CONCEPTUAL STORMWATER MANAGEMENT PLAN

Proposed Commercial Development

DEVELOPMENT ADDRESS

Valley Drive
Lithgow, NSW 2790

LEGAL DESCRIPTION

Pt LOT 26 DP1244557

FOR

Ceedive Pty Ltd

ORIGINAL REPORT DATE
March 2022

AMENDMENT / DATE
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Report Details

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Valley Drive
Lithgow, NSW 2790

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FIGURES

1. INTRODUCTION

Developer	Ceedive Pty Ltd
Address	Valley Drive, Lithgow, NSW 2790
Local Authority	Lithgow City Council
Property Description	Pt LOT 26 DP1244557
Size of Development	Approx. ~1.46ha
Type of Development	Proposed Commercial Development
Time to Undertake Works	6 – 9 Months
Existing Land Use & Zone	Currently Vacant Land – B4 Mixed Use
Adjacent Land Use & Zone	Adjacent sites comprise of existing residential dwellings & commercial development – B4 Mixed Used, R1 General Residential
Engineering Consultant	Calare Civil
Report Written By	Grant Lyons
Qualifications	Senior Civil Designer
Experience	25+ years civil engineering experience. 10 years New Zealand, 2 years England & 15+ years Australia, Prepared Stormwater Management Plans since 2004 (2006 Australia).
Report Checked By	Garth Dean BE (Civil) - Director
Qualifications	BE, CPEng
Experience	30+ Years Civil Engineering Experience
Purpose of Report	To ascertain the requirements to control stormwater exiting the site and ensure that it has no adverse effect on the downstream receiving waters. This report addresses the issue of quality & quantity runoff.

2. SITE DESCRIPTION

2.1. Proposed Development

The proposed development is located on the southern side of Valley Drive, Lithgow approximately 190m south east of the intersection with Hassans Walls Road.

The development is on a 1.46 ha portion of the existing Lot 26 DP1244557 for which the entire site is approximately 58ha.

It is intended to construct a Bunnings small format store on the site with associated access and carparking.

Additionally a private access to service the Bunnings site will be constructed to Council standards outside of the principle development lot but within the balance Lot 26 DP1244557.

2.2. Topography & Existing Drainage

A portion of the site has been excavated to a flat pad while the remainder is natural. There is a difference in elevation between the pad and the natural surface above of some 6m. The grade of the upper level is around 7% falling towards the existing pad.

The existing cut pad will have to be extended to enable the construction for the proposed extents.

As the site will be reshaped due to the development, considerations have been taken into account for the future overland flowpaths to ensure all runoff will discharge to the legal point of discharge.

There is an existing stormwater line in Valley Drive, for which a small portion of the development will discharge to, the remaining development will discharge to the Sheedy's Gully creek. Both of these locations are deemed to be legal points of discharge.

2.3. Soils

A Geotechnical investigation has not been undertaken for this site to date. For the purposes of this report only the exposed pad soils have been observed as light clay.

2.4. Watercourses

In its current state there is an external upstream catchment that traverses toward the site from Chinaman's Gully. It is noted that although the catchment is quite large it has been recognised by Water NSW in a letter dated 28 November 2017 Ref:08380-a2, that there is no longer an overland flowpath passing through the site due to the extensive mine extractions and a dam formed by the extension of Silcock Street diverting runoff to the underground mine system.

As such it is deemed and agreed with WaterNSW that there is no overland flow passing through the site.

2.5. Flood Impact

Similarly with the flooding impact of the site, Councils modelling indicates that the site is prone to flooding, this report was undertaken prior to the current alterations to the site and the acknowledgement by Water NSW that upstream flows do now not impact the site. Therefore we assess that there are no flood impacts on the site and will not impact the proposed development.

3. Data

3.1. Related Studies

There have been numerous studies undertaken for the site in its entirety to supplement a DCP application. Please refer to this documentation for overall assessment.

This document is specific to the proposed 1.46ha development site and is for the control of stormwater discharge only.

3.2. Existing Stormwater Infrastructure

There is an existing stormwater system in Valley Drive adjacent to the proposed development, there is also an existing creek running through the principal site, both of these locations are deemed to be legal points of discharge for this development.

3.3. Stormwater Management Plans

The Site Based Stormwater Management Plan (SBSMP) described below is in accordance with the Water NSW Guidelines for Using MUSIC in Sydney Drinking Water Catchment & Landcom's Managing Urban Stormwater 4th Edition, March 2004 (Bluebook)

3.4. Hydrologic & Hydraulic needs/wants

To prevent stormwater in a major storm event inundating unnecessarily on the neighbouring properties it is intended to capture the design storm flows on site and direct to an onsite detention system.

3.5. Water Quality/Stream Health

No study has been undertaken to determine the water quality of the recipient waterway and does not form a part of this document.

4. OPPORTUNITIES AND CONSTRAINTS

4.1. Key Site Characteristics

As detailed previously the site has an existing pad that will need to be extended, therefore earthworks will be required to prepare the site for development.

It is proposed to capture all storm flows (up to and including the 1% AEP event), to be controlled and discharged from the site via a piped network with all runoff (up to and including the 1% AEP event) collected directed towards the proposed detention system.

To ensure the site captures and contains all storm events up to and including the 1% AEP event the site will require reshaping.

5. STORMWATER QUANTITY

5.1. Existing Conditions

From a site inspection, provided survey information and as items discussed earlier in this report, it is determined that the pre-developed site will not receive any overland flow water from an upstream catchment

Of the flows within the site all stormwater currently sheet flows to the west of the site.

To develop this site, it will be regraded as previously mentioned to ensure the overland flow discharges to Sheedys Gully creek or Valley Drive.

Due to the increase in impervious area from what is existing and the knowledge that the receiving watercourse is prone to flooding it is intended to ensure that the development sites runoff is mitigated to ensure no nett worsening than what currently exists, this will be undertaken by providing on-site detention.

5.2. Methodology

To undertake the hydrologic analysis of the development, the Australian Rainfall & Runoff 2016 (AR&R) manual has been used. Flows and levels have been calculated using a rainfall intensity chart developed using the Bureau of Meteorology IFD software (refer **Appendix A**) for the Lithgow area.

5.3. Watercom Drains

A hydrologic assessment of the proposed system has been undertaken using Watercom Drains, producing an Initial Loss – Continuous Loss (IL-CL) model to ensure that the development does not adversely affect the downstream system by decreasing the time of concentration and increasing the runoff.

The model has been set up with two systems, the first being the pre-developed, unmitigated, site, the second is the developed site.

This model has used the East Coast South temporal pattern and the AR&R 2016 rainfall depths based on the co-ordinates of the site and obtained from the BoM.

The total site area of 1.46ha has been used for the calculations with both the pre and post development catchments have been subdivided into sub catchments for which each has been modelled,

The site runoff will be collected via a piped system to the stormwater treatment area prior to discharge from the site.

The developed scenario will require onsite detention to mitigate the increase in flows. Due to the site constraints it is proposed to use above ground ponding within the carpark areas to a maximum depth under 250mm for the 1% AEP conditions. It should be noted that the ponding in the carparks only occurs in storm events greater than the 20% AEP event.

Additionally, the proposed bio-retention basins, discussed later in this report, will also contain some detention volume.

The table below shows the comparison between the pre and post developed site the detention system.

Table 5.1 – Watercom Drains Modelling

Watercom Drains Results						
Storm Event (AEP)	Pre-Developed Site Flow (m^3/s)	Post Developed Site (Mitigated) Flow (m^3/s)	Reduction(-) / Increase (+) in flow due to mitigation. Compared to Existing Conditions (%)	Post Developed Site (Unmitigated) Flow (m^3/s)	Reduction(-) / Increase (+) in flow due to mitigation. Compared to Developed Unmitigated Conditions (%)	Peak Volume (m3)
20%	0.059	0.064	+8.47%	0.396	-83.8%	163.9
10%	0.083	0.071	-14.46%	0.464	-84.7%	212.5
5%	0.171	0.081	-52.63%	0.536	-84.9%	276.3
2%	0.213	0.142	-33.33%	0.630	-77.5%	341.0
1%	0.263	0.253	-3.80%	0.705	-64.1%	361.9

It can be seen in the results that with the implementation of a detention system that all of the storm events assessed ensure that the runoff has a no nett worsening effect due to the proposed development.

If the Watercom drains file is not included in this package it can be obtained by contacting the author. Watercom Drains results are included in **Appendix B**.

Proposed mitigation measures

The following is proposed as a best practice site specific solution.

1. All roof runoff is to be collected by 4x22.5KL & 1x3KL rainwater tanks for onsite reuse.

2. Ground areas will be directed via a piped system to the proposed bioretention basins. All pits and pipes for this system are to be sized in accordance with the preliminary design plans to ensure the detention system functions as designed.

3. The detention system is to comprise of a ponding areas within the carpark along with additional detention capacity stored within the bio-retention basins above the extended detention depth.

4. Discharge from the detention system is to be via a piped outlets to the proposed legal points of discharge.

Refer to the drawings supplied in the **Figures** section of this report for further details.

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It should be noted that the detention assessment has only been undertaken for the site of development, the proposed private access road has not been assessed as this is to be compensated in the global development as part of any future DCP development.

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6. STORMWATER QUALITY

6.1. Existing Conditions

The site is currently vacant with no vegetation present.
There are no stormwater quality mitigation measures being implemented in its current state.

6.2. Receiving Waters

The existing condition of the receiving waterway is unknown, so it is intended to keep the post development runoff levels to at least 10% less than the pre-developed state.

Due to the nature of this development there is a high probability that the increase of nutrient pollutants could be significant, any increase in litter, nutrients or suspended solids entering the receiving body of water can impact on the ecosystem therefore all runoff will be treated to ensure a neutral or beneficial effect (NorBE) on water quality.

6.3. Construction Phase

This section details the treatment to be used for the construction phase of the development in accordance with the Landcom – Managing Urban Stormwater (Bluebook) document.

6.3.1. Potential Sediment Generation

The development will result in one catchment from which sediment can be generated.

The area to be disturbed is 1.708ha which is the entire site area.

While the potential exists for sediment to be generated during the construction phase, the potential sediment volume is dependent upon rainfall, site topography, the material type exposed, flow characteristics, and the construction practices and programme.

The potential for sediment generation for the site in the pre-development stage and due to the development is calculated using the Revised Universal Soil Loss Equation.

The sediment generation potential for the development is calculated at **8m^3/ha/yr**. This equates to **13.664m^3/yr** for the site during construction.

Due to the low volume expected a sediment basin is not warranted and as such the use of sediment fences, diversion drains and designated stockpile areas during the earthworks stage is considered adequate to cater for that sediment generated.

Once the earthworks phase is complete the site will be stabilised with gravel base for the pavement and concrete pads for the building, when these are in place it is deemed that the use of sediment fences only will be satisfactory.

Refer to **Appendix C** for calculations.

6.3.2. Construction Phase Control Measures

The works proposed to control erosion are detailed on the civil works drawings:

- Construct stabilised shake down area at the site access.
- Construct diversion drains
- Erect sediment fences
- Strip topsoil and stockpile within the controlled area on site. Remove from the site any material which is not required for rehabilitation of disturbed areas.
- Exposed soils and stockpiles are to be watered, as required, to minimise soil losses as a result of wind.
- Ensure all litter is collected and disposed of onsite in an appropriate fashion.
- Ensure all machinery is in good working order, repair any leaks immediately.
- Contain any spills immediately to ensure that they do not enter the stormwater system.
- All wash waters are to be kept away from the stormwater system.
- Finalised earthworks to be top soiled and seeded/hydro-mulched or landscaped as directed.
- Place geo-textile field gully inlet filters around entry points to the drainage system until the pavement is complete or until grass is established.
- Construct buildings and pavement.
- Geo-textile filters to be replaced with mesh filters until landscaping is complete and stabilised.
- Maintain all sediment devices and other interim controls regularly.
- Remove sediment fences and inlet filters after the establishment of the landscaping and grass cover.

6.3.3. Erosion and Sediment Control Management

The installation of erosion and sediment control devices requires maintenance of these devices to ensure their effectiveness in the control of potential environmental impact. Summary of the objectives and maintenance requirements for this project are detailed below.

6.3.4. Objectives

The objectives of this erosion and sediment control plan are:

- To ensure that the water quality of the receiving waters is not worsened by the site's development minimise sediment transport in surface water runoff during the construction and operational stages.
- And to provide a monitoring and maintenance programme for implementation during the construction phase.

6.3.5. Maintenance of Controls

The Contractor is responsible for the installation and maintenance of the sediment and erosion control measures during the construction phase and are only to be removed upon practical completion.

Maintenance responsibilities for the establishment of vegetation, which is the requirement to irrigate the plants and grass used to generate ground cover, lies with the Contractor initially but ultimately reverts to the property owners once the defects liability period has expired.

Maintenance will require:

- Inspection of silt fences, diversion drains and hay bale barriers weekly during construction and after any rainfall event.
- Clean out sediment build-up following each event that causes deposits.
- Clean up soil and sediment deposits promptly as they occur.
- Provide inlet protection where soil disturbance is to occur.

6.3.6. Responses to Complaints

Complaints during this type of construction usually relate to noise and dust.

Generally the complaint is made known to the Contractor, the Principal, the Superintendent and/or the Council.

The Contractor shall keep a record of all complaints identifying the nature of the complaint and any remedial action taken to address such complaint.

The Contractor shall act as soon as possible to remedy the problem, if the complaint is considered valid and reasonable.

A complaints record shall be made available by the contractor for regular inspection by the Superintendent. For the purpose of direction by others, the Contractor's details are to be supplied to Council prior to commencement of the works.

Complaints relating to dust shall require the Contractor to immediately water the exposed earth surfaces and any soil stockpile areas as well as haul roads to control dust. Such watering shall occur immediately the complaint is registered with the Contractor. Watering should continue periodically until conditions suit, or the works are completed to a state that prevents dust transport.

6.3.7. Monitoring

The installation of the erosion and sediment control measures as detailed in this plan will ameliorate potential impact to water quality in the receiving waters.

A monitoring program is proposed to ensure that the control measures achieve the desired goals.

A visual monitoring program is proposed due to the relatively small size of the development and the amount of earthworks is to take place.

6.4. Operational Phase

6.4.1. Objectives

The use of stormwater quality improvement devices (SQUIDs) will address the NorBE objectives as detailed below.

10% reduction in Total Suspended Sediment (TSS)
10% reduction in Total Nitrogen
10% reduction in total Phosphorus

6.4.2. Methodology

The pollutant impact assessment has been carried out using the MUSIC model system.

The pollutant assessment considered two scenarios as follows:

- Pre Development
- Post Development treated.

This has been further subdivided into two areas:

- The principal site of development
- The proposed access road

Although there are 2 discharge points from the proposed development they all ultimately converge and discharge to same catchment, as such the pre-development site has been modelled as one catchment with the adopted catchment land uses are tabulated below.

The sub-catchment trains for the pre-developed site are shown in **Appendix D**:

Table 5.2 – Catchment Areas and Land Uses – Pre Development

Catchment Table – Principal Site of Development				
Catchment Name	Usage Type	Music Usage Type	Catchment Area (Ha)	Effective Impervious Area (Ha)
Ex Cat Site	Vacant Commercial Lot	Mixed	1.465	0

Catchment Table – Access Road				
Catchment Name	Usage Type	Music Usage Type	Catchment Area (Ha)	Effective Impervious Area (Ha)
Ex Cat Road	Vacant Commercial Lot	Mixed	0.243	0

It should be noted that the soil type “light clay” was adopted for the modelling.

Given the majority of this development is hardstand or roof no adjustment has been made to the Total Impervious Area (TIA).

The post development model has numerous catchments, the adopted catchment land uses are tabulated below.

The sub-catchment trains for the developed site are shown in **Appendix E**:

Table 5.3 – Catchment Areas and Land Uses – Post Development

Catchment Table – Principal Site of Development					
Catchment Name	Usage Type	Music Usage Type	Catchment Area (Ha)	Fraction Impervious	Effective Impervious Area (Ha)
Roof to Toilet	Roof	Roof	0.015	1.0	0.015
Roof to Tanks	Roof	Roof	0.555	1.0	0.555
Carpark	Ground	Sealed Road	0.895	0.79	0.707

Catchment Table – Access Road					
Catchment Name	Usage Type	Music Usage Type	Catchment Area (Ha)	Fraction Impervious	Effective Impervious Area (Ha)
Access Road	Ground	Sealed Road	0.243	0.70	0.170

The land fall data used in the modelling was the Zone 4 rainfall data obtained from Water NSW.

Five year, six minute time step rainfall data was used from 01 January 1997 to 31 December 2001 to run the MUSIC model.

The daily values for average areal potential evapotranspiration for the site were calculated within the MUSIC software from the same data source as the rainfall data.

The proposed treatment train for the sub-catchments is as follows:

Development Site

- Runoff from the roof is to be captured and directed to rainwater tanks.
  - 3KL tank for reuse in toilet will capture 150m^2 of roof area
  - the remaining roof area (5550m^2) is to be directed to 4x22.5KL tanks for irrigation reuse.
  - The volume of these tanks has been derived by a water balance model within MUSIC, the reuse has been adopted from historic water use from the existing Lithgow Bunnings.
- Overflow from the rainwater tanks will enter the internal piped network.
- Ground runoff will be directed to the internal piped network
- The internal piped network will discharge to various bio-retention basins around the perimeter of the site, the total treatment area is equal to or greater than the MUSIC model requirement of 450m^2.

Access Road

- Runoff from the entire access road corridor is to be directed to four (4) Street Tree Bio-Retention areas with a combined total area of 60m^2.
- Overflow from the bio-basins will enter the piped network.

The treatment trains and catchment have been set up in accordance with the Water NSW MUSIC Standards.

The pre-developed and post developed scenarios are tabulated below.

It should be noted that the drainage links were modelled with no routing as each catchment has not been confirmed by full design at time of author.

6.4.3. Model Analysis

The modelling resulted in the following:

Table 5.4 – Treatment Train Model

Mean Annual Loads – Principal Site of Development			
	Pre development (untreated)	Post development (treated)	% Reduction
Flow (ml/yr)	3.00	8.03	N/A
TSS (kg/yr)	345	65.7	81%
TP (kg/yr)	0.882	0.651	26.2%
TN (kg/yr)	7.64	6.68	12.6%

Mean Annual Loads – Access Road			
	Pre development (untreated)	Post development (treated)	% Reduction
Flow (ml/yr)	0.498	1.25	N/A
TSS (kg/yr)	56.7	15.0	73.5%
TP (kg/yr)	0.151	0.114	24.5%
TN (kg/yr)	1.26	1.12	11.1%

A review of the MUSIC model results shows that the proposed stormwater treatment train through the use of the bio-retention basins will reduce the expectant pollutant export loads leaving the site. The comparison of results between Pre-Development (untreated) and Post Development (treated) models shows that the inclusion of the proposed stormwater treatment train will reduce the pollutant loads to be at least 10% less than the Pre-developed site and therefore complies with the Water NSW requirements for NorBE.

6.5. Impact of Development

The development of this site will increase loadings on the stormwater quality which is to be minimised by the implementation of primary and secondary treatment devices as detailed in this report and will be monitored as detailed in Appendix F.

6.6. Proposed Management Strategies

The objective is to provide a stormwater drainage system that reduces the impact of the development compared with the existing pre-development loads. Management practices to assist in the reduction of the reliance on the primary treatment structures will be implemented.

Provision of long term water quality monitoring for this development is considered impractical. Hence, the operational monitoring will consist of event samplings only if requested by the relevant local authority and will involve collecting stormwater prior to it leaving the site. Monitoring shall be for the following:

Table 5.5 – Operational Phase Water Quality Parameters

Insitu	Laboratory Parameters
pH	Suspended Solids
Turbidity	Total Nitrogen
Temperature	Total Phosphorus
Dissolved Oxygen	
Salinity	
Specific Conductance	

The operational phase monitoring is detailed in Section 9.0 of this report.

7. STORMWATER MANAGEMENT OPTIONS

7.1. Selection & Assessment of Stormwater Quality Controls.

Only a primary form of treatment is required to address the stormwater quality within the site.

These being Spel Storm Sacks and are to be used as primary treatment devices for water from the site catchment, these devices are to be installed in all pits ensuring that the roof water runoff enters the pit above the Storm Sack filter system.

These are to be installed and maintained in accordance with the manufacturers.

7.2. Integration with Waterway Corridor

The catchment will ultimately drain into the Sheedy's Gully Creek via an outlet headwall.

8. LIFECYCLE COST ASSESSMENT

As this is a private development no assets are to be handed over to Council and a cost assessment has not been undertaken.

9. ASSET HANDOVER

There are no assets to hand over to Council

10. REFERENCES

1. Australian Rainfall & Runoff
2. Bureau of Meteorology
3. Water NSW – Using MUSIC in Sydney Drinking Water Catchment.
4. Landcom – Managing Urban Stormwater – Soils And Construction 4th Edition March 2004. (Bluebook)

APPENDIX A
Rainfall IFD Chart – Lithgow
(BoM – ARR 2016)

All Design Rainfall Depth (mm)

Issued: 30-Sep-20

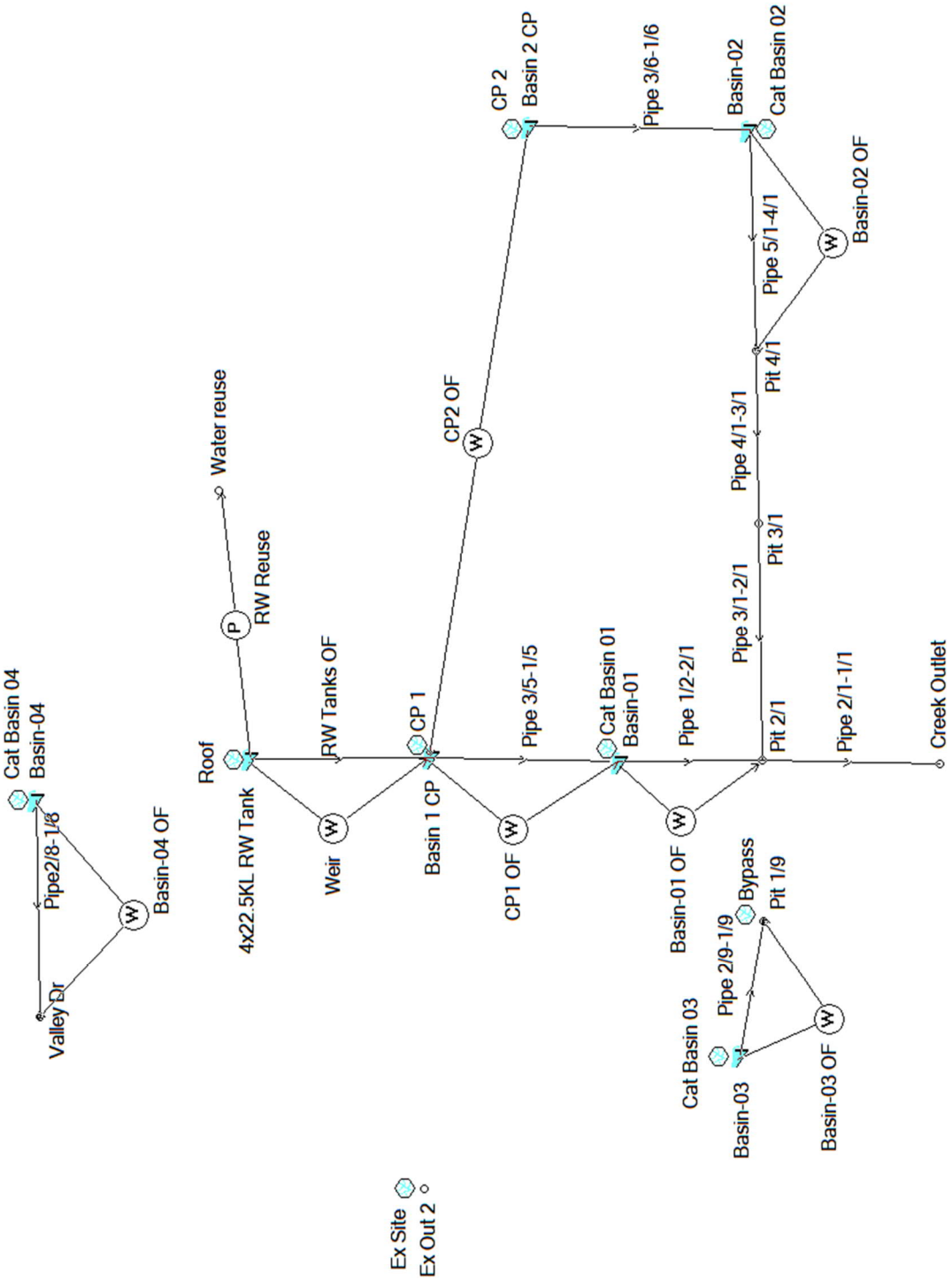
Location L Lithgow CBD

Requeste Latitude -33.4828 Longitude 150.1529

Nearest g Latitude 33.4875 (S Longitude 150.1625 (E)

		Exceedan	Annual Exceedance Probability (AEP)																
Duration	Duration in	12EY	6EY	4EY	3EY	2EY	63.20%	50%	0.5EY	20%	0.2EY	10%	5%	2%	1%	1 in 200	1 in 500	1 in 1000	1 in 2000
1 min	1	0.661	0.787	1.01	1.17	1.4	1.82	2.03	2.26	2.73	2.79	3.22	3.71	4.38	4.9	5.33	5.96	6.43	6.9
2 min	2	1.15	1.36	1.72	1.98	2.34	2.96	3.28	3.65	4.36	4.45	5.14	5.87	6.87	7.65	8.4	9.45	10.3	11.1
3 min	3	1.56	1.86	2.37	2.74	3.25	4.12	4.58	5.09	6.1	6.22	7.18	8.21	9.62	10.7	11.7	13.2	14.3	15.4
4 min	4	1.92	2.29	2.95	3.41	4.07	5.19	5.78	6.42	7.72	7.87	9.08	10.4	12.2	13.6	14.9	16.7	18	19.4
5 min	5	2.23	2.68	3.46	4.01	4.8	6.15	6.87	7.63	9.19	9.37	10.8	12.4	14.6	16.3	17.8	19.9	21.5	23.1
10 min	10	3.46	4.15	5.37	6.25	7.51	9.77	10.9	12.2	14.7	15	17.4	20	23.7	26.5	28.8	32.1	34.7	37.1
15 min	15	4.35	5.18	6.66	7.74	9.31	12.1	13.6	15.1	18.3	18.7	21.7	25	29.6	33.2	36	40.3	43.4	46.5
20 min	20	5.06	5.99	7.64	8.86	10.6	13.9	15.5	17.2	20.9	21.3	24.7	28.6	33.8	37.9	41.2	46.1	49.7	53.3
25 min	25	5.64	6.65	8.43	9.75	11.7	15.2	17	18.9	22.9	23.4	27.1	31.3	37	41.5	45.1	50.5	54.5	58.4
30 min	30	6.15	7.21	9.1	10.5	12.5	16.3	18.2	20.2	24.5	25	28.9	33.4	39.5	44.4	48.3	54	58.3	62.6
45 min	45	7.37	8.55	10.7	12.2	14.5	18.7	20.9	23.2	28	28.6	33.1	38.1	45	50.5	55	61.6	66.5	71.5
1 hour	60	8.32	9.59	11.9	13.5	16	20.5	22.9	25.4	30.6	31.2	36	41.4	48.9	54.8	59.7	66.9	72.3	77.7
1.5 hour	90	9.78	11.2	13.7	15.6	18.3	23.3	25.9	28.7	34.4	35.1	40.4	46.4	54.6	61.2	66.7	74.7	80.7	86.7
2 hour	120	10.9	12.5	15.2	17.2	20.1	25.5	28.3	31.4	37.5	38.2	44	50.4	59.3	66.3	72.2	80.8	87.3	93.7
3 hour	180	12.7	14.5	17.5	19.8	23.1	29.1	32.3	35.9	42.7	43.5	49.9	57.2	67.1	75	81.5	91	98.2	105
4.5 hour	270	14.8	16.8	20.4	23	26.8	33.6	37.3	41.4	49.3	50.3	57.6	66	77.4	86.3	93.6	104	113	121
6 hour	360	16.4	18.7	22.7	25.6	29.9	37.5	41.7	46.3	55.2	56.3	64.5	73.9	86.7	96.7	105	117	126	134
9 hour	540	19	21.7	26.5	30	35	44.1	49.2	54.6	65.6	66.9	76.8	88.3	104	116	125	139	150	160
12 hour	720	21.1	24.2	29.6	33.6	39.4	49.7	55.7	61.8	74.7	76.1	87.8	101	119	133	144	160	172	184
18 hour	1080	24.4	28.1	34.6	39.4	46.4	59	66.4	73.7	90.2	92	107	124	146	163	177	197	213	228
24 hour	1440	27	31.1	38.5	43.9	51.9	66.5	75.1	83.4	103	105	123	144	170	190	206	231	249	267
30 hour	1800	29	33.5	41.6	47.6	56.5	72.8	82.4	91.4	114	116	137	161	190	213	235	264	287	309
36 hour	2160	30.8	35.6	44.3	50.8	60.4	78.1	88.5	98.3	124	126	149	176	208	233	259	293	319	345
48 hour	2880	33.5	38.8	48.5	55.7	66.5	86.7	98.5	109	139	142	169	201	238	267	298	338	369	401
72 hour	4320	37.2	43.2	54.3	62.6	75.1	98.5	112	124	159	163	196	235	279	313	349	397	434	472
96 hour	5760	39.3	45.9	58	67.1	80.7	106	121	134	172	175	212	255	303	340	377	429	470	511
120 hour	7200	40.6	47.7	60.6	70.3	84.7	112	127	141	179	183	220	266	316	354	392	447	488	531
144 hour	8640	41.2	48.8	62.5	72.7	87.8	116	131	145	183	187	223	271	321	361	399	454	496	539
168 hour	10080	41.4	49.5	64	74.7	90.3	119	134	149	186	189	224	271	321	361	400	455	497	540

APPENDIX B
Watercom Drains Results


Cat Basin 04
Basin-04
Pipe2/8-1/8
Basin-04 OF
Valley Dr
Water reuse
RW Reuse
Roof
4x22.5KL RW Tank
RW Tanks OF
Weir
CP 1
Basin 1 CP
CP2 OF
CP 2
Basin 2 CP
Pipe 3/5-1/5
CP1 OF
Cat Basin 01
Basin-01
Pipe 1/2-2/1
Basin-01 OF
Pipe 3/6-1/6
Basin-02
Cat Basin 02
Pipe 4/1-3/1
Pipe 5/1-4/1
Basin-02 OF
Pit 4/1
Pipe 3/1-2/1
Pit 3/1
Pit 2/1
Pipe 2/1-1/1
Creek Outlet
Cat Basin 03
Pipe 2/9-1/9
Bypass
Pit 1/9
Basin-03
Basin-03 OF
Ex Site
Ex Out 2

Drains Data

PIT / NODE DETAILS			Version 15										
Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id
Ex Out 2	Node							0		381.053	-261.889		1395
Water reuse	Node					923		0		777.778	-145.833		29742
Pit 1/9	Node					925.38		0		532.883	-454.437		378744
Pit 2/1	Node					924.913		0		623.981	-453.747		378741
Creek Outlet	Node					923.74		0		622.222	-554.861		29896
Pit 4/1	Node					926.95		0		856.557	-450.297		378736
Pit 3/1	Node					926.6		0		758.558	-451.677		378739
Valley Dr	Node					925.42		0		478.362	-43.806		559829

DETENTION BASIN DETAILS													
Name	Elev	Surf. Area	Not Used	Outlet Typ	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL
Basin-03	924.51	1		Orifice		50	924.6			456.944	-441.667	No	
	925.59	1											
	925.6	45											
	929	45											
4x22.5KL RW Tank	924.35	38.4		Culvert	0.5					625	-163.889	No	
	926.7	38.4											
Basin 1 CP	925.67	1		Culvert	0.5					625.694	-266.667	No	
	926.32	1											
	926.4	60											
	926.5	275											
	926.6	660											
Basin-01	924.3	1		Orifice		90	924.35			623.032	-373.611	No	
	925.79	1											
	925.8	140											
	929	140											
Basin 2 CP	925.71	1		Culvert	0.5					984.028	-322.222	No	
	926.44	1											
	926.5	90											
	926.6	225											
	926.7	960											
Basin-02	924.81	1		Orifice		70	924.85			981.944	-446.528	No	
	925.84	1											
	925.85	175											
	928	175											
Basin-04	924.15	1		Orifice		65	924.2			601.206	-41.736	No	
	925.19	1											
	925.2	91											
	929	91											

SUB-CATCHMENT DETAILS													
Name	Pit or Node	Total Area (ha)	EIA %	Perv Area %	RIA %	EIA Time (min)	Perv Time (min)	RIA Time (min)	EIA Length (m)	Perv Length (m)	RIA Length (m)	EIA Slope(%) %	Perv Slope %
Ex Site	Ex Out 2	1.465	0	100	0	5	5	2					
Cat Basin 03	Basin-03	0.0605	90	10	0	5	5	2					
Bypass	Pit 1/9	0.0971	50	50	0	5	5	2					
Roof	4x22.5KL F	0.57	100	0	0	5	5	2					
CP 1	Basin 1 CP	0.1754	100	0	0	5	5	2					
Cat Basin 01	Basin-01	0.0193	0	100	0	5	5	2					
CP 2	Basin 2 CP	0.2743	79	21	0	5	5	2					
Cat Basin 02	Basin-02	0.0269	0	100	0	5	5	2					
Cat Basin 04	Basin-04	0.2415	90	10	0	5	5	2					

PIPE DETAILS												
Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From
Pipe 2/9-1/9	Basin-03	Pit 1/9	5.5	924.51	924.45	1.09	Concrete, u	225	225	0.013	NewFixed	1	Basin-03
RW Tanks OF	4x22.5KL F	Basin 1 CP	10	926.5	925.78	7.2	uPVC, not u	90	86	0.012	NewFixed	4	4x22.5KL F
Pipe 3/5-1/5	Basin 1 CP	Basin-01	30	925.78	925.63	0.5	uPVC, not u	300	303	0.012	NewFixed	1	Basin 1 CP
Pipe 1/2-2/1	Basin-01	Pit 2/1	24	924.3	924.13	0.71	Concrete, u	375	375	0.013	NewFixed	1	Basin-01
Pipe 2/1-1/1	Pit 2/1	Creek Out	50	924.13	923.74	0.78	Concrete, u	525	525	0.013	NewFixed	1	Pit 2/1
Pipe 3/6-1/6	Basin 2 CP	Basin-02	30	925.8	925.65	0.5	uPVC, not u	225	242	0.012	NewFixed	1	Basin 2 CP
Pipe 5/1-4/1	Basin-02	Pit 4/1	7.7	924.81	924.77	0.52	Concrete, u	300	300	0.013	NewFixed	1	Basin-02
Pipe 4/1-3/1	Pit 4/1	Pit 3/1	16.7	924.77	924.69	0.48	Concrete, u	525	525	0.013	NewFixed	1	Pit 4/1
Pipe 3/1-2/1	Pit 3/1	Pit 2/1	49	924.69	924.18	1.04	Concrete, u	525	525	0.013	NewFixed	1	Pit 3/1
Pipe2/8-1/8	Basin-04	Valley Dr	7.68	924.15	923.8	4.56	uPVC, unde	225	242	0.012	NewFixed	1	Basin-04

DETAILS of SERVICES CROSSING PIPES										
Pipe	Chg (m)	Bottom Elev (m)	Height of (m)	Chg (m)	Bottom Elev (m)	Height of (m)	Chg (m)	Bottom Elev (m)	Height of (m)	etc etc

CHANNEL DETAILS												
Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Widt (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

PIPE COVER DETAILS					
Name	Type	Dia (mm)	Safe Cove	Cover (m)	
Pipe 2/9-1/9	Concrete,	225	0.6	-0.26	Unsafe
RW Tanks OF	uPVC, not	86	0.3	-2.24	Unsafe
Pipe 3/5-1/5	uPVC, not	303	0.3	-1.64	Unsafe
Pipe 1/2-2/1	Concrete,	375	0.6	-0.41	Unsafe
Pipe 2/1-1/1	Concrete,	525	0.6	-0.57	Unsafe
Pipe 3/6-1/6	uPVC, not	242	0.3	-1.09	Unsafe
Pipe 5/1-4/1	Concrete,	300	0.6	-0.33	Unsafe
Pipe 4/1-3/1	Concrete,	525	0.6	1.34	
Pipe 3/1-2/1	Concrete,	525	0.6	0.16	Unsafe
Pipe2/8-1/8	uPVC, unc	242	0.5	-0.25	Unsafe

This model has no pipes with non-return valves

20% AEP Results

DRAINS results prepared from Version 2021.031							
PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Water reuse	923		0				
Pit 1/9	924.5		0.017				
Pit 2/1	924.23		0				
Creek Outlet	923.84		0				
Pit 4/1	924.84		0				
Pit 3/1	924.75		0				
Valley Dr	923.85		0				
SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm
Ex Site	0.059	0	0.059	5	2	5	20% AEP, 6 hour burst, Storm 6
Cat Basin 03	0.017	0.017	0	5	2	5	20% AEP, 5 min burst, Storm 1
Bypass	0.015	0.015	0	5	2	5	20% AEP, 5 min burst, Storm 1
Roof	0.175	0.175	0	5	2	5	20% AEP, 5 min burst, Storm 1
CP 1	0.054	0.054	0	5	2	5	20% AEP, 5 min burst, Storm 1
Cat Basin 01	0.001	0	0.001	5	2	5	20% AEP, 6 hour burst, Storm 6
CP 2	0.066	0.066	0	5	2	5	20% AEP, 5 min burst, Storm 1
Cat Basin 02	0.001	0	0.001	5	2	5	20% AEP, 6 hour burst, Storm 6
Cat Basin 04	0.067	0.067	0	5	2	5	20% AEP, 5 min burst, Storm 1
PIPE DETAILS							
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm		
Pipe 2/9-1/9	0.006	0.79	925.242	924.503	20% AEP, 20 min burst, Storm 1		
RW Tanks OF	0.001	0.2	926.516	926.085	20% AEP, 45 min burst, Storm 8		
Pipe 3/5-1/5	0.061	1	926.051	925.871	20% AEP, 3 hour burst, Storm 9		
Pipe 1/2-2/1	0.021	0.85	925.525	924.233	20% AEP, 15 min burst, Storm 1		
Pipe 2/1-1/1	0.032	1.07	924.233	923.843	20% AEP, 20 min burst, Storm 9		
Pipe 3/6-1/6	0.064	1.39	926.345	926.026	20% AEP, 5 min burst, Storm 1		
Pipe 5/1-4/1	0.011	0.76	925.572	924.848	20% AEP, 30 min burst, Storm 10		
Pipe 4/1-3/1	0.011	0.71	924.839	924.756	20% AEP, 30 min burst, Storm 8		
Pipe 3/1-2/1	0.011	0.86	924.747	924.238	20% AEP, 30 min burst, Storm 8		
Pipe2/8-1/8	0.011	1.67	924.961	923.847	20% AEP, 45 min burst, Storm 3		
CHANNEL DETAILS							
Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm		
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
Basin-03 OF							
Weir							
RW Reuse	0.03	0.03					
CP1 OF							
Basin-01 OF							
CP2 OF							
Basin-02 OF							
Basin-04 OF							
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level		
Basin-03	925.68	4.8	0.006	0.006	0		
4x22.5KL RW Tank	926.52	83.2	0.031	0.001	0.03		
Basin 1 CP	926.09	0.4	0.061	0.061	0		
Basin-01	925.87	12	0.021	0.021	0		
Basin 2 CP	926.39	0.7	0.064	0.064	0		
Basin-02	926.03	32.5	0.011	0.011	0		
Basin-04	925.57	35.1	0.011	0.011	0		
Run Log for 2021.1178 run at 09:47:07 on 23/3/2022 using version 2021.031							

10% AEP Results

DRAINS results prepared from Version 2021.031							
PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)	
			(cu.m/s)	(cu.m)	(m)		
Water reuse	923		0				
Pit 1/9	924.5		0.02				
Pit 2/1	924.24		0				
Creek Outlet	923.85		0				
Pit 4/1	924.84		0				
Pit 3/1	924.75		0				
Valley Dr	923.85		0				
SUB-CATCHMENT DETAILS							
Name	Max	EIA	Remaining	EIA	RIA	PA	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)
Ex Site	0.083	0	0.083	5	2	5	10% AEP, 2 hour burst, Storm 3
Cat Basin 03	0.02	0.02	0	5	2	5	10% AEP, 5 min burst, Storm 1
Bypass	0.017	0.017	0	5	2	5	10% AEP, 5 min burst, Storm 1
Roof	0.205	0.205	0	5	2	5	10% AEP, 5 min burst, Storm 1
CP 1	0.063	0.063	0	5	2	5	10% AEP, 5 min burst, Storm 1
Cat Basin 01	0.001	0	0.001	5	2	5	10% AEP, 2 hour burst, Storm 3
CP 2	0.078	0.078	0	5	2	5	10% AEP, 5 min burst, Storm 1
Cat Basin 02	0.002	0	0.002	5	2	5	10% AEP, 2 hour burst, Storm 3
Cat Basin 04	0.078	0.078	0	5	2	5	10% AEP, 5 min burst, Storm 1
PIPE DETAILS							
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm		
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)			
Pipe 2/9-1/9	0.006	0.79	925.261	924.503	10% AEP, 20 min burst, Storm 8		
RW Tanks OF	0.018	0.77	926.604	926.396	10% AEP, 20 min burst, Storm 10		
Pipe 3/5-1/5	0.107	1.49	926.339	926.043	10% AEP, 20 min burst, Storm 10		
Pipe 1/2-2/1	0.022	0.87	925.661	924.235	10% AEP, 30 min burst, Storm 8		
Pipe 2/1-1/1	0.033	1.08	924.235	923.845	10% AEP, 30 min burst, Storm 9		
Pipe 3/6-1/6	0.069	1.49	926.422	926.08	10% AEP, 5 min burst, Storm 1		
Pipe 5/1-4/1	0.011	0.77	925.605	924.849	10% AEP, 30 min burst, Storm 9		
Pipe 4/1-3/1	0.011	0.71	924.84	924.756	10% AEP, 30 min burst, Storm 9		
Pipe 3/1-2/1	0.011	0.87	924.748	924.239	10% AEP, 30 min burst, Storm 1		
Pipe2/8-1/8	0.011	1.68	925.023	923.848	10% AEP, 45 min burst, Storm 5		
CHANNEL DETAILS							
Name	Max Q	Max V			Due to Storm		
	(cu.m/s)	(m/s)					
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
Basin-03 OF	0.004	0.003					
Weir	0.084	0.083					
RW Reuse	0.03	0.03					
CP1 OF							
Basin-01 OF							
CP2 OF							
Basin-02 OF							
Basin-04 OF							
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q	Max Q	Max Q		
			Total	Low Level	High Level		
Basin-03	925.71	6.2	0.009	0.006	0.004		
4x22.5KL RW Tank	926.63	87.4	0.131	0.018	0.113		
Basin 1 CP	926.4	2.2	0.107	0.107	0		
Basin-01	926.04	36	0.022	0.022	0		
Basin 2 CP	926.47	1.1	0.069	0.069	0		
Basin-02	926.08	41.9	0.011	0.011	0		
Basin-04	925.67	43.9	0.011	0.011	0		
Run Log for 2021.1178 run at 09:50:19 on 23/3/2022 using version 2021.031							

5% AEP Results

DRAINS results prepared from Version 2021.031							
PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)	
			(cu.m/s)	(cu.m)	(m)		
Water reuse	923		0				
Pit 1/9	924.5		0.023				
Pit 2/1	924.24		0				
Creek Outlet	923.85		0				
Pit 4/1	924.84		0				
Pit 3/1	924.75		0				
Valley Dr	923.85		0				
SUB-CATCHMENT DETAILS							
Name	Max	EIA	Remaining	EIA	RIA	PA	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)
Ex Site	0.171	0	0.171	5	2	5	5% AEP, 2 hour burst, Storm 2
Cat Basin 03	0.023	0.023	0	5	2	5	5% AEP, 5 min burst, Storm 1
Bypass	0.02	0.02	0	5	2	5	5% AEP, 5 min burst, Storm 1
Roof	0.236	0.236	0	5	2	5	5% AEP, 5 min burst, Storm 1
CP 1	0.072	0.072	0	5	2	5	5% AEP, 5 min burst, Storm 1
Cat Basin 01	0.002	0	0.002	5	2	5	5% AEP, 2 hour burst, Storm 2
CP 2	0.09	0.09	0	5	2	5	5% AEP, 5 min burst, Storm 1
Cat Basin 02	0.003	0	0.003	5	2	5	5% AEP, 2 hour burst, Storm 2
Cat Basin 04	0.09	0.09	0	5	2	5	5% AEP, 5 min burst, Storm 1
PIPE DETAILS							
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm		
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)			
Pipe 2/9-1/9	0.006	0.79	925.266	924.503	5% AEP, 20 min burst, Storm 3		
RW Tanks OF	0.018	0.79	926.62	926.487	5% AEP, 20 min burst, Storm 8		
Pipe 3/5-1/5	0.11	1.52	926.45	926.252	5% AEP, 20 min burst, Storm 3		
Pipe 1/2-2/1	0.023	0.89	925.826	924.238	5% AEP, 30 min burst, Storm 3		
Pipe 2/1-1/1	0.035	1.1	924.238	923.848	5% AEP, 30 min burst, Storm 3		
Pipe 3/6-1/6	0.069	1.51	926.458	926.135	5% AEP, 5 min burst, Storm 1		
Pipe 5/1-4/1	0.012	0.77	925.64	924.85	5% AEP, 45 min burst, Storm 3		
Pipe 4/1-3/1	0.012	0.72	924.841	924.757	5% AEP, 45 min burst, Storm 2		
Pipe 3/1-2/1	0.012	0.87	924.749	924.239	5% AEP, 45 min burst, Storm 3		
Pipe2/8-1/8	0.011	1.7	925.095	923.849	5% AEP, 45 min burst, Storm 5		
CHANNEL DETAILS							
Name	Max Q	Max V			Due to Storm		
	(cu.m/s)	(m/s)					
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
Basin-03 OF	0.009	0.009					
Weir	0.125	0.124					
RW Reuse	0.03	0.03					
CP1 OF							
Basin-01 OF							
CP2 OF							
Basin-02 OF							
Basin-04 OF							
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q	Max Q	Max Q		
			Total	Low Level	High Level		
Basin-03	925.72	6.5	0.015	0.006	0.009		
4x22.5KL RW Tank	926.63	87.7	0.173	0.018	0.155		
Basin 1 CP	926.49	14.7	0.11	0.11	0		
Basin-01	926.25	65.3	0.023	0.023	0		
Basin 2 CP	926.5	3	0.069	0.069	0		
Basin-02	926.14	51.6	0.012	0.012	0		
Basin-04	925.78	54	0.011	0.011	0		
Run Log for 2021.1178 run at 09:53:51 on 23/3/2022 using version 2021.031							

2% AEP Results

DRAINS results prepared from Version 2021.031							
PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)	
			(cu.m/s)	(cu.m)	(m)		
Water reuse	923		0				
Pit 1/9	924.5		0.028				
Pit 2/1	924.28		0				
Creek Outlet	923.89		0				
Pit 4/1	924.9		0				
Pit 3/1	924.79		0				
Valley Dr	923.85		0				
SUB-CATCHMENT DETAILS							
Name	Max	EIA	Remaining	EIA	RIA	PA	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)
Ex Site	0.213	0	0.213	5	2	5	2% AEP, 2 hour burst, Storm 6
Cat Basin 03	0.026	0.026	0	5	2	5	2% AEP, 5 min burst, Storm 1
Bypass	0.024	0.024	0	5	2	5	2% AEP, 5 min burst, Storm 1
Roof	0.277	0.277	0	5	2	5	2% AEP, 5 min burst, Storm 1
CP 1	0.085	0.085	0	5	2	5	2% AEP, 5 min burst, Storm 1
Cat Basin 01	0.003	0	0.003	5	2	5	2% AEP, 2 hour burst, Storm 6
CP 2	0.105	0.105	0	5	2	5	2% AEP, 5 min burst, Storm 1
Cat Basin 02	0.004	0	0.004	5	2	5	2% AEP, 2 hour burst, Storm 6
Cat Basin 04	0.106	0.106	0	5	2	5	2% AEP, 5 min burst, Storm 1
PIPE DETAILS							
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm		
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)			
Pipe 2/9-1/9	0.006	0.79	925.269	924.503	2% AEP, 10 min burst, Storm 4		
RW Tanks OF	0.019	0.82	926.632	926.542	2% AEP, 10 min burst, Storm 4		
Pipe 3/5-1/5	0.11	1.52	926.524	926.424	2% AEP, 1 hour burst, Storm 2		
Pipe 1/2-2/1	0.024	0.6	925.971	924.278	2% AEP, 45 min burst, Storm 3		
Pipe 2/1-1/1	0.066	1.32	924.278	923.889	2% AEP, 45 min burst, Storm 4		
Pipe 3/6-1/6	0.07	1.52	926.498	926.186	2% AEP, 5 min burst, Storm 1		
Pipe 5/1-4/1	0.012	0.41	925.693	924.898	2% AEP, 30 min burst, Storm 6		
Pipe 4/1-3/1	0.039	1.03	924.898	924.811	2% AEP, 45 min burst, Storm 7		
Pipe 3/1-2/1	0.038	1.36	924.795	924.278	2% AEP, 45 min burst, Storm 7		
Pipe2/8-1/8	0.012	1.71	925.162	923.85	2% AEP, 45 min burst, Storm 10		
CHANNEL DETAILS							
Name	Max Q	Max V			Due to Storm		
	(cu.m/s)	(m/s)					
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
Basin-03 OF	0.013	0.012					
Weir	0.162	0.161					
RW Reuse	0.03	0.03					
CP1 OF	0.038	0.038					
Basin-01 OF	0.015	0.015					
CP2 OF							
Basin-02 OF	0.027	0.027					
Basin-04 OF	0.021	0.021					
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q	Max Q	Max Q		
			Total	Low Level	High Level		
Basin-03	925.72	6.7	0.018	0.006	0.013		
4x22.5KL RW Tank	926.64	88	0.211	0.019	0.192		
Basin 1 CP	926.54	32.5	0.148	0.11	0.038		
Basin-01	926.42	89.4	0.04	0.024	0.015		
Basin 2 CP	926.54	7.4	0.07	0.07	0		
Basin-02	926.19	60.4	0.039	0.012	0.027		
Basin-04	925.88	63.3	0.033	0.012	0.021		
Run Log for 2021.1178 run at 09:51:59 on 23/3/2022 using version 2021.031							

1% AEP Results

DRAINS results prepared from Version 2021.031							
PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)	
			(cu.m/s)	(cu.m)	(m)		
Water reuse	923		0				
Pit 1/9	924.5		0.032				
Pit 2/1	924.36		0				
Creek Outlet	923.97		0				
Pit 4/1	924.92		0				
Pit 3/1	924.81		0				
Valley Dr	923.85		0				
SUB-CATCHMENT DETAILS							
Name	Max	EIA	Remaining	EIA	RIA	PA	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)
Ex Site	0.263	0	0.263	5	2	5	1% AEP, 2 hour burst, Storm 10
Cat Basin 03	0.03	0.03	0	5	2	5	1% AEP, 5 min burst, Storm 1
Bypass	0.026	0.026	0	5	2	5	1% AEP, 5 min burst, Storm 1
Roof	0.31	0.31	0	5	2	5	1% AEP, 5 min burst, Storm 1
CP 1	0.095	0.095	0	5	2	5	1% AEP, 5 min burst, Storm 1
Cat Basin 01	0.003	0	0.003	5	2	5	1% AEP, 2 hour burst, Storm 10
CP 2	0.118	0.118	0	5	2	5	1% AEP, 5 min burst, Storm 1
Cat Basin 02	0.005	0	0.005	5	2	5	1% AEP, 2 hour burst, Storm 10
Cat Basin 04	0.118	0.118	0	5	2	5	1% AEP, 5 min burst, Storm 1
PIPE DETAILS							
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm		
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)			
Pipe 2/9-1/9	0.006	0.79	925.272	924.503	1% AEP, 10 min burst, Storm 4		
RW Tanks OF	0.02	0.85	926.64	926.557	1% AEP, 10 min burst, Storm 4		
Pipe 3/5-1/5	0.111	1.54	926.544	926.472	1% AEP, 10 min burst, Storm 7		
Pipe 1/2-2/1	0.025	0.35	926.026	924.361	1% AEP, 30 min burst, Storm 2		
Pipe 2/1-1/1	0.152	1.66	924.361	923.971	1% AEP, 30 min burst, Storm 2		
Pipe 3/6-1/6	0.07	1.53	926.521	926.196	1% AEP, 5 min burst, Storm 1		
Pipe 5/1-4/1	0.012	0.35	925.707	924.918	1% AEP, 25 min burst, Storm 1		
Pipe 4/1-3/1	0.051	1.08	924.918	924.833	1% AEP, 30 min burst, Storm 6		
Pipe 3/1-2/1	0.051	1.36	924.811	924.361	1% AEP, 30 min burst, Storm 6		
Pipe2/8-1/8	0.012	1.72	925.172	923.85	1% AEP, 30 min burst, Storm 2		
CHANNEL DETAILS							
Name	Max Q	Max V			Due to Storm		
	(cu.m/s)	(m/s)					
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
Basin-03 OF	0.017	0.017					
Weir	0.211	0.21					
RW Reuse	0.03	0.03					
CP1 OF	0.098	0.098					
Basin-01 OF	0.078	0.078					
CP2 OF							
Basin-02 OF	0.04	0.04					
Basin-04 OF	0.04	0.04					
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q	Max Q	Max Q		
			Total	Low Level	High Level		
Basin-03	925.73	6.9	0.023	0.006	0.017		
4x22.5KL RW Tank	926.65	88.3	0.26	0.02	0.241		
Basin 1 CP	926.56	39.2	0.209	0.111	0.098		
Basin-01	926.47	96.1	0.103	0.025	0.078		
Basin 2 CP	926.57	11.4	0.07	0.07	0		
Basin-02	926.2	62.2	0.052	0.012	0.04		
Basin-04	925.9	64.7	0.051	0.012	0.04		
Run Log for 2021.1178 run at 09:18:12 on 23/3/2022 using version 2021.031							

APPENDIX C
Sediment Yield Calculations

1. Erosion Hazard and Sediment Basins

Site Name: Bunnings

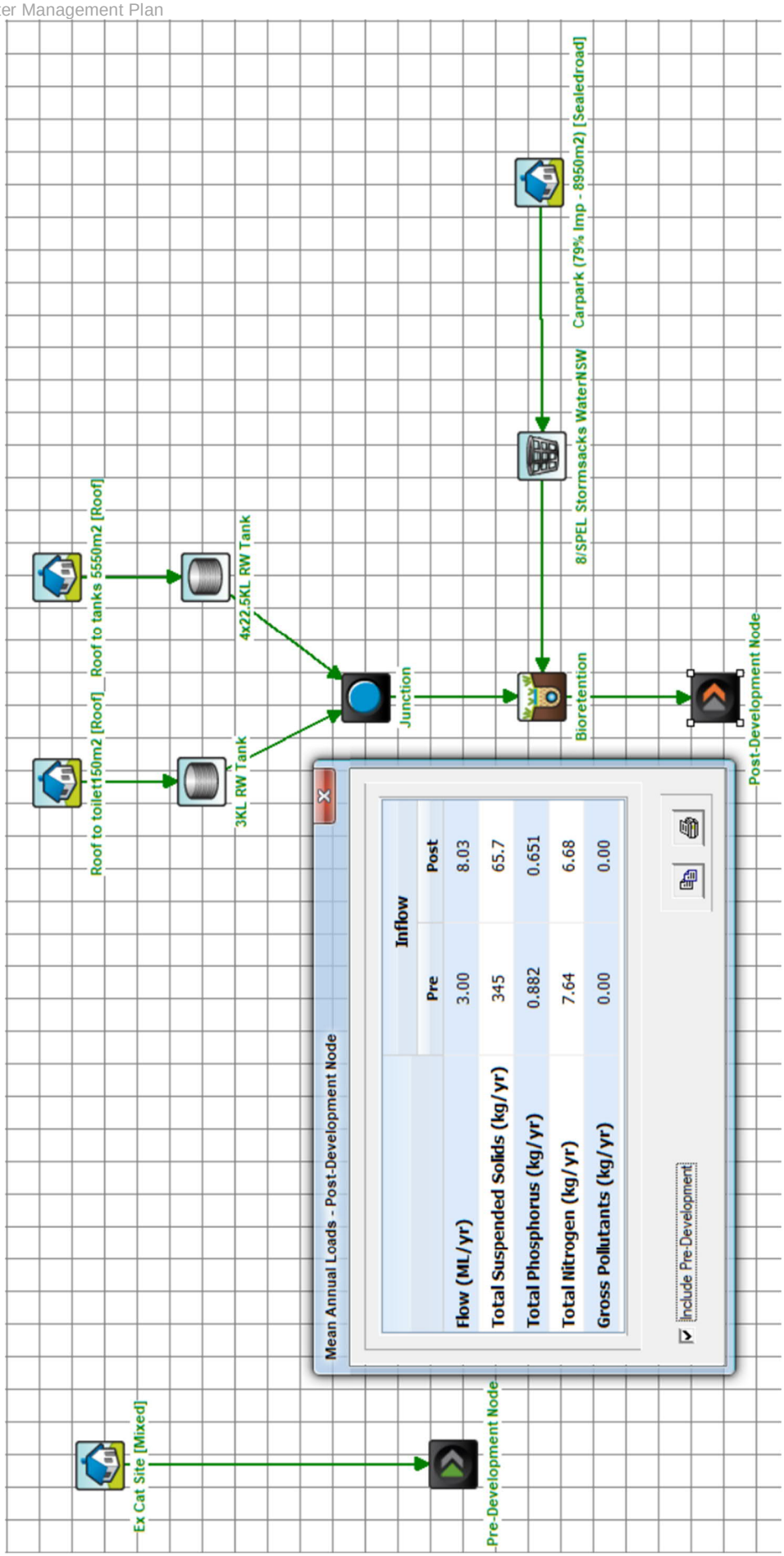
Site Location: Valley Drive Lithgow

Precinct/Stage:

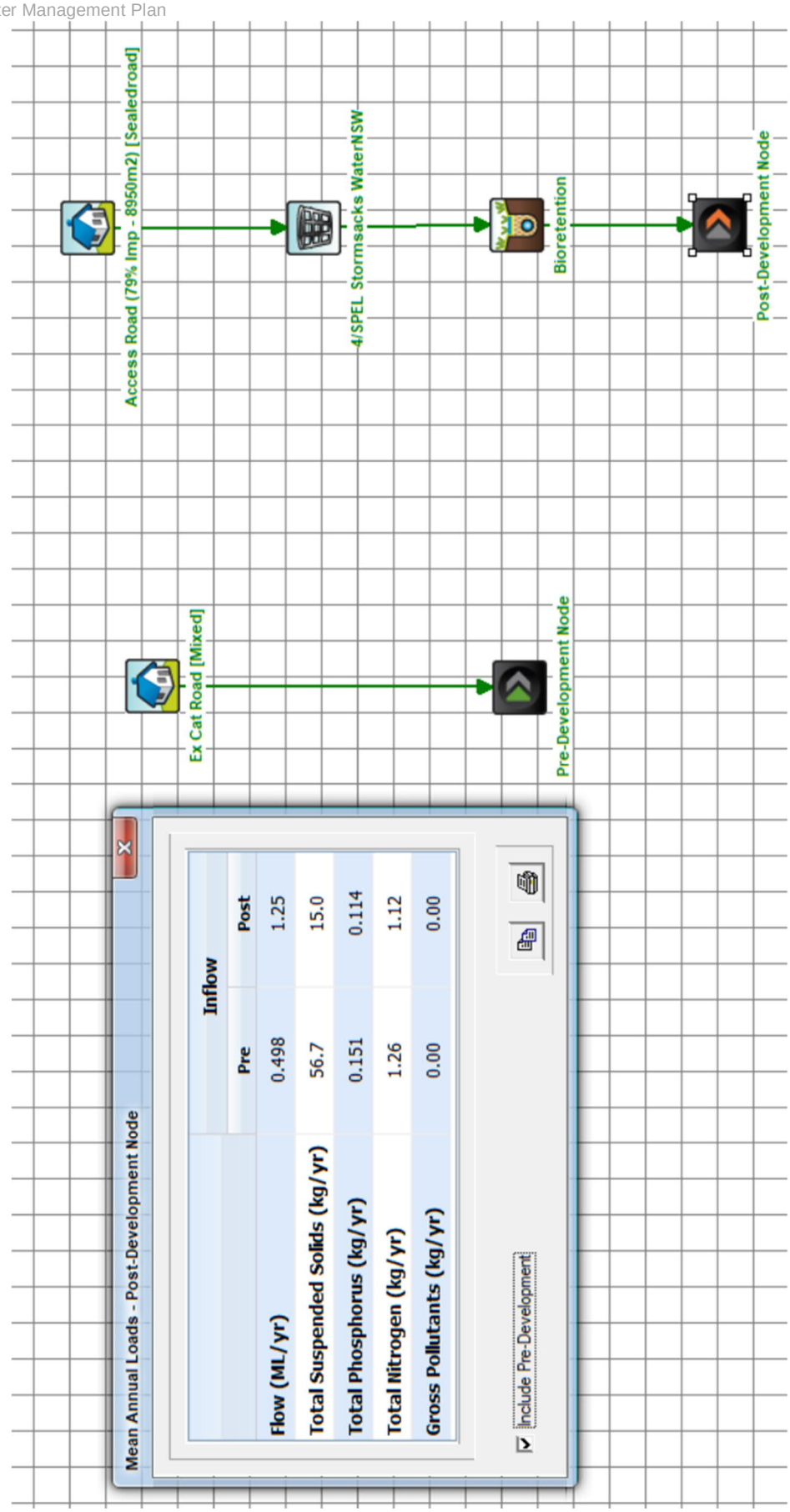
Other Details:

Site area	Sub-catchment or Name of Structure						Notes
	STG 1						
Total catchment area (ha)	1.708						
Disturbed catchment area (ha)	1.708						
Soil analysis (enter sediment type if known, or laboratory particle size data)							
Sediment Type (C, F or D) if known:	D						From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	D						Automatic calculation from above
Rainfall data							
Design rainfall depth (no of days)	5						See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	85						
x-day, y-percentile rainfall event (mm)	29.4						
Rainfall R-factor (if known)							Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	7.72						
RUSLE Factors							
Rainfall erosivity (*R*-factor)	1450						Auto-filled from above
Soil erodibility (*K*-factor)	0.03						RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	80						
Slope gradient (%)	1						
Length/gradient (*LS*-factor)	0.19						
Erosion control practice (*P*-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1	1	1	1	1	1	
Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)							
Storage (soil) zone design (no of months)	2						Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.56						See Table F2, page F-4 in Appendix F
Calculations and Type D/F Sediment Basin Volumes							
Soil loss (t/ha/yr)	11						
Soil Loss Class	1						See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	8						Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	2						See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	281						See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	283						

APPENDIX D
MUSIC Model Treatment Train – Development Site


Ex Cat Site [Mixed]
Pre-Development Node
Roof to toilet150m2 [Roof]
Roof to tanks 5550m2 [Roof]
3KL RW Tank
4x22.5KL RW Tank
Junction
8/SPEL Stormsacks WaterNSW
Carpark (79% Imp - 8950m2) [Sealedroad]
Bioretention
Post-Development Node
Mean Annual Loads - Post-Development Node
Inflow
Pre
Post
Flow (ML/yr) 3.00 8.03
Total Suspended Solids (kg/yr) 345 65.7
Total Phosphorus (kg/yr) 0.882 0.651
Total Nitrogen (kg/yr) 7.64 6.68
Gross Pollutants (kg/yr) 0.00 0.00
Include Pre-Development

APPENDIX E
MUSIC Model Treatment Train – Access Road


Access Road (79% Imp - 8950m2) [Sealedroad]
4/SPEL Stormsacks WaterNSW
Bioretention
Post-Development Node
Ex Cat Road [Mixed]
Pre-Development Node
Mean Annual Loads - Post-Development Node
Inflow
Pre
Post
Flow (ML/yr) 0.498 1.25
Total Suspended Solids (kg/yr) 56.7 15.0
Total Phosphorus (kg/yr) 0.151 0.114
Total Nitrogen (kg/yr) 1.26 1.12
Gross Pollutants (kg/yr) 0.00 0.00
Include Pre-Development

APPENDIX F
Bio-Basin Maintenance Schedule

MAINTENANCE REQUIREMENTS FOR BIOFILTRATION SYSTEMS

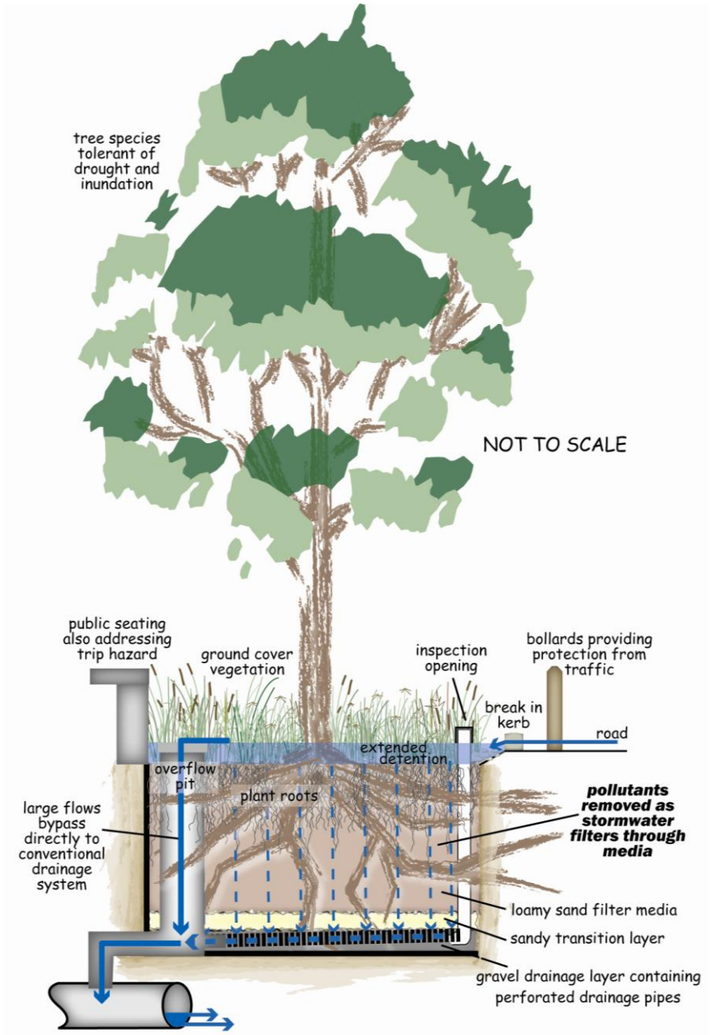


Figure 1. Conceptual drawing of a biofiltration system illustrating stormwater flow pathways and subsurface infrastructure.

Biofiltration systems (also known as biofilters, bioretention systems and rain gardens) are designed with the primary intent of removing pollutants from stormwater before the water is discharged to the local waterway or reused for other applications (e.g. irrigation). They are typically constructed as basins, trenches or tree pits (Figure 1). Stormwater runoff generally enters the biofiltration system through a break in a standard road kerb where it temporarily ponds on the surface before slowly filtering through the soil media. Treated stormwater is then collected at the base of the biofiltration system via perforated pipes located within a gravel drainage layer before being discharged to conventional stormwater pipes or collected for reuse. Note that, in some cases, the drainage pipe is upturned to create a permanent pool of water, or submerged zone, in the bottom of the biofiltration system. Conventional stormwater pipes also act as an overflow in most designs, taking flows that exceed the design capacity of the biofiltration system.

There are a number of maintenance activities that need to be carried out to ensure effective long-term function of biofiltration systems. Table 1 provides example illustrations of maintenance issues while Table 2 outlines inspection tasks, recommended frequencies and associated maintenance actions.

Table 1. Examples of issues requiring maintenance.

Build-up of fine sediments on the surface of the filter media reduces surface porosity and treatment capacity.		Holes, erosion and scour should be repaired and inflow controls provided or augmented.	
Anthropogenic and organic litter build-up is unsightly and can hinder flow paths and infiltration.		Anthropogenic and organic litter build-up is unsightly and can hinder flow paths and infiltration.	
Poor plant growth can be a sign of too much or too little water, or of poor filter function.		Vegetation die off can be a sign of too much or too little water, or of poor filter function.	
Weeds are unsightly and can reduce treatment capacity.		Blocked overflow grates can result in nuisance flooding.	
Overfilling of filters reduces the extended detention storage and treatment capacity.		Overflow levels that are set too low reduces the extended detention storage and treatment capacity.	

MAINTENANCE REQUIREMENTS FOR BIOFILTRATION SYSTEMS

Table 2. Inspection and maintenance tasks for biofiltration systems.

Inspection Task	Frequency	Comment	Maintenance Action
FILTER MEDIA			
Check for sediment deposition	3 monthly, after rain	Blocking of inlets and filter media reduces treatment capacity.	• Remove sediment from inlets, forebays and other pre-treatment measures, and the surface of biofiltration street trees
Check for holes, erosion or scour	3 monthly, after rain	Holes, erosion and scour can be a sign of excessive inflow velocities due to poor inflow control or inadequate provision for bypass of high flows.	• Infill any holes, repair erosion and scour • Provide/augment energy dissipation (e.g. rocks and pebbles at inlet) • Reconfigure inlet to bypass high flows • Relocate inlet
Inspect for the build-up of oily or clayey sediment on the surface of the filter media	3 monthly, after rain	Reduced surface porosity reduces treatment capacity.	• Clear away any mulch on the surface and lightly rake over the surface of the filter media between plants
Check for litter in and around treatment areas	3 monthly, after rain	Flow paths and infiltration through the filter media may be hindered.	• Remove both organic and anthropogenic litter
HORTICULTURAL			
Assess plants for disease or pest infection	3 monthly, or as desired for aesthetics		• Treat or replace as necessary
Check plants for signs of stunted growth or die off	3 monthly, or as desired for aesthetics	Poor plant health can be a sign of too much or too little water, or poor flow control.	• Check inlet and overflow levels are correct and reset as required For too much water: • Replace plants with species more tolerant of wet conditions OR • Replace filter media with that of a higher infiltration capacity For too little water: • Consider installing a choke on the outlet OR • Replant with species more tolerant of dry conditions
Check that original plant densities are maintained	3 monthly, or as desired for aesthetics	Plants are essential for pollutant removal and maintaining drainage capacity. Plants should be close enough that their roots touch each other; 6 – 10 plants/m^2 is generally adequate. A high plant density also helps prevent ingress of weeds.	• Carry out infill planting as required – plants should be evenly spaced to help prevent scouring due to a concentration of flow
Check for presence of weeds	3 monthly, or as desired for aesthetics	Weeds can reduce aesthetics and treatment capacity because some plants are more effective at pollutant removal than others.	• Manually remove weeds where possible – where this is not feasible, spot spray weeds with a herbicide appropriate for use near waterways
DRAINAGE			
Check that underdrain is not blocked with sediment or roots	6 monthly, after rain	Filter media and plants can become waterlogged if the underdrain is choked or blocked. Remote camera (CCTV) inspection of pipelines could be useful.	• Clear underdrain as required using a pipe snake or water jet • Water jets should be used with care in perforated pipes
Check that the water level in the submerged zone (if applicable) is at the design level	6 monthly, after rain	Drawdown during dry periods is expected.	• Check outflow level is correct and reset as required
Check that inflow areas, weirs and grates over pits are clear of litter and debris and in good and safe condition.	Monthly, and occasionally after rain	A blocked grate or inlet would cause nuisance flooding.	• Replace dislodged or damaged pit covers as required • Remove sediment from pits and entry sites (likely to be an irregular occurrence in mature catchments)
OTHER			
Observe biofiltration system after a rainfall event to check drainage	Twice a year, after rain	Ponding on the filter media surface for more than a few hours after rain is a sign of poor drainage	• Check catchment land use and assess whether it has altered from design capacity (e.g. unusually high sediment loads may require installation of a sediment forebay)

APPENDIX G
Existing Site Survey

LOT 501
DP1030314

ALDI

LOT 602
DP1051775

VARIOUS SHOPS AND CARPARK

SSM97595

VALLEY

LOT 601
DP1061438

DRIVE

PRAM RAMP

KIP

OF

CONCRETE

BITUMEN

LOT 701
DP1150747

SMH

EDGE

LOT 603
DP1244557

925.0

237° 59' 05" 110.00

205°51'56" 8.45

352° 26' 37" 160.197

BOTTOM

TOP

927.5

930.0

932.5

BANK

LANE

LOT 2
DP1209073

LOT 1
DP1209073

LOT 103
DP1111768

LOT 102
DP1111768

LOT 101
DP1111768

LOT 100
DP1111768

LOT 99
DP1111768

SILCOCK STREET

MGA56

SITE BOUNDARY
1.46ha
(As per DWG 2021.1178-Concept-P1-4-Bunnings.dwg)

LOT 26
DP1244557
54.5ha CALC

173° 30' 59" 112.49

79° 49' 59" 107.00

CONTOUR INTERVAL 2.5m MAJOR 0.5m MINOR

DISCLAIMER:
THE SITE BOUNDARY, DIMENSIONS AND AREA SHOWN ON THIS PLAN HAVE BEEN DERIVED FROM DESIGN DRAWING INFORMATION SUPPLIED TO CEH BY THE CLIENT.

NOTES:
1. COPYRIGHT OF THIS PLAN & ASSOCIATED ELECTRONIC FILES VESTS WITH CEH SURVEY.
2. THE PLAN & ASSOCIATED ELECTRONIC FILES SHALL ONLY BE USED BY THE ADDRESSED CLIENT FOR THE PURPOSE OF THE SURVEY.
3. THIS SURVEY AND PLAN IS FOR CONTOUR & DETAIL / PLANNING PURPOSES ONLY.
4. THE BOUNDARIES, AREAS & DIMENSIONS OF THE LAND, AS SHOWN, ARE BASED ON ORIGINAL DATA AND HAVE NOT BEEN SUBJECT TO REDEFINITION.
5. CONTOURS SHOW THE GENERAL SURFACE TOPOGRAPHY ONLY.
6. VISIBLE SERVICES HAVE BEEN SHOWN.
   CEH ACCEPTS NO RESPONSIBILITY FOR SERVICES NOT SHOWN. RING 1100; "DIAL BEFORE YOU DIG" CABLE LOCATIONS, CONTACT RELEVANT AUTHORITIES & LOCAL COUNCIL FOR OTHER SERVICE LOCATIONS.
7. THESE NOTES FORM AN INTEGRAL PART OF THE PLAN AND MUST NOT BE REMOVED FROM THE PLAN.

PLOT DATE/TIME:
10/02/2022 10:10:54 AM D.MACKIE

D:\CURRENT\AUTOCAD_DM\4_PROPERTY JOBS\4883_Valley Drive Investigation (PS)\2021_Valley Drive Site Detail (BN,PS)\4883_CONT_SITE.dwg

CEH SURVEY
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
"Astrolabe" 1 Rutherford Lane, LITHGOW 2790
ABN: 68 056 544 551 Office: (02) 6351 2281
Email: survey@ceh.com.au Website: www.ceh.com.au

0 5 10 15 20 30 40 50m
Metres

SCALE: 1 : 700
ISO full bleed A3 (420.00 x 297.00 MM)

AHD LEVEL DATUM:	MGA56 GDA94
CLIENT:	O'CONNOR C/o PROJECT INNOVATIONS PTY LTD
LOCALITY:	SHEEDYS GULLY/POTTERY ESTATE
LGA:	LITHGOW CITY

PLAN: **PARTIAL CONTOUR AND DETAIL**
- SITE BOUNDARY AS PER DWG 2021.1178-Concept-P1-4-Bunnings -
LOT 26 DP1244557
SHEEDYS GULLY/POTTERY ESTATE NSW 2790

SURVEYOR:	DRAWN:	DATE OF SURVEY:	PLAN No.
B.NANCARROW	D.MACKIE	10-09-2021	4883_CONT_SITE

Figures

NO GO ZONE

N

Designated stockpile site

GIF

Extent on batter to natural ground, indicative only. To be determined on site

IL 923.719

Sediment fence

Stabilised site access

Clean water diversion drain

NO GO ZONE

Straw bale or coir log filter at dirty water drain outlet. Provide fabric ground cover from end of drain to back of kerb

Dirty water diversion drain

SD 5-8 Energy Dissipater. Provide D_{50} 300mm angular rip rap on A34 geotextile or similar. Shape batter drain to retain water flow within rip rap.

NO GO ZONE

LEGEND

- SD 6-7 Straw Bale Filter or Coir Log Filter
- SD 6-8 Sediment Fence
- Clean water Diversion
- Drain Dirty water Diversion Drain
- Single Sandbag/ Line of Sandbags
- SD 6-13 Kerbside Turf Strip
- Un-Disturbed Area
- SD 6-14 Stabilised Site Access
- SD 6-11 Mesh and Gravel Inlet Filter
- SD 6-12 Geotextile Inlet Filter

GIF

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27 2022 - 11:22:52

Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL
P5	19/05/22	Gradients added	GBL
P4	10/05/22	Notes added	GBL
P3	03/05/22	Footpath access to site added	GBL
P2	29/03/22	FOR APPROVAL	BB
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL

Drawn:	GBL
Designed:	GBL
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg
Scale (A1):	1:500
Date:	12/11/21

Approved for Construction:

PRELIMINARY

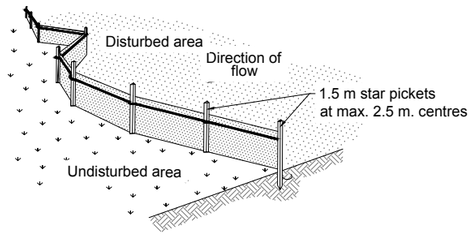
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

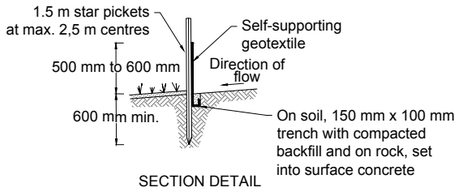
EROSION AND SEDIMENT CONTROL PLAN

CEEDIVE

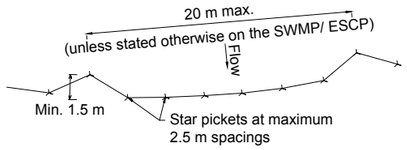
CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No.	2021.1178
DWG. No.	ES01
Issue	P6
No. in set	18





SECTION DETAIL



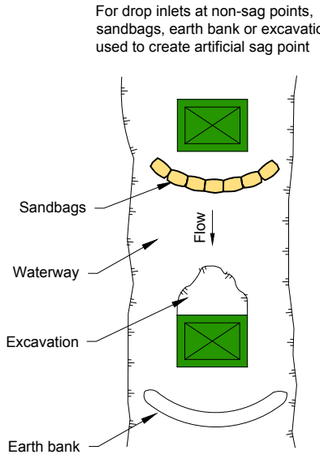
PLAN

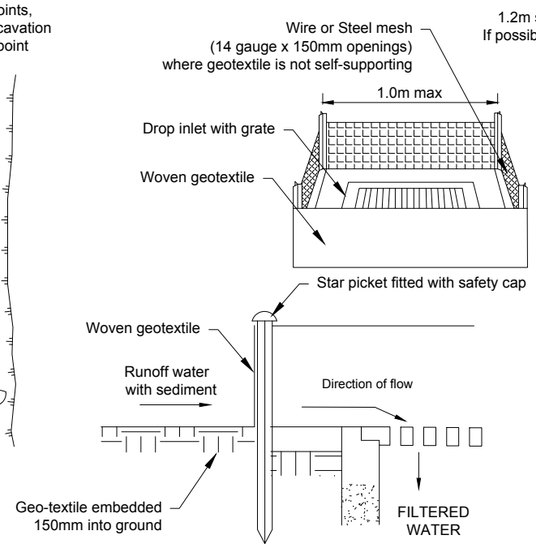
SEDIMENT FENCE - SD 6-8

SCALE: NTS

Construction Notes:

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10% AEP.
2. Cut a 150 mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre star pickets into the ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile yo the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextle with wire ties or as recommended by the manufacturer. only use geotextile specifically produced for sediment fencing. the use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150 mm overlap.
6. Backfill the trench over the base of the fabric and compact it throughly over the geotextile.



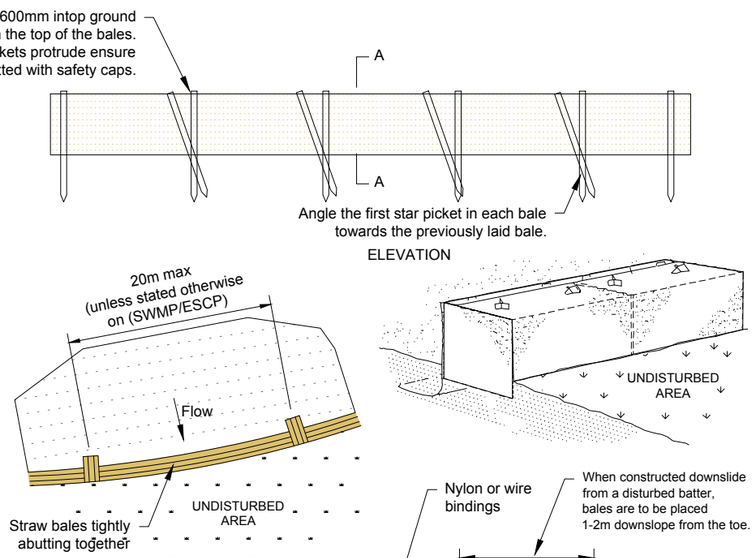


GEO TEXTILE INLET FILTER - SD 6-12

SCALE NTS

Construction Notes:

1. For instillation procedures for the straw bales or geo fabric Refer the NSW Managing Urban Stormwater BlueBook, Soils and Construction, Section 6.3 Std Dwg 6-7 and 6-8
2. In water ways, artificial sag points can be created with sand bags or earth banks.
3. Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it

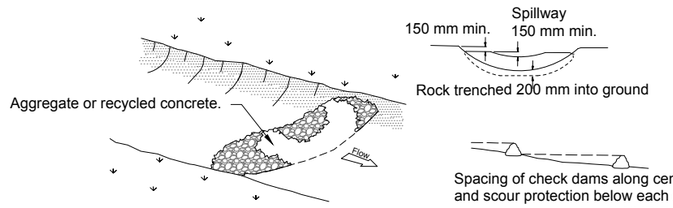


STRAW BALE FILTER - SD 6-7

SCALE NTS

Construction Notes:

1. Construct as close as possible to be parallel to site contours.
2. Place bales leangthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales.
3. Ensure that the maximum height of the filter is one bale.

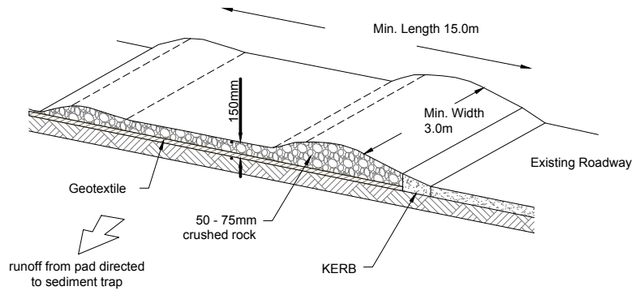


ROCK CHECK DAM - SD 5-4

SCALE: NTS

Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.



STABILISED SITE ACCESS DETAIL - SD 6-14

SCALE NTS

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:22:54

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
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P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	AS SHOWN	PRELIMINARY
Date:	12/11/21	

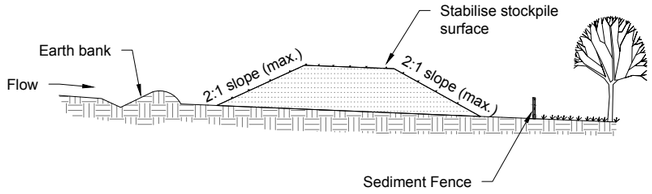
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

EROSION AND SEDIMENT CONTROL NOTES & DETAILS

CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No.	2021.1178
DWG. No.	ES02
Issue	P6
No. in set	18

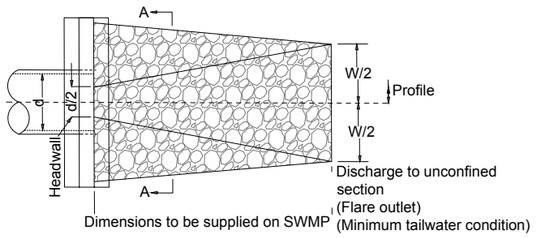


STOCKPILES - SD 4-1

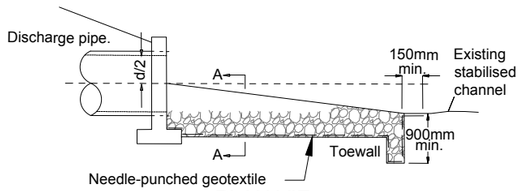
SCALE: NTS

Construction Notes

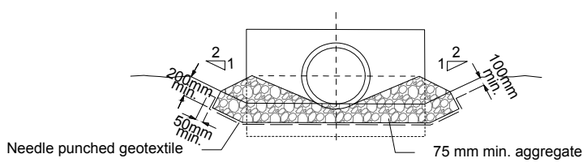
1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.



PLAN VIEW



PLAN VIEW



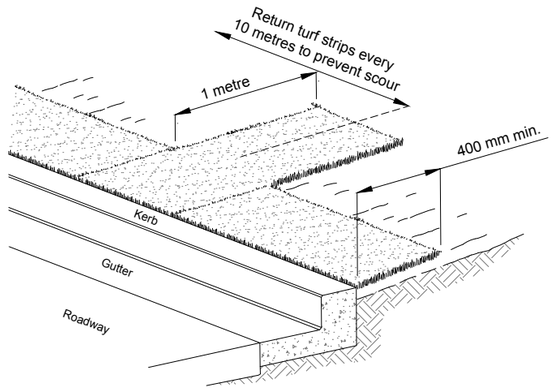
CROSS SECTION AA

ENERGY DISSIPATER - SD 5-8

SCALE: NTS

Construction Notes:

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will endure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair ir before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete orriprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

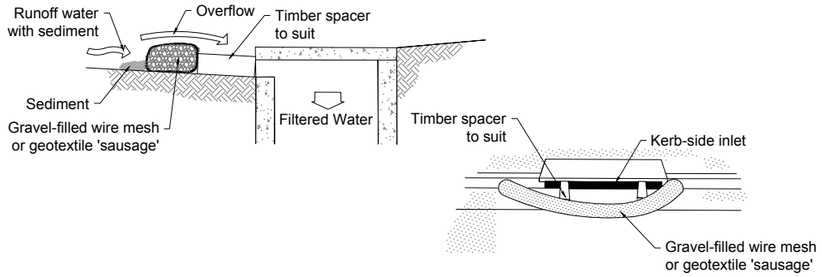


KERBSIDE TURF STRIP - SD 6-13

SCALE: NTS

Construction Notes:

1. Install a 400 mm minimum wide roll of turf onthe footpath next to the kerb and at the same level as the top of the curve.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the kerb.



MESH AND GRAVEL INLET FILTER - SD 6-11

SCALE: NTS

Construction Notes:

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 22 mm to 50mm gravel.
3. Form an elliptical cross section about 150 mm high x 400 mm wide.
4. Place the filter at the openingleaving at least a 100 mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent bypassing the filter.
6. Sandbags filled with gravel can substitute for mesh or geotextile providing they are placed so that they firmly abut each other, and sediment laden waters cannot pass between.

NOTES : SEDIMENT CONTROL

1. EROSION AND SEDIMENTATION CONTROL SHALL BE IN ACCORDANCE WITH NSW LANDCOM GUIDELINES " MANAGING URBAN STORMWATER - SOILS & CONSTRUCTION" 4TH EDITION. MINIMISE DISTURBANCE OF EXISTING VEGETATION DURING CONSTRUCTION. EROSION & SEDIMENT CONTROLS TO BE IN PLACE PRIOR TO ANY CONSTRUCTION WORK COMMENCING.
2. CONSTRUCTION IS TO BE PROGRAMMED TO PROVIDE INSTALLATION OF PERIMETER LANDSCAPING/SURFACE TREATMENT AS EARLY AS PRACTICAL.
3. AT THE PRESTART MEETING THE CONTRACTORS WORKS PROGRAM IS TO BE REVIEWED. ALTERATIONS TO THE PROGRAM MAY BE REQUIRED TO ENSURE SATISFACTORY EROSION AND SEDIMENT CONTROL.
4. A PHOTOGRAPHIC RECORD OF SEDIMENT AND EROSION CONTROL DEVICES AND THE IMMEDIATE DOWNSTREAM STORMWATER SYSTEM IS TO BE CARRIED OUT ON A FORTNIGHTLY CYCLE AND AFTER EACH MAJOR STORM EVENT. CARRY OUT CORRECTIVE AND PREVENTATIVE ACTION AS REQUIRED.
5. PUBLIC AND WORKPLACE SAFETY ISSUES MUST BE CONSIDERED AND MONITORED FOR EACH DEVICE TO THE SATISFACTION OF THE SUPERINTENDENT.
6. WOVEN FABRICS ARE TO BE USED FOR SEDIMENT FENCE FILTER FABRIC.
7. SEDIMENT MANAGEMENT DEVICES SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES AND MAINTAINED AT A SUITABLE LEVEL/CONDITION THROUGHOUT CONSTRUCTION. SEDIMENT FENCES ARE TO BE CLEANED OUT WHEN CAPACITY IS REDUCED BY 30%. DRAINAGE STRUCTURE PROTECTION IS TO BE CLEANED FOLLOWING EACH SIGNIFICANT RUNOFF PRODUCING STORM.
8. THE CONTRACTOR SHALL PROVIDE TEMPORARY DRAINAGE CONTROL TO DIVERT FLOW FROM UNDISTURBED AREAS AROUND DISTURBED AREAS AND DIRECT FLOW FROM DISTURBED AREAS TOWARDS CONTROL DEVICES.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSPECTION AND MAINTENANCE OF SEDIMENT AND EROSION CONTROL DEVICES. ALL DEVICES ARE TO BE INSPECTED AT LEAST WEEKLY AND AFTER SIGNIFICANT RUNOFF PRODUCING STORMS.
10. IF EROSION AND SEDIMENT CONTROL DEVICES HAVE BEEN FOUND TO BE DEFICIENT OR FAILED IN SERVICE DUE TO UNFORESEEN CIRCUMSTANCES CORRECTIVE ACTION IS TO BE UNDERTAKEN BY THE CONTRACTOR IMMEDIATELY WHICH MAY INCLUDE;
AMENDMENTS/ADDITIONS TO THE ORIGINAL EROSION CONTROL PLANS. SUCH ADDITIONS OR AMENDMENTS ARE TO BE APPROVED BY THE SUPERINTENDENT.
11. STRAW BALES USED IN SEDIMENT DEVICES ARE TO BE REPLACED AFTER A MAXIMUM SERVICE PERIOD OF 6 WEEKS OR AS REQUIRED.
12. SEDIMENT MANAGEMENT DEVICES ARE TO BE MAINTAINED BY THE CONTRACTOR AS NOTED AND DETAILED UNTIL APPROVAL HAS BEEN GRANTED BY THE ENGINEER FOR THEIR REMOVAL. THE CONTRACTOR IS TO REMOVE AND DISPOSE OF THESE DEVICES OFF SITE.
13. ALL TEMPORARY ACCESS ROADS AND HARDSTAND AREAS ARE TO BE TRIMMED AND MAINTAINED IN A SERVICEABLE CONDITION FOR THE DURATION OF THE CONTRACT.
14. ALL TEMPORARY ACCESS ROADS AND HARDSTAND AREAS ARE TO BE REINSTATED TO THE SATISFACTION OF THE SUPERINTENDENT AT THE END OF THE CONTRACT.

CLEAN/ DIRTY WATER DIVERSION DRAIN SIZING - FLAT BOTTOM DRAIN

Design Rainfall Event = 10% AEP
Catchment Area = 3000m^2
Runoff = 0.034m^3/s
Average longitudinal drain slope = -5%
Side slopes = 1:3
Bottom of drain width = 0.1m
Top of drain width = 0.82m
Calculated depth plus 1/3 freeboard = 0.12m

Clean water and Dirty water diversion drain size based on largest catchment area.

All drain/bund mounds to be compacted to minimum 95% standard compaction. Drains must be maintained and kept clear of sediment build up. All diversion drains/bunds are to be lined with Kikuyu to min. 50mm vegetation growth length

DUST MANAGEMENT

1. Ground disturbance is to be minimised and all site vehicle movements are to be maintained with the designated haulage tracks and or roads.
2. All site traffic speeds are to be kept to a minimum. Maximum speed 10 kph.
3. Water tankers are to be kept onsite for the duration of works and until seeded areas are considered stabilised or when ground cover achieves 70% plant density to at least 100mm in height.
4. The contractor will ensure that haul roads and all denuded areas are watered as required and a trackifier such as curosol may be required.
5. In the event that dust becomes a nuisance council may instruct the contractor to cease all work until a satisfactory control has been reached.

REVEGETATION MANAGEMENT

1. All flat bottom drains to be top soiled and turfed along base and one third height of batters. Remainder of batters to be top soiled and sprayed with seeded hydromulch.
2. All V drains to be top soiled and turfed within the cut and fill. bunds to be sprayed with seeded hydromulch.
3. All batters & reinstatement works adjacent to new construction works shall be carried out as soon as possible after completion.
4. All disturbed areas & batters shall be turfed or grassed as soon as practical after reinstatement and achieve 70% cover after 10 working days. Areas not worked for 20 days must achieve 50% cover.
5. Replace topsoil on all disturbed areas to a depth of at least 75mm depth on slopes less than 4h:1v and 40mm to 60mm on lands where slopes exceed 4h to 1v.
6. Sow or hydromulch disturbed areas with approved seed/fertiliser mixture.

MONITORING & TESTING

The installation of the erosion and sediment control measures as detailed in this plan will ameliorate potential impact to water quality in the receiving waters. A monitoring program is proposed to ensure that the control measures achieve the desired goals.

A visual monitoring program is proposed due to the relatively small size of the development and the amount of earthworks that is to take place. Inspections of all controls to take place weekly and before and after rainfall events (70% chance of 5mm or more)

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Designed:	GBL		
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PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

EROSION AND SEDIMENT CONTROL NOTES & DETAILS

CEEDIVE

CALARE CIVIL
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Job No. 2021.1178
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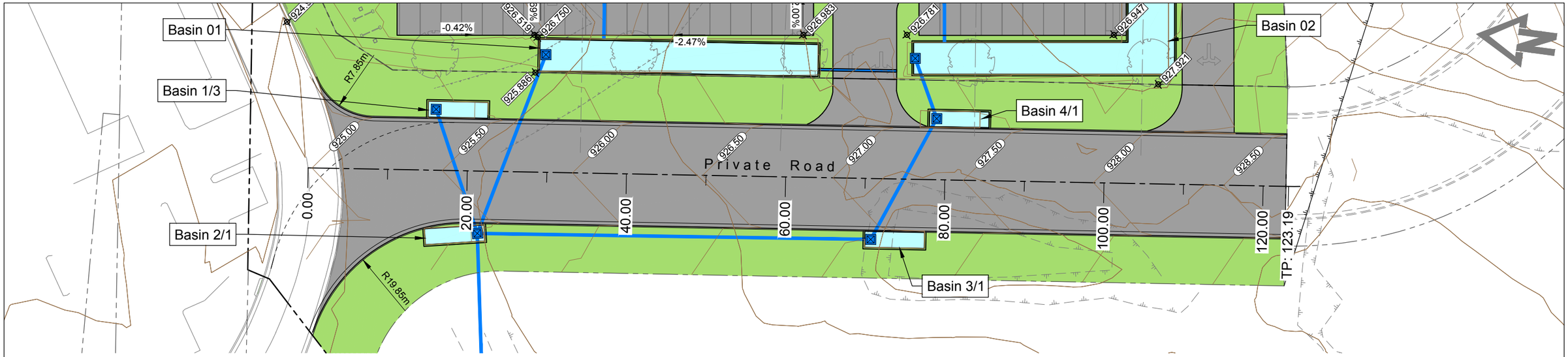

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DESIGN SURFACE	924.99	925.60	926.21	926.82	927.43	928.04	928.65	928.75
CUT (-) FILL (+)	+0.000	-0.254	-0.572	-0.574	-0.381	-0.189	+0.586	+0.636
CHAINAGE	0.000	20.000	40.000	60.000	80.000	100.000	120.000	123.193
HORIZONTAL GEOMETRY	L=123.193 B=173°30'59"							

LONGITUDINAL SECTION
SCALE 1:250 H 1:100 V

Silcock-Extn

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:00

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Date:	12/11/21

Approved for Construction:

PRELIMINARY

PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

PRIVATE ROAD PLAN AND LONGSECTION

CEEDIVE

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Job No.	2021.1178
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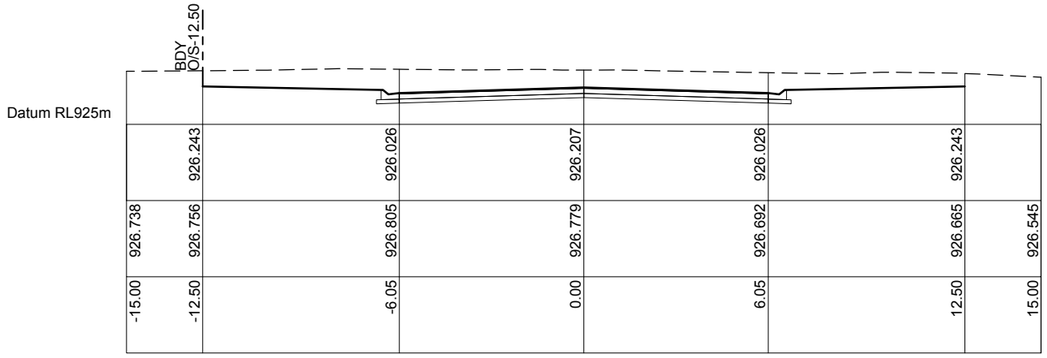

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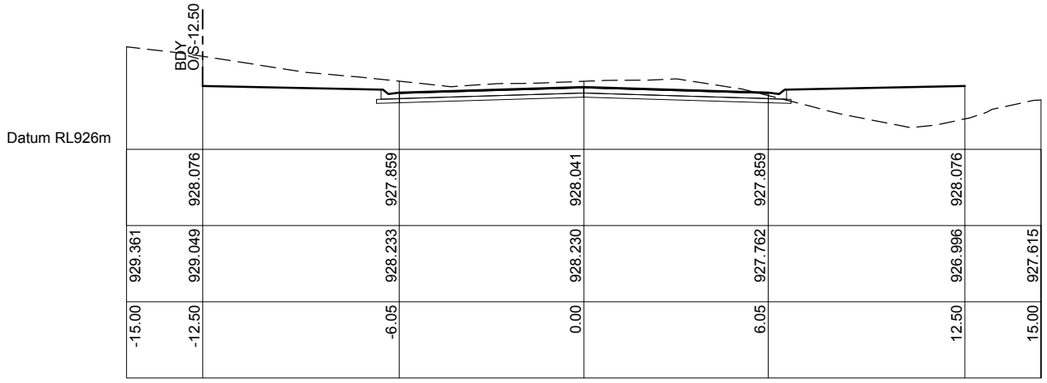

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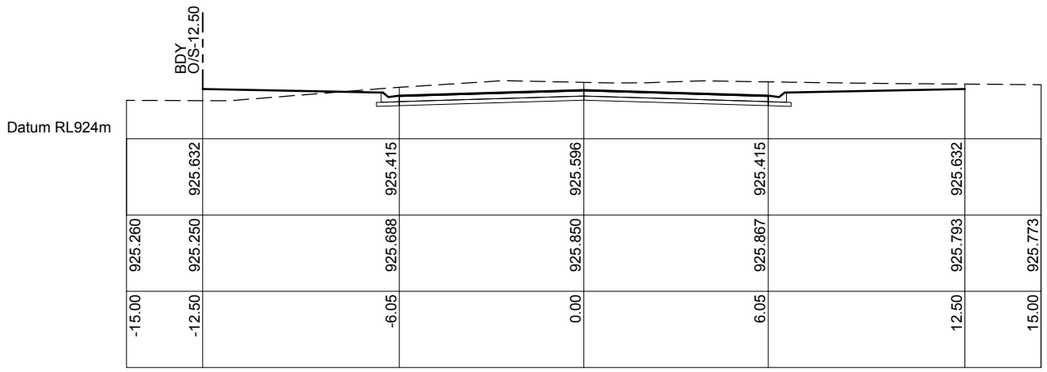

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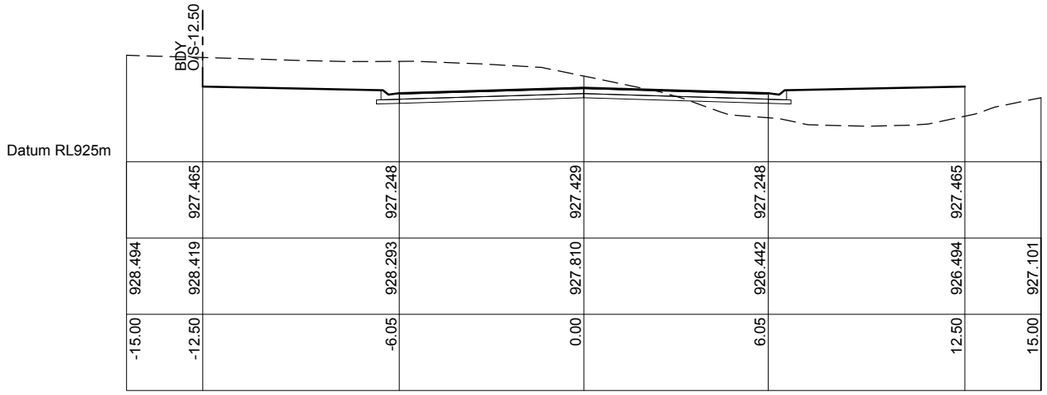

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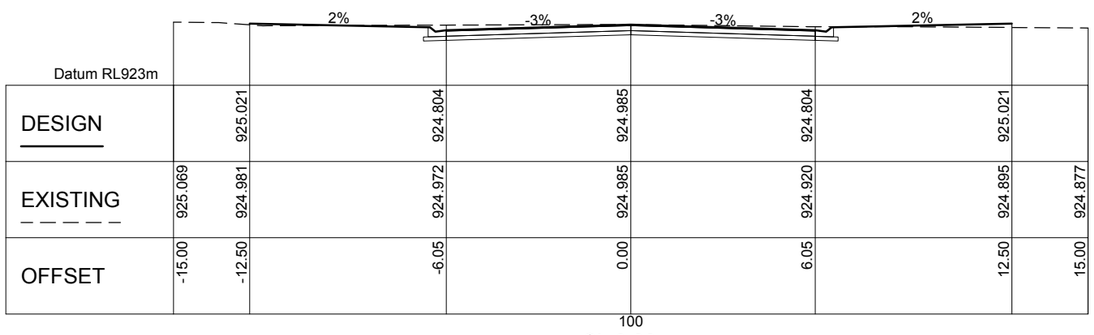

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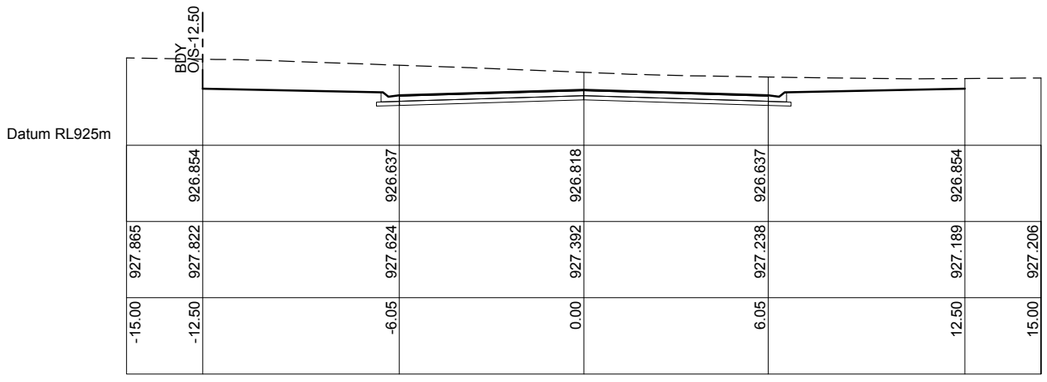

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PROPOSED BUNNINGS SITE AND NEW ROAD
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LITHGOW, NSW 2790

PRIVATE ROAD CROSS SECTIONS

CEEDIVE

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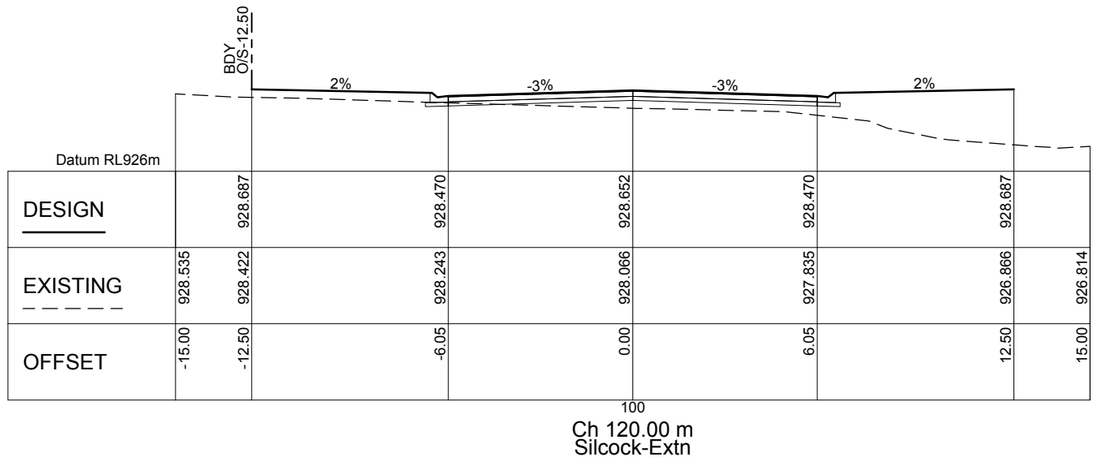

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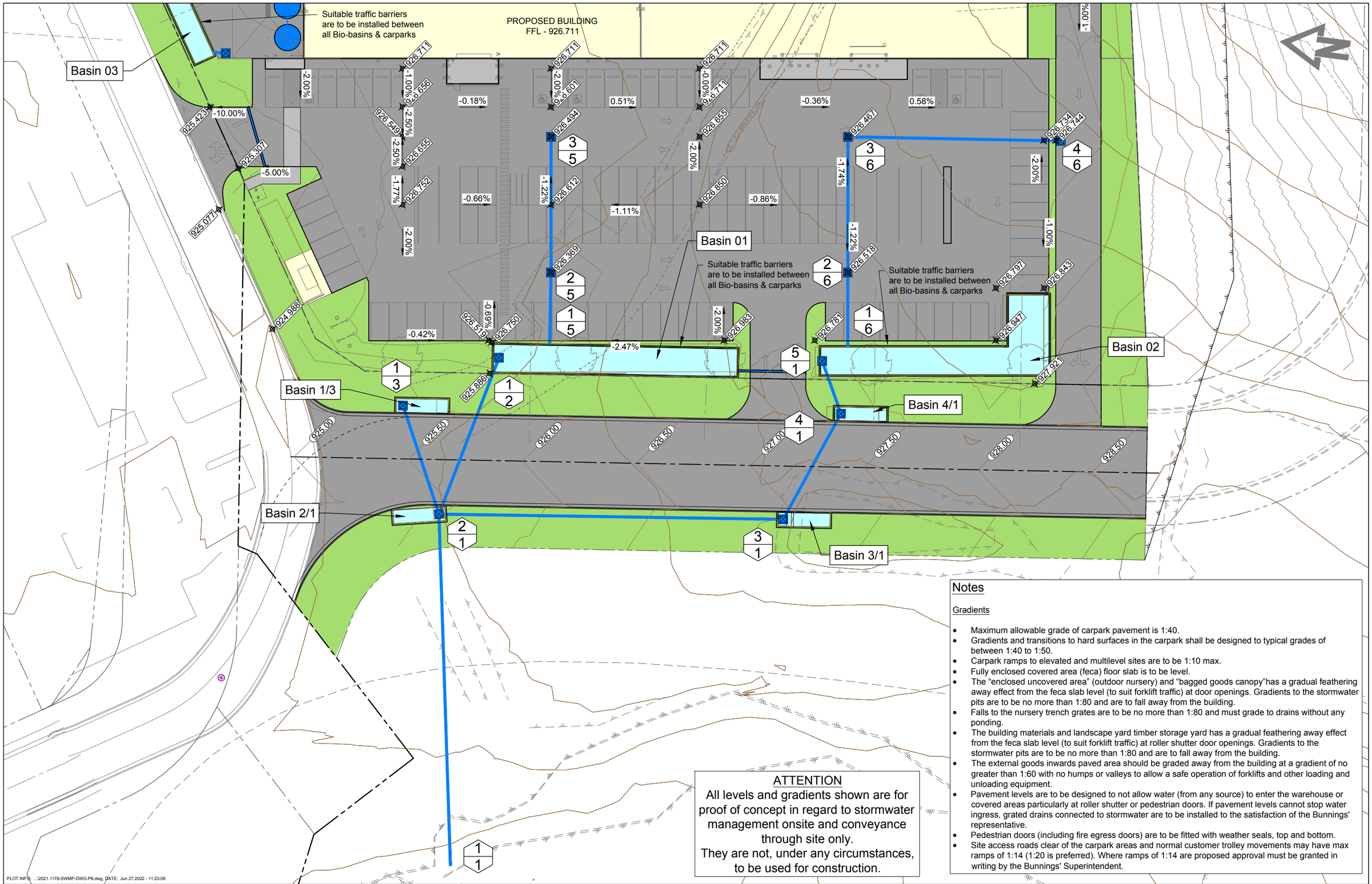


Notes

Gradients

- Maximum allowable grade of carpark pavement is 1:40.
- Gradients and transitions to hard surfaces in the carpark shall be designed to typical grades of between 1:40 to 1:50.
- Carpark ramps to elevated and multilevel sites are to be 1:10 max.
- Fully enclosed covered area (feca) floor slab is to be level.
- The “enclosed uncovered area” (outdoor nursery) and “bagged goods canopy”has a gradual feathering away effect from the feca slab level (to suit forklift traffic) at door openings. Gradients to the stormwater pits are to be no more than 1:80 and are to fall away from the building.
- Falls to the nursery trench grates are to be no more than 1:80 and must grade to drains without any ponding.
- The building materials and landscape yard timber storage yard has a gradual feathering away effect from the feca slab level (to suit forklift traffic) at roller shutter door openings. Gradients to the stormwater pits are to be no more than 1:80 and are to fall away from the building.
- The external goods inwards paved area should be graded away from the building at a gradient of no greater than 1:60 with no humps or valleys to allow a safe operation of forklifts and other loading and unloading equipment.
- Pavement levels are to be designed to not allow water (from any source) to enter the warehouse or covered areas particularly at roller shutter or pedestrian doors. If pavement levels cannot stop water ingress, grated drains connected to stormwater are to be installed to the satisfaction of the Bunnings' representative.
- Pedestrian doors (including fire egress doors) are to be fitted with weather seals, top and bottom.
- Site access roads clear of the carpark areas and normal customer trolley movements may have max ramps of 1:14 (1:20 is preferred). Where ramps of 1:14 are proposed approval must be granted in writing by the Bunnings' Superintendent.

ATTENTION

All levels and gradients shown are for proof of concept in regard to stormwater management onsite and conveyance through site only.
They are not, under any circumstances, to be used for construction.

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:09

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	1:250	PRELIMINARY
Date:	12/11/21	

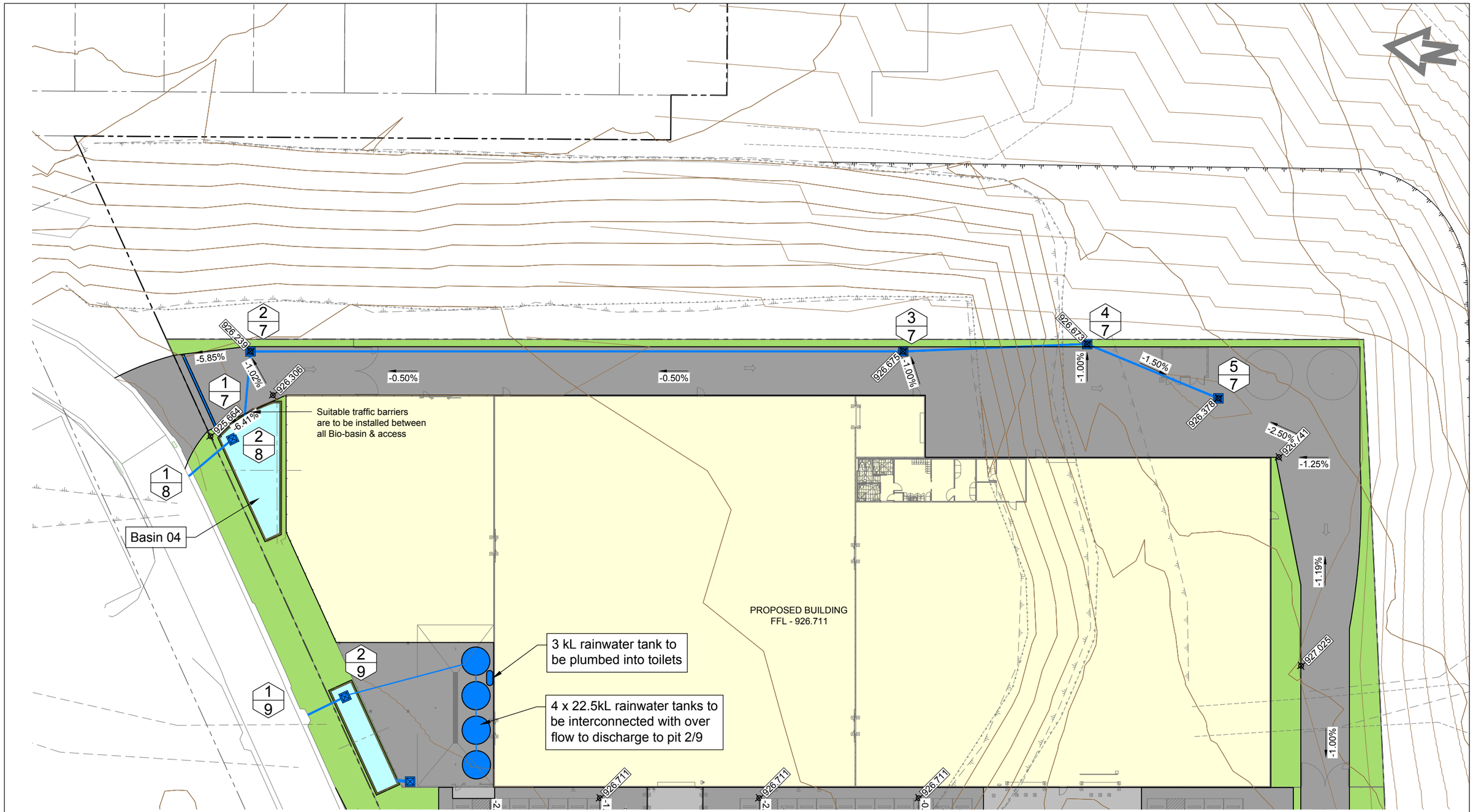
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

STORMWATER LAYOUT PLAN

CEEDIVE

CALARE CIVIL CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW01 Issue P6
No. in set 18



ATTENTION

All levels and gradients shown are for proof of concept in regard to stormwater management onsite and conveyance through site only.
They are not, under any circumstances, to be used for construction.

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:12

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL
Designed:	GBL
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg
Scale (A1):	1:250
Date:	12/11/21

Approved for Construction:

PRELIMINARY

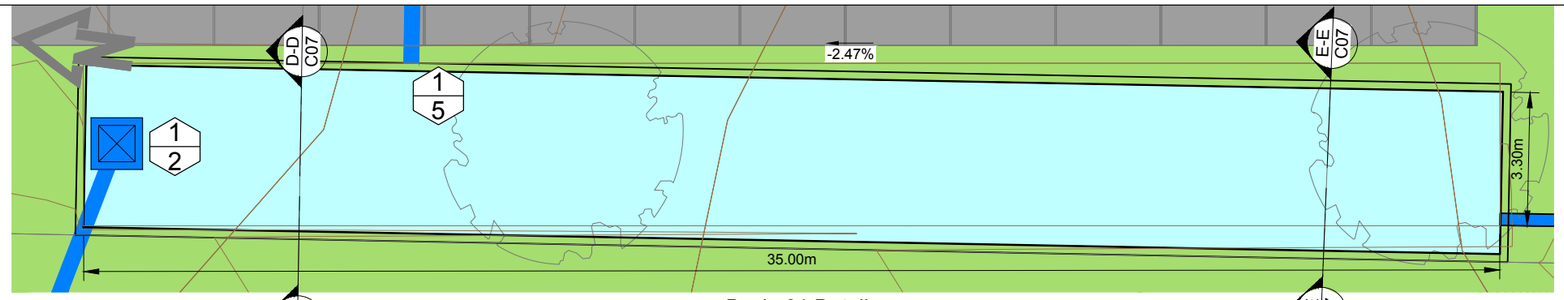
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

STORMWATER LAYOUT PLAN

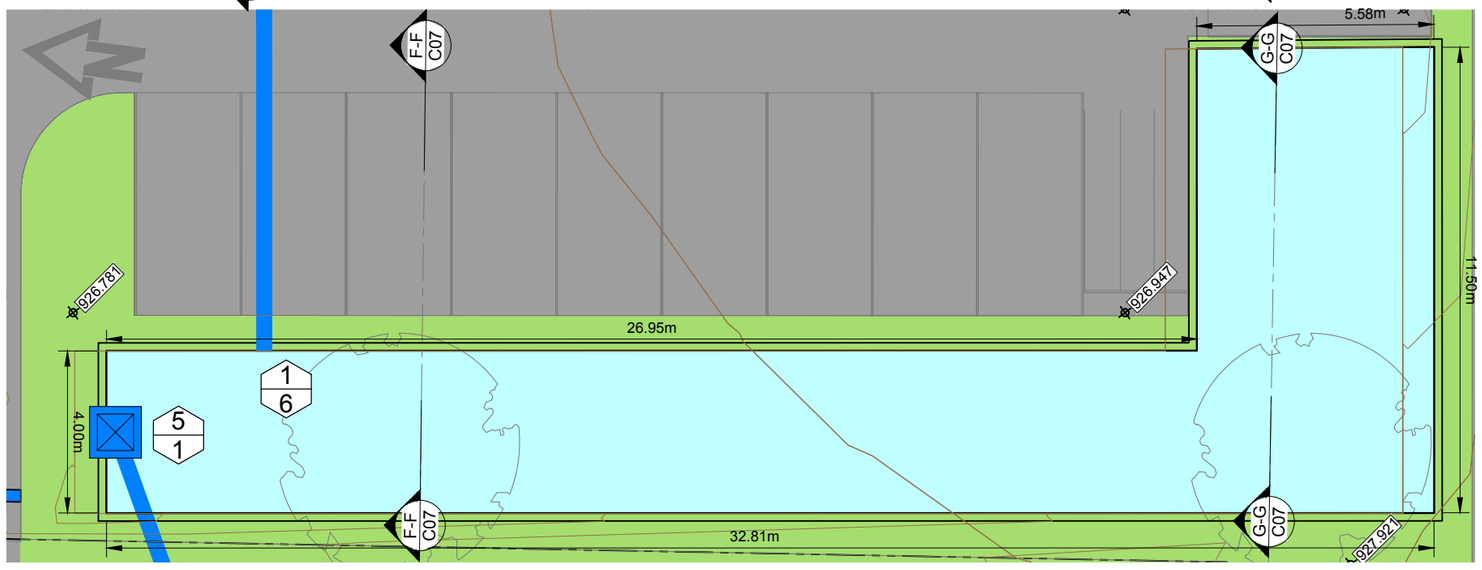
CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No.	2021.1178
DWG. No.	SW02
Issue	P6
No. in set	18



Basin 01 Details
Scale 1:75



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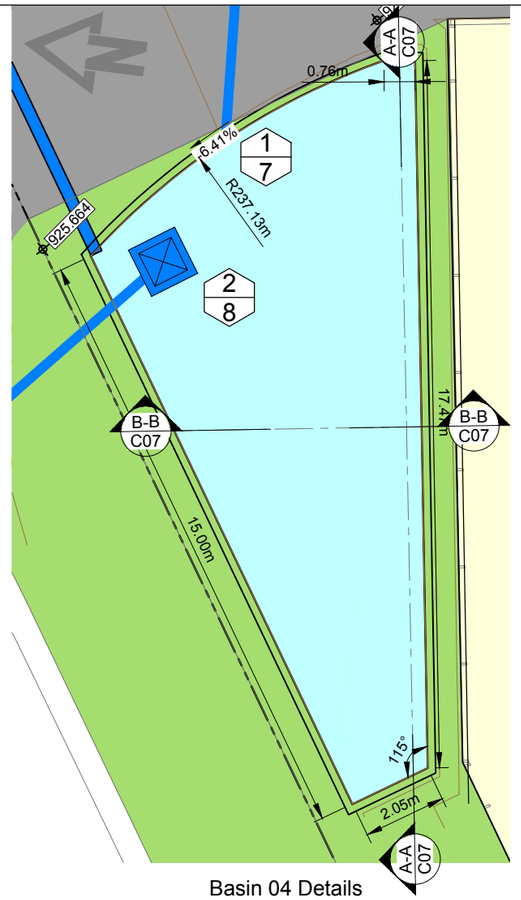
Scale 1:75



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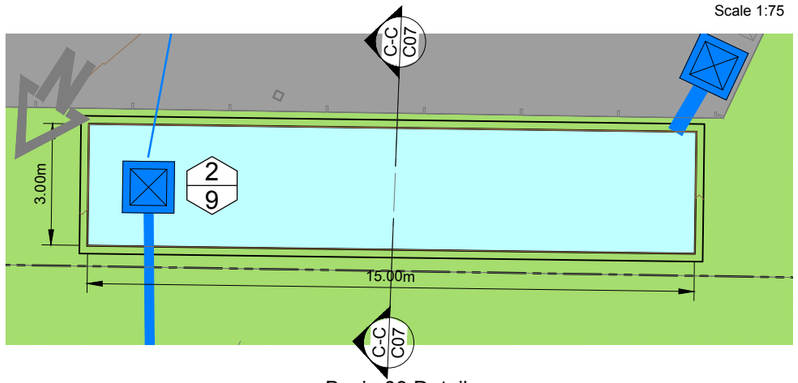
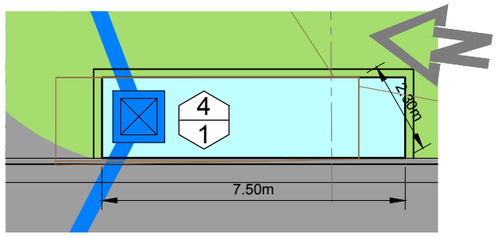
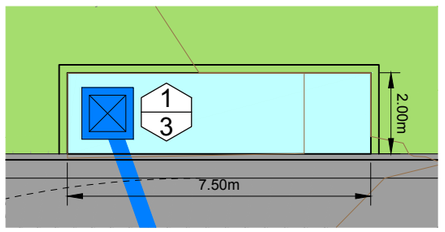
Scale 1:75



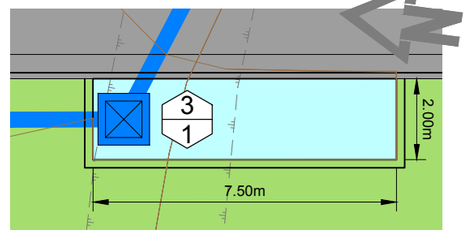
Basin 03 Details
Scale 1:75



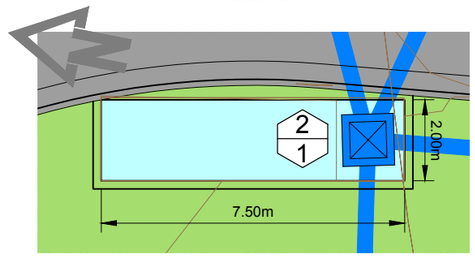
Basin 4/1 Details
Scale 1:75



Basin 1/3 Details
Scale 1:75



Basin 3/1 Details
Scale 1:75



Basin 2/1 Details
Scale 1:75

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:33

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL
Designed:	GBL
CADRef:	2021.1178-SWMP-DWG-P6.dwg
Scale (A1):	1:75
Date:	12/11/21

Approved for Construction:

PRELIMINARY

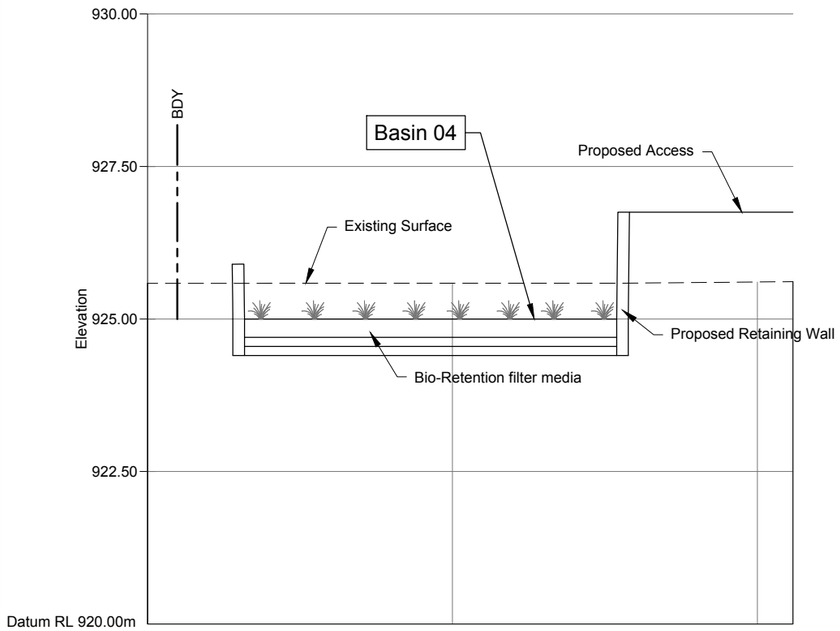
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

BIO-RETENTION LAYOUT PLAN

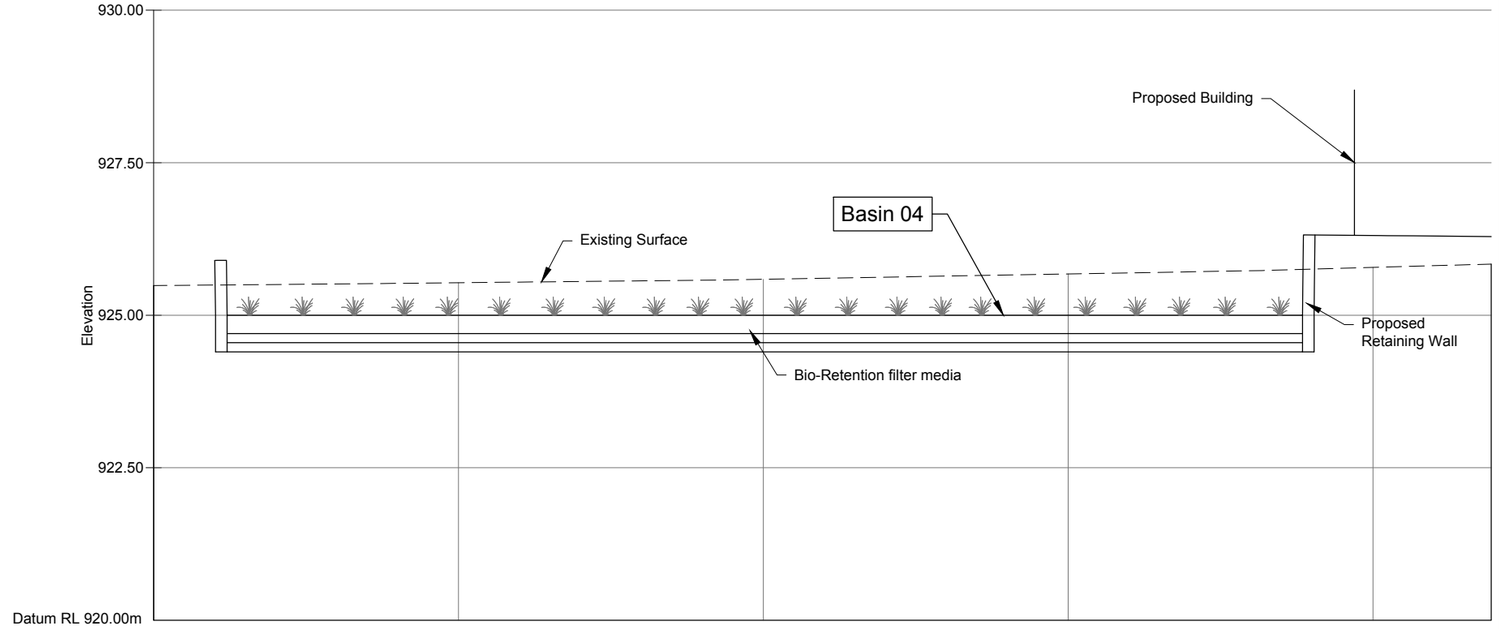
CEEDIVE

CALARE CIVIL CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

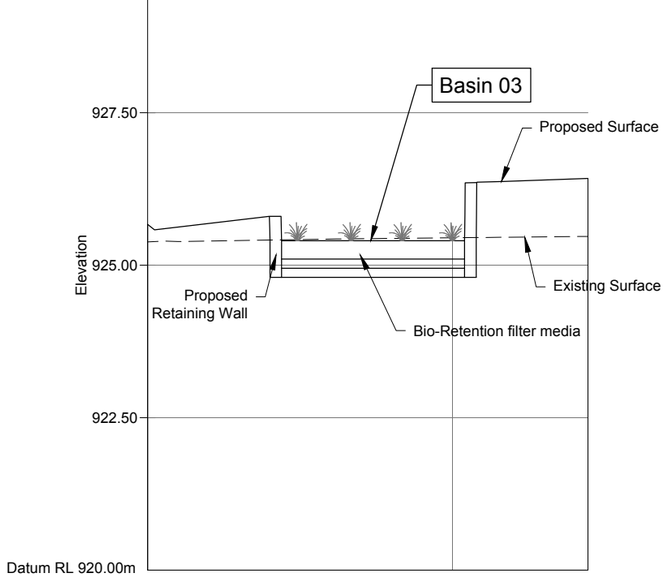
Job No.	2021.1178
DWG. No.	SW03
Issue	P6
No. in set	18



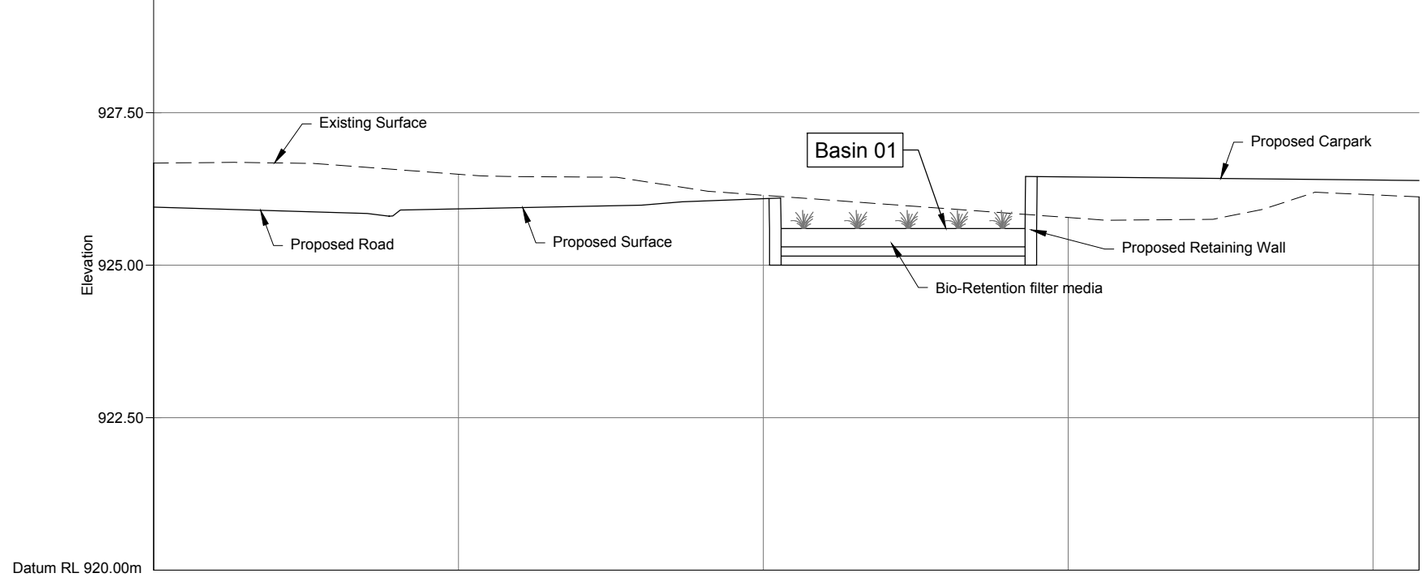
Section A-A
Scale 1:50



Section B-B
Scale 1:50



Section C-C
Scale 1:50



Section D-D
Scale 1:50

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:42

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	1:50	PRELIMINARY
Date:	12/11/21	

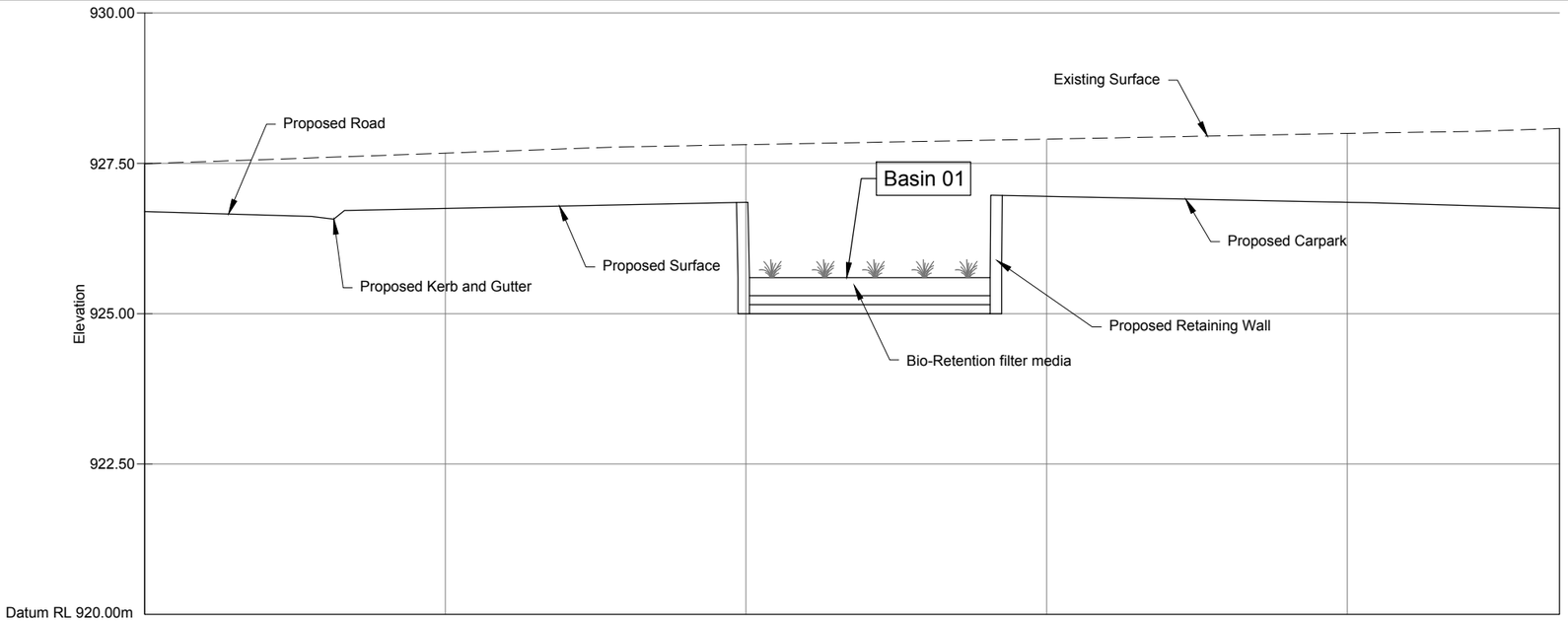
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

BIO-RETENTION CROSS SECTIONS

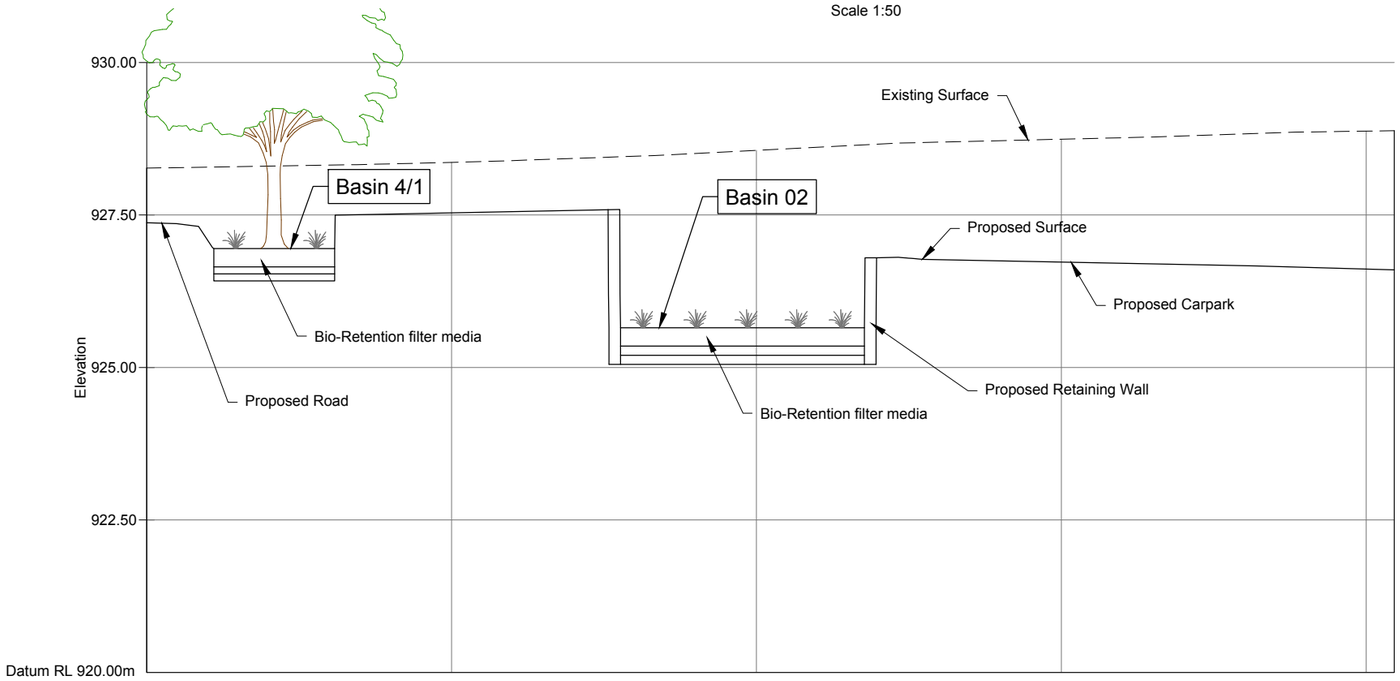
CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW04 Issue P6
No. in set 18



Section E-E
Scale 1:50



Section F-F
Scale 1:50

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:46

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:	
Designed:	GBL		
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg		
Scale (A1):	1:50	PRELIMINARY	
Date:	12/11/21		

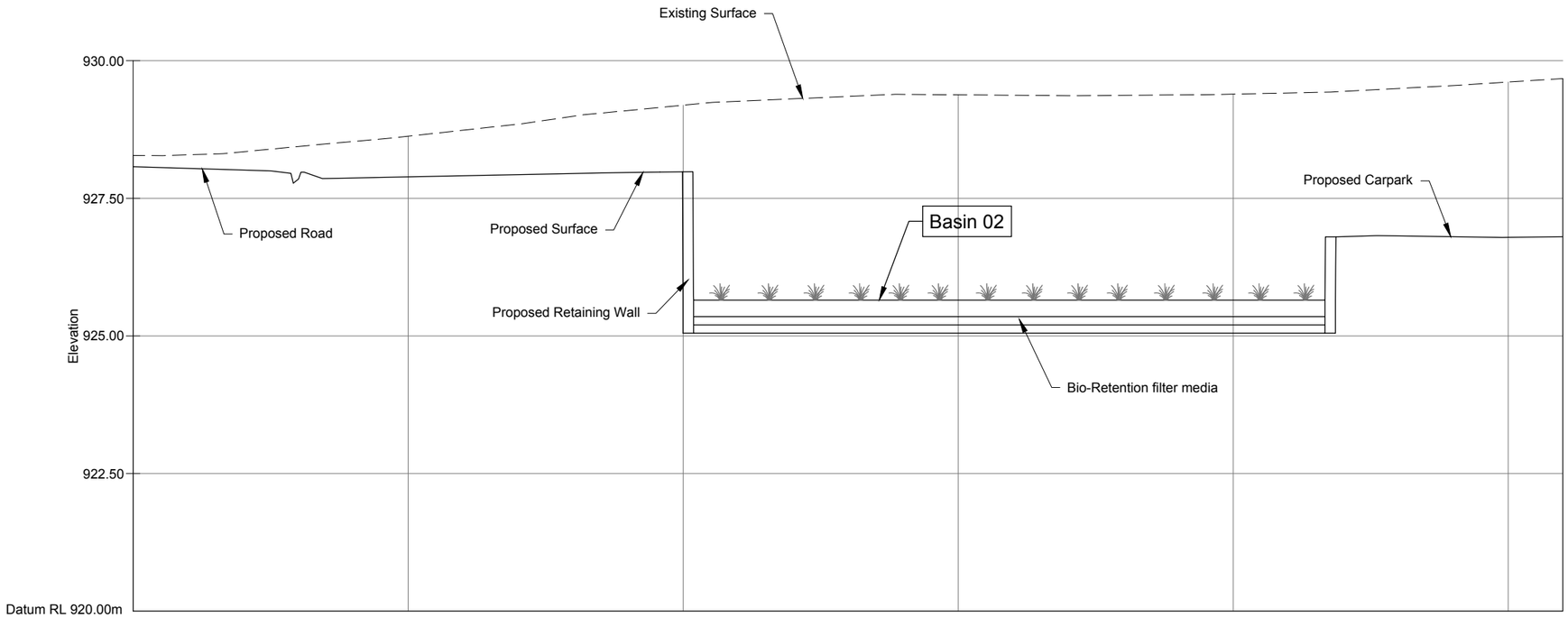
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

BIO-RETENTION CROSS SECTIONS

CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW05 Issue P6
No. in set 18



Section G-G
Scale 1:50

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:48

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL
Designed:	GBL
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg
Scale (A1):	1:50
Date:	12/11/21

Approved for Construction:

PRELIMINARY

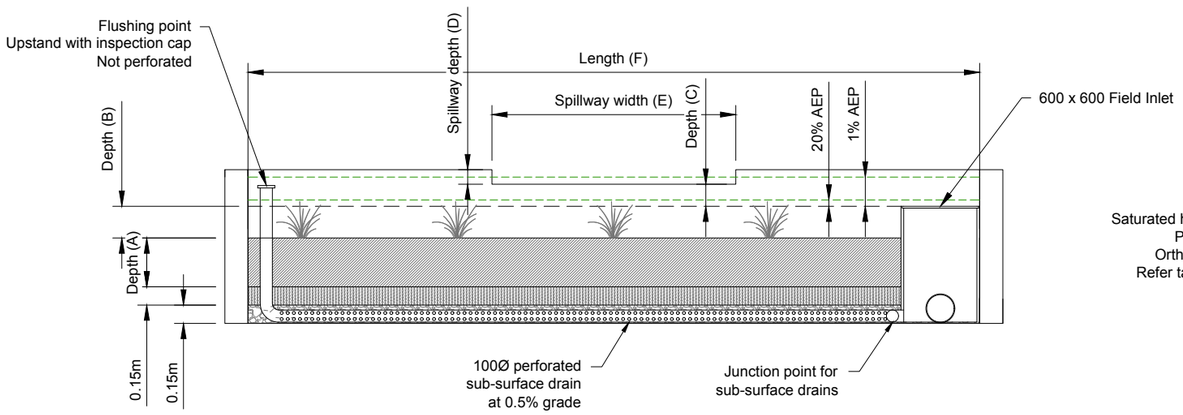
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

BIO-RETENTION CROSS SECTIONS

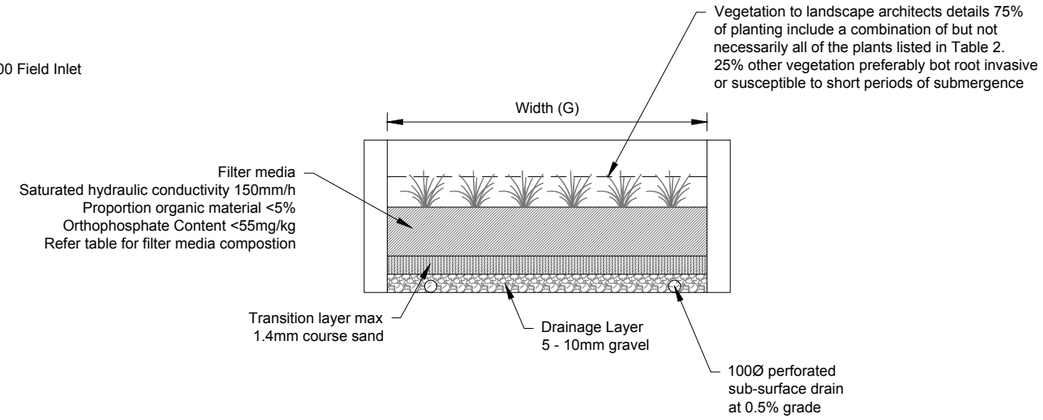
CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW06 Issue P6
No. in set 18



BIO-RETENTION DETAIL (Typical Long Section)
Not to Scale



BIO-RETENTION DETAIL (Typical Cross Section)
Not to Scale

Table 1	
Name	Quantity (kg/100m2 filter area)
Granulated poultry manure fines	50
Superphosphate	2
Magnesium sulphate	3
Potassium sulphate	2
Trace element mix	1
Fertiliser NPK (16.4.14)	4
Lime	20
Total	82

Filter Media

Structural Stability

Dispersibility testing should be done if soil may be structurally unstable

Engineered filter media

Washed sand with appropriate Ks
Top 100mm should be ameliorated with organic material, fertiliser and trace elements as detailed in Table 1

Table 2
Plant name Listed in order of preference
Carex appressa
Melaleuca ericifolia
Goodenia ovata
Ficinia nodosa
Juncus amabilis
Juncus flavidus
For bio-retention swale use suitable deep rooting heavy mat grass eg. buffalo grass or Kasbah Cocksfoot- refer to local turf specialist recommendations

Table 3									
Bioretention Area Name	A	B	C	D	E	Length F	Width G	20% AEP	1% AEP
01	0.4m	0.2m	0.4m	0.2m	2m	35m	4m	0.07m	0.67m
02	0.4m	0.2m	0.3m	0.2m	2m	REFER C03 FOR DETAILS		0.18m	0.35m
03	0.4m	0.2m	0.1m	0.1m	2m	15m	3m	0.08m	0.13m
04	0.4m	0.2m	0.65m	0.15m	2m	REFER C03 FOR DETAILS		0.37m	0.5m

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:51

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	AS SHOWN	PRELIMINARY
Date:	12/11/21	

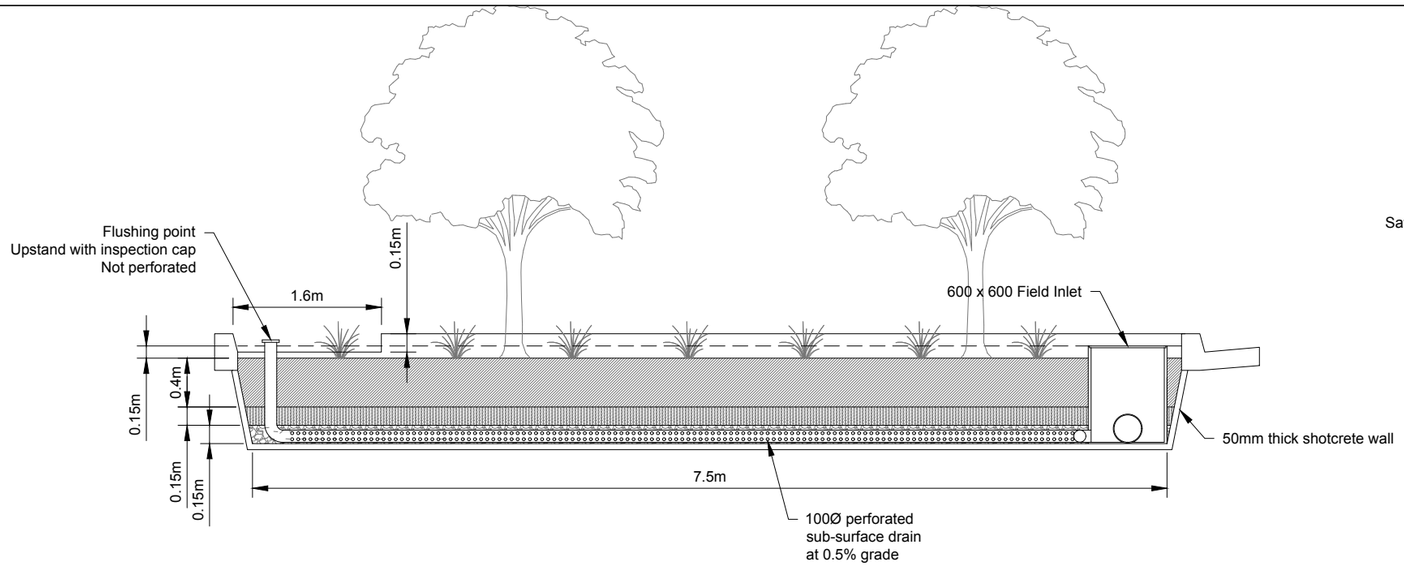
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

BIO-RETENTION DETAILS

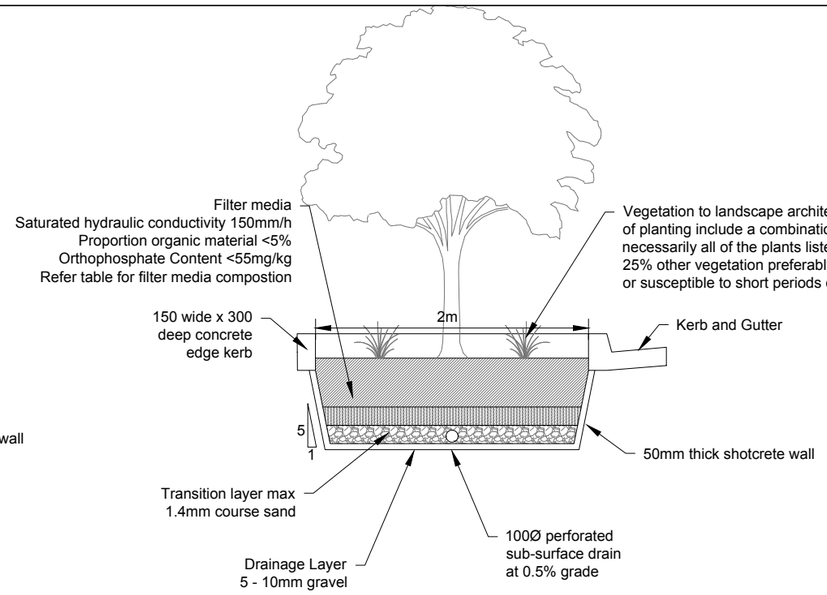
CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

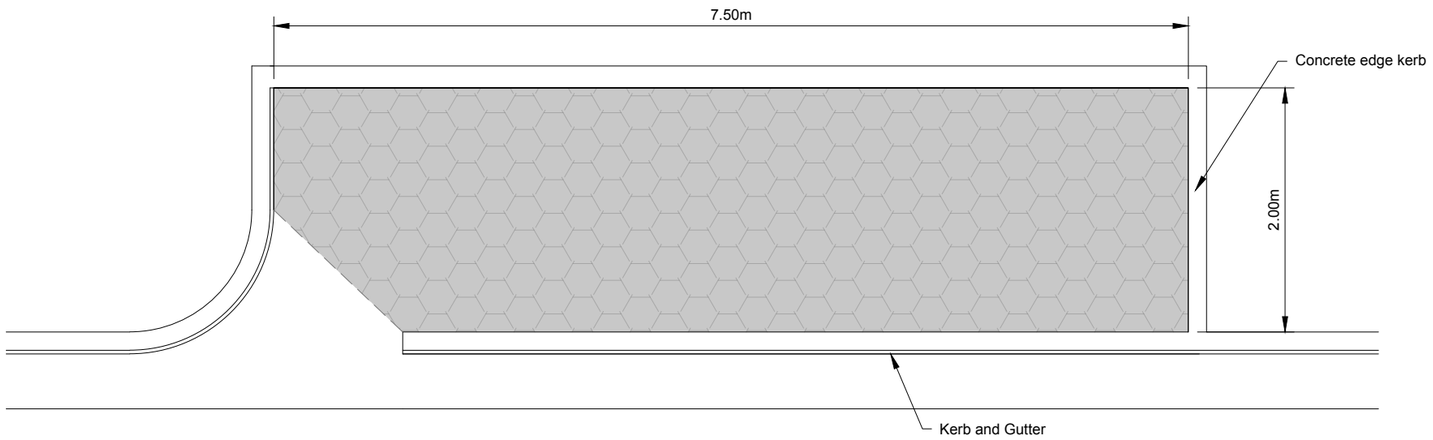
Job No. 2021.1178
DWG. No. SW07 Issue P6
No. in set 18



BIO-RETENTION DETAIL (Typical Long Section)
Not to Scale



BIO-RETENTION DETAIL (Typical Cross Section)
Not to Scale



BIO-RETENTION DETAIL (Typical Long Section)
Not to Scale

Filter Media

Structural Stability

Dispersibility testing should be done if soil may be structurally unstable

Engineered filter media

Washed sand with appropriate Ks
Top 100mm should be ameliorated with organic material, fertiliser and trace elements as detailed in Table 1

Table 1	
Name	Quantity (kg/100m2 filter area)
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Potassium sulphate	2
Trace element mix	1
Fertiliser NPK (16.4.14)	4
Lime	20
Total	82

Table 2
Plant name Listed in order of preference
Carex appressa
Melaleuca ericifolia
Goodenia ovata
Ficinia nodosa
Juncus amabilis
Juncus flavidus
For bio-retention swale use suitable deep rooting heavy mat grass eg. buffalo grass or Kasbah Cocksfoot- refer to local turf specialist recommendations

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:53

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	AS SHOWN	PRELIMINARY
Date:	12/11/21	

PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

STREET TREE BIO-RETENTION DETAILS

CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW08 Issue P6
No. in set 18

Roof - CAT
0.57ha

Basin 04 - CAT
0.2415ha

Basin 03 - CAT
0.0605ha

Bypass - CAT
0.0971ha

CP 2 - CAT
0.2743ha

Basin 02 - CAT
0.0269ha

Basin 01 - CAT
0.0193ha

CP 1 - CAT
0.1754ha

PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:23:57

Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL
P5	19/05/22	Gradients added	GBL
P4	10/05/22	Notes added	GBL
P3	03/05/22	Footpath access to site added	GBL
P2	29/03/22	FOR APPROVAL	BB
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	1:250	PRELIMINARY
Date:	12/11/21	

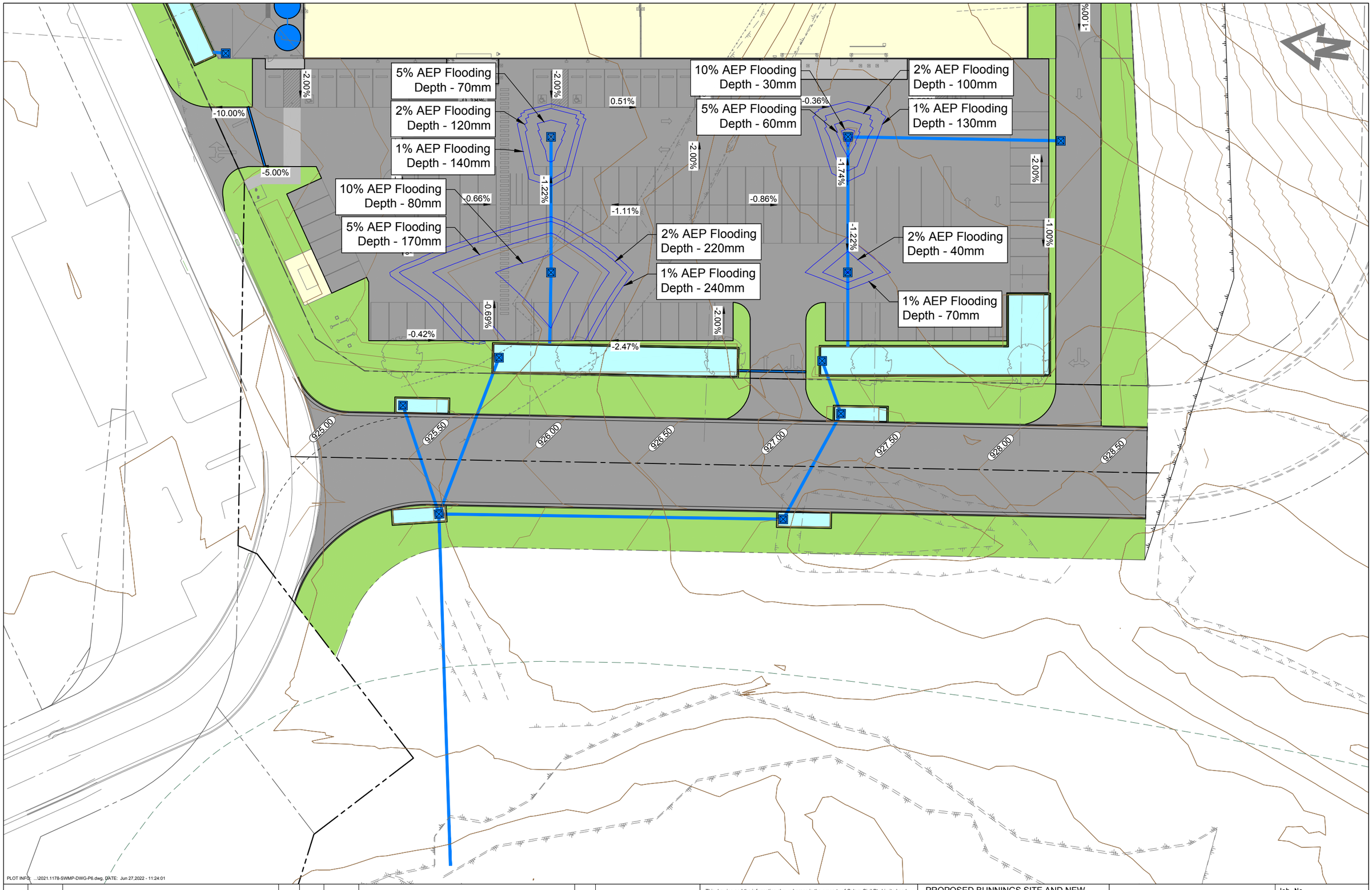
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

STORMWATER CATCHMENT PLAN

CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW09 Issue P6
No. in set 18



PLOT INFO: ...\2021.1178-SWMP-DWG-P6.dwg, DATE: Jun 27,2022 - 11:24:01

Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	1:250	PRELIMINARY
Date:	12/11/21	

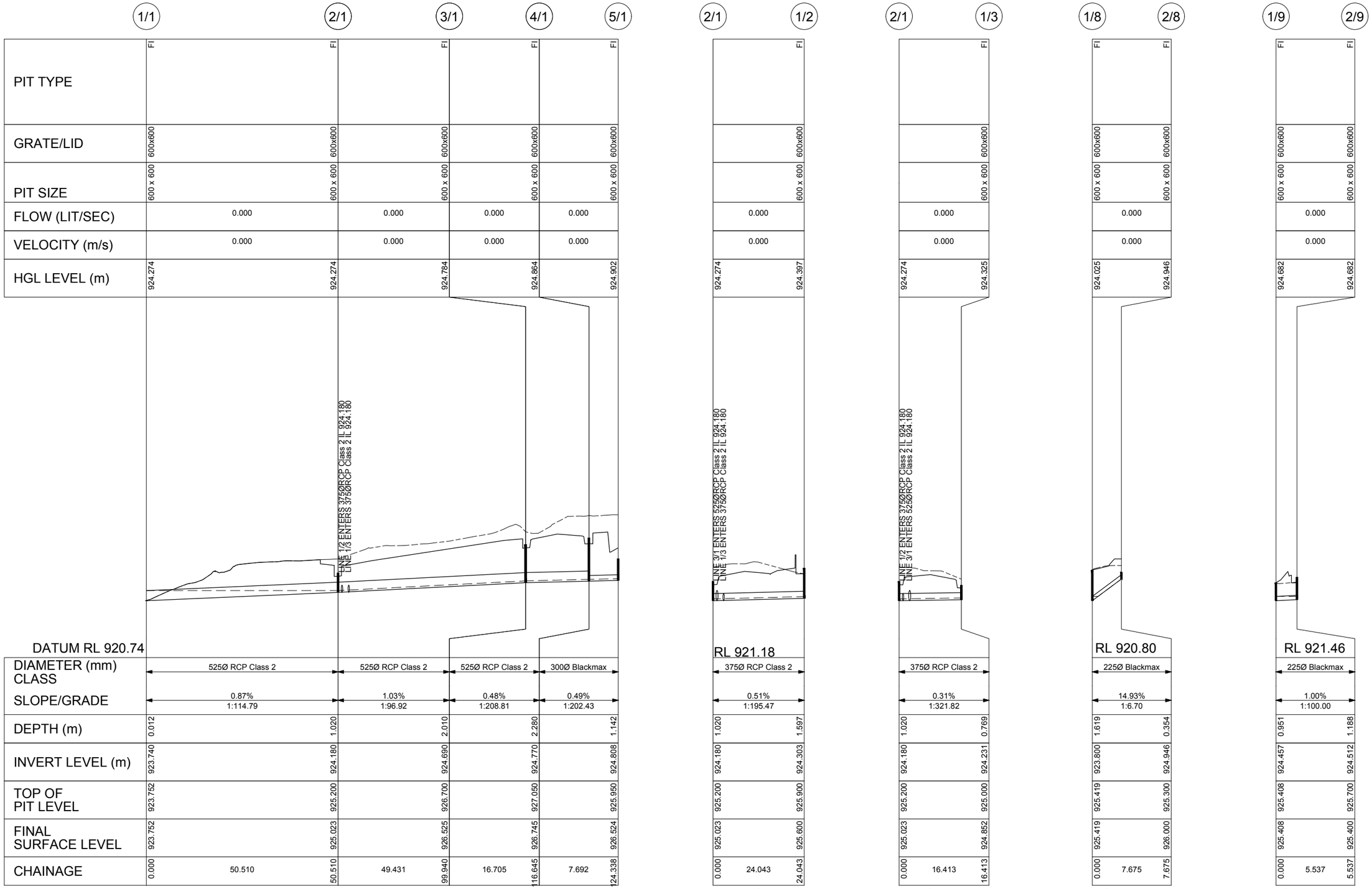
PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

DETENTION PONDING EXTENTS

CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW10 Issue P6
No. in set 18



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Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL
P5	19/05/22	Gradients added	GBL
P4	10/05/22	Notes added	GBL
P3	03/05/22	Footpath access to site added	GBL
P2	29/03/22	FOR APPROVAL	BB
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL

Drawn:	GBL	Approved for Construction:
Designed:	GBL	
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg	
Scale (A1):	1:500h 1:100v	PRELIMINARY
Date:	12/11/21	

PROPOSED BUNNINGS SITE AND NEW ROAD
VALLEY DRIVE
LITHGOW, NSW 2790

STORMWATER LONGSECTION

CEEDIVE

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
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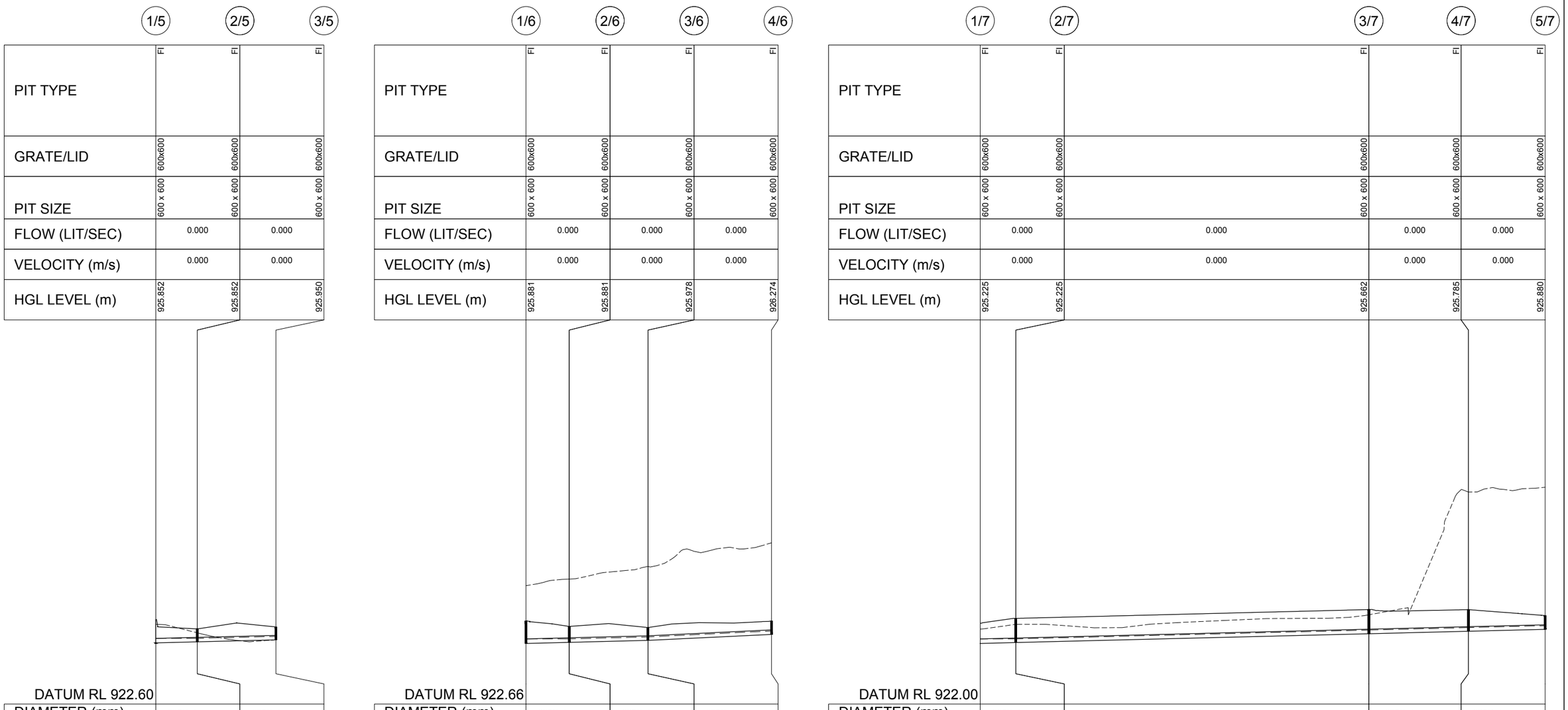
Tel: (02) 63323343 Fax: (02) 63318210

Job No. 2021.1178
DWG. No. SW11 P6
Issue
No. in set 18



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Amend	Date	Description	By	Amend	Date	Description	By
P6	27/06/22	Minor Alteration to Service Road	GBL				
P5	19/05/22	Gradients added	GBL				
P4	10/05/22	Notes added	GBL				
P3	03/05/22	Footpath access to site added	GBL				
P2	29/03/22	FOR APPROVAL	BB				
P1	12/11/21	PRELIMINARY ISSUE - CONCEPT ONLY.	GBL				

Drawn:	GBL	Approved for Construction:	
Designed:	GBL		
CAD Ref:	2021.1178-SWMP-DWG-P6.dwg		
Scale (A1):	1:500h 1:100v	PRELIMINARY	
Date:	12/11/21		

PROPOSED BUNNINGS SITE AND NEW ROAD
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LITHGOW, NSW 2790

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CEEDIVE

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Job No. 2021.1178
DWG. No. SW12 Issue P6
No. in set 18