PINNACLE
ENGINEERING GROUP

DETAILED SITE BASED STORMWATER MANAGEMENT PLAN

RESIDENTIAL DEVELOPMENT

1 Philip Street, Goonellabah NSW

SOCIAL FUTURES

JANUARY 2024

REVISION 02

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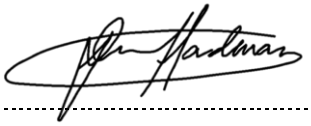
In accordance with the requirements of the *Queensland Professional Engineers Act 2002*, this document was prepared under the supervision of, reviewed and approved by the following experienced Registered Professional Engineer of Queensland (RPEQ).



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1 Introduction

Pinnacle Engineering Group (Pinnacle) was engaged by Social Futures to prepare a site based stormwater management plan (SBSMP) and associated investigations, to provide supporting documentation, for the proposed development application for a residential development located at 1 Philip Street, Goonellabah NSW, within the local authority of the Lismore City Council (LCC).

1.1 Scope of Investigation

This report addresses the proposed stormwater management strategy for the aforementioned development, including but not limited to the following elements:

- Pre and post development flows for various Average Exceedance Probability (AEP) / Average Recurrence Interval (ARI) design storm events;
- Nomination of the Lawful Point of Discharge for the site;
- Details of the stormwater quantity management strategy;
- Details of the stormwater quality management strategy and proposed treatment train;
- Maintenance schedules and techniques for each of the proposed stormwater quality improvement devices; and
- Details of the proposed sediment and erosion control plan.

1.2 Site Description

1.2.1 Site Location

Street Address	-	1 Philip Street, Goonellabah NSW 2489
RP Description	-	Lot 69 to 71 on DP230448
Site Area	-	0.1833 Hectares
Current Zoning	-	R1 General Residential
Proposed Use	-	Multi-unit Residential
Local Authority	-	LCC

Refer to Figure 1.1 for the site location.

1.2.2 Existing Site Topography

A review of the topographic survey and aerial photography has revealed that the subject site is currently occupied by two unit blocks with direct driveway access from McDermott Avenue to the north. No existing easements are observed to burden the subject site, and all existing vegetation is to be cleared as part of the proposed works.

The highest elevation of the site of RL159.44m AHD is reached along the southern boundary of the site with the lowest elevation of RL154.57m AHD reached at the northwest corner of the of the subject site.

Refer to Figure 1.2 for the aerial view of the subject site.

1.2.3 Proposed Development

The proposed development will deliver eighteen housing units of varying mix (1 and 2 bed) over the existing allotment. Vehicular access will be provided via a new heavy duty VXO from McDermott Avenue to the north of the subject site.

Architectural drawings of the proposed development are included in Appendix A.

1.2.4 Existing Drainage System

Currently, the stormwater runoff from the subject site generally discharges via piped and overland sheet flow towards the McDermott Avenue kerb and channel.

The nearest LCC stormwater pit and pipe network is located directly adjacent to the subject site, within the McDermott Avenue road reserve. The aforementioned stormwater network consists of Reinforced Concrete Pipes (RCP) and grades to the north. The pipe reach immediately downstream of the subject site appears to be a 375mm RCP.

1.2.5 External Catchments

Whilst it is noted that the topography indicates that the adjoining land parcel to the south of the subject site falls towards the proposed development, we note that stormwater discharge from this site appears to discharge to the Philip Street road reserve to the east of the subject site.

We can therefore conclude that no external catchments discharge through the subject site.

1.2.6 Flood Assessment

A review of Council's interactive mapping has revealed that the site is located outside of the mapped flood affected zone.

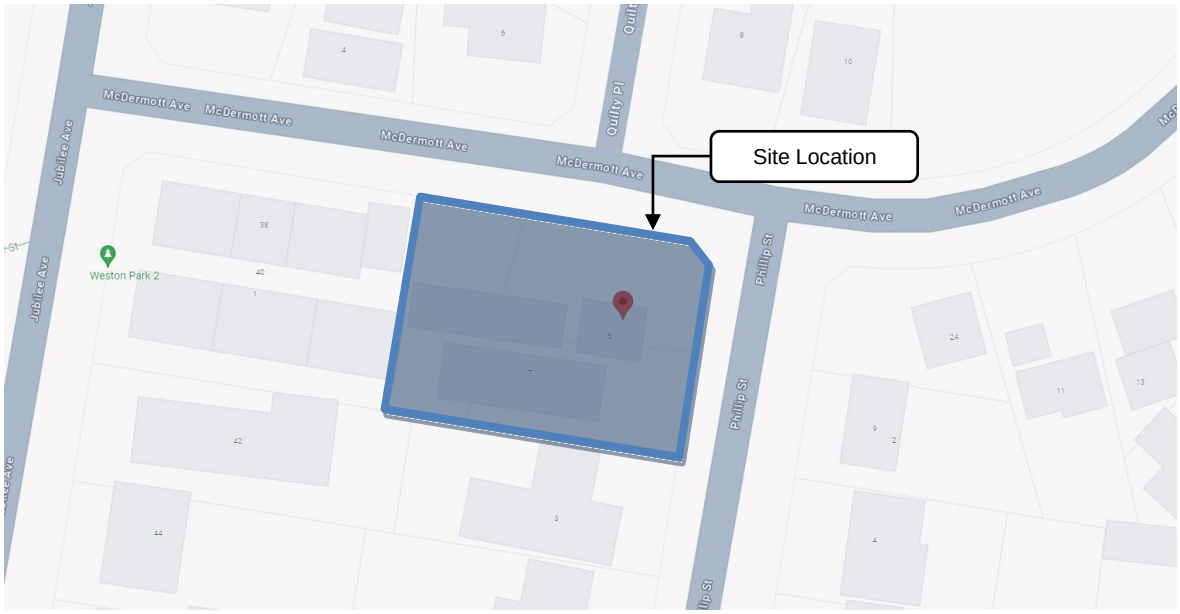


Figure 1.1: Map View (Source: Google Maps)

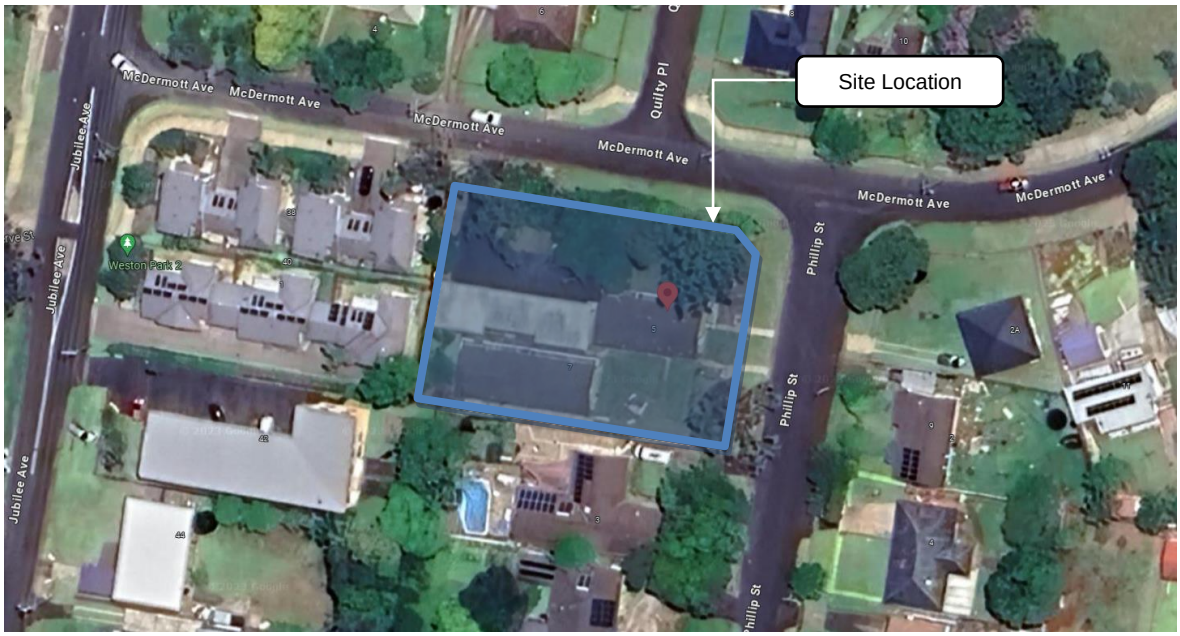


Figure 1.2: Aerial View (Source: Google Maps)

2 Stormwater Quantity Assessment

2.1 Hydrologic Objectives

The hydrologic objectives for the site were set in accordance with the LCC Development Design Specification D10: Handbook for Stormwater Drainage Design and the Queensland Urban Drainage Manual (QUDM). These objectives include but are not limited to:

- The proposed development shall ensure that all stormwater drainage is directed to the Lawful Point of Discharge in accordance with QUDM Section 3.9;
- Minor System Design for 18% AEP (Q_5) storm event;
- Major System Design for 1% AEP (Q_{100}) storm event;
- No adverse impact on adjoining or downstream properties; and
- No increase in post-development flows, up to and including the 1% AEP (Q_{100}) storm event.

2.2 Lawful Point of Discharge

The Lawful Point of Discharge for the subject site is taken as the McDermott Avenue road reserve, and the existing LCC stormwater drainage infrastructure located within the adjacent road reserve.

2.3 Stormwater Quantity Analysis

The analysis of the surface water runoff from the site was performed using the Rational Method.

2.3.1 Data Collation

The design rainfall Intensity Frequency Duration (IFD) data for the storm events up to and including the 1% AEP (Q100) storm event was derived based on the LCC Development Design Specification D10: Handbook for Stormwater Drainage Design and QUDM.

The rainfall temporal patterns utilised by the XP-Rafts analysis were derived in accordance with Australian Rainfall and Runoff (AR&R), 2016 edition.

The design IFD data for the catchment is summarised in Figure 2.1 below.

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	146	163	219	256	292	340	376
2 min	122	136	183	215	247	293	329
3 min	114	128	171	201	231	273	306
4 min	108	121	163	191	219	257	287
5 min	103	115	155	182	208	244	271
10 min	83.5	93.7	125	147	167	194	214
15 min	70.4	78.9	105	123	140	162	179
20 min	61.1	68.5	91.4	107	122	141	155
25 min	54.1	60.7	81.0	94.7	108	125	138
30 min	48.8	54.7	73.0	85.4	97.4	113	125
45 min	38.1	42.7	57.2	67.1	76.8	89.7	99.7
1 hour	31.7	35.5	47.8	56.2	64.5	75.8	84.6
1.5 hour	24.2	27.2	36.9	43.6	50.4	59.7	67.1
2 hour	20.0	22.6	30.7	36.5	42.4	50.5	57.0
3 hour	15.3	17.3	23.9	28.6	33.4	40.1	45.5
4.5 hour	11.9	13.5	18.8	22.6	26.6	32.1	36.6
6 hour	9.92	11.3	15.9	19.3	22.7	27.5	31.4
9 hour	7.79	8.93	12.7	15.5	18.4	22.2	25.3
12 hour	6.60	7.59	10.9	13.3	15.8	19.1	21.7
18 hour	5.24	6.05	8.75	10.7	12.7	15.3	17.4
24 hour	4.45	5.15	7.47	9.14	10.9	13.0	14.7
30 hour	3.91	4.54	6.59	8.05	9.54	11.4	12.8
36 hour	3.51	4.08	5.92	7.22	8.54	10.2	11.4
48 hour	2.94	3.42	4.96	6.03	7.09	8.41	9.39
72 hour	2.25	2.61	3.77	4.55	5.31	6.25	6.95
96 hour	1.82	2.12	3.03	3.64	4.23	4.96	5.49
120 hour	1.53	1.78	2.53	3.03	3.50	4.10	4.53
144 hour	1.32	1.52	2.16	2.58	2.98	3.48	3.84
168 hour	1.15	1.33	1.88	2.24	2.58	3.01	3.32

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Figure 2.1: Lismore, NSW IFD (mm/hr) (Source: BOM)

2.3.2 XP-Rafts Modelling Inputs

The rainfall loss parameters for each sub-catchment were applied using an initial and continuing rainfall loss model. The design rainfall loss parameters input into the XP-Rafts model are based on the guideline values recommended by the AR&R, and other reputable industry standards.

The rainfall loss parameters adopted for this XP-Rafts model are as tabulated below.

Table 2.1: Adopted XP-Rafts Rainfall Loss Parameters

Storm Event	Pervious Areas		Impervious Areas	
AEP (%)	Initial Loss (mm)	Continuing Loss (mm)	Initial Loss (mm)	Continuing Loss (mm)
39-18	15	2.5	1	0
10-5	10	2.5	1	0
2-1	2.5	2.5	0	0

2.3.3 XP-Rafts Model Validation

The validation of the XP-Rafts model was undertaken through the comparison of the XP-Rafts generated stormwater discharge rates to the pre-development Rational Method calculations included within Appendix D.

The Rational Method adopted a C_{10} coefficient of runoff of 0.71 for the pre-development catchment, in accordance with Table 4.5.3 of QUDM. As detailed in Table 2.2 below, the stormwater discharge rates calculated using the Rational Method are generally comparable to the stormwater discharge rates calculated using the XP-Rafts model. We can therefore reasonably adopt the stormwater discharge rates generated from the XP-Rafts model.

2.3.4 Critical Duration Analysis

Design storm durations ranging from 10-minutes to 720-minutes were simulated by the XP-Rafts model analysis in order to determine the design stormwater discharge for the subject site.

2.3.5 Existing Discharge Locations

As outlined in the previous sections of this report the subject site discharges to the McDermott Avenue road reserve and therefore was assessed as a single catchment.

2.4 Hydrologic Analysis

2.4.1 Pre-development Scenario

The results obtained from the XP-Rafts model generally show that the critical storm duration throughout the local catchment analysed for all storm events is generally the 15-minute and 25-minute storm events.

A fraction impervious area of 0.47 was calculated for the pre-development catchment from the topographic survey included within Appendix B.

The pre-development catchment discharges for the 18%, 10%, 5%, 2% and 1% AEP storm events are detailed in Table 2.2 below.

Table 2.2: Pre-development Catchment Details and Discharges

Catchment	Area (ha)	Imp. Area (ha) (Slope)	Perv. Area (ha) (Slope)	XP-Rafts Results (Peak discharge, m^3/s)					Rational Method (C_{10} = 0.71)
				18.1% AEP	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP
A1 (Roof)	0.0545	0.0545 (2.0%)	0.0000	0.026	0.031	0.035	0.042	0.047	-
A2 (Ground)	0.1288	0.0323 (12.0%)	0.0965 (12.0%)	0.053	0.060	0.069	0.069	0.078	-
A Total	**0.1833**	**0.0868**	**0.0965**	**0.079**	**0.091**	**0.104**	**0.111**	**0.125**	**0.118**
Critical Storm Duration				**2hrs**	**25mins**	**25mins**	**15mins**	**15mins**	**-**

2.4.2 Post-development Scenario – Unmitigated

The proposed development of the subject site will deliver a multi-unit residential development and associated infrastructure over the existing allotments. The site will have direct driveway access to McDermott Avenue to the north via a new vehicular crossover.

A fraction impervious of 0.69 was calculated for the subject site post-development scenario from the architectural drawings provided. For the purposes of this analysis the post-development catchment was further split into sub-catchments being the roof, driveway and ground areas.

A copy of the architectural drawings is included in Appendix A. The post-development catchment plan is included in Appendix C.

The impervious areas were modelled using the second sub-catchment option within XP-Rafts. The total impervious area for each sub-catchment is tabulated below. The results of the XP-Rafts post-development analysis show that the critical storm duration throughout the catchment for all storm events is generally the 15-minute and 25-minute storm events.

Table 2.3 summarises the unmitigated peak flow rates for the post-development catchment.

Table 2.3: Post-development Catchment Details and Discharges (Unmitigated)

Catchment	Area (ha)	Imp. Area (ha) (Slope)	Perv. Area (ha) (Slope)	XP-Rafts Results (Peak discharge, m^3/s)				
				18.1% AEP	10% AEP	5% AEP	2% AEP	1% AEP
A1 (Roof)	0.1162	0.1016 (2.0%)	0.0146 (2.0%)	0.054	0.061	0.070	0.087	0.096
A2 (Driveway)	0.0060	0.0060 (12.5%)	0.0000	0.001	0.002	0.002	0.003	0.003
A3 (Ground)	0.0611	0.0104 (1.0%)	0.0507 (8.0%)	0.023	0.025	0.031	0.030	0.034
A Total	**0.1833**	**0.1180**	**0.0653**	**0.078**	**0.088**	**0.103**	**0.120**	**0.133**
Critical Storm Duration				**2hrs**	**25mins**	**25mins**	**15mins**	**15mins**

A comparison of the XP-Rafts results in Tables 2.2 and 2.3 for Catchment A indicates increases of 0.008m^3/s and 0.009m^3/s for the 2% AEP and 1% AEP storm events respectively. A decrease in peak development flows of 0.001m^3/s, 0.003m^3/s and 0.001m^3/s is observed for the 18%, 10% and 5% AEP storm events (respectively) in the post-development when compared to the pre-development scenario.

These observed changes in discharge are attributed to the increased fraction impervious and flattening of ground catchments observed across the site during the post-development scenario.

2.5 Post Development Stormwater Mitigation Strategy

Based on the above investigation, the following stormwater management strategy is proposed to mitigate the post-development stormwater discharge to the site's pre-development discharge rates.

- Attenuation of the post-development roofwater discharge through the use of a private dual-use onsite detention/treatment tank prior to discharge to the Council stormwater network located within the adjoining road reserve;
- Discharge roofwater runoff from the subject site to the proposed private dual-use onsite detention/treatment tank prior to discharge to the Lawful Point of Discharge;
- Discharge stormwater runoff from the driveway and ground catchments unmitigated to the Lawful Point of Discharge;
- Discharge the minor 18.1% AEP event stormwater runoff from the post development catchment to the Lawful Point of Discharge via a piped network;
- Discharge the major 1% AEP event stormwater runoff from the post development catchment to the Lawful Point of Discharge via piped and overland flow; and
- Generally, maintain the existing drainage regimes and drainage discharge locations.

2.5.1 Detention Tank Design

Table 2.4 details the proposed detention tank characteristics with Table 2.5 detailing the adopted tank storage/height relationship. The proposed detention tank was used to mitigate the flow discharging from the post-development site.

Table 2.4: Detention Tank Details

Design Parameter	Details					
Tank Outlets	Low-flow Outlet = 225mm diameter PVC pipe outlet at 0.5% grade Low-flow Outlet Level = +0.00m (at base of tank) High-flow Outlet = 2 x 100mm diameter PVC pipe outlets High-flow Outlet Level = +0.70m above base of tank					
Tank Geometry	Base Area = 20.0m^2 Storage Height = 0.9m Storage Volume = 18.0m^3					
Tank Modelling Summary	AEP (%)	Peak Outflow (m^3/s)	Stage (m)	AEP (%)	Peak Outflow (m^3/s)	Stage (m)
	63	0.034	0.268	5	0.058	0.566
	39	0.038	0.295	2	0.066	0.700
	18	0.046	0.405	1	0.073	0.783
	10	0.052	0.493	-	-	-

Table 2.5: Tank Height/Storage Relationship

Tank Height (m)	Tank Storage (m^3)	Tank Height (m)	Tank Storage (m^3)
0.0	0.0	0.5	10.0
0.1	2.0	0.6	12.0
0.2	4.0	0.7	14.0
0.3	6.0	0.8	16.0
0.4	8.0	0.9	18.0

2.5.2 **Pre-development and Post-development Scenario Comparison**

Table 2.6 details the comparison between the pre-development and post-development site total discharges.

Table 2.6: Pre-development and Post-development Scenario Comparison

Storm Event	**Catchment A** Total (Discharge to McDermott Avenue)		Difference (m^3/s)
	Pre (m^3/s)	Post (m^3/s)	
63% AEP (Q_5)	0.048	0.046	-0.002
39% AEP (Q_{10})	0.061	0.057	-0.004
18% AEP (Q_5)	0.079	0.071	-0.008
10% AEP (Q_{10})	0.091	0.079	-0.012
5% AEP (Q_{20})	0.104	0.090	-0.014
2% AEP (Q_{50})	0.111	0.101	-0.010
1% AEP (Q_{100})	0.125	0.111	-0.014

The results presented above demonstrate that the proposed detention tank successfully attenuates the post-development site discharge to at or below pre-development rates.

3 Stormwater Quality Assessment

3.1 Water Quality Objectives

This water quality analysis was undertaken in accordance with the LCC Development Design Specification D10: Handbook for Stormwater Drainage Design, the LCC Development Control Plan Chapter 22: Water Sensitive Design and the Healthy Waterways WSUD Technical Design Guidelines for South East Queensland – Version 1.

The pollutant types and the associated Load Reduction Objectives (LRO) that will be evaluated are deemed to be as follows for the occupational phase of the development.

Table 3.1: LRO Summary for Occupational Phase

Pollutant Types	Site Water Quality Objective
Total Suspended Solids (TSS)	75% reduction
Total Phosphorous (TP)	65% reduction
Total Nitrogen (TN)	40% reduction
Gross Pollutants >5mm (GP)	90% reduction

3.2 Proposed Treatment Strategy

In order to meet the above water quality objectives, a treatment train has been proposed for the site which comprises of a number of individually designed proprietary ATLAN Stormwater treatment devices that collectively contribute to the achievement of whole site water quality objectives.

3.3 Proposed Treatment Measures

The following water quality treatment measures are proposed for this development. We note that if an approved equivalent product is proposed by the Developer, appropriate modelling and testing data shall be provided by the supplier and approved by Council prior to installation to ensure that the water quality objectives for the site can be achieved.

3.3.1 ATLAN Stormwater Water Quality Treatment Products

The ATLAN Stormwater devices effectively act as a gross pollutant trap, and is typically located within inlet pits or immediately preceding an inflow pipe into a rainwater or detention tank receiving surface runoff. The system uses a mesh and grated system to capture ‘large’ pollutants prior to further nutrient and fine particle treatment.

The ATLAN Filter Cartridge system is a passive, flow-through stormwater filtration system which consists of a number of filter cartridges containing a variety of filter media. The system works based on the incoming hydraulic grade forcing water up and into the cartridge system which traps and slowly releases the runoff, containing pollutants within the filter. Clean water is then discharged out of the system and into downstream infrastructure.

Figure 3.1 below illustrates a typical ATLAN Stormwater treatment train configuration. Additional information on ATLAN Stormwater treatment devices is included in Appendix H.

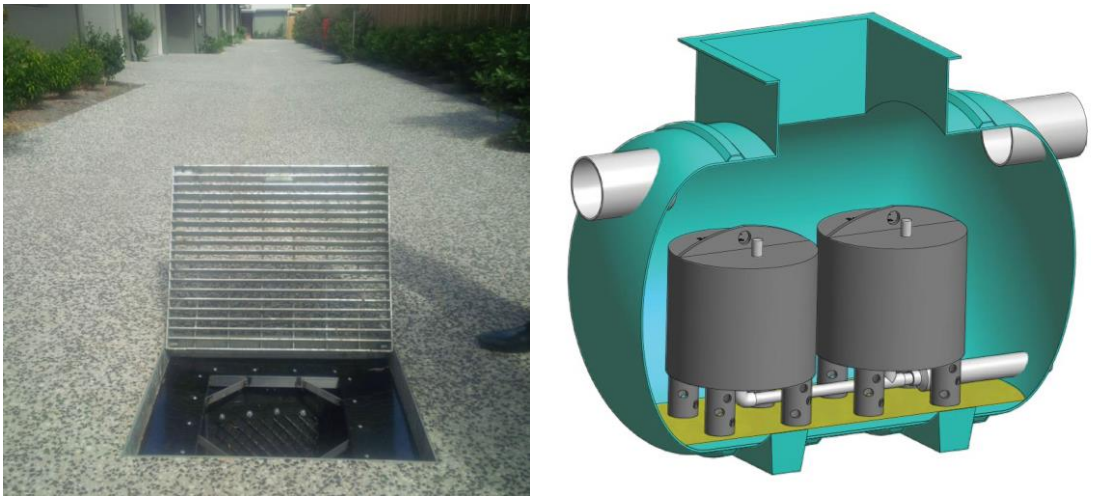


Figure 3.1: Typical ATLAN Stormwater Treatment Train Configuration (Source: ATLAN Stormwater)

3.4 MUSIC Modelling

The proposed treatment train is detailed Appendix F with additional details of the modelling procedure described in the following sections.

3.4.1 Meteorological Data

The meteorological data inputs utilised by MUSIC to simulate catchment hydrology processes includes rainfall data (at intervals relevant to the time step being modelled) and average areal potential evapotranspiration (measured in millimetres per day).

The meteorological data adopted for this model was the Lismore 58214 (6-minute time step 2002-2009).

3.4.2 MUSIC Source Nodes

The MUSIC source node properties for a split catchment were obtained from the Healthy Waterways MUSIC Modelling Guidelines for Southeast Queensland and are as follows.

Table 3.2: Pollutant Export Parameter for Split Catchment (Log^{10} Values)

Land Use		Mean EMC (mg/L)					
		TSS		TP		TN	
Residential		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Roof	Mean	1.30	0.00	-0.89	0.00	0.26	0.00
	Std. Deviation	0.39	0.00	0.31	0.00	0.23	0.00
Roads	Mean	2.43	1.00	-0.30	-0.97	0.26	0.20
	Std. Deviation	0.39	0.34	0.31	0.31	0.23	0.20
Ground	Mean	2.18	1.00	-0.47	-0.97	0.26	0.20
	Std. Deviation	0.39	0.34	0.31	0.31	0.23	0.20

3.5 **Performance Assessment**

The site was modelled as a number of commercial source nodes. The MUSIC model parameters were adopted in accordance with the Healthy Waterways MUSIC Modelling Guidelines for Southeast Queensland and are outlined within Table 3.3 below.

Table 3.3: Adopted MUSIC Model Source Node Parameters

Parameter	Value
Source Data	
Rainfall data and modelling period	Lismore 58214
Modelling period	2002 – 2009
Model time step	6 Minute
Soil properties (Rainfall runoff parameter)	Urban Residential (Healthy Waterways MUSIC Modelling Guidelines for Southeast Queensland)
Site Data	
Catchment A – Commercial	A1 – 0.1162 Ha – Roof (87% Impervious) A2 – 0.0060 Ha – Road/Driveway (100% Impervious) A3 – 0.0611 Ha – Landscaping/Ground (17% Impervious)

Table 3.4: Adopted MUSIC Model Treatment Node Parameters

Parameter	Value
Treatment Devices	
Catchment A – ATLAN Vault	ATLAN Vault High flow bypass = 100m^3/s Storage surface area = 4.0m^2 Extended detention depth = 0.55m Low flow pipe diameter = 62mm ATLAN Filter Cartridge Type = 550mm SF.15-EMC-M Required number = 4 High flow bypass = 0.006m^3/s

3.5.1 **MUSIC Analysis Results**

Table 3.5 summarises the load analysis and reduction achieved by MUSIC using the WSUD strategy outlined above. As detailed within Table 3.5 below, the LRO of 75% for TSS, 65% for TP, 40% for TN and 90% for GP as described in Section 3.1 have been achieved for the post-development scenario.

Table 3.5: MUSIC Pollutant Load Assessment

System	Parameter	Sources	Residual Load	Reduction (%)
Receiving node	Total Suspended Solids (kg/yr)	45	11.2	75.2
	Total Phosphorous (kg/yr)	0.157	0.0535	65.9
	Total Nitrogen (kg/yr)	1.53	0.716	53.2
	Gross Pollutants (kg/yr)	22	0	100

4 Monitoring and Maintenance Strategy

4.1 Monitoring of Devices

A monitoring program will be established for the stormwater treatment devices as required by ATLAN Stormwater.

ATLAN Stormwater will be responsible for all monitoring activities associated with the operation of the treatment train which will be undertaken under a maintenance agreement between ATLAN Stormwater and the Developer.

4.2 Maintenance of Devices

The ongoing performance of the ATLAN Stormwater treatment devices will be dependent on the regular maintenance conducted.

The maintenance program will be as required by ATLAN Stormwater and will be undertaken as part of maintenance agreement between ATLAN Stormwater and the Developer.

5 Erosion and Sediment Control Strategy

The objective of erosion and sediment management on construction sites is to minimise soil erosion and control silt and/or sediment discharge from the sites through the use of suitable control devices during the four primary phases of the project lifecycle being:

1. Pre-construction/Establishment Phase;
2. Bulk Earthworks/Change to Ground Level Phase;
3. Construction Phase; and
4. Post-development/Operational Phase.

Sections 5.2 and 5.3 below outline the typical and industry best practice erosion and sediment control measures that will be implemented throughout the lifecycle of this project.

5.1 Development Lifecycle Erosion and Sediment Management

5.1.1 Pre-construction Phase

Prior to the commencement of construction, during the site establishment phase of the works, the following sediment and erosion control measures will be implemented in order to minimise site disturbance and ensure that water quality is maintained.

- Silt/Sediment fences will be installed around the proposed bulk earthworks site (along the toe of the batter alignment) and any environmentally sensitive areas; and
- A construction vehicle entry/exit shakedown area will be installed and will comprise of a vibratory cattle grid or gravel/rock pad in accordance with the IEAust Guidelines.

5.1.2 Change to Ground Level Phase

Excavation during the bulk earthworks/change to ground level phase of the project will be staged in a manner that runoff will generally be directed towards sediment and erosion controls established during the pre-construction phase.

As applicable, sediment basins will be constructed within proposed park/open space areas generally in the location of the proposed bio-retention basins to ensure that all sediment runoff is intercepted and treated prior to discharging from site.

5.1.3 Construction Phase

During the construction phase of the project, the following erosion and sediment controls will be implemented to ensure water quality is maintained.

- Sediment fences will be erected at the base of all batters and stockpiles to prevent sediment transportation offsite;
- All sediment and erosion control structures will be maintained and inspected regularly as well as after each storm event to ensure the ongoing integrity is maintained. No structure is to accumulate sediment above 40% of its capacity; and
- Regular monitoring of water quality will be undertaken to determine the effectiveness of the sediment and erosion control measures. Testing may be required and shall be provided to the Local Authority on request.

5.1.4 Operational Phase

Following the completion of the construction phase of the project and the development reaching 'Practical Completion' and/or 'On-maintenance', a monitoring program will be established for the stormwater treatment devices outlined previously within this report, where applicable. The monitoring program will ensure the ongoing integrity and effectiveness of these stormwater treatment devices following the completion of the construction phase of the project.

5.2 Dust Suppression and Erosion Control Measures

The time of disturbance onsite will be kept to a minimum by ensuring that the civil works are undertaken directly following the earthworks phase. Consideration to staging of the works shall be given in order to minimise the area of exposed earthworks at any given time.

Erosion control and dust suppression measures shall be applied to the exposed areas of the site as deemed necessary by the site supervisor in order to prevent the emission of dust from the site.

A number of erosion control measures are available inclusive of but not limited to the following:

- Water spraying (by water truck);
- Dust suppressants;
- Surface stabilisation; and
- Covering of exposed areas.

5.3 Sediment Control Measures

With reference to the IEAust Guidelines and Current Industry Best Practice, there are three (3) fundamental sediment control principles that have been identified for use during construction:

- Construction Vehicle Shakedown and/or Entry/Exit;
- Sediment Fences; and
- Sediment Barriers.

5.3.1 Construction Vehicle Shakedown and/or Entry/Exit

A dedicated construction vehicle shakedown will be installed at the site's entry/exit point for road and construction vehicles. This construction vehicle shakedown area will be established to facilitate the removal of soil, mud, dust and debris from the tyres of vehicles prior to leaving the construction site. The construction shakedown will comprise of a gravel/rock pad designed or a vibratory grid system constructed and maintained in accordance with the IEAust Guidelines. The advantages of the vibratory grid system include ease of movement and ability to reuse for several years at different construction sites.

5.3.2 Sediment Fences

Sediment fencing will be established at the bottom of slopes on any exposed earthworks batters where there is an established risk of contaminated water discharging from the site prior to clearing and earthworks commencing. Sediment fencing may be required at regular spacing down the disturbed slope to limit scour and rutting caused by channelising of stormwater discharge. Sediment fences will be used to protect any temporary stockpile sites as required. Sediment collected from sediment barriers will be regularly removed and either taken offsite as part of the earthworks phase or stockpiled for use during revegetation works.

5.3.3 Sediment Barriers

Sediment barriers will be constructed around all stormwater drainage gully pits and field inlets where contaminated water may enter the existing and proposed stormwater network. The provision of these sediment barriers will facilitate the settlement of sediments prior to entering the downstream stormwater drainage network. Sediment barriers will generally comprise of gravel wrapped in geotextile 'sausage', sediment fences around field inlets or similar approved products.

5.4 Monitoring and Maintenance

The site supervisor will be responsible for the following regular monitoring and maintenance activities during the various phases of the development:

1. Inspection of downstream stormwater network as well as sediment and erosion controls will be conducted at the end of each construction day and after each rainfall event greater than 25mm.
2. If any established complaints by neighbouring property owners and/or local authority or evidence of water quality deterioration is reported downstream of the works site the following actions are to be taken immediately:

    a. locate source of stormwater quality deterioration.
    b. construct temporary erosion and sediment controls to prevent the continuing short term stormwater quality deterioration.
    c. repair existing erosion and sediment controls, modify construction procedures or construct additional controls to prevent further deterioration.

6 Conclusions and Recommendations

This report outlines the stormwater management strategy developed to manage potential impacts due to the proposed residential development located at 1 Philip Street, Goonellabah.

Following the investigation, the following stormwater design strategy has been adopted for the site:

- Attenuation of the post-development roofwater discharge through the use of a private dual-use onsite detention/treatment tank prior to discharge to the Council stormwater network located within the adjoining road reserve;
- Discharge roofwater runoff from the subject site to the proposed private dual-use onsite detention/treatment tank prior to discharge to the Lawful Point of Discharge;
- Discharge stormwater runoff from the driveway and ground catchments unmitigated to the Lawful Point of Discharge;
- Discharge the minor 18.1% AEP event stormwater runoff from the post development catchment to the Lawful Point of Discharge via a piped network; and
- Best practice stormwater quality management techniques will be implemented to achieve water quality objectives by directing stormwater runoff from the development to the proprietary Ocean Protect treatment devices for treatment prior to discharging from the site; and
- Implementation of typical erosion and sediment control devices during the four (4) primary phases of the proposed development.

Following the conclusion of this investigation we can conclude that the development site, with the implementation of the stormwater management strategy outlined in this report, will result in a ‘no worsening’ effect of the current stormwater discharge conditions upstream or downstream of the site.

7 Reference Documentation

Lismore City Council Engineering Specifications (LCC)

LCC Development Design Specification D10: Handbook for Stormwater Drainage Design (LCC)

LCC Development Control Plan Chapter 22 – Water Sensitive Design (LCC)

Institute of Public Works Engineers Australia (Queensland Division) (2016) “Queensland Urban Drainage Design Manual (QUDM)”, Fourth Edition

Institution of Engineers, Australia (2016) "Australian Rainfall and Runoff – A Guide to Flood Estimation"

Water by Design (2018) “MUSIC Modelling Guidelines Version 3.0” – Consultation Draft, November 2018

Appendix A

Proposed Development Plans

RPD

5-7 McDermott Ave & 1 Phillip Street
Goonellabah NSW 2480

Proposal

TOTAL UNITS	18		
COMMUNAL SPACE	163.1m²	|	8.95%
DEEP SOIL ZONES / COS	276.1m²	|	15.15%
LANDSCAPE / COS	81.2m²	|	4.45%
PRIVATE YARDS LANDSCAPE	245.4m²	|	13.45%
TOTAL LANDSCAPED AREA	765.8m²	|	42.00%

Development Summary

Site Area m²	1,821
Site Cover (Roof)	1,095.6 | 60.1%
Floor Space Ratio	0.62:1

RESIDENTIAL YIELD

LEVEL	1 BED	2 BED		TOTAL
Level 1 Ground	*CAR PARK*			
level 2	3	6		9
Level 3	3	6		9
Totals	**6**	**12**		**18**

Cars Parking Required	*15*
Visitors Parking Required	*3.6*
Bicycle Parking Required	*10*

[RES. 0.5 per 1Bed and 1 per 2Bed | VIS. 1 per 5 Units as per Lismore DCP]

PARKING - Ground Level

TYPE	REQUIRED	PROVIDED
CAR	18.6	19
BIKE	10	10

AREAS	GFAm²	POSm²	GBAm²
LEVEL 1 Ground			
LOBBY, CARPARK, STORAGE	0	0	**771.5**
LEVEL 2			
UNIT 1 (2 BEDROOM)	70	10.2	80.2
UNIT 2 (2 BEDROOM)	70	79.6	149.6
UNIT 3 (1 BEDROOM)	50.7	33.4	84.1
UNIT 4 (1 BEDROOM)	50.7	33	83.7
UNIT 5 (1 BEDROOM)	50.7	33.4	84.1
UNIT 6 (2 BEDROOM)	70	66.1	136.1
UNIT 7 (2 BEDROOM)	70	30.4	100.4
UNIT 8 (2 BEDROOM)	70	20.6	90.6
UNIT 9 (2 BEDROOM)	70	10.2	80.2
OTHER			481.6
LEVEL 2 TOTAL	**572.1**	**316.9**	**1370.6**
LEVEL 3			
UNIT 10 (2 BEDROOM)	70	10.2	80.2
UNIT 11 (2 BEDROOM)	70	10.2	80.2
UNIT 12 (1 BEDROOM)	50.7	8	58.7
UNIT 13 (1 BEDROOM)	50.7	8	58.7
UNIT 14 (1 BEDROOM)	50.7	8	58.7
UNIT 15 (2 BEDROOM)	70	10.2	80.2
UNIT 16 (2 BEDROOM)	70	10.2	80.2
UNIT 17 (2 BEDROOM)	70	10.2	80.2
UNIT 18 (2 BEDROOM)	70	10.2	80.2
OTHER			238.5
LEVEL 3 TOTAL	**572.1**	**85.2**	**895.8**
TOTAL	**1144.2**	**402.1**	**3037.9**

GFA (Gross Floor Area)
Means the sum of the floor area of each floor of a building measured from the **internal face of external walls**, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes—
(a) the area of a mezzanine, and
(b) habitable rooms in a basement or an attic, and
(c) any shop, auditorium, cinema, and the like, in a basement or attic,
but excludes—
(d) any area for common vertical circulation, such as lifts and stairs, and
(e) any basement—
(i) storage, and
(ii) vehicular access, loading areas, garbage and services, and
(f) plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
(g) car parking to meet any requirements of the consent authority (including access to that car parking), and
(h) any space used for the loading or unloading of goods (including access to it), and
(i) terraces and balconies with outer walls less than 1.4 metres high, and
(j) voids above a floor at the level of a storey or storey above.

POS (private open space)
Means an area external to a building (including an area of land, terrace, balcony or deck) that is used for private outdoor purposes ancillary to the use of the building.

GBA (Gross Building Area)
The total enclosed and unenclosed area of the building at all building floor levels measured between the normal **outside face** of any enclosing walls, balustrades and supports
GBA measurement also includes external verandahs, balconies, porches & structural columns.
Upper portions of rooms/voids/shafts etc are also included in GBA measurement.

RAUNIK design group ARCHITECTS

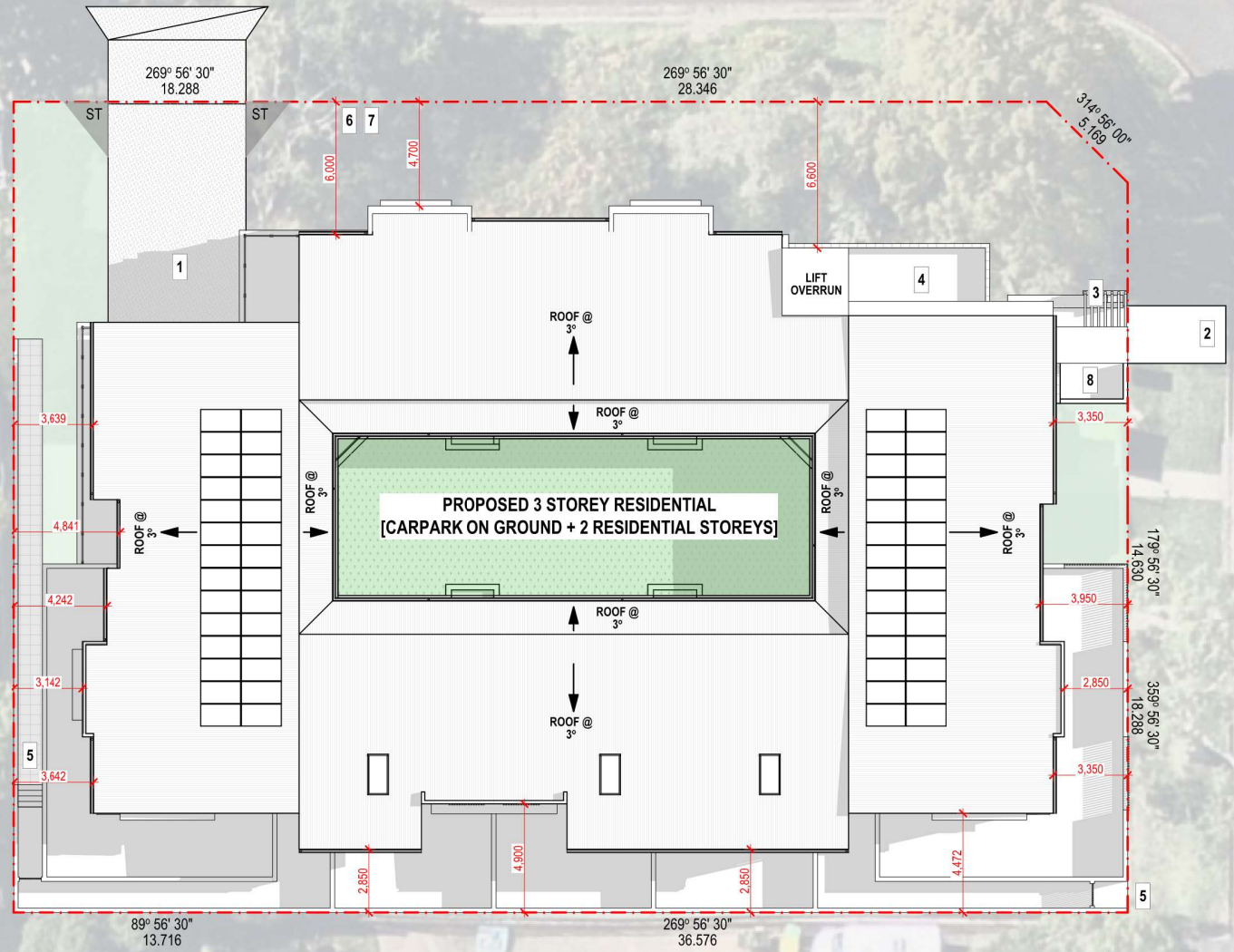
@A3
DEVELOPMENT SUMMARY

5-7 McDERMOTT AVE +
1 PHILLIP STREET,
GOONELLABAH NSW 2480

SITE AREA. 1,821m²
FSR. 0.62:1

SITE PLAN LEGEND

1 VEHICULAR ENTRY
2 PEDESTRIAN ENTRY
3 MAILBOXES
4 BIKE PARKING
5 FIRE EGRESS
6 WATER METER
7 BOOSTER
8 TEMP. BIN STORE

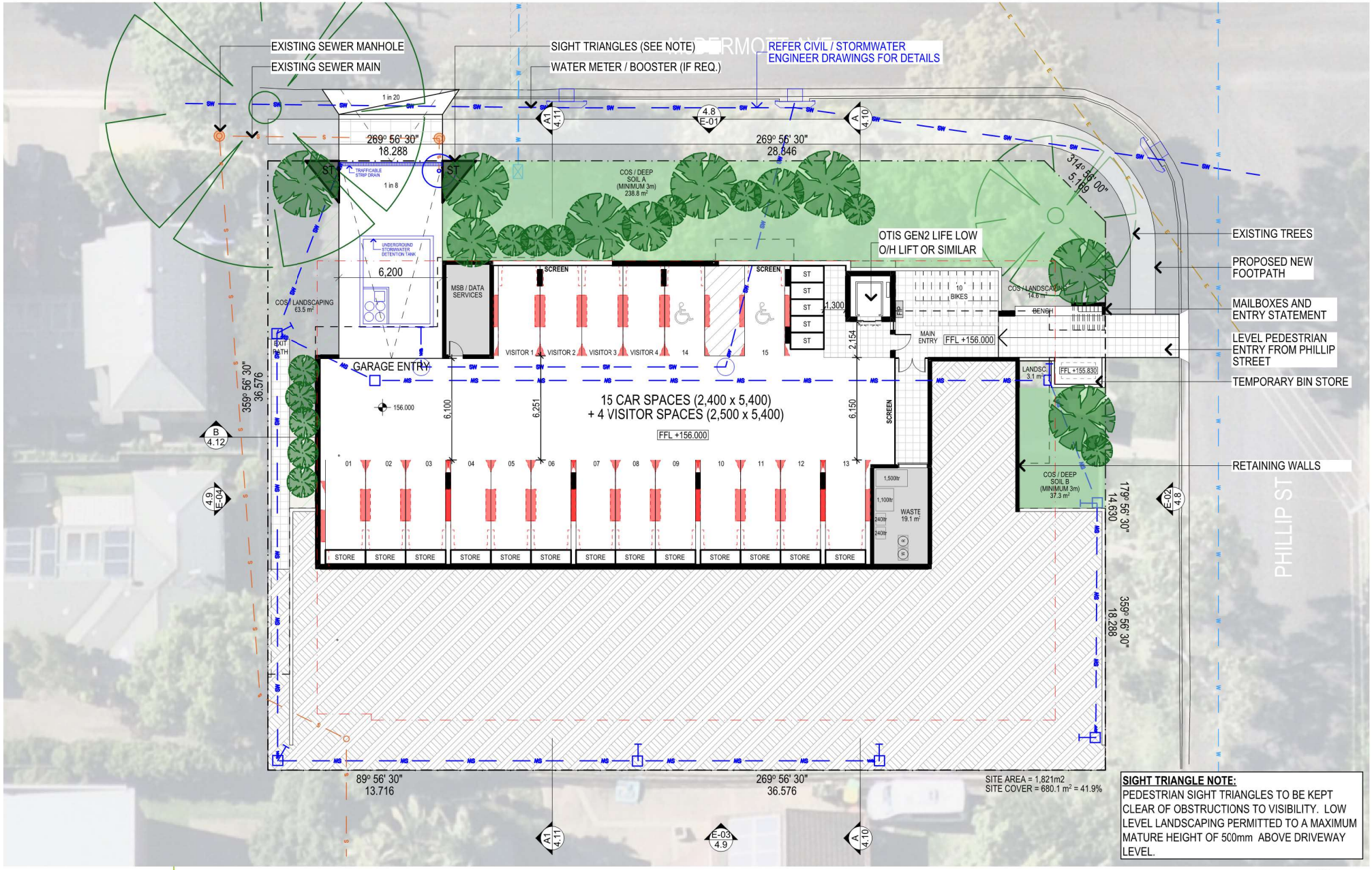


RAUNIK design group ARCHITECTS

1:200@A3

SITE PLAN

23891 | PHILLIP ST. GOONELLABAH | DEVELOPMENT APPLICATION | 19/01/2024 | 4.1 | REV E



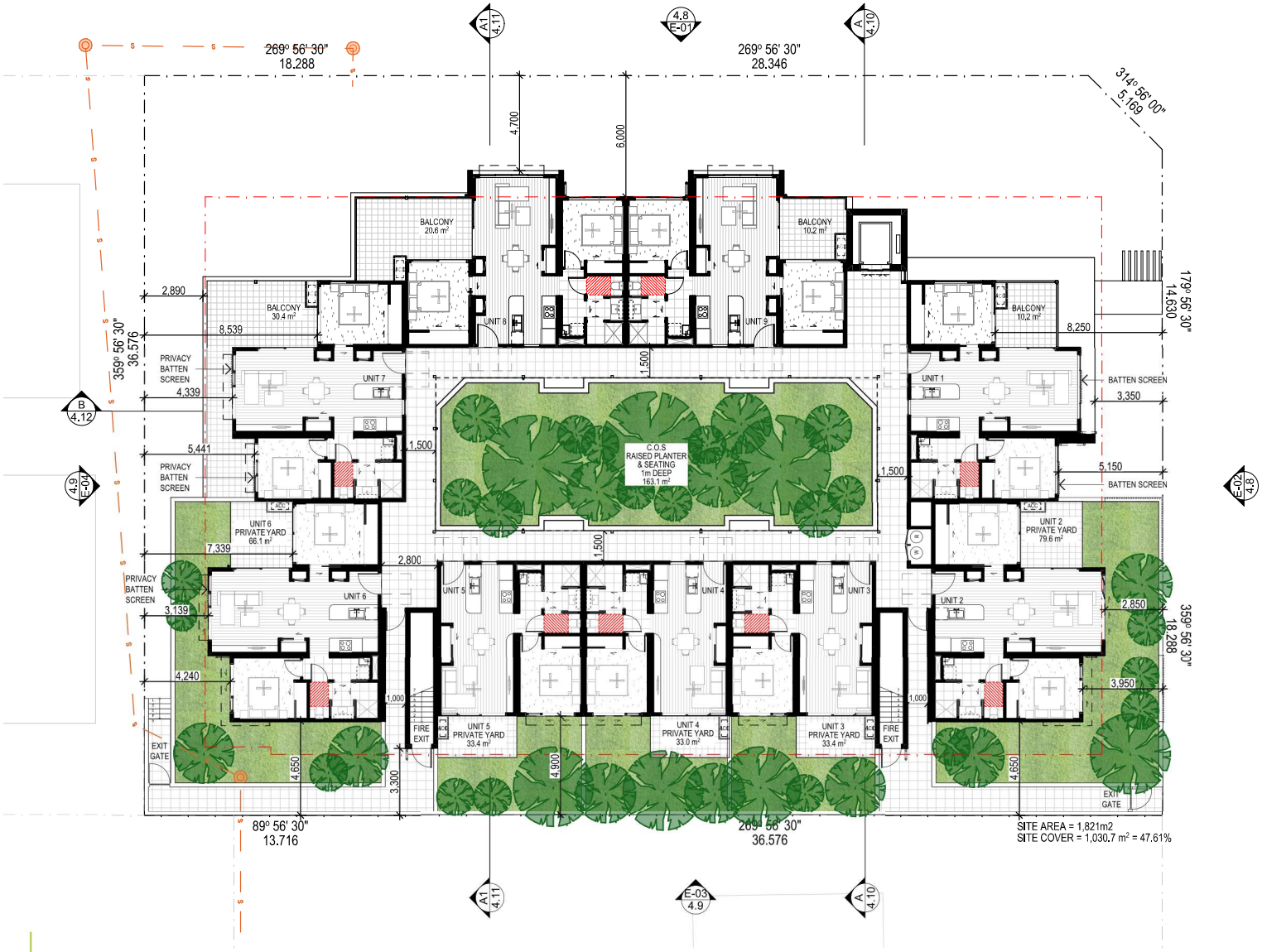
SIGHT TRIANGLE NOTE:
PEDESTRIAN SIGHT TRIANGLES TO BE KEPT CLEAR OF OBSTRUCTIONS TO VISIBILITY. LOW LEVEL LANDSCAPING PERMITTED TO A MAXIMUM MATURE HEIGHT OF 500mm ABOVE DRIVEWAY LEVEL.

RAUNIK design group ARCHITECTS

1:200@A3

LEVEL 1 GROUND

23891 | PHILLIP ST. GOONELLABAH | DEVELOPMENT APPLICATION | 19/01/2024 | 4.2 | REV E

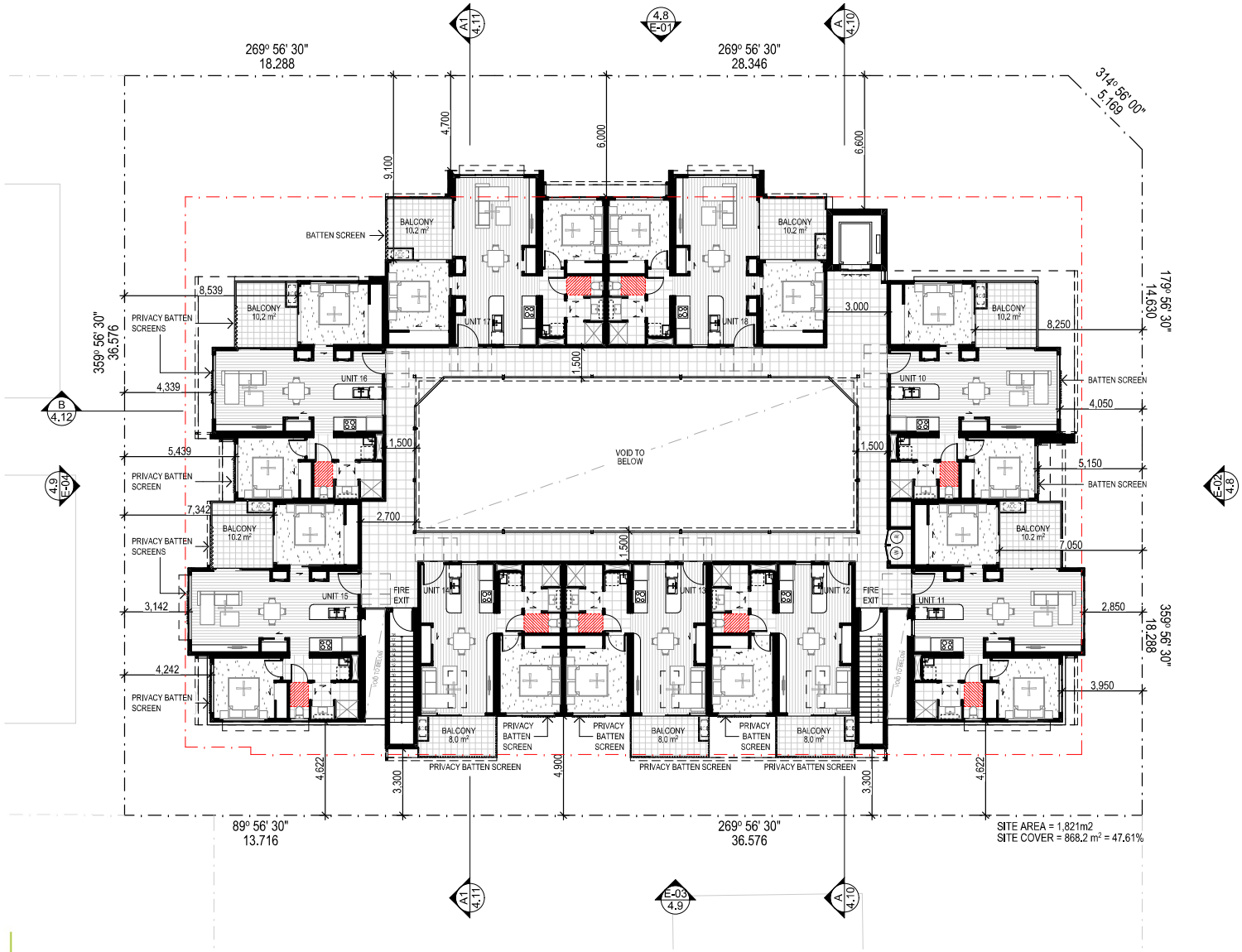


RAUNIK
design group
ARCHITECTS

1:200@A3

LEVEL 2

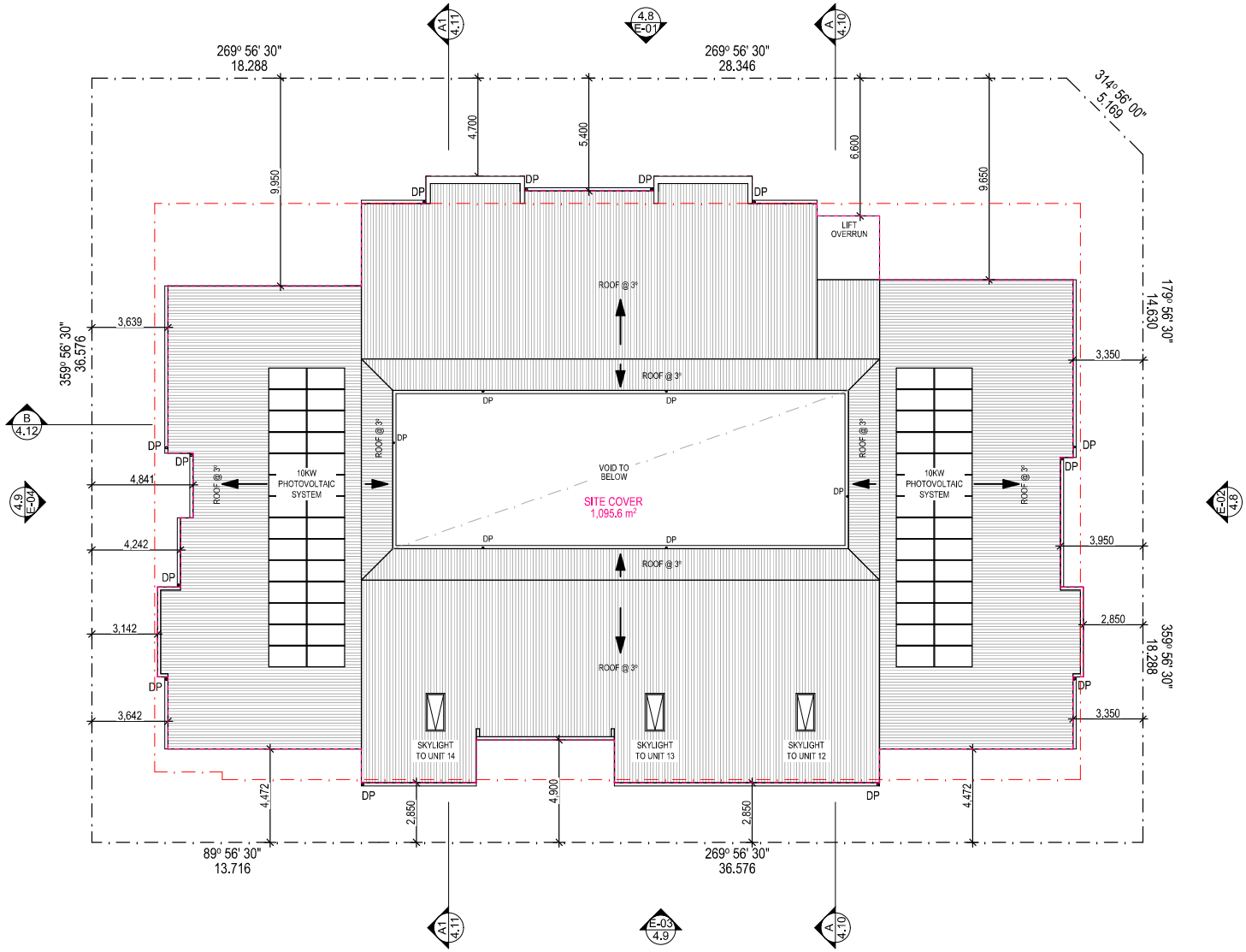
23891 | PHILLIP ST. GOONELLABAH | DEVELOPMENT APPLICATION | 19/01/2024 | 4.3 | REV E



RAUNIK design group ARCHITECTS

1:200@A3

LEVEL 3



RAUNIK design group ARCHITECTS

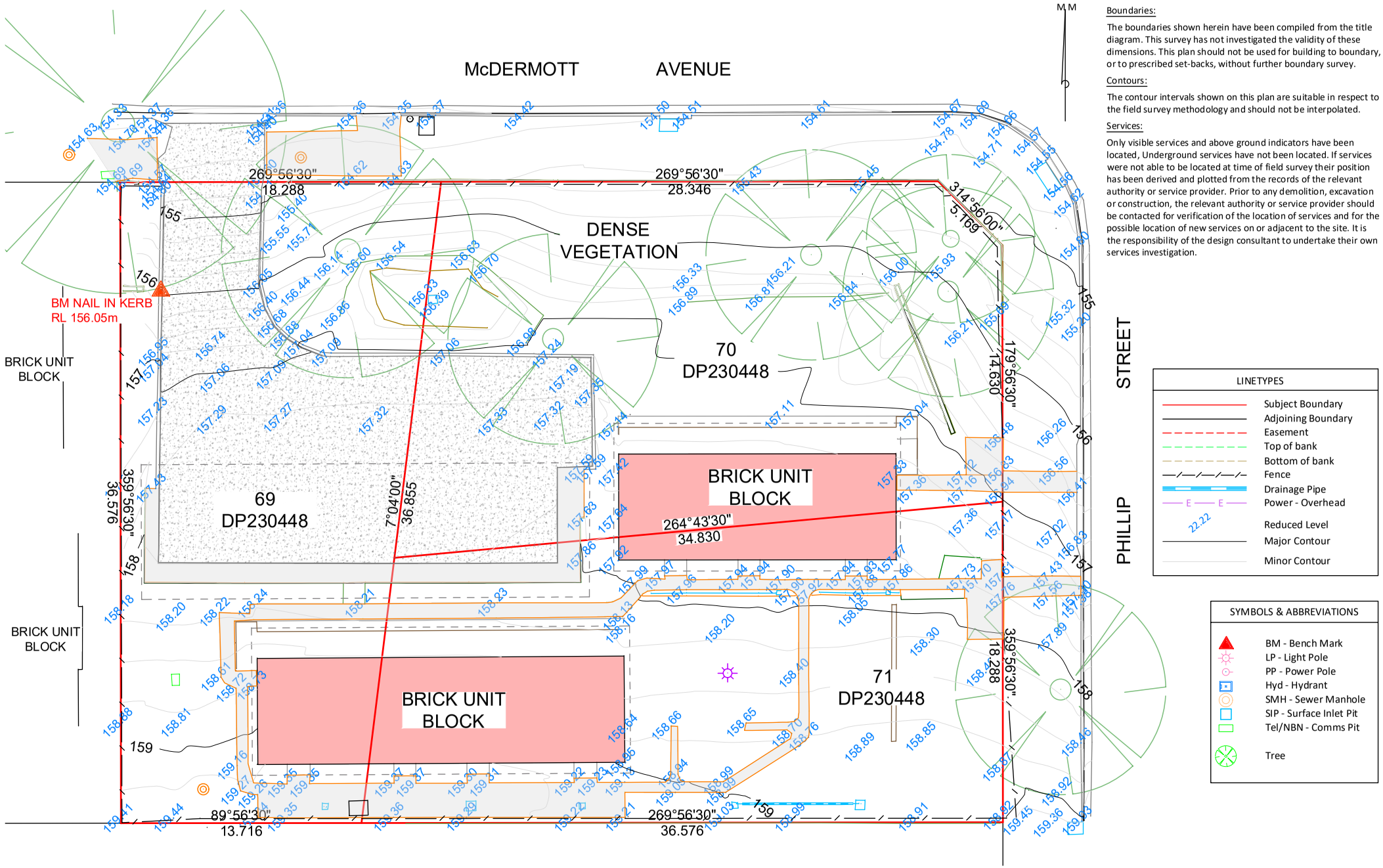
1:200@A3

ROOF

23891 | PHILLIP ST. GOONELLABAH | DEVELOPMENT APPLICATION | 19/01/2024 | 4.5 | REV E

Appendix B

Topographic Survey



Boundaries:

The boundaries shown herein have been compiled from the title diagram. This survey has not investigated the validity of these dimensions. This plan should not be used for building to boundary, or to prescribed set-backs, without further boundary survey.

Contours:

The contour intervals shown on this plan are suitable in respect to the field survey methodology and should not be interpolated.

Services:

Only visible services and above ground indicators have been located, Underground services have not been located. If services were not able to be located at time of field survey their position has been derived and plotted from the records of the relevant authority or service provider. Prior to any demolition, excavation or construction, the relevant authority or service provider should be contacted for verification of the location of services and for the possible location of new services on or adjacent to the site. It is the responsibility of the design consultant to undertake their own services investigation.

LINETYPES

- Subject Boundary
- Adjoining Boundary
- Easement
- Top of bank
- Bottom of bank
- Fence
- Drainage Pipe
- Power - Overhead
- Reduced Level
- Major Contour
- Minor Contour

SYMBOLS & ABBREVIATIONS

- BM - Bench Mark
- LP - Light Pole
- PP - Power Pole
- Hyd - Hydrant
- SMH - Sewer Manhole
- SIP - Surface Inlet Pit
- Tel/NBN - Comms Pit
- Tree

REV	DESCRIPTION	BY	APP.	DATE
A	FIRST ISSUE			

REVISIONS

A3 SIZE ORIGINAL DRAWING
0 2 4 6
1:200
SCALE (m) A3

SCALES

HORIZ. DATUM	GROUND	DRAWN	MC
PROJECTION	GDA2020	CHECKED	NDC
MERIDIAN	MGA	DESIGN	
VERT. DATUM	AHD	CHECKED	
VERT. ORIGIN	SCIMS	APPROVED CERTIFICATION DATE	
SURVEYED BY	MC		
SURVEYED DATE	14/06/2023		

SURVEY DATA APPROVALS

Newton Denny Chapelle
Surveyors Planners Engineers
Lismore and Kingscliff
Phone | 02 6622 1011
Email | office@ndc.com.au

Client: SOCIAL FUTURES

Site: LOTS 69, 70, 71 DP230448
1 PHILLIP STREET
GOONELLABAH

DETAIL SURVEY
1 PHILLIP STREET
GOONELLABAH

Reference No.	DRAWING No.	REVISION
230180	230180-01-SU-DS-01	A

Appendix C

Stormwater Catchment Plans

LEGEND

- EXISTING TELSTRA CABLE
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING OVERHEAD ELECTRICAL
- EXISTING UNDER GROUND ELECTRICAL
- SEWER RETICULATION FLOW DIRECTION
- EXISTING BOUNDARY
- EXISTING NOMINAL KERB LINE
- INDICATIVE WORKS AREA
- EXISTING SURFACE CONTOURS (0.5m)
- EXISTING FEATURE TO BE DEMOLISHED
- ROOF / BUILDING HARDSTAND AREA
- CONCRETE DRIVEWAY / PAVED AREA
- PERVIOUS AREA
- OVERLAND FLOW DIRECTION
- CATCHMENT BOUNDARY
- A — CATCHMENT LABEL

CATCHMENT TABLE (PRE)

CATCHMENT AREA - A	0.1833 ha

CATCHMENT DATA	A
BUILDING / ROOF AREA	0.0545 ha
HARDSTAND / DRIVEWAY	0.0323 ha
GARDEN / PERVIOUS AREA	0.0965 ha
TOTAL IMPERVIOUS AREA	0.0868 ha
TOTAL PERVIOUS AREA	0.0965 ha

NOTES

1. THE LOCATION OF THE EXISTING SERVICES HAS BEEN PLOTTED FROM SURVEY AND RECORDS AND IS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. HISTORICAL AERIAL PHOTOGRAPHY HAS BEEN USED TO VALIDATE SURVEY DATA AND ESTABLISH PRE-DEVELOPMENT CATCHMENTS.

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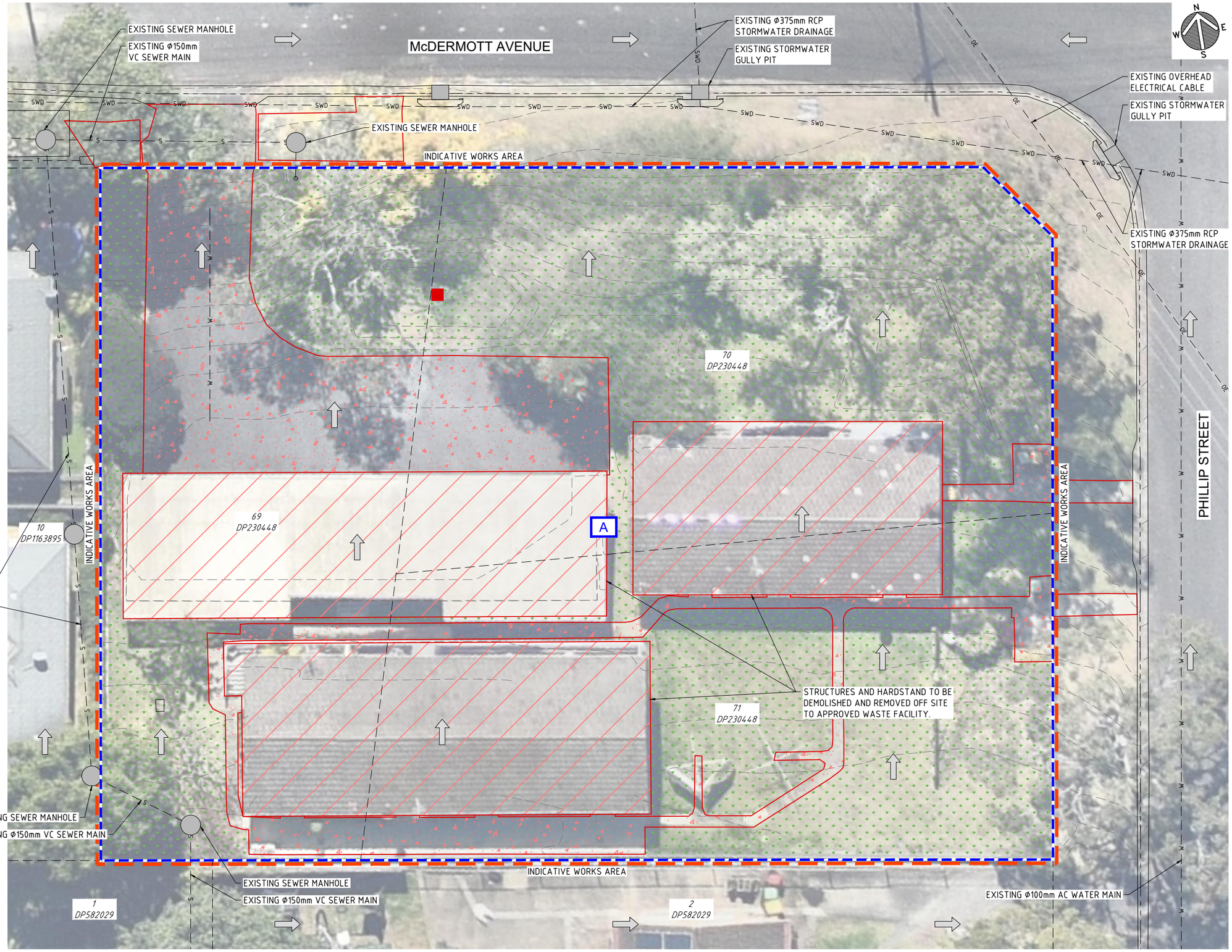


PINNACLE ENGINEERING GROUP
LEVEL 1 19 SHORT STREET, SOUTHPORT QLD 4215
(PO BOX 517, PARADISE POINT QLD 4216)
WWW.PINNACLEENG.COM.AU

REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	M.G.	30.11.2023

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		30.11.2023
DESIGN	A. CRESSWELL		30.11.2023
DRAWN	M. GLASSON		30.11.2023

SCALE 1 0 1 2 3 4 5 1:100

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: SOCIAL FUTURES

PROJECT: PROPOSED RESIDENTIAL DEVELOPMENT
1 PHILLIP STREET,
GOONELLABAH NSW 2480
(LOT 69, 70 & 71 ON DP230448)

DRAWING TITLE: PRE DEVELOPMENT CATCHMENT LAYOUT

STATUS: PRELIMINARY
(NOT TO BE USED FOR CONSTRUCTION)

APPROVED

RPEQ No

DRAWING NUMBER: PEG1114-DA-SK01

REVISION: A

LEGEND

— T —	EXISTING TELSTRA CABLE
— S —	EXISTING SEWERAGE RETICULATION
— W —	EXISTING WATER RETICULATION
— SWD —	EXISTING STORMWATER PIPE
— OE —	EXISTING OVERHEAD ELECTRICAL
— UE —	EXISTING UNDER GROUND ELECTRICAL
— — —	EXISTING BOUNDARY
- - -	EXISTING NOMINAL KERB LINE
red dashed line	INDICATIVE WORKS AREA
hatched	ROOF / BUILDING HARDSTAND AREA
grey	CONCRETE DRIVEWAY / PAVED AREA
dotted green	PERVIOUS AREA
arrow	OVERLAND FLOW DIRECTION
blue dashed line	CATCHMENT BOUNDARY
A1	CATCHMENT LABEL
PROP. BDY.	EXISTING WATER SERVICES
PROP. BDY.	PROPOSED WATER SERVICE
	STORMWATER DETENTION TANK
— SWD —	PROPOSED STORMWATER
blue arrow	STORMWATER FLOW DIRECTION
red arrow	SEWER RETICULATION FLOW DIRECTION

NOTES

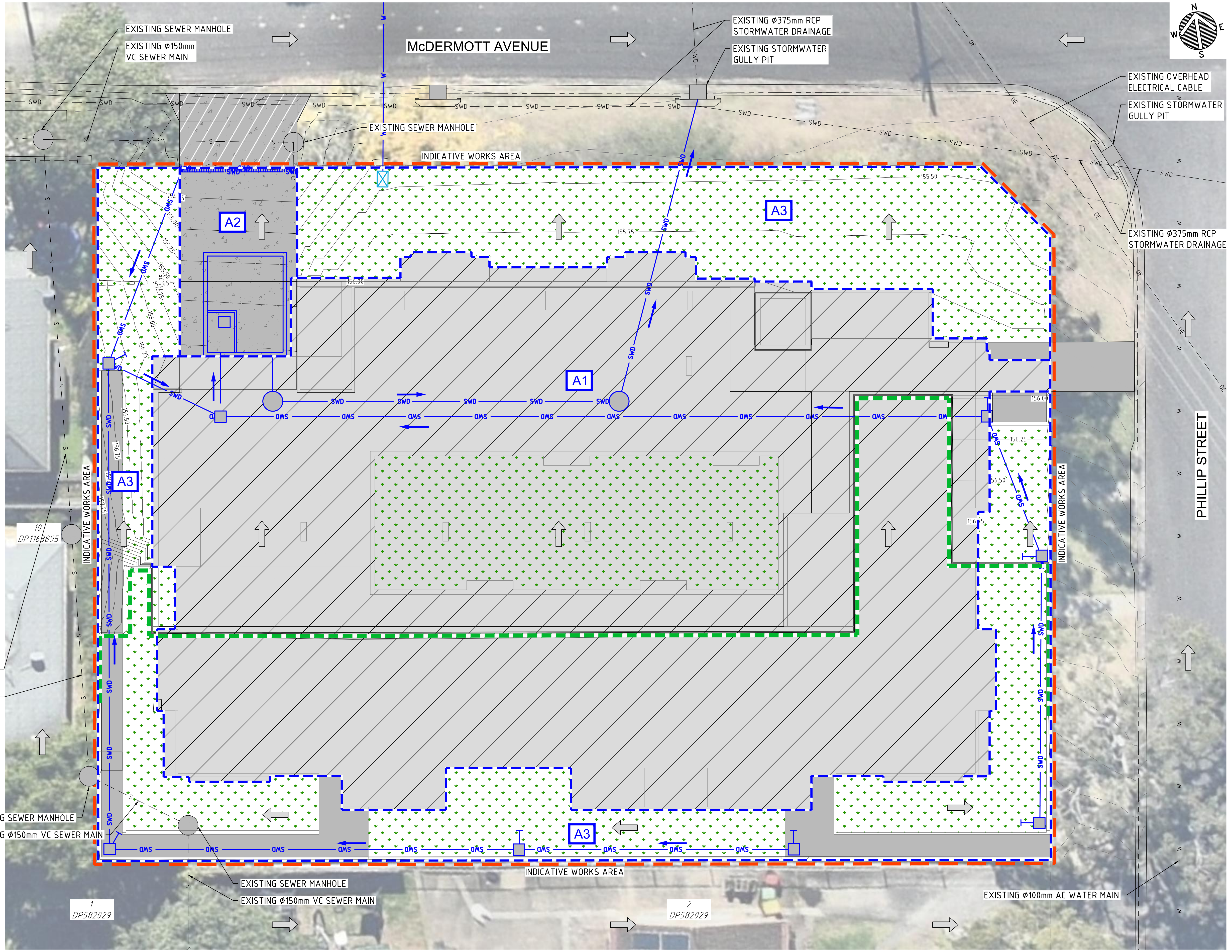
1. THE LOCATION OF THE EXISTING SERVICES HAS BEEN PLOTTED FROM SURVEY AND RECORDS AND IS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. THE DETAILED DESIGN OF THE DISCHARGE PIPE WORK IS THE SUBJECT OF THE SEPARATE PLUMBING AND DRAINAGE APPLICATION.

CATCHMENT TABLE (POST)

CATCHMENT AREA - A1 (ROOF/BUILDING)	0.1162 ha
CATCHMENT AREA - A2 (DRIVEWAY/SLAB)	0.0060 ha
CATCHMENT AREA - A3 (GROUND/LANDSCAPING)	0.0611 ha

CATCHMENT DATA

CATCHMENT DATA	A1	A2	A3
ROOF / BUILDING AREA	0.1162 ha	N/A	N/A
DRIVEWAY / ROAD	N/A	0.0060 ha	N/A
GROUND / GARDEN	N/A	N/A	0.0611 ha
TOTAL IMPERVIOUS AREA	0.1016 ha	0.0060 ha	0.0104 ha
TOTAL PERVIOUS AREA	0.0146 ha	N/A	0.0507 ha



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PINNACLE ENGINEERING GROUP
LEVEL 1 19 SHORT STREET, SOUTHPORT QLD 4215
(PO BOX 517, PARADISE POINT QLD 4216)
WWW.PINNACLEENG.COM.AU

REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	M.G.	30.11.2023
B	REVISED LAYOUT	J.H.	18.01.2024

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		30.11.2023
DESIGN	A. CRESSWELL		30.11.2023
DRAWN	M. GLASSON		30.11.2023

SCALE 1:100 (SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: SOCIAL FUTURES

PROJECT: PROPOSED RESIDENTIAL DEVELOPMENT
1 PHILLIP STREET, GOONELLABAH NSW 2480
(LOT 69, 70 & 71 ON DP230448)

DRAWING TITLE: POST DEVELOPMENT CATCHMENT LAYOUT

STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

APPROVED | RPEQ No

DRAWING NUMBER: PEG1114-DA-SK02 | REVISION: B

PINNACLE ENGINEERING GROUP

Appendix D

Rational Method Calculations

RATIONAL METHOD CALCULATIONS

Project:	PEG1114_1 Phillip Street, Goonellabah
Date:	27.11.2023
Designed:	J. Hardman
Comments:	Catchment A - Pre-development

PARAMETERS	VALUE		
Catchment Name	A		
Catchment Size	0.1833	ha	
C10 Coefficient of Runoff	0.71		QUDM T4.5.3 1I10 = 56.2, 47% Imp.

Total Time of Concentration — QUDM

Total time of Conentration **(tc)** — **5.0 mins**

Rational Method for Peak Catchment flow — Q = 0.00278 x C x I x A

AEP%	Rainfall Intensity (mm/h)	Rainfall Depth (mm)	Fy	Coefficient of Runoff	Discharge (m^3/s)
3 month					0.012
63.2	103.00	8.58	0.80	0.57	0.030
39.3	115.00	9.58	0.85	0.60	0.035
18.1	155.00	12.92	0.95	0.67	0.053
10	182.00	15.17	1.00	0.71	0.066
5	208.00	17.33	1.05	0.75	0.079
2	244.00	20.33	1.15	0.82	0.101
1	271.00	22.58	1.20	0.85	0.118

Appendix E

Stormwater Management Layout

LEGEND

- EXISTING TELSTRA CABLE
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING OVERHEAD ELECTRICAL
- EXISTING UNDER GROUND ELECTRICAL
- EXISTING BOUNDARY
- EXISTING NOMINAL KERB LINE
- INDICATIVE WORKS AREA
- ROOF / BUILDING HARDSTAND AREA
- CONCRETE DRIVEWAY / PAVED AREA
- PERVIOUS AREA
- OVERLAND FLOW DIRECTION
- CATCHMENT BOUNDARY
- A1 — CATCHMENT LABEL
- PROP. BDY. — EXISTING WATER SERVICES
- PROP. BDY. — PROPOSED WATER SERVICE
- STORMWATER DETENTION TANK
- SWD — PROPOSED STORMWATER
- STORMWATER FLOW DIRECTION
- SEWER RETICULATION FLOW DIRECTION

NOTES

1. THE LOCATION OF THE EXISTING SERVICES HAS BEEN PLOTTED FROM SURVEY AND RECORDS AND IS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. THE DETAILED DESIGN OF THE DISCHARGE PIPE WORK IS THE SUBJECT OF THE SEPARATE PLUMBING AND DRAINAGE APPLICATION.

CATCHMENT TABLE (POST)

CATCHMENT AREA - A1 (ROOF/BUILDING)	0.1162 ha
CATCHMENT AREA - A2 (DRIVEWAY/SLAB)	0.0060 ha
CATCHMENT AREA - A3 (GROUND/LANDSCAPING)	0.0611 ha

CATCHMENT DATA	A1	A2	A3
ROOF / BUILDING AREA	0.1162 ha	N/A	N/A
DRIVEWAY / ROAD	N/A	0.0060 ha	N/A
GROUND / GARDEN	N/A	N/A	0.0611 ha
TOTAL IMPERVIOUS AREA	0.1016 ha	0.0060 ha	0.0104 ha
TOTAL PERVIOUS AREA	0.0146 ha	N/A	0.0507 ha

EXISTING Ø150mm ENC SEWER MAIN
US.I.L. 154.87m DS.I.L. 153.55m

EXISTING Ø150mm ENC SEWER MAIN
US.I.L. 157.91m DS.I.L. 156.25m

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UNDERGROUND PUBLIC UTILITY PLANT EXISTS IN THIS VICINITY. THE CONTRACTOR IS ADVISED TO CONTACT THE RELEVANT AUTHORITIES TO CONFIRM THE EXACT LOCATION OF PUBLIC UTILITY PLANT ON SITE PRIOR TO THE COMMENCEMENT OF ANY EXCAVATION OR CONSTRUCTION WORKS.

McDERMOTT AVENUE

PHILLIP STREET

EXISTING SEWER MANHOLE

EXISTING Ø150mm VC SEWER MAIN

EXISTING SEWER MANHOLE

EXISTING Ø375mm RCP STORMWATER DRAINAGE

EXISTING STORMWATER GULLY PIT

EXISTING OVERHEAD ELECTRICAL CABLE

EXISTING STORMWATER GULLY PIT

EXISTING Ø375mm RCP STORMWATER DRAINAGE

INDICATIVE WORKS AREA

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.155.15m,
D.S.I.L.155.05m

PROVIDE TRAFFICABLE STRIP DRAIN TO DRIVEWAY

PROPOSED 20.0m² UNDERGROUND STORMWATER DETENTION TANK TO ACCEPT AND TREAT DISCHARGE FROM BUILDING (CATCHMENT A1) VIA GRAVITY AND CATCHMENTS A2 AND A3 VIA GRAVITY FROM INDICATIVE DRAINAGE SHOWN PRIOR TO GRAVITY DISCHARGE. REFER TO DWG No. PEG1114-DA-SK04 FOR DETAILS.
D.S.I.L. 154.7, U.S.I.L.154.8

PROPOSED Ø375mm RCP STORMWATER PIPE
U.S.I.L. 154.5m
D.S.I.L. 153.5m
VERGE / ROADWAY REINSTATEMENT TO CoGC STANDARD SPECIFICATION.

PROPOSED Ø300mm PVC STORMWATER PIPE
U.S.I.L.154.65m, D.S.I.L. 154.5m

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.155.55m, D.S.I.L. 155.0m

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.155.0m, D.S.I.L. 154.95m

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.155.05m, D.S.I.L. 155.00m

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.158.05m, D.S.I.L. 155.05m

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.156.65m, D.S.I.L. 155.55m

PIT AND PIPED NETWORK TO CAPTURE ROOF (CATCHMENT A1) AND SURFACE FLOWS (CATCHMENTS A2 AND A3) VIA GRAVITY FROM INDICATIVE DRAINAGE AND DISCHARGE TO EXISTING STORMWATER NETWORK AS SHOWN. STORMWATER DRAINAGE PIPES AND PITS SHOWN INDICATIVE ONLY, SUBJECT TO FUTURE DETAILED DESIGN AND BUILDING CERTIFICATION AND PLUMBING AND DRAINAGE APPROVALS.. SHOWN ONLY TO PROVE CONCEPT.

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.158.45m, D.S.I.L. 156.65m

PROVIDE Ø150mm PVC STUB FOR ROOFWATER DRAINAGE CONNECTION. REFER TO DWG No. PEG1114-DA-SK04 FOR DETAIL.

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.158.25m, D.S.I.L. 158.05m

PROPOSED Ø225mm PVC STORMWATER PIPE
U.S.I.L.158.45m, D.S.I.L. 158.25m

EXISTING SEWER MANHOLE

EXISTING Ø150mm VC SEWER MAIN

EXISTING SEWER MANHOLE

EXISTING Ø150mm VC SEWER MAIN

INDICATIVE WORKS AREA

EXISTING Ø100mm AC WATER MAIN

10 DP1163895

1 DP582029

2 DP582029

A1 A2 A3

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LEVEL 1 19 SHORT STREET, SOUTHPORT QLD 4215
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REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	M.G.	30.11.2023
B	REVISED LAYOUT	J.H.	18.01.2024

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		30.11.2023
DESIGN	A. CRESSWELL		30.11.2023
DRAWN	M. GLASSON		30.11.2023

SCALE 1 0 1 2 3 4 5 1:100

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: SOCIAL FUTURES

PROJECT: PROPOSED RESIDENTIAL DEVELOPMENT
1 PHILLIP STREET,
GOONELLABAH NSW 2480
(LOT 69, 70 & 71 ON DP230448)

DRAWING TITLE: STORMWATER MANAGEMENT LAYOUT

STATUS: PRELIMINARY
(NOT TO BE USED FOR CONSTRUCTION)

APPROVED RPEQ No

DRAWING NUMBER: PEG1114-DA-SK03

REVISION: B

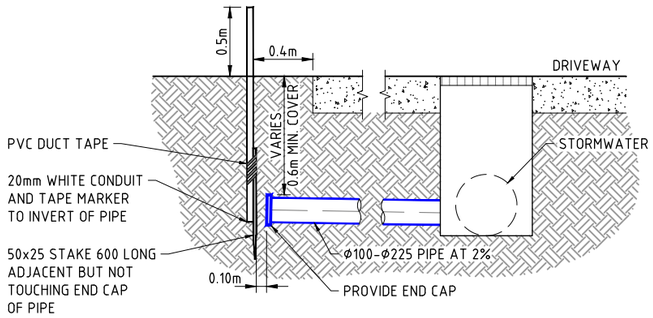
PEG1114-DA-SK03 STORMWATER MANAGEMENT LAYOUT.dwg 19.01.2024 Letter (8.5in x 11.00 inches) Travis Jones-Hawkins

DETENTION DETAILS

PARAMETERS	TANK
TANK OUTLETS	
LOW FLOW OUTLET	= Ø225mm PVC PIPE OUTLET AT 0.5% GRADE (DISCHARGE TO McDERMOTT AVENUE STORMWATER NETWORK)
LOW FLOW OUTLET LEVEL	= AT BASE OF TANK
HIGH FLOW OUTLET	= 2 x Ø100mm PVC PIPE OUTLETS AT 0.5% GRADE (DISCHARGE TO McDERMOTT AVENUE STORMWATER NETWORK)
HIGH FLOW OUTLET LEVEL	= 0.70m ABOVE BASE OF TANK
TANK GEOMETRY	
STORAGE AREA	= 20.0m^2 MIN.
STORAGE HEIGHT	= 0.90m
STORAGE VOLUME	= 18.0m^3
TANK MODELLING SUMMARY	
Q10 PEAK OUTFLOW	= 0.052m^3/s
Q10 PEAK STAGE	= 0.493m ABOVE BASE OF TANK
Q100 PEAK OUTFLOW	= 0.073m^3/s
Q100 PEAK STAGE	= 0.783m ABOVE BASE OF TANK

QUALITY TREATMENT DETAILS

CATCHMENT A - ATLAN VAULT	
HIGH FLOW BYPASS	= 100m^3/s
STORAGE SURFACE AREA	= 4.0m^2
EXTENDED DETENTION DEPTH	= 0.55m
EQUIVALENT PIPE DIA.	= 62mm
SPELFILTER CARTRIDGE TYPE	= 660mm FIL.15-EMC-M
REQUIRED NUMBER	= 4
HIGH FLOW BYPASS	= 0.006m^3/s

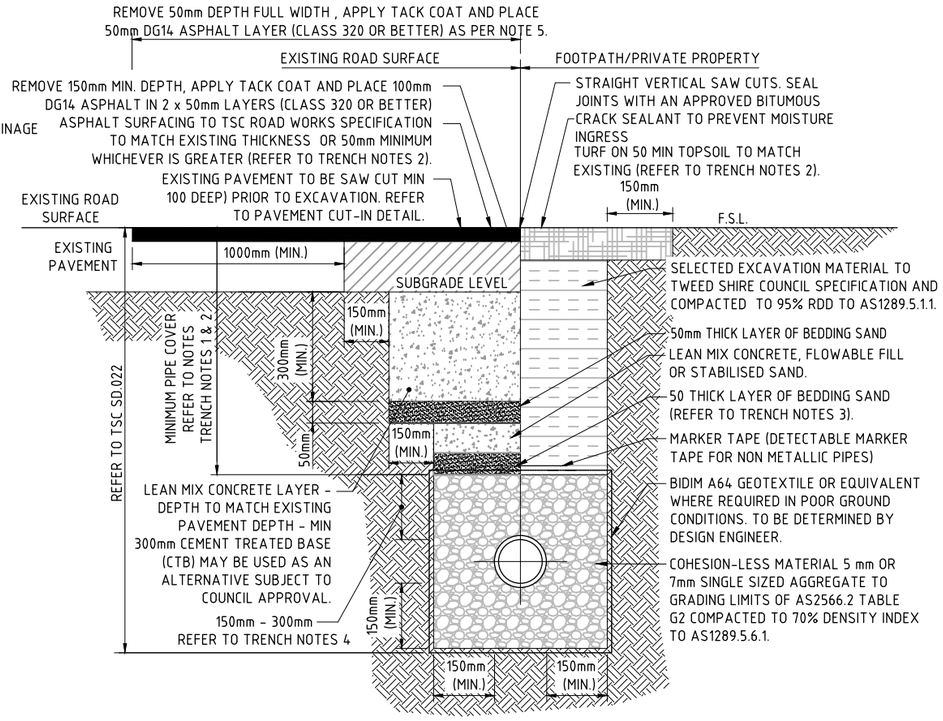


STORMWATER BRANCH DETAIL

SCALE: N.T.S.

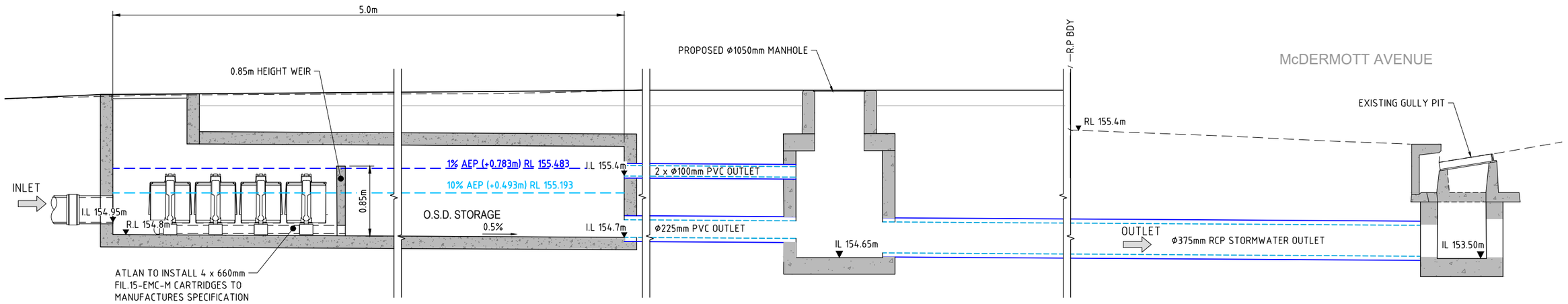
TRENCH NOTES

1. MINIMUM COVER TO MAINS FROM PERMANENT LEVEL SHALL BE IN ACCORDANCE IN ACCORDANCE WITH LCC STANDARD DRAWINGS AND SPECIFICATIONS.
2. ROAD CROSSING, VERGES AND PATHS TRENCH RESTORATION SHALL BE IN ACCORDANCE WITH LCC STANDARD DRAWINGS AND SPECIFICATIONS.
3. PROVIDE 50mm THICK LAYER OF BEDDING SAND IF FLOWABLE FILL CONCRETE OR OTHER LOW PERMEABLE FILL IS USED AS EMBEDMENT.
4. 150mm MINIMUM OVERLAY FOR NON-TRAFFICABLE AND 300mm MINIMUM FOR TRAFFICABLE.
5. THE VERTICAL DEVIATION FROM A STRAIGHT EDGE PARALLEL TO THE CENTRE LINE OF THE EXISTING ROAD IS NOT TO EXCEED 5mm.



TYPICAL TRENCH DETAIL

SCALE N.T.S.



TANK SECTION

SCALE 0.5 0 0.5 1.0 1:25

ATLAN STORMWATER DETAILS

ATLAN STORMWATER DETAILS AND ARRANGEMENT ARE INDICATIVE ONLY AND ARE TO BE CONFIRMED BY THE CONTRACTOR WITH THE MANUFACTURER PRIOR TO PROCUREMENT AND CONSTRUCTION.

PINNACLE ENGINEERING GROUP
LEVEL 1 19 SHORT STREET, SOUTHPORT QLD 4215
(PO BOX 517, PARADISE POINT QLD 4216)
WWW.PINNACLEENG.COM.AU

REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	M.G.	30.11.2023
B	REVISED LAYOUT	J.H.	18.01.2024

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		30.11.2023
DESIGN	A. CRESSWELL		30.11.2023
DRAWN	M. GLASSON		30.11.2023

SCALE: AS SHOWN (SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: SOCIAL FUTURES

PROJECT: PROPOSED RESIDENTIAL DEVELOPMENT
1 PHILLIP STREET,
GOONELLABAH NSW 2480
(LOT 69, 70 & 71 ON DP230448)

DRAWING TITLE: STORMWATER MANAGEMENT DETAILS

STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

APPROVED

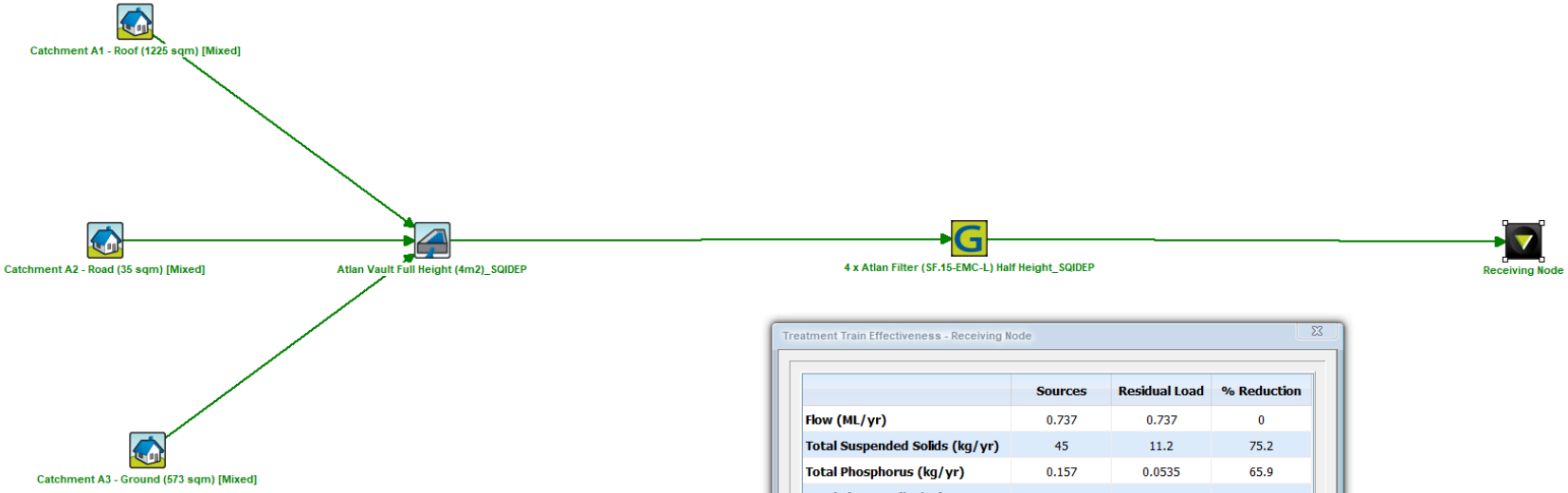
RPEQ No

DRAWING NUMBER: PEG1114-DA-SK04

REVISION: B

Appendix F

MUSIC Model



Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	0.737	0.737	0
Total Suspended Solids (kg/yr)	45	11.2	75.2
Total Phosphorus (kg/yr)	0.157	0.0535	65.9
Total Nitrogen (kg/yr)	1.53	0.716	53.2
Gross Pollutants (kg/yr)	22	0	100

PINNACLE ENGINEERING GROUP

Appendix G

LCC Mapping

Lismore City Council
43 Oliver Avenue
Goonellabah NSW 2480
Post: PO Box 23A, Lismore NSW 2480
Phone: 1300 87 83 87
Fax: 02 66 250 400
Email: council@lismore.nsw.gov.au
Web: www.lismore.nsw.gov.au

Created By: anonymous

Projection: GDA2020 / MGA zone 56

Date: 22/11/2023 10:38 AM

Flood Map

Appendix H

ATLAN Stormwater Data

AtlanFilter

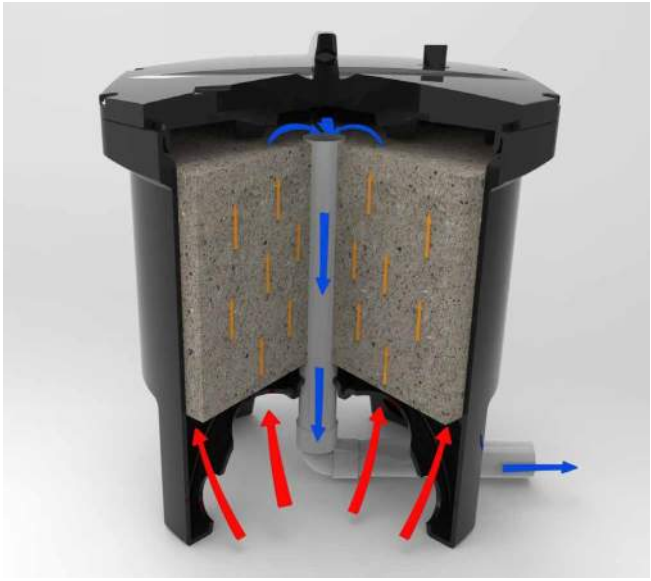
Cartridge filter for tertiary stormwater treatment

SQIDEP VERIFIED

STORMWATER QUALITY IMPROVEMENT DEVICE EVALUATION PROTOCOL

Atlan STORMWATER

atlan.com.au



APPLICATIONS

- Car Parks & Shopping Centres
- Council Depots
- Industrial Estates
- Heavy Vehicle Maintenance
- Airport Aprons & Tarmacs
- Transport Depots & Loading Bays
- Tunnels
- Highways & Transport Corridors
- Recycling Yards

AtlanFilter is a cartridge filter system that incorporates an upflow treatment process that maximises surface treatment area. Flow through the filter cartridges utilises a self-regulating siphon which results in low maintenance and high performance stormwater treatment. Automatic backwash technology further lengthens the lifespan of the filter.

Hydraulic pressure forces water through the filter media resulting in a constant velocity throughout the filter area. This ensures consistent media contact time and treatment outcomes.

Optimised to suit your site specific water quality outcomes and local authority requirements, The AtlanFilter has no moving parts and uses a true siphon effect to ensure high-performance pollution removal. These devices maintain excellent removal efficiency whilst maintaining site surface yield.

FEATURES

The media cartridge provides a significantly greater surface contact area to footprint ratio than other filters.

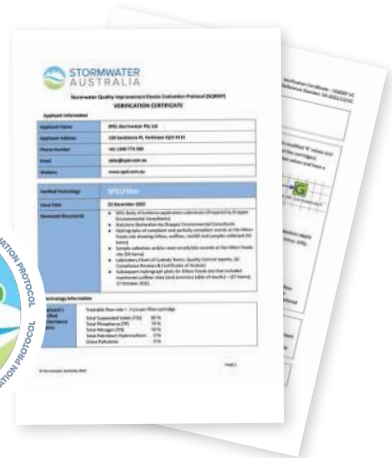
With a flow rate of 3L/s per cartridge and underground installation, the AtlanFilter provides excellent removal efficiency whilst maintaining site surface yield.

- No moving parts, generating a true siphon effect
- Small footprint
- Inorganic filter media (doesn't leach nutrients)
- Can be deployed in various drainage structures such as manholes, OSD tanks, & vaults
- Contains no moving parts

Tested Treatment Efficiencies*

POLLUTANT	EFFICIENCY
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	74%
Total Nitrogen (TN)	59%

*Contact Atlan to confirm approved performance for the project LGA



AtlanFilter is SQIDEP approved after passing Stormwater Australia's rigorous testing and performance assessment process.

BENEFITS

PROVEN SAND FILTER PERFORMANCE

The uniform size silica-sand filter media provides higher removal efficiencies than coarser types of media. AtlanFilter media is inorganic – it doesn't leach nitrogen and other nutrients.

Each AtlanFilter automatically backflushes under gravity. The backflush clears most sediment particles from out of the media and back into the vault floor, which allows the hydraulic conductivity from degrading throughout its service life. No moving parts are involved, which increases reliability. The AtlanFilter cartridge design life is in excess of 5 years.

HOW IT WORKS

The AtlanFilter has an upflow treatment process that maximises surface area. The innovative cartridge filter system provides excellent pollutant removal in a small footprint.

Hydraulic pressure forces water through the filter media, which discharges through the centre tube and out through the outlet collection manifold.

Upon completion of a treatment cycle, each cartridge backwashes and effectively dislodges particulates from the filtration layers. This reestablishes filter media porosity. The dislodged particles accumulate on the vault floor for easy removal during maintenance. AtlanFilter's design has no moving parts and generates a true siphon effect.

AtlanFilters are often installed downstream of nearby devices in a treatment train. For example, a Flowceptor Class 1 upstream greatly increases the life cycle interval of the AtlanFilter. These devices will remove larger gross pollutants, coarse sediments, total suspended solids and hydrocarbons - enabling the AtlanFilter to target fine particulate matter and nutrients.

FLEXIBILITY

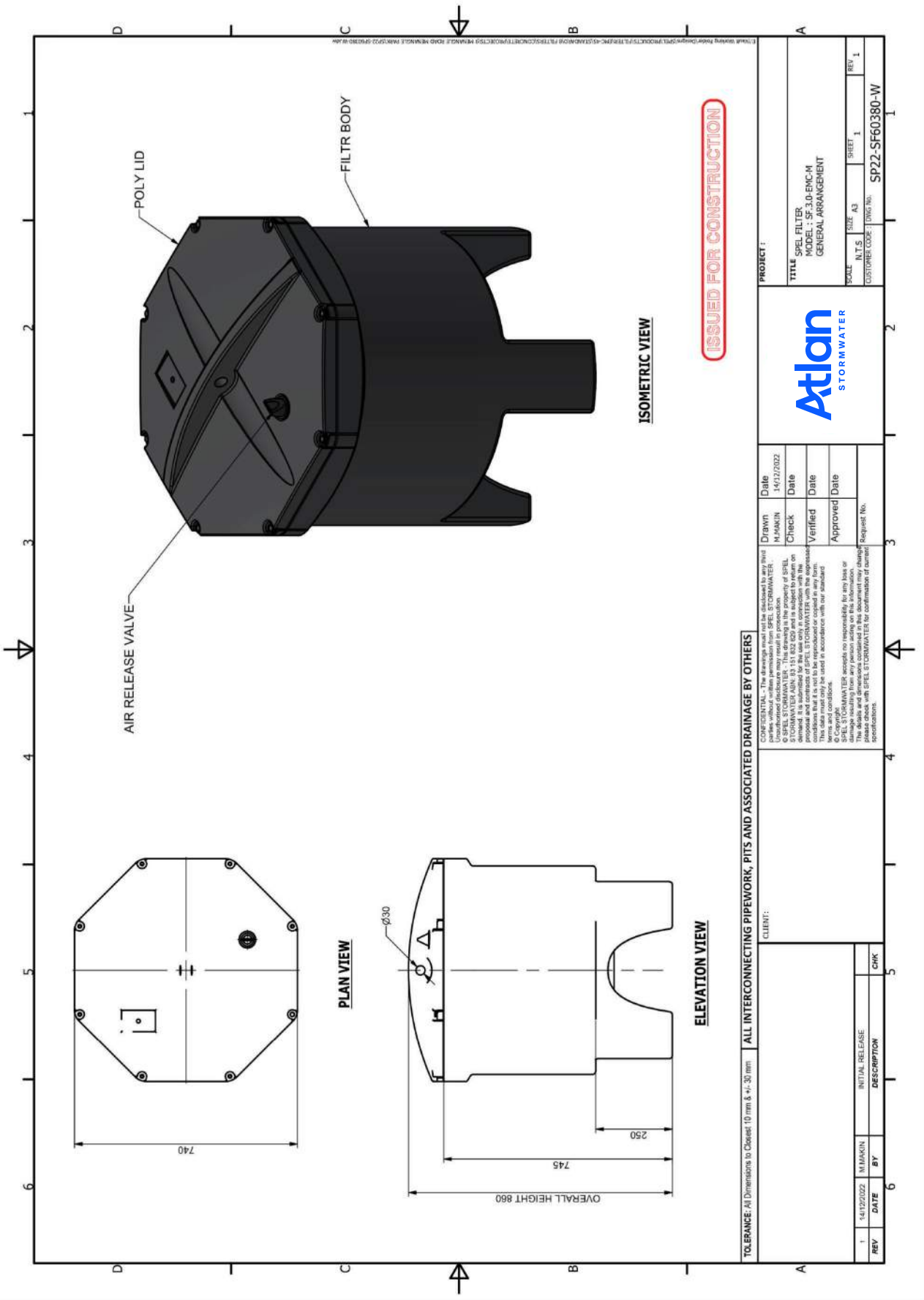
Due to greater surface area and high flow capacity, combined with the modular cartridge design, the AtlanFilter systems can be deployed in a variety of structures including manholes, precast vaults, and cast-in-place structures.

Each system is optimised to suit your specific site and local authority requirements by qualified and experienced professionals.

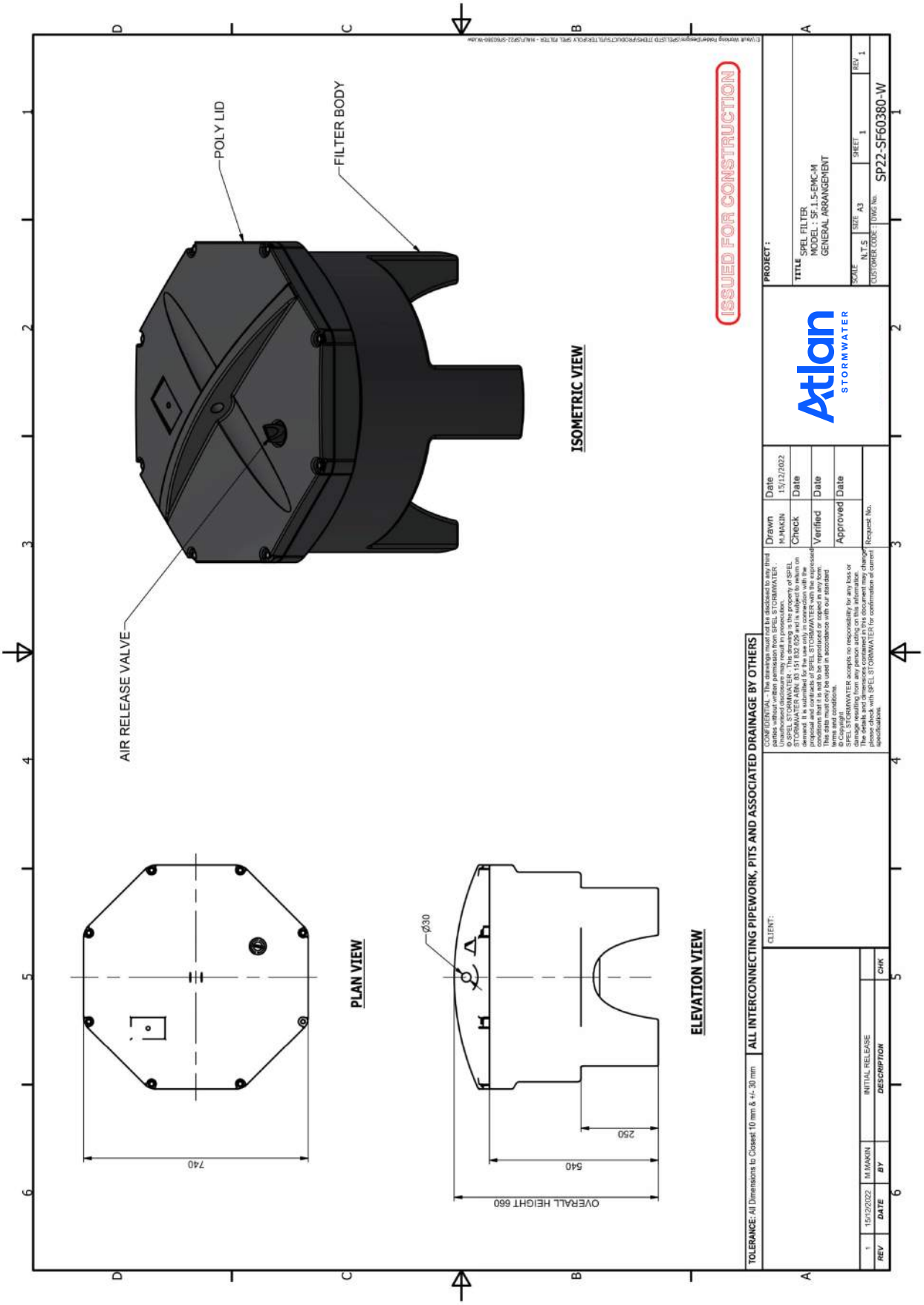
SIZE SPECIFICATIONS

ATLAN FILTER	FULL HEIGHT FIL.30-EMC-M	HALF HEIGHT FIL.15-EMC-M
Total height	860mm	660mm
Diameter	740mm	740mm
Minimum head required	850mm	550mm
Treatment flow rate	3.0L/s	1.5 L/s
Height of inlet ports above vault floor	250mm	250mm
Filtered water collection pipe diameter	50mm	50mm

DRAWING - FULL HEIGHT

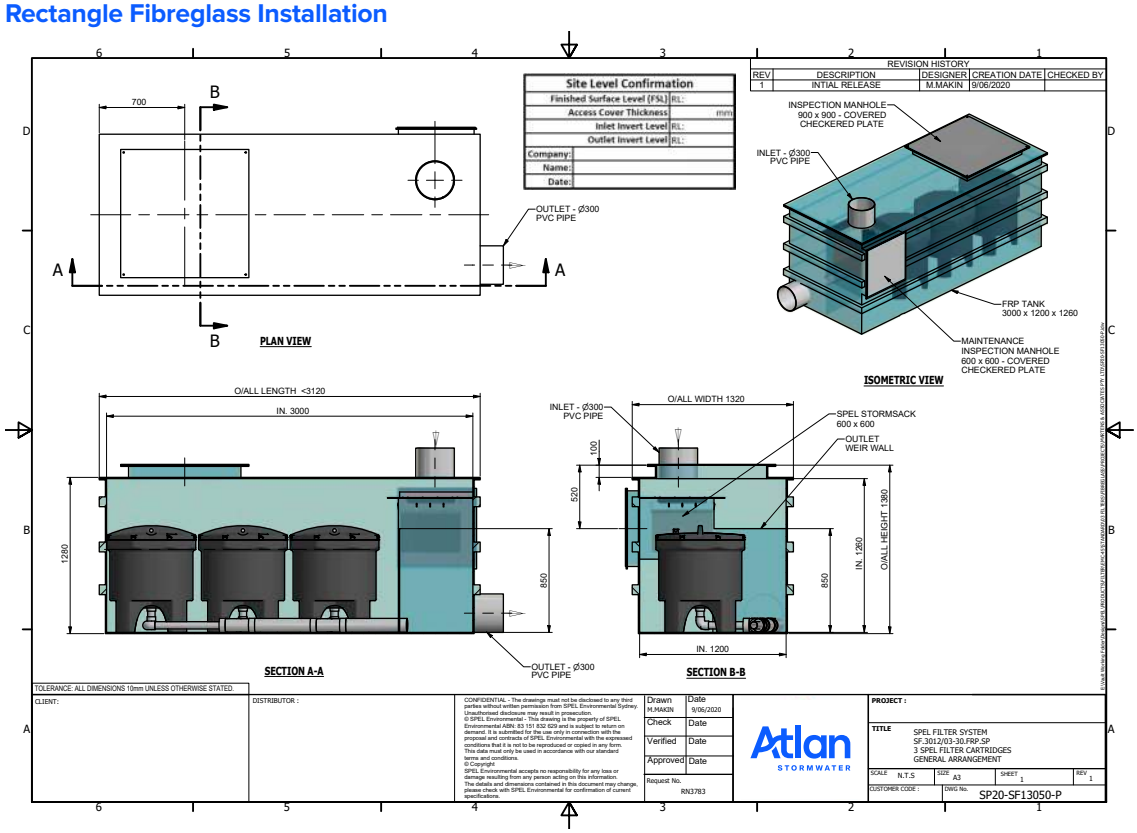


DRAWING - HALF HEIGHT

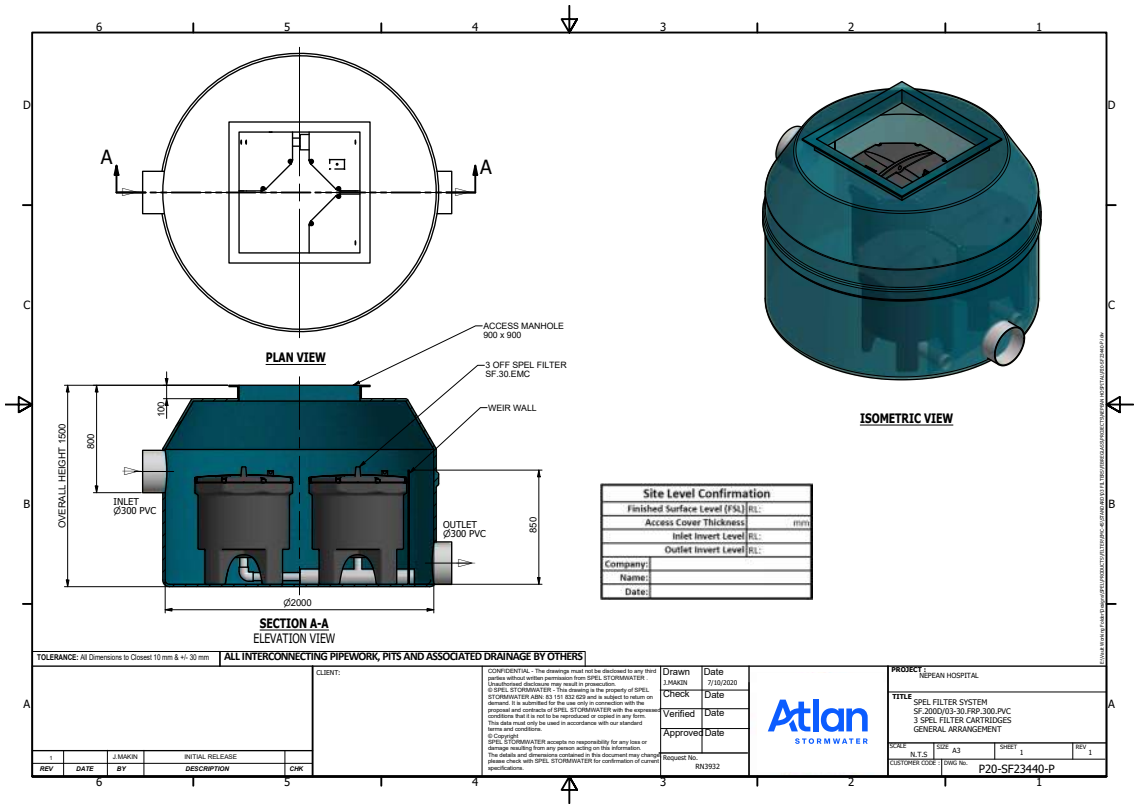


DRAWINGS

Rectangle Fibreglass Installation

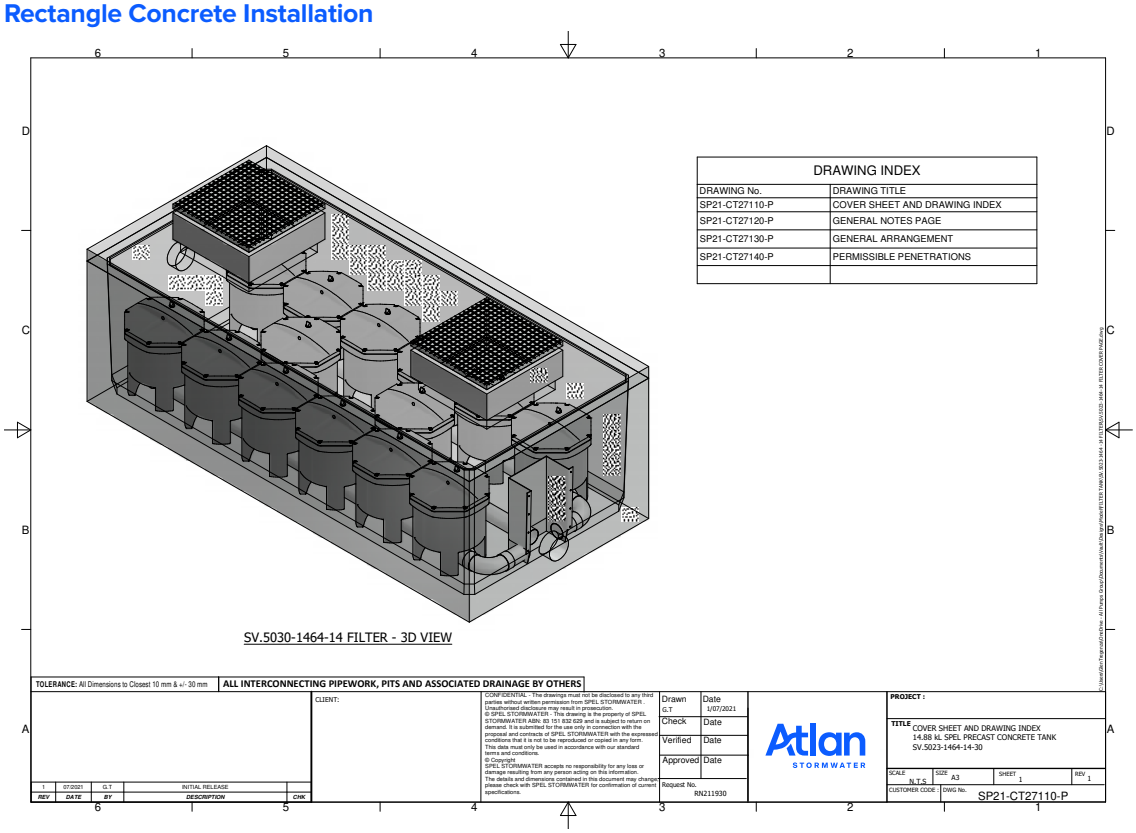


Round Fibreglass Tank Installation



DRAWINGS

Rectangle Concrete Installation



DRAWING INDEX	
DRAWING No.	DRAWING TITLE
SP21-CT27110-P	COVER SHEET AND DRAWING INDEX
SP21-CT27120-P	GENERAL NOTES PAGE
SP21-CT27130-P	GENERAL ARRANGEMENT
SP21-CT27140-P	PERMISSIBLE PENETRATIONS

SV.5030-1464-14 FILTER - 3D VIEW

TOLERANCE: All Dimensions to Closest 10 mm & +/- 30 mm | ALL INTERCONNECTING PIPEWORK, PITS AND ASSOCIATED DRAINAGE BY OTHERS

CLIENT:

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REV	DATE	BY	DESCRIPTION	CHK
1	07/2021	G.T	INITIAL RELEASE	

Drawn	G.T	Date 1/07/2021
Check		Date
Verified		Date
Approved		Date

Request No. RN211930

Atlan STORMWATER

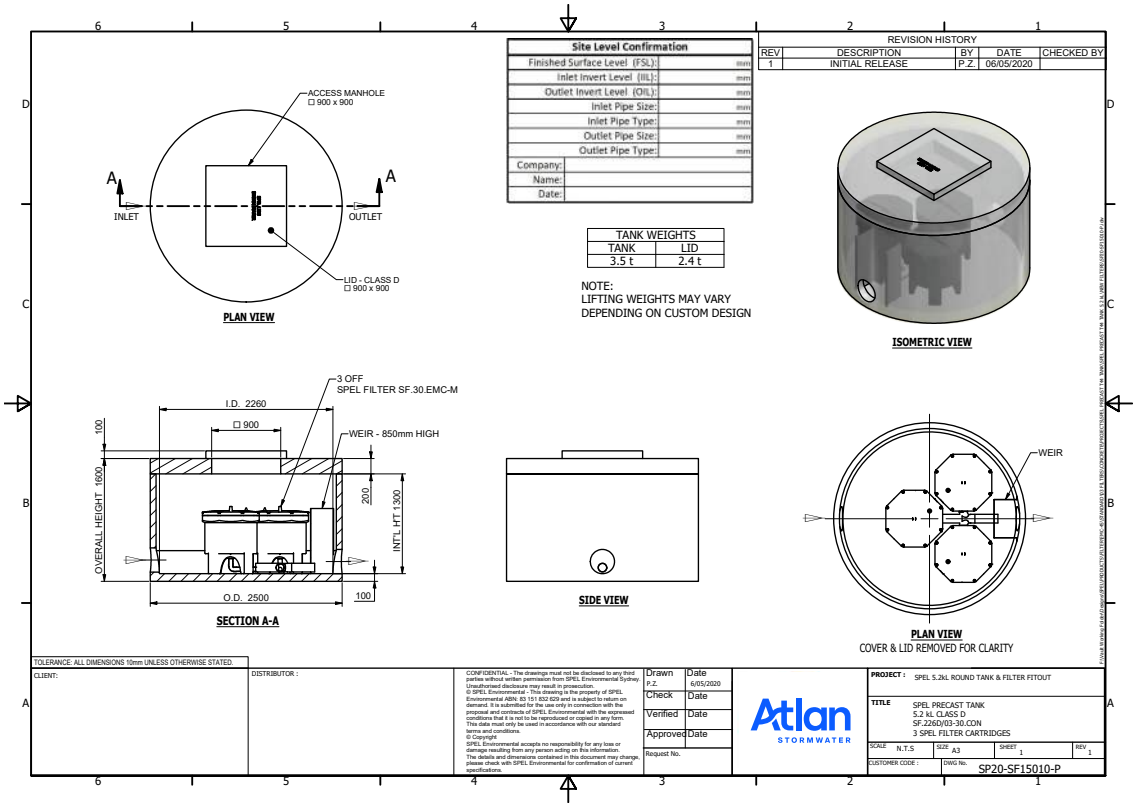
PROJECT :

TITLE COVER SHEET AND DRAWING INDEX
14.88 kL SPEL PRECAST CONCRETE TANK
SV.5023-1464-14-30

SCALE N.T.S | SIZE A3 | SHEET 1 | REV 1

CUSTOMER CODE | DWG No. SP21-CT27110-P

Round Concrete Tank Installation



Site Level Confirmation	
Finished Surface Level (FSL):	mm
Inlet Invert Level (IIL):	mm
Outlet Invert Level (OIL):	mm
Inlet Pipe Size:	mm
Inlet Pipe Type:	mm
Outlet Pipe Size:	mm
Outlet Pipe Type:	mm
Company:	
Name:	
Date:	

REVISION HISTORY

REV	DESCRIPTION	BY	DATE	CHECKED BY
1	INITIAL RELEASE	P.Z.	06/05/2020	

TANK WEIGHTS	
TANK	LID
3.5 t	2.4 t

NOTE:
LIFTING WEIGHTS MAY VARY
DEPENDING ON CUSTOM DESIGN

ACCESS MANHOLE
□ 900 x 900
A
INLET
OUTLET
LID - CLASS D
□ 900 x 900

PLAN VIEW

ISOMETRIC VIEW

3 OFF
SPEL FILTER SF.30.EMC-M
I.D. 2260
□ 900
WEIR - 850mm HIGH
100
OVERALL HEIGHT 1600
200
INTL HT 1300
O.D. 2500
100

SECTION A-A

SIDE VIEW

WEIR

PLAN VIEW
COVER & LID REMOVED FOR CLARITY

TOLERANCE: ALL DIMENSIONS 10mm UNLESS OTHERWISE STATED.

CLIENT:

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Drawn	P.Z.	Date 6/05/2020
Check		Date
Verified		Date
Approved		Date

Request No.

Atlan STORMWATER

PROJECT : SPEL S.2kL ROUND TANK & FILTER FITOUT

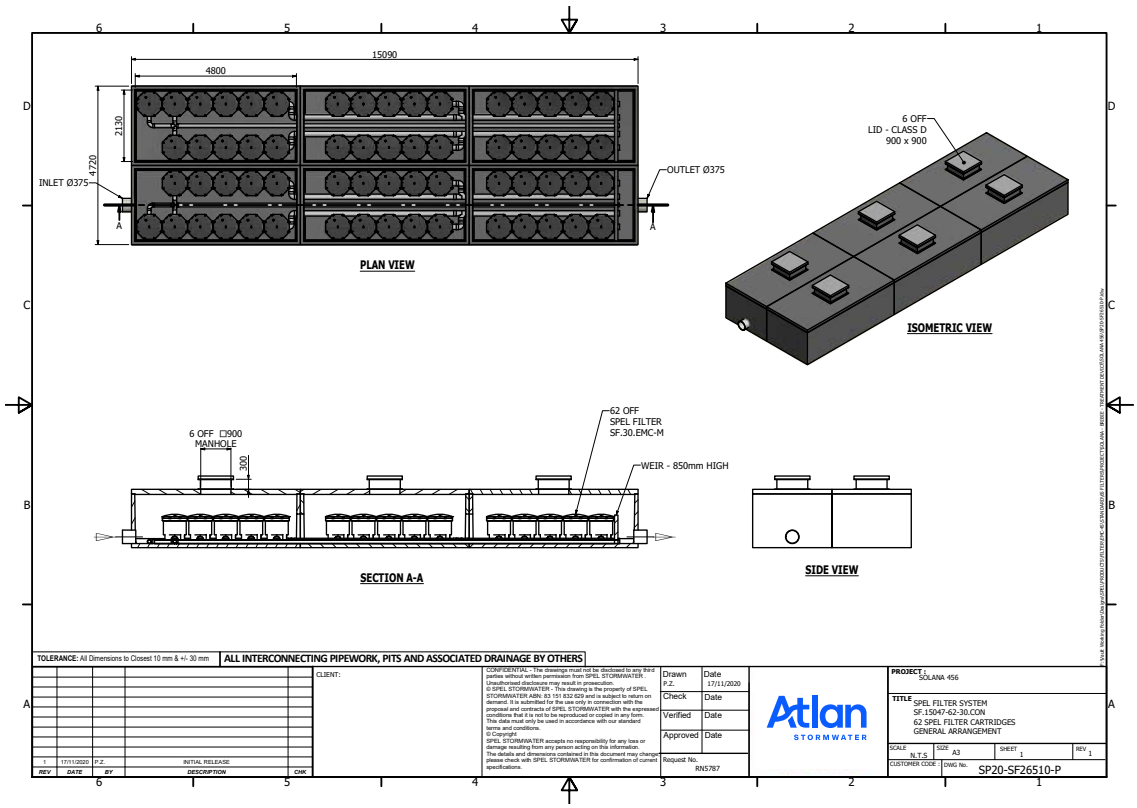
TITLE SPEL PRECAST TANK
5.2 kL CLASS D
SF.226D/03-30.CON
3 SPEL FILTER CARTRIDGES

SCALE N.T.S | SIZE A3 | SHEET 1 | REV 1

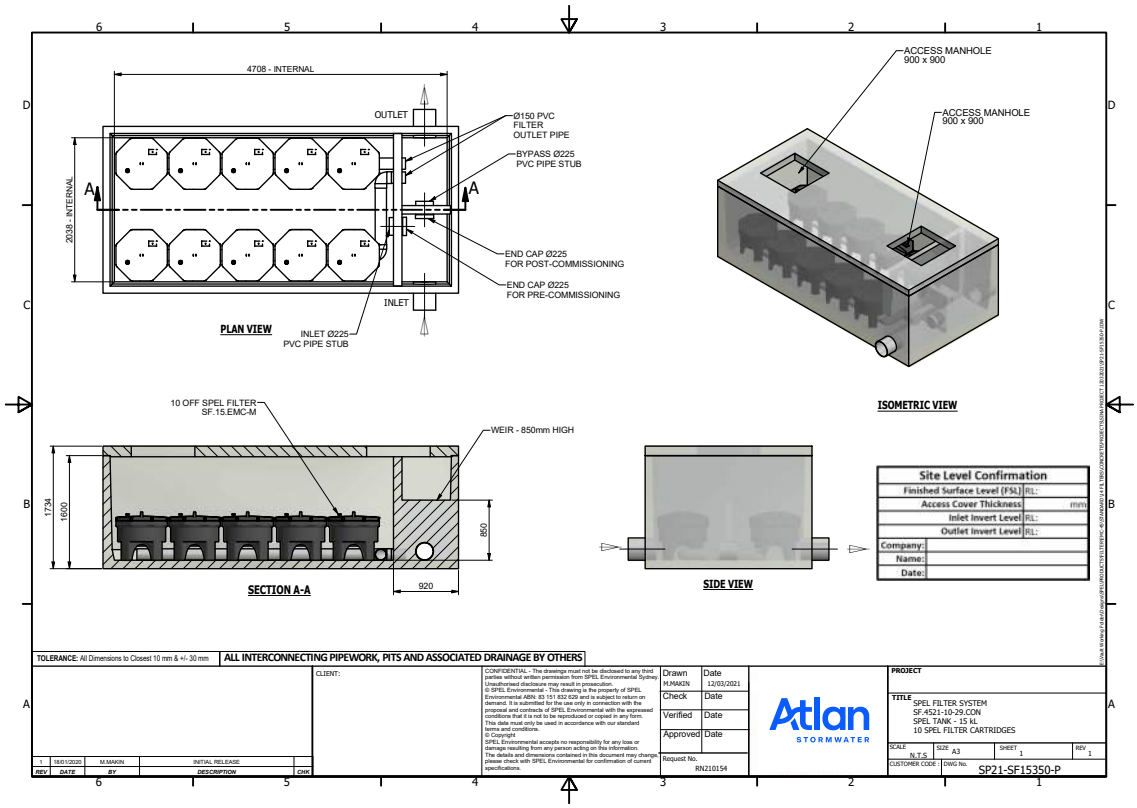
CUSTOMER CODE : | DWG No. SP20-SF15010-P

DRAWINGS

Modular Filtration Tank Installation



Internal Bypass Arrangement Tank



AtlanFilter

Cartridge filter for tertiary stormwater treatment

NSW HEAD OFFICE 100 Silverwater Rd, Silverwater NSW 2128 PO Box 7138, Silverwater NSW 1811 P: +61 2 8705 0255 P: 1300 773 500 nsw.sales@atlan.com.au	**QLD MAIN OFFICE** 130 Sandstone Pl, Parkinson QLD 4115 P: +61 7 3271 6960 P: 1300 773 500 qld.sales@atlan.com.au	**VIC & TAS OFFICE** 897 Wellington Rd Rowville VIC 3178 P: +61 3 5274 1336 P: 1800 810 139 sales@atlan.com.au **VIC GEELONG BRANCH** 70 Technology Close, Corio VIC
SA OFFICE 9 Hampden Road, Mount Barker SA 5251 P: 1300 773 500 sales@atlan.com.au	**QLD SUNSHINE COAST BRANCH** 19-27 Fred Chaplin Cct, Bells Creek, QLD 4551 P: 1300 773 500 qld.sales@atlan.com.au	**WA OFFICE** 2 Modal Cres Canning Vale WA 6155 P: +61 8 9350 1000 P: 1800 335 550 sales@atlan.com.au
NZ OFFICE WANGANUI 43 Heads Road Wanganu New Zealand P: +64 6 349 0088 sales@atlan.com.au atlan.co.nz	**NZ OFFICE WELLINGTON** 41 Raiha St Porirua Wellington New Zealand P: +64 4 239 6006 sales@atlan.com.au atlan.co.nz	**NZ OFFICE AUCKLAND** 100 Montgomerie Road Airport Oaks P: +64 9 276 9045 sales@atlan.com.au atlan.co.nz

Joy in water

'We believe clean waterways are a right not a privilege and we work to ensure a joy in water experience for you and future generations.'

Andy Hornbuckle

Atlan STORMWATER

P 02 8705 0255 | sales@atlan.com.au
100 Silverwater Rd, Silverwater NSW 2128 Australia
atlan.com.au

spelstormwater
joy in water

Installation Manual

SPELFilter®

spel.com.au

CONTENTS

FIGURE 1 SPELFilter specifications

INTRODUCTION

Understanding how to correctly and safely install the SPELFilter is essential for the preservation of the filter's condition and its operational effectiveness.

The SPELFilter is a highly engineered Stormwater filtration device designed to remove fine sediments, heavy metals, nitrogen and phosphorus from stormwater runoff.

The SPELFilter relies on a spiral wound media filter cartridge. The Filters can be housed in either a concrete or fiberglass structure that evenly distributes the flow between cartridges. Flow through the filter cartridges is gravity driven and self-regulating, which makes the SPELFilter system a low maintenance, high performance stormwater treatment device.

This manual will provide the necessary steps that are to be taken to correctly and efficiently install the SPELFilter product.

VAULT TYPES

There are three vault types, which the SPELFilter can be installed into:

1. Precast vault: Monolithically poured concrete vault (base and walls).
2. Cast in place vault: Custom designed for site.
3. Fiberglass vault: Must be made by an approved supplier.

FIGURE 2 SPELFilter install

INSTALL PREREQUISETS

- Vault must be clean from all debris, etc.
- Vault must be easily accessible.
- 900 x 900mm lid must be installed correctly and operational.
- Structure of the tank must be safe and hazard free.

HEALTH & SAFETY

PERSONAL HEALTH & SAFETY

When carrying out the necessary installation operations of the SPELFilter all contractors and staff personnel must comply with all current workplace health and safety legislation.

The below measures should be adhered to as practically as possible.

- Comply with all applicable laws, regulations and standards.
- All those involved are informed and understand their obligations in respect of the workplace health and safety legislation.
- Ensure responsibility is accepted by all employees to practice and promote a safe and healthy work environment.

FIGURE 3 Safety materials

PERSONAL PROTECTIVE EQUIPMENT/SAFETY EQUIPMENT

When carrying out the necessary installation operations of the SPELFilter, wearing the appropriate personal protective equipment and utilising the adequate safety equipment is vital to reducing potential hazards.

Personal protective equipment/safety equipment in this application includes:

- Eye protection
- Safety apron
- Fluorescent safety vest
- Form of skin protection
- Puncture resistant gloves
- Steel capped safety boots
- Ear muffs
- Hard hat/s
- Sunscreen

IF CLASSED AS CONFINED SPACE

- Harness
- Gas detector
- Tripod
- Spotter

MATERIALS REQUIRED

MATERIALS REQUIRED TO INSTALL SPELFILTERS

When installing the SPELFilter, having the necessary tools and equipment is vital to efficiently and effectively installing the SPELFilters.

Tools that will be required include:

- PVC pipe primer
- PVC pipe cement
- Hammer drill
- Hammer
- Hole saw
- Battery/power drill
- Hack saw
- Ratchet kit
- Shovel
- Tripod
- Winch/chain block for lowering Filters into vault
- Ladder
- Sikaflex gun

Items/products that will be included:

- SPELFilter/s
- Weir wall & fixings
- Energy dissipater (if required)
- Pipework & fittings
- Fixings
- Anti-floatation brackets

FIGURE 4 SPELFilter install set-up

INSTALLATION

SPELFilter installation procedures may vary depending on the configuration of the SPELFilters, the type of vault and engineers specs. Installation instructions for manhole SPELFilter systems and precast vault SPELFilter systems are contained in this section.

Custom SPELFilter systems may have particular installation issues that will be addressed during the design.

INSTALLATION OF A SPEL FILTER SYSTEM PROCEEDURE

1. Implement pre-start safety measures.

Ensure that the area in which operational works are to be carried out is cordoned off, to prevent unauthorised access. Adequate safety barriers must be erected. Area in which work is to be carried out must be clean, safe and hazard free. (Refer to figure 4.)

2. Set-up Gantry Tri-pod above Manhole.

Assemble and position the gantry above the manhole safely and as practically as possible. Attach the winch or chain block to the gantry for lifting the SPEL Filters. Perform safety procedures ie. Attach harnesses etc. (if confined space).

3. Open manhole lid.

Once you have sent up the Gantry and ensured that the area is safe to operate in, you can proceed to open the manhole lid, using lid lifters.

4. Conduct Gas tests (If tank is classed confined space).

Once the lids have been removed to a safe distance to prevent tripping, you must then proceed to conduct gas tests. Perform necessary gas tests according to the confined space regulations.

5. Once confined space has been deemed safe to operate in, enter tank safely.

Once you have carried out the required gas test and the work area is deemed safe, you may then enter the pit via a ladder or winch system to assess the work area you will be operating in. Ensure all confined space procedures are followed.

6. Set up weir wall over outlet pipe and energy dissipater over inlet pipe (if required).

When installing the weir wall you must ensure that it is securely bolted to the tank wall and completely sealed. Centre the aluminium weir over the outlet pipe and fix weir to tank wall with the supplied fixings. Then use Sikaflex to seal around the edge of the weir and filter outlet pipework.

7. Install pipework and SPELFilters.

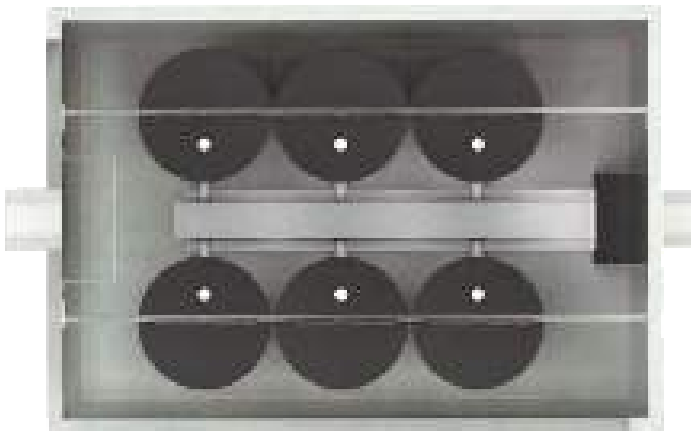
Please refer to the below standard install diagrams for the SPEL Filters. Then refer to your site specific drawings, as site requirements may require something different to the standard layout. Lower filters into tank, position into place, connect filter outlet pipework with the supplied fittings.

8. Install anti-floatation bars.

Please refer refer to the detailed drawings showing how the Anti – Floatation (Anchor) bars are to be installed.

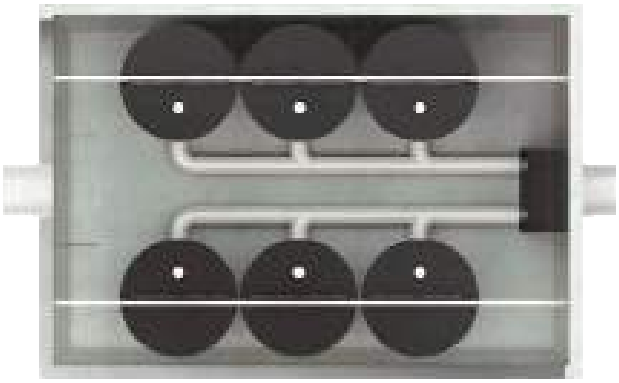
INSTALL EXAMPLES

FIGURE 5
Standard install with PVC Outlet pipework



INSTALL EXAMPLES

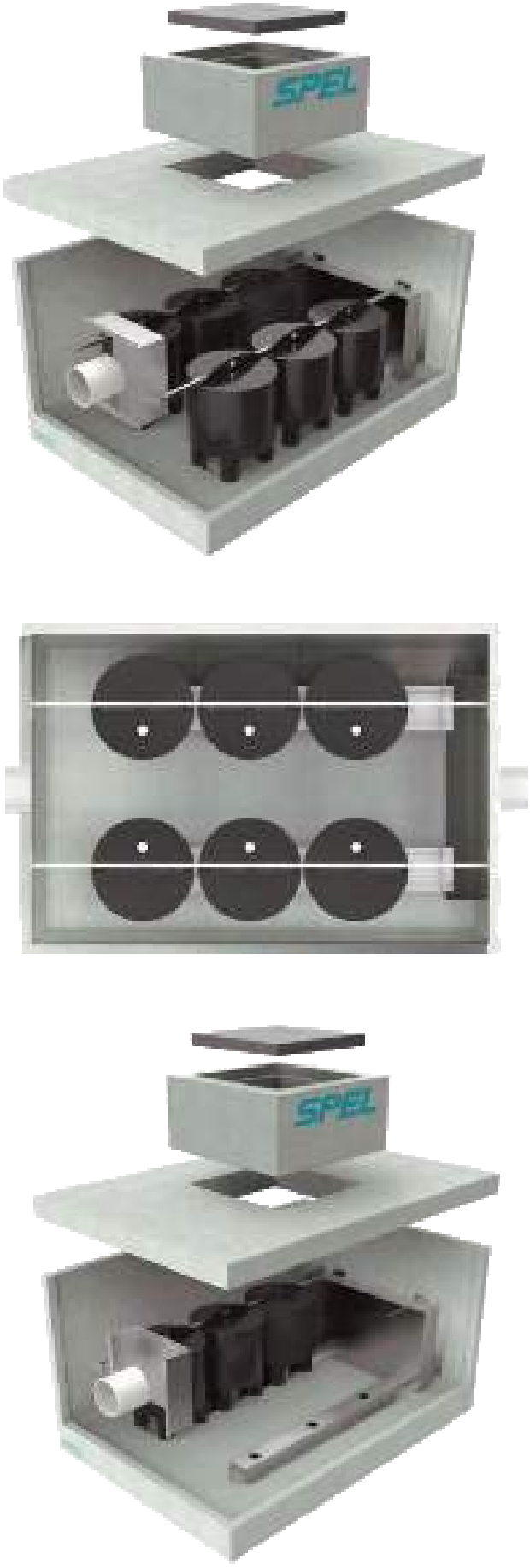
FIGURE 6 Standard install with Channel system Outlet pipework (1)



spelstormwater joy in water

INSTALL EXAMPLES

FIGURE 7 Standard install with Channel system Outlet pipework (2)



Installation Manual

SPELFilter®

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Operation & Maintenance Manual

SPELFilter®

Cartridge filter for tertiary stormwater treatment

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Contents

Introduction

Understanding how to correctly and safely maintain the SPELFilter is essential for the preservation of the filter's condition and its operational effectiveness. The SPELFilter is a highly engineered stormwater filtration device designed to remove sediments, heavy metals, nitrogen and phosphorus from stormwater runoff.

The filters can be housed in either a concrete or fibreglass structure that evenly distributes the flow between cartridges.

Flow through the filter cartridges is gravity driven and self-regulating, which makes the SPELFilter system a low maintenance, high performance stormwater treatment device.

This Guide will provide the necessary steps that are to be taken to correctly and efficiently ensure the life of the SPELFilter product

Figure 1 - SPELFilters in a concrete chamber / vault

Features

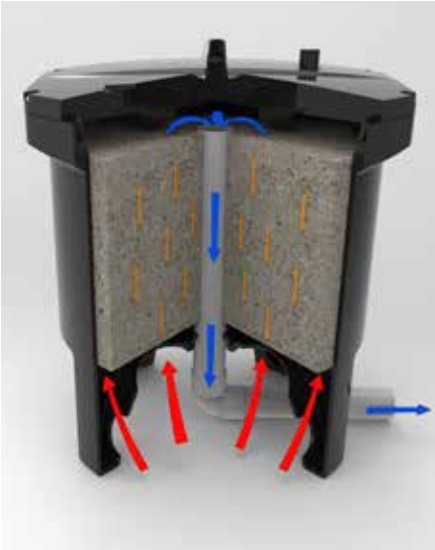


Figure 2 - Diagram of water flow through SPELFilter

The SPELFilter has a patented design that facilitates influent flow over the entire surface area of the media, providing consistent pollutant removal within a small footprint.

The SPELFilter provides highly effective media filtration using gravity flow conditions, without the need for moving parts or floating valves. This eliminates the risk of mechanical failure, such as stuck valves and seizing components during its service life. This provides highly robust treatment performance.

Hydraulic head provided by a suitably sized weir in the filter vault forces stormwater through the filter media via the inlet ports underneath the filter cartridge. Refer to the table below for minimum head required for the SPELFilter cartridges to assist in sizing the weir.

The water to be treated enters the SPELFilter cartridge via an upwards direction as the water level builds up around the SPELFilter. This 'up flow' reduces the amount of sediment that could enter the media cartridge, as the sediment is allowed to drop to the vault floor under gravity. Any remaining sediment in the water is introduced through the filter media under hydraulic pressure and is filtered.

Water is filtered through the media, where dissolved and particulate Total Nitrogen and Total Phosphorus are removed via reaction with the media, in addition to the removal of Total Suspended Solids / sediment.

SPELFilter Media Self-Backwash feature

A one-way air release valve located at the top of the filter cartridge allows air to escape as the cartridge fills up with water. This creates a siphonic flow condition as the air is completely evacuated from inside the SPELFilter cartridge. Siphonic flow conditions are maintained until such time the water level outside of the cartridge falls beneath the inlet ports underneath the filter. At this moment, the water level inside the SPELFilter cartridge is higher than the surrounding water level. The water inside the SPELFilter cartridge is then expelled upon the break of the siphon, and the water flows down and out of the inlet ports under gravity, onto the vault floor.

This is a highly effective backwash of the media and allows the expulsion of a high proportion of sediment out from the SPELFilter media. The expelled sediment can be removed either manually or with a vacuum from the vault floor.

This backwash effect allows the media to remain highly conductive and is the key to the industry leading longevity of the SPELFilter cartridge system, which does not need replacement for at least 5 years, and typically will achieve up to 6-8years of service, subject to the SPELFilter being regularly maintained in accordance with this guideline and in accordance with the specific needs of the catchment.

Figure 3 - Typical Outlet Weir Wall

Features

Self Supporting Feet

Each SPELFilter cartridge stands on 4 feet, which negates the need for the construction of a false floor in the vault. The feet are bolted to the vault floor with the supplied stainless steel angles and M10 bolts. The feet allow a clear height from the vault floor up to the inlet ports of 240mm. The absence of a false floor allows plenty of room for backwashed sediment to evacuate from underneath the cartridges and thereby avoid blocking the inlet ports to the SPELFilter from sediment buildup. It is for this reason that SPEL recommended the sediment buildup not exceed 150mm above the vault floor, so as to avoid blocking the inlet ports of the SPELFilter. Blockage of the inlet ports due to sediment accumulation in the vault floor will cause the SPELFilter to go into bypass and be ineffective. Hence it is important to keep up to date with monitoring and maintaining the SPELFilter vault.

Figure 4 - Bolting the feet

Figure 5 - Underside of the SPELFilter showing the screened inlet ports and the connection for the outlet pipe in the middle

Figure 6 - the top of the SPELFilter showing the location of the one way air valve

Sizes

SPEL Stormwater manufactures two height cartridges for varying site constraints as shown below. Each cartridge is designed to treat stormwater at a flow rate of 1.47 Litres per second and 2.83 Litres per second for the half-height cartridge (model No. SF.15-EMC-M) and full-height cartridge (model No. SF.30-EMC-M) respectively.

	Full Height SF.30-EMC -M	Half height SF.15–EMC-M
SPELFilter total height	874mm	560mm
SPELFilter Diameter	726mm	726mm
Minimum Head required	850mm	550mm
Treatment flow rate	2.83 L/s	1.47 L/s
Height of inlet ports above vault floor	250mm	250mm
Filtered water collection pipe diameter	50mm	50mm

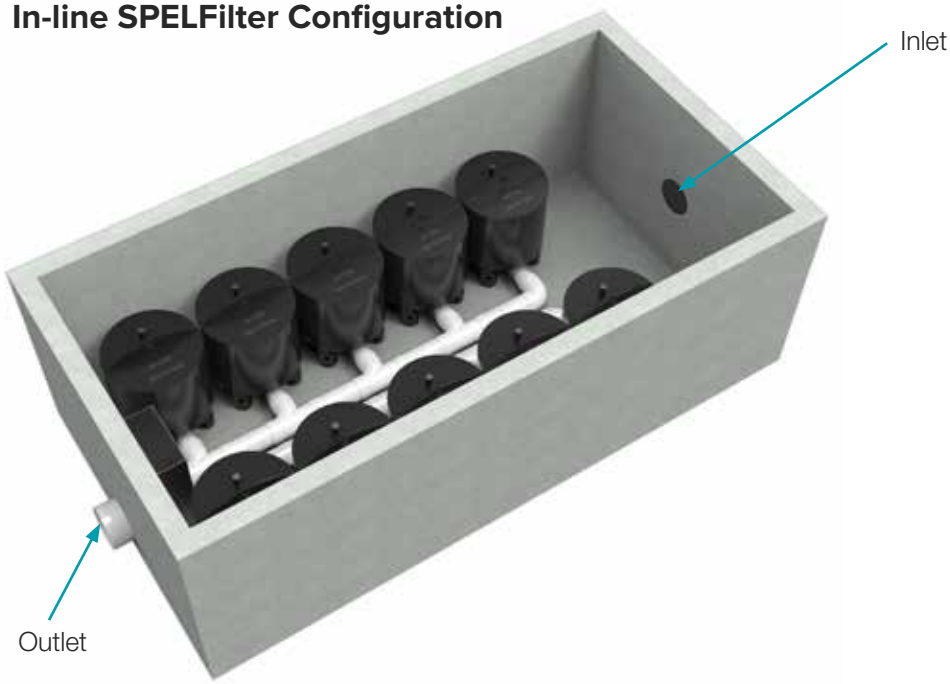
SPELFilter Full Height- SF.30-EMC-M

SPELFilter Half Height - SF.15-EMC-M

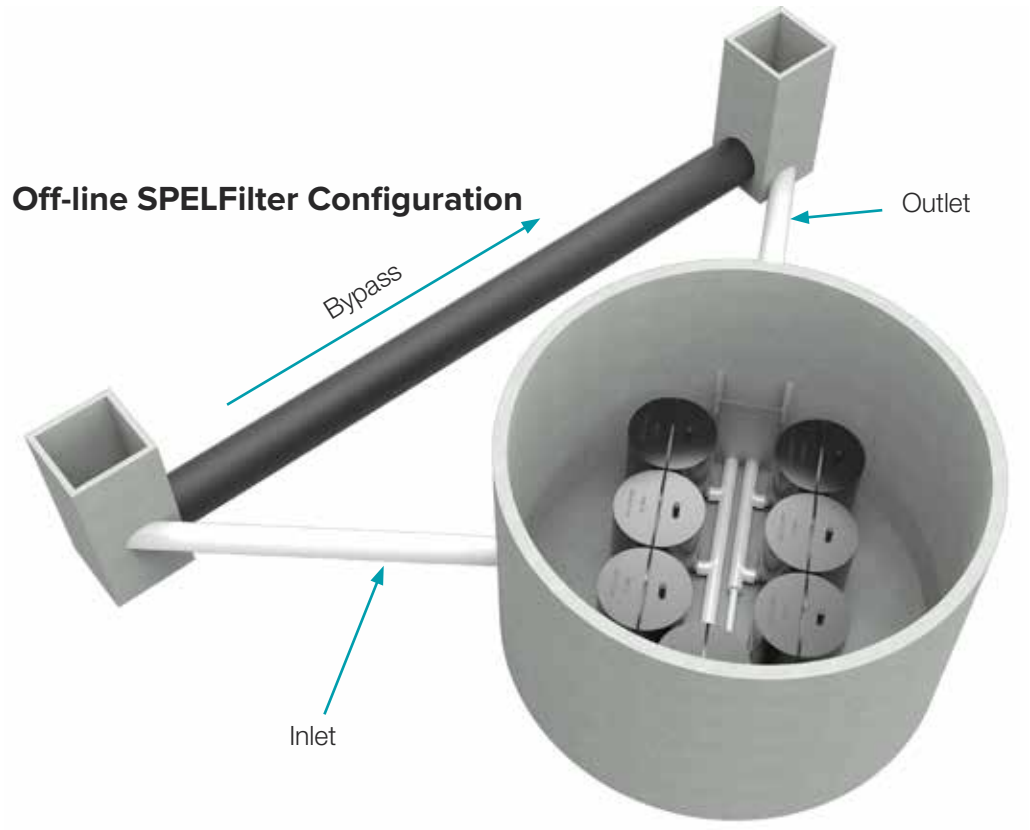
System Configuration

SPELFilter cartridges are installed in concrete or fibreglass tanks commonly referred to as ‘vaults’. The vault selection and configuration are based on site characteristics and/or constraints; computational stormwater quality modelling; and selected SPELFilter models. Typical SPELFilter system configurations are shown below.

In-line SPELFilter Configuration



Off-line SPELFilter Configuration



Health and Safety

A. Personal Health & Safety

When carrying out the necessary installation operations of the SPEL Filter all contractors and staff personnel must comply with all current workplace health and safety legislation.

The below measures should be adhered to as practically as possible.

- Comply with all applicable laws, regulations and standards
- All those involved are informed and understand their obligations in respect of the workplace health and safety legislation.
- Ensure responsibility is accepted by all employees to practice and promote a safe and healthy work environment.

B. Personal Protective Equipment / Safety equipment

When carrying out the necessary installation operations of the SPEL Filter, wearing the appropriate personal protective equipment and utilising the adequate safety equipment is vital to reducing potential hazards.

Personal protective equipment / safety equipment in this application includes:

- Eye protection
- Safety apron
- Fluorescent safety vest
- Form of skin protection
- Puncture resistant gloves
- Steel capped safety boots
- Ear muffs
- Hard hat/s
- Sunscreen

C. Confined space

In the event access is required into the vault, confined space permits will be required which is not covered in this Guide. Typical equipment required for confined space entry include:

- Harness
- Gas detector
- Tripod
- Spotter

D. Traffic Control

It is not uncommon for SPEL Filter cartridges to be installed underneath trafficable areas. Minimum traffic control measures will need to be put in place in accordance with traffic control plans set out by respective local and state road authorities.

Vaults are to be treated as confined space. Entry by permit only.

Monitor weather conditions prior to operation maintenance. Do not enter a vault during an episode of heavy rain as this can create a risk of drowning.

Maintenance Frequency

The SPELFilter's design allows for a greater life span when frequently maintenance. Maintenance is broken up into three categories which include: standard inspection; general cleaning; and cartridge replacement.

Standard inspection

Standard inspections are conducted at regular four-month intervals. At this time, an approved trained maintenance officer or SPEL representative shall undertake all measures outlined in Maintenance Procedure, Standard Inspection.

General Cleaning

At the end of each standard inspection, trigger measures will identify if general cleaning is required. General cleaning will need to be executed immediate during standard inspections if the follow triggers are satisfied:

- Build-up of debris/pollutants within the vault greater than 150mm;
- Accumulation of debris/pollutants on the outlet chamber of the SPELFilter vault;
- After large storm events, tidal or flooding impacts at the request of the owner;

Cartridge Replacement

Stormwater treatment is dependent on the effectiveness of the SPELFilter cartridge system. As the SPELFilter ages, pollutants will inundate the cartridge and ultimately reduce the treatment flow rate. At this point, a SPELFilter flow test apparatus will be utilities to determine if replacement cartridges are required.

Based on the [site] concept modelling (MUSIC) and previous industry experience, we estimate the life of the SPELFilter to be between 6 - 8 years. As a minimum requirement, each SPELFilter cartridge should be replaced within 10 years.

The life cycle of the SPELFilter can be impacted if standard inspections and general maintenance is not undertaken in accordance with this operation and maintenance Guide. Other factors that will affect the above life cycle of the SPELFilter include:

- Installation of cartridge system during construction phase and impacted by construction sediment loads;
- Neglecting to install pre-treatment using an industry approved GPT or a surface inlet pit trash bag such as the SPEL StormSack.
- Unforeseen environmental hazards affecting the SPELFilter functionality.

Maintenance Procedures

Stormwater pollutants captured and retained by the SPELFilter system need to be periodically removed to ensure environmental values are upheld. All associated maintenance works is heavily dependent on the site's operational activities and generated stormwater pollutants. To ensure the longevity of the installed SPELFilter treatment system, it is imperative that the procedures detailed in this Guide are followed and all appropriate measures are actioned immediately.

Standard inspection

The standard inspection requires personal experience of SPEL products to visual inspection the vault and filter conditions.

Confined space requirements may not be required if a full inspection and assessment of each SPELFilter can be achieved at surface level without being deemed a confined space entry.

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Confined space requirements may not be required if a full inspection and assessment of each SPELFilter can be achieved at surface level without being deemed a confined space entry.

Site Inspection Procedures

1. Implement Pre-start safety measures.

Ensure that the area in which operational works are to be carried out is cordoned off, to prevent unauthorised access. Adequate safety barriers must be erected. Area in which work is to be carried out must be clean, safe and hazard free. (Refer to figure 4.)

2. Set-up Gantry Tri-pod above Manhole.

Assemble and position the gantry above the manhole safely and as practically as possible. Attach the winch or chain block to the gantry for lifting the SPEL Filters. Perform safety procedures ie. Attach harnesses etc. (if confined space).

3. Open manhole lid.

Once you have sent up the Gantry and ensured that the area is safe to operate in, you can proceed to open the manhole lid, using lid lifters.

4. Conduct Gas tests.

(If tank is classed confined space)

Once the lids have been removed to a safe distance to prevent tripping, you must then proceed to conduct gas tests. Perform necessary gas tests according to the confined space regulations.

5. Once confined space has been deemed safe to operate in, enter tank safely.

Once you have carried out the required gas test and the work area is deemed safe, you may then enter the pit via a ladder or winch system to assess the work area you will be operating in. Ensure all confined space

6. SPELFilter system assessment.

Perform a review of the SPELFilter system using the SPELFilter assessment report/checklist. Sign off and forward a copy of the report to property manager and SPEL representative.

7. Reinstate SPELFilter system and disposal.

At the completion of the site inspection, ensure the site is reinstated back to its initial state and all pollutants are removed from the site in line with pollutant disposal procedures.

8. Sign off and forward a copy of the report to property manager and SPEL representative.

General Cleaning

Vacuum out of Filter tank, removal, and disposal of pollutants at the completion of a standard inspection, general cleaning may be deemed necessary immediately or scheduled for a future date. Steps undertaken for general cleaning should be in general accordance with the procedure outlined below but not limited.

1. Implement Pre-start safety measures.

Ensure that the area in which operational works are to be carried out is cordoned off, to prevent unauthorised access. Adequate safety barriers must be erected. Area in which work is to be carried out must be clean, safe and hazard free. (Refer to figure 4.)

2. Set-up Gantry Tri-pod above Manhole.

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Once you have carried out the required gas test and the work area is deemed safe, you may then enter the pit via a ladder or winch system to assess the work area you will be operating in. Ensure all confined space

6. SPELFilter system assessment.

Perform a review of the SPELFilter system using the SPELFilter assessment report/checklist.

7. Pollutant removal from tank.

Perform clean-up using a licenced vacuum truck contractor or wet/dry vacuum, depending on level of sediment built up and/or tank size.

8. Reinstate SPELFilter system and disposal.

At the completion of the site inspection, ensure the site is reinstated back to its initial state and all pollutants are removed from the site in line with pollutant disposal procedures.

9. Sign off and forward a copy of the report to property manager and SPEL representative.

Cartridge Recycling and Replacement

SPELFilter cartridges can be swapped out for new cartridges. The spent SPELFilter cartridges can be collected from site and sent to SPEL Stormwater's facilities – where the spent media will be removed from the cartridge in factory conditions and disposed of in accordance with environmental regulations.

The SPELFilter cartridge will be recharged with new media – thereby recycling and repurposing the cartridge.

SPEL Filter replacement procedures may vary depending on the configuration of the SPEL Filters, the type of vault and engineers' specs. Replacement instructions for manhole SPEL Filter systems and precast vault SPEL Filter systems are contained in this section.

At the completion of a standard inspection, SPEL Filter replacement may be deemed necessary immediately or scheduled for a future date. Steps undertaken for cartridge replacement should be in general accordance with the procedure outlined below but not limited.

1. Implement Pre-start safety measures.

Ensure that the area in which operational works are to be carried out is cordoned off, to prevent unauthorised access. Adequate safety barriers must be erected. Area in which work is to be carried out must be clean, safe and hazard free.

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Once the lids have been removed to a safe distance to prevent tripping, you must then proceed to conduct gas tests. Perform necessary gas tests according to the confined space regulations.

5. Once confined space has been deemed safe to operate in, enter tank safely.

Once you have carried out the required gas test and the work area is deemed safe, you may then enter the pit via a ladder or winch system to assess the work area you will be operating in. Ensure all confined space procedures are followed.

6. Remove exhausted cartridges.

Disconnect all internal pipe work from inside the vault. Un-bolt anti-floatation measures and remove cartridges from the vault using Gantry Tri-pod method.

7. Pollutant removal.

Using a wet/dry vacuum or sucker truck, suck out all the residual pollutant from the vault.

8. Install pipework and SPEL Filters.

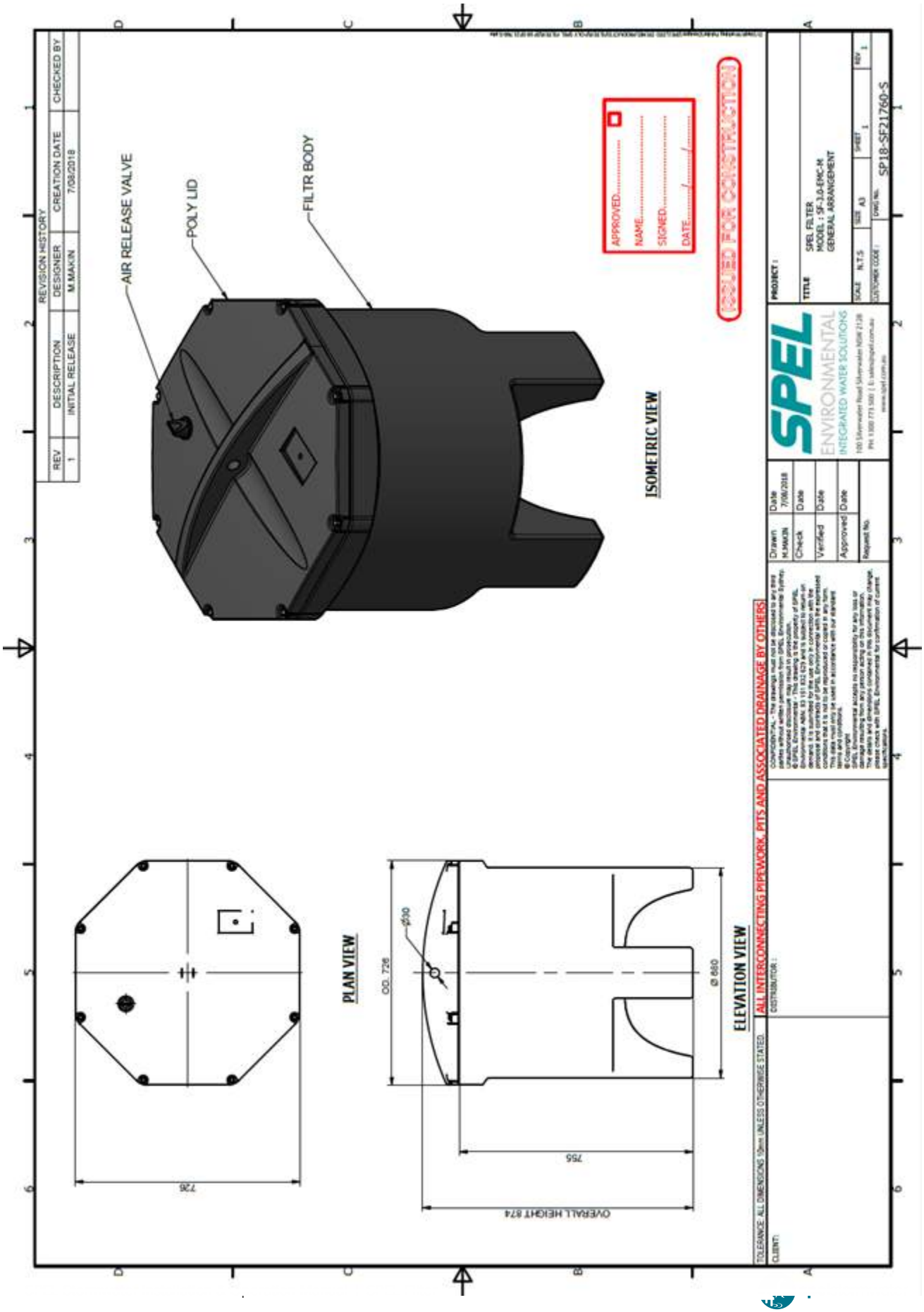
Please refer to the below standard install diagrams for the SPEL Filters. Then refer to your site specific drawings, as site requirements may require something different to the standard layout. Lower filters into tank, position into place, connect filter outlet pipework with the supplied fittings.

9. Install anti–floatation system.

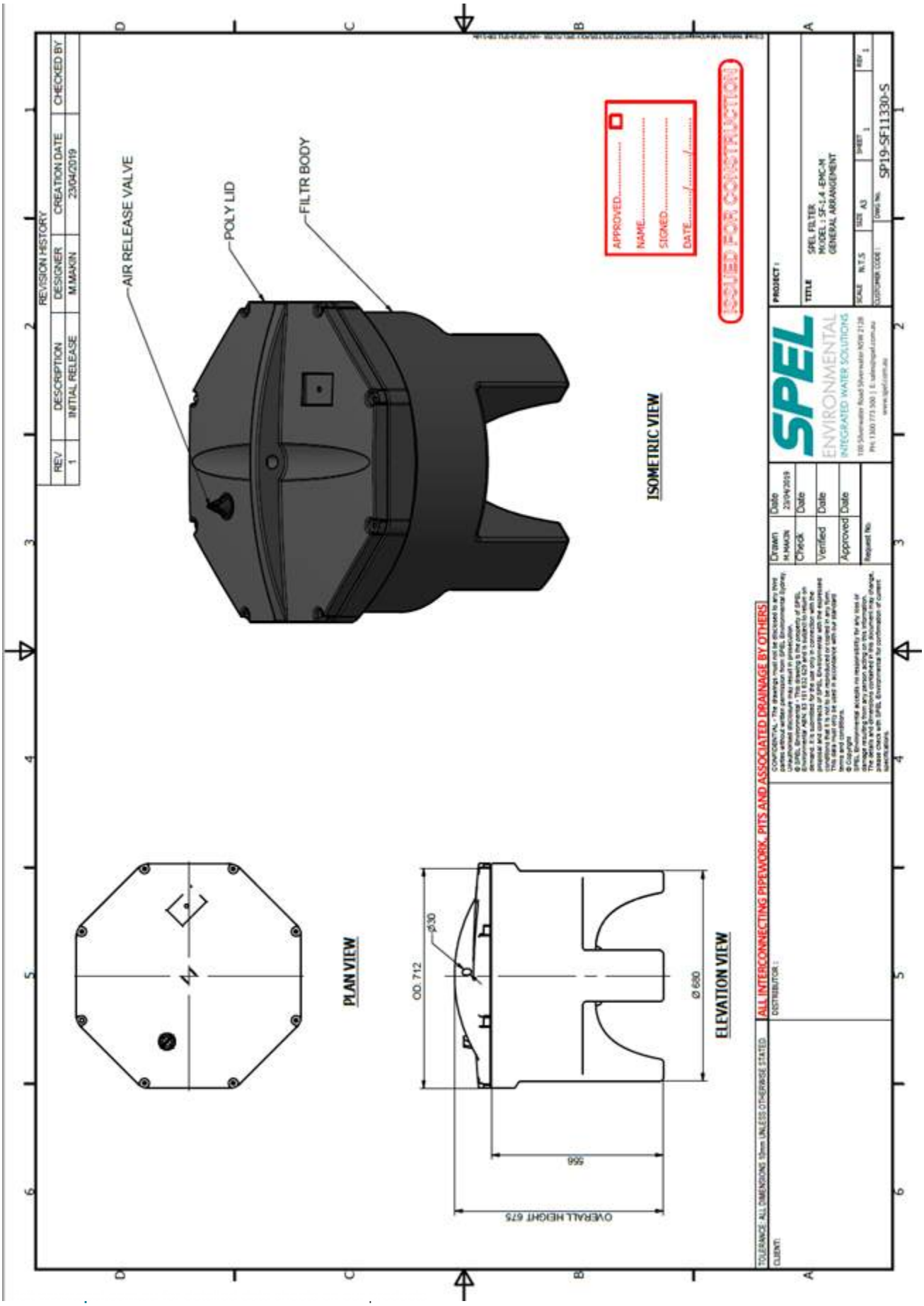
Please refer to the detailed drawings showing how the Anti – Floatation (Anchor) bars are to be installed.

10. Sign off and forward a copy of the report to property manager and SPEL representative.

Standard Drawings - Full Height



Standard Drawings - Half Height



Site Exit & Clean Up

At the end of the scheduled maintenance, approved contractors or SPEL maintenance crew are required to reinstate the site to pre-existing conditions. Steps included but limited to are:

- Ensure all access covers are securely inserted back into their frames;
- Remove and dispose collected pollutants from the site in accordance with local regulator authorities;
- Retrieve all traffic control measures and maintenance tools; and
- Return all exhausted and/or damaged SPEL products to SPEL Stormwater to begin recycling program.

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