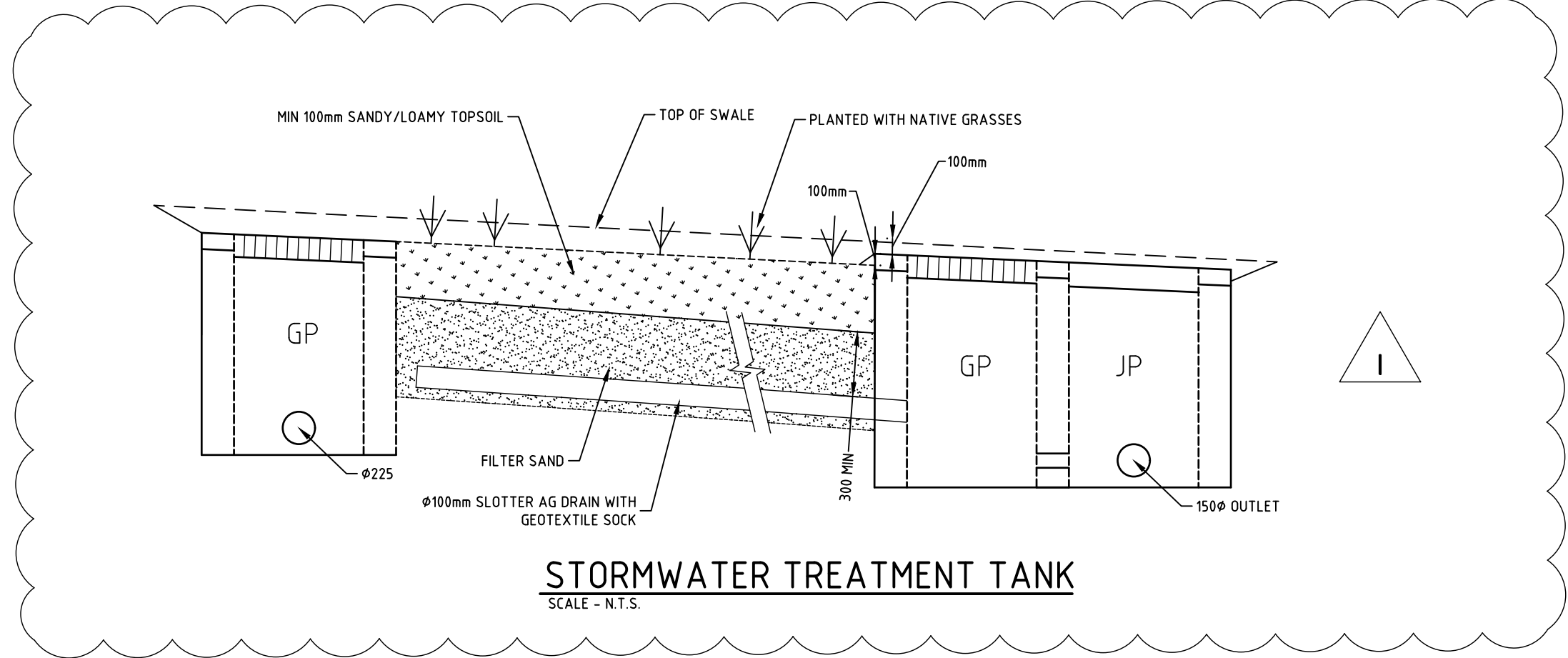
Pit No.	Pit Type	Pit Width	Pit Length	Outlet Diameter	Outlet Invert RL	Inlet Diameter	Inlet Invert RL	Pit Depth	Pit Lid Level	Easting	Northing	Comment
		(mm)	(mm)	(mm)	(m)	(mm)	(m)	(m)	(m)	(m)	(m)	
1/1	GP 900x600	600	900			225	8.959	2.400	11.359	628984.04	5752236.062	PRE-CAST 1300X900 DUAL COMPARTMENT PIT
1/2	GP 900x600	600	900	225	10.794	225	10.798	0.678	11.472	628980.43	5752240.318	GRATED SURCHARGE PIT
1/3	GP 900x600	600	900	225	12.373	225	12.423	0.993	13.366	628962.58	5752233.911	
1/4	GP 900x600	600	900	225	12.481	225	12.531	0.699	13.180	628961.34	5752239.550	CLASS 'D' LID
2/1	GP 600x600	600	600	225	13.360			0.966	14.326	628967.03	5752214.456	
1/5	GP 900x600	600	900	225	13.355	225	13.405	1.614	14.969	628934.06	5752234.126	CLASS 'D' LID
1/6	GP 600x600	600	600	225	13.626	225	13.651	1.174	14.800	628934.94	5752253.987	CLASS 'D' LID
1/7	GP 600x600	600	600	225	14.193	225	14.218	1.103	15.296	628923.83	5752259.754	
1/8	GP 600x600	600	600	225	14.518	225	14.504	1.698	16.216	628894.32	5752264.864	
1/9	GP 600x600	600	600	225	16.708	225	16.733	1.887	18.595	628896.16	5752238.109	
1/10	GP 600x600	600	600	225	17.373	225	17.398	1.258	18.631	628885.53	5752233.373	
1/11	GP 600x600	600	600	225	17.605	225	17.630	0.927	18.532	628900.76	5752219.438	
1/12	GP 600x600	600	600	225	17.848			0.627	18.475	628905.10	5752197.480	



SEVERAL CHANGES TO INLET & OUTLET HEIGHTS



PLANNING and ENVIRONMENT ACT  
Warnambool PLANNING SCHEME  
PERMIT NO. PA2201869  
MODIFIED ENDORSED PLAN  
Sheet 23 of 23  
Signed: [Signature] for  
MINISTER FOR PLANNING  
Date: 06-March 2024



REV.	DESCRIPTION	DATE
I	NETBALL RAMP & UNDERGROUND SW TANK ADJUSTMENT	30/11/2023
H	TENDER ADDENDUM	16/05/2023
G	MINOR AMENDMENTS FOR TENDER ISSUE	24/04/2023
F	TENDER ISSUE	21/04/2023
E	TENDER ISSUE	11/04/2023
D	ISSUED FOR TENDER COORDINATION	16/03/2023

APPROVED

THE CSE GROUP  
CONSULTING ENGINEERS

116 Timor Street Warnambool Vic 3280  
T. 03 5562 4930 F. 03 5562 0763  
E. engineers@thecsegroup.com.au  
thecsegroup.com.au

DESIGNED: S. Brodie  
DRAWN: A. Stevenson  
SCALE: A1 1:500  
DATE: APRIL 2023

PROJECT TITLE  
YEAR 9 CENTRE AND CARPARK  
EMMANUEL COLLEGE  
BOTANIC ROAD, WARRNAMBOOL  
DRAWING TITLE  
STORMWATER DETAILS

PROJECT No.  
2022.152  
SHEET C-32 REV. I