

Proposed Multi-Storey Residential Apartments at No.23-25 Ashton Avenue, The Entrance NSW

Stormwater Management and Soil & Water Management Report

for

Pacific Link Housing

MPC Ref: 230490
25 March 2026
[2]

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Revision	Author	Issue	Approved for Issue	Date
0	TC	Work in progress	BC	28.1.2026
1	TC	DA	BC	11.3.2026
2	TC	DA	BC	25.3.2026

1. Background Information

1.1 Basis of Report

This report has been prepared by MPC Consulting Engineers ('MPC') to assist with the Development Approval of the Stormwater Management and Soil & Water Management works for the multi-storey residential apartment building at No. 23-25 Ashton Avenue, The Entrance NSW. It is not intended to represent a final engineering design for the proposed stormwater infrastructure.

Further detailed design and documentation of the stormwater management infrastructure would be conducted for the Construction Certificate application once approval of the concept has been advised and any specific Development Conditions issued by Central Coast Council ('CCC').

MPC will be happy to provide any additional information, regarding the proposed stormwater management or sediment and erosion control measures, which would assist with the Development Approval process, if requested by CCC.

1.2 Preamble

The general arrangement of the proposed multi-storey apartment building and associated car park is depicted on the architectural site plan by SDA that is included in **Appendix A** of this report.

Pavements will generally comprise a combination of permeable paving and concrete for the car park, and concrete slabs on ground for pathways.

Management of stormwater runoff for the proposed development has been designed in accordance with the Council's Development Control Plan and relevant Technical Manuals, relevant Australian Standards (in particular AS3500.3) and Australian Rainfall and Runoff.

1.3 Issues Addressed by this Report.

In devising this Stormwater Management Plan for the proposed development, the following issues have been addressed:

- Water Quality Management.
- Stormwater Management (including On-Site Detention)
- Soil & Water Management (construction phase)
- Stormwater Harvesting / Re-use

The stormwater and environmental management philosophy employed is discussed in Section 3 of this report.

Specifics for the proposed stormwater management facilities for the development are described in Section 4 of this report.

Construction phase soil and water management controls are addressed in Section 5 of this report.

1.4 Background Information

The following background information has been considered in the design of the proposed stormwater management system.

- Architectural drawings prepared by SDA – a copy of the site plan (Drawing DD103 Rev F dated 18/03/2026) is included in **Appendix A** of this report.
- Site survey prepared by Clark Dowdle & Associates (Ref: 25958 Rev A dated 5/12/2023) - copy included in **Appendix B** of this report.
- Flood report prepared by Torrent Consulting (Ref: R.T2388.001.02 dated 17.3.2026) – copy included in **Appendix C** of this report.
- Geotechnical report prepared by Regional Geotechnical Solutions (Ref: RGS50080.2 - AD, dated 5/12/2023)
- Information obtained from the pre-DA engagement with CCC's stormwater engineering team and the Record of Pre-Development Advice from CCC

2. Site and Catchment Details

2.1 The Existing Site

The existing site is situated within a lot of approximately 2,336m² being bounded by Ashton Avenue to the north, Campbell Avenue to the south, commercial lots to the east and residential lots to the west. The location of the development site is depicted in **Figure 1**.

The existing ground surface generally slopes from the east down to the west with slopes in the order of 6%, and with a slight fall from Campbell Avenue down towards the north-west corner of the property adjacent to Ashton Avenue.

An existing stormwater drainage culvert runs south-to-north under the the western portion of the property.



Figure 1: Site Location

An existing twin-cell underground box culvert comprising 2x 900mm wide x 600mm deep cells extends under the western edge of the property from Campbell Avenue to Ashton. Information relating to the existing in-ground stormwater drainage assets in the area was obtained from Central Coast Council, with a relevant extract included in **Figure 2**. A full version of the stormwater asset diagram is included in Appendix F of this report.

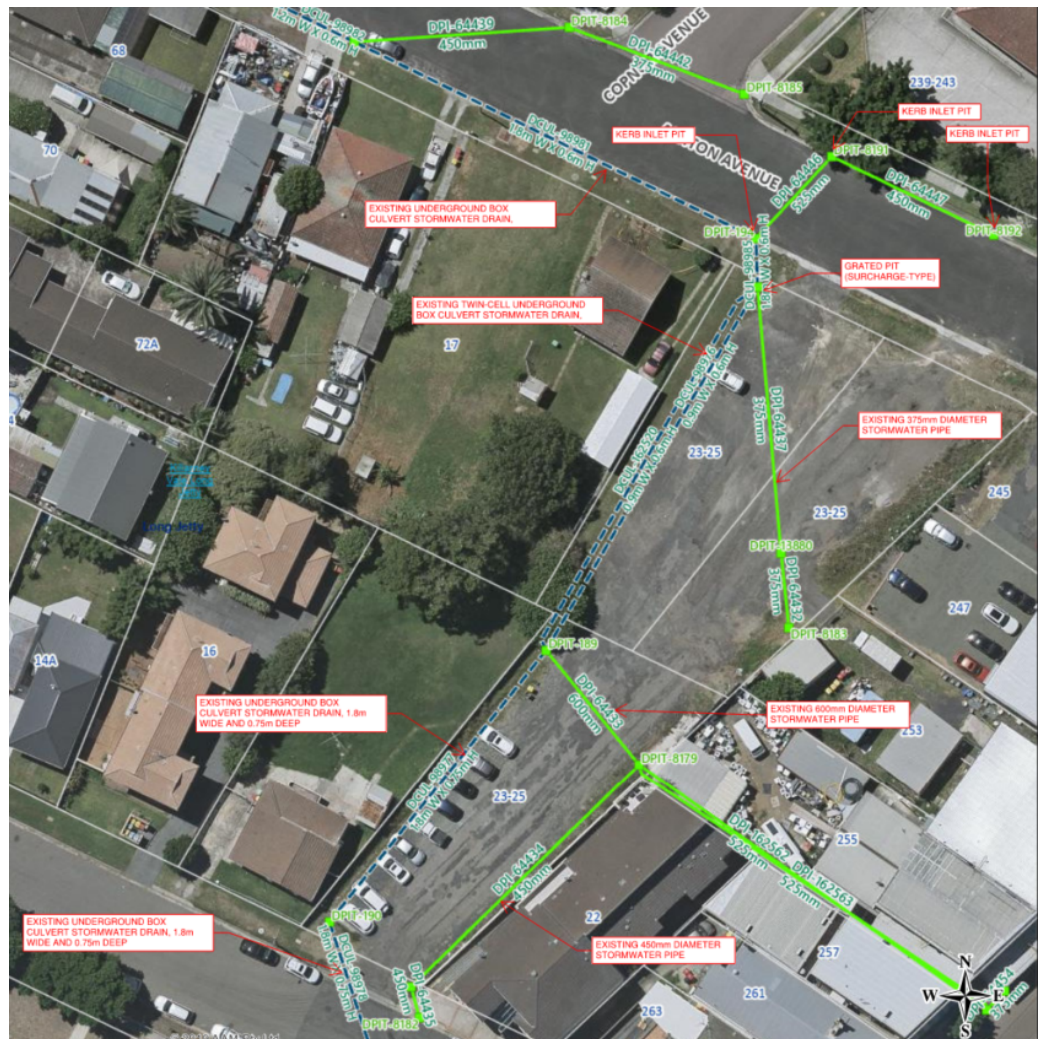


Figure 2: Existing Stormwater Drainage Assets

Surface and invert levels for the existing stormwater drainage infrastructure adjacent to and within the subject site has been obtained from survey data, a copy of which is included in **Appendix B** of this report.

2.2 The Proposed Site

Architectural drawings by SDA Architects show the site layout for the proposed development. These have been used as the basis of the stormwater management and sediment and erosion control concept design. A copy of the architectural site plan is included in **Appendix A** of this report.

The general arrangement of the proposed stormwater drainage infrastructure for the development is illustrated on the Stormwater Management Plans in **Appendix D** of this report.

3. Stormwater Management Philosophy

The proposed stormwater management system has been designed in accordance with the requirements of the current Central Coast Council Development Control Plan, relevant CCC Technical Manuals, *AS3500.3 Stormwater Drainage*, and Australian Rainfall and Runoff.

The key design considerations were as follows.

- Safety and Efficiency

Ensure that rainwater runoff from the developed site for all design storms up to a 1:100-year ARI (1% AEP) event is directed through the drainage network to the proposed stormwater discharge points safely and efficiently and in accordance with CCC Development Control Plan ('DCP') and AS/NZS 3500.3-2003.

Ensure that overland flow in the event of a choked or blocked piped system does not adversely impact on adjacent properties and does not exceed accepted safe velocity-depth criteria.

- Flood

Ensure consideration of and compliance with:

- the recommendations from the *Flood Impact and Risk Assessment* report prepared by Torrent Consulting dated 17 March 2026 (Ref: R.T2388.001.02).
- Chapter 3.1 Floodplain Management / Water Cycle Management from the Central Coast Council DCP, for a "Type 2" development ("Significant Development").
- The *Floodplain Development Manual* prepared by the NSW Department of Infrastructure, Planning and Natural Resources

- Stormwater Quantity

Provide detention of the post-developed flows for all storms up to the 100-year ARI (1% AEP) event, such that they do not exceed the pre-developed condition.

- Stormwater Quality

Ensure contaminated water from developed areas is passed through an appropriate pollution and sediment control system and meets the WSUD requirements of the CCC DCP.

- Stormwater Re-Use / Harvesting

New rainwater collection tanks with a water re-use facility to service irrigation of surrounding landscaped areas and for water re-use in common areas of the development.

4. Proposed Stormwater Management Facilities

4.1 Description of Proposed Stormwater Management Facilities

The stormwater management concept plans are shown in **Appendix D** to this report. The principal stormwater management components are listed below:

4.1.1 Stormwater Drainage Infrastructure

- Stormwater runoff from roof areas will be directed via an in-ground pipe network (charged system) to in-ground rainwater storage tanks located beneath the car park. The rainwater tanks will be fitted with a first-flush system to address water quality and will be plumbed back into the facility to re-use collected water for irrigation. There are 2x individual rainwater tanks proposed, each with 25,000L storage capacity, so a total storage of 50,000L has been provided.
- Overflow from the rainwater tanks will be directed to an in-ground On-Site Detention tank beneath the car park pavement. The OSD tank will have a filter vault/chamber with 6x proprietary Atlan Filter units. Overflows from the filter vault will spill into the OSD chamber. Details of the proposed OSD tank configuration are included on the stormwater plans in **Appendix D** of this report.
- Where possible, rainwater runoff from new paved pathways and courtyard surfaces around the buildings will be directed to landscaped/turfed areas or permeable paving for infiltration. Regardless of those infiltration opportunities, grated stormwater drainage pits have been specified around the buildings to collect surface stormwater.
- Stormwater collected in grated pits from paved and landscaped surfaces around the buildings will be directed to the in-ground On-Site Detention tank. Two of the proposed new pits will replace existing pit connections to the underground culvert. Those pits will bypass the OSD and treatment system on the site and so have been specified to be fitted with a proprietary drop-in filter screen (Atlan Stormsack) to address water quality requirements for those sub-catchments.

4.2 Design Storm Events

The stormwater management system will collect runoff for all design events up to the 100-year ARI for subsequent storage, re-use and disposal (as appropriate).

In-ground pits and pipes on the proposed development have been designed for a Minor Storm event of 1:10 years ARI (10% AEP).

The site has been designed for a 1:100-year ARI (1% AEP) Major Storm event using a pit blockage factor of 0.5 for all pits.

4.3 Site Catchment Parameters

4.3.1 Pre-Developed Site

MPC conducted a site analysis using the following information:

- Site survey (copy included in **Appendix B** of this report)
- Geotechnical report (prepared by Douglas Partners, Ref: 83390.00.R.002.Rev0 dated 12 June 2023).

The existing site was split into sub-catchments as depicted in **Figure 3**, based on the existing surface fall directions and the extent of the proposed development. A larger resolution copy of this site analysis diagram is included in **Appendix E** of this report.

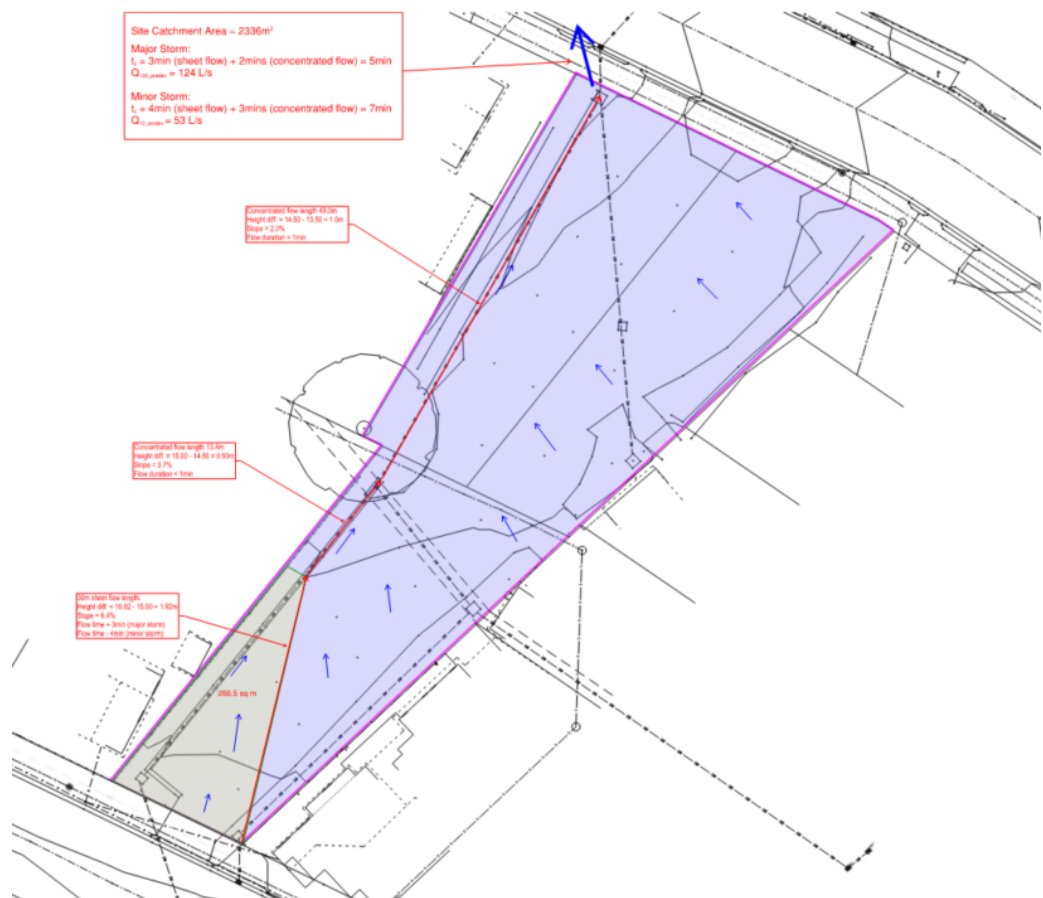


Figure 3: Pre-Developed Sub-Catchment Plan (Site Analysis)

The overall lot area (Lot 24, 36 & 37 DP 14230) is approximately 2,335m². This sub-catchment is relatively flat with surface falls in the order of 2% to 4% from the southern boundary (fronting Campbell Avenue) down to the northern boundary (fronting Ashton Avenue).

An existing twin cell underground box culvert 900 wide x 600 deep runs across entire property. Stormwater flows through this culvert have been estimated by the Flood Engineer in their *Flood Impact and Risk Assessment* report.

The kinematic wave equation plus an estimate of concentrated flow times was used to estimate the time of concentration for the existing sub-catchments. Additional information relating to the existing sub catchment parameters is included in **Appendix E** of this report.

The results of the site analysis were relied on for estimating pre-developed storm flows for all storms up to and including the major storm event.

Table 1: Pre-Developed Catchment Parameters and Flows

Sub-catchment ID	Sub-catchment Description	Area (Ha)	Minor (ARI= 10yrs)	Storm	Major (ARI= 100yrs)	Storm
			tc (min)	Q ₁₀ (L/s)	tc (min)	Q ₁₀₀ (L/s)
1	Existing site	0.2336	7	53	5	124

4.3.2 Post-Developed Site

The arrangement of sub-catchments adopted in the stormwater management design for this development are depicted in Figure 4 and Table 2 below.

- Total development footprint area is approximately 2,337m², with approximately 72% impervious area.
- All stormwater pits were checked for inlet capacity using a 50% pit blockage factor for the major storm analysis.

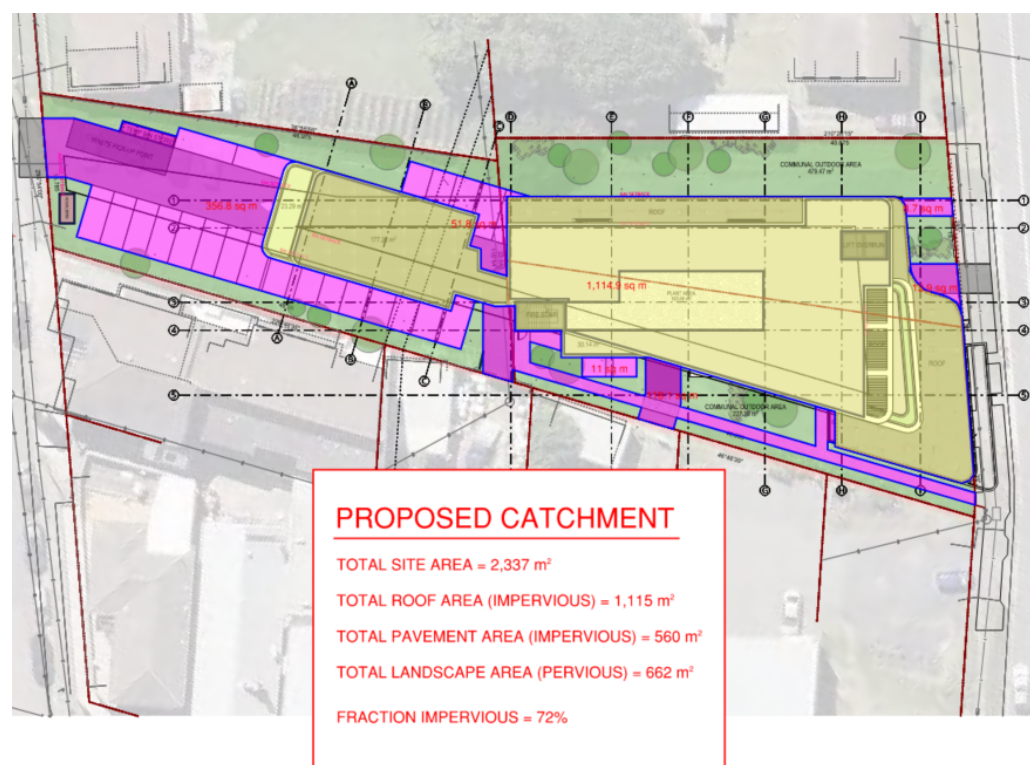


Figure 4: Post-Developed Sub-Catchment Plan

4.4 OSD / Retention Targets

MPC has checked the proposed development against the requirements of Section 3.1.11.2 of the DCP. Using the “Deemed-to-comply” formula and Table 2 from the DCP:

- Development area = 2,336m²
- Fraction impervious = 72%
- Stormwater Retention Volume = $0.01(2336)(0.02 \times 72)^2 = 48.4\text{m}^3$

The proposed development provides the on-site rainwater retention of 50,000L in the 2x 25,000L rainwater re-use tanks. Therefore:

- Total retention storage provided = $50\text{m}^3 > 48.4\text{m}^3$ therefore okay

MPC’s DRAINS stormwater model indicated that the configuration of OSD flow controls (orifice plates and high-level overflow pipes) detains flows to produce the post-developed flows listed in Table 2.

Table 2: Pre-Dev and Post-Dev Flows using OSD

Storm Event	Pre-Development Flow (L/s)	Post-Development Flow (L/s)	Post-Dev < Pre-Dev Flow?
1% AEP	124	122	Pass
2% AEP	106	93	Pass
5% AEP	67	65	Pass
10% AEP	53	46	Pass
20% AEP	44	36	Pass
50%	31	24	Pass

MPC has subsequently checked all storms up to and including the 1% AEP and confirms that the controlled post-developed flows for the development, using the configuration of stormwater controls described on MPC’s civil engineering drawings submitted for the Development Application, do not exceed the pre-developed flows from the property.

4.4.1 Pits and Pipes

In-ground stormwater pits and pipes were sized using the following:

- Rainfall intensities as specified in the IFD table obtained from BOM website (up-to-date rainfall data).
- Sub-catchments as illustrated in Figure 4 of this report.
- Pit inlet capacities using methods prescribed in Australian Rainfall and Runoff
- Pipe flow capacities using methods prescribed in Australian Rainfall and Runoff and AS3500.3.

- Pits and pipes modelled using DRAINS software using an ILSAX hydrological model (Figure 5 below depicts a screenshot from the DRAINS model).

Figure 5: Screenshot from MPC's DRAINS stormwater model for the site.

- During a minor storm event, all pits have adequate freeboard and no pits are surcharging. The proposed pipe network therefore has adequate hydraulic capacity.
- During a major storm event, surface flows are within safe velocity-depth limits, and concentrated surface flows are directed along the boundary of the site to Ashton Avenue rather than being directed over the west boundary to the neighbouring residential lot (as per the pre-developed arrangement).

4.5.2 Filling

Only minor cut and fill is needed for the development. The approach of the civil design has been to maintain finished pavement surface levels as closely as possible to existing ground surface levels to minimise risk of surface existing surface stormwater movements being obstructed.

MPC has coordinated the proposed post-development surface levels with the flood modeller to ensure that surface water conveyance through the site considers the proposed surface shape.

4.6 Stormwater Quality (WSUD)

Stormwater quality requirements from the CCC DCP have been incorporated into the overall stormwater management design for the site.

Water quality measures for the site have been modelled using MUSIC software and include the following:

- The rainwater tanks will be fitted with a first-flush system to address water quality and will be plumbed back into the facility to re-use collected water for irrigation.
- The OSD tank will have a filter vault/chamber with 6x proprietary Atlan Filter units.
- Where possible, rainwater runoff from new paved pathways and courtyard surfaces around the buildings will be directed to landscaped/turfed areas or permeable paving for infiltration.
- Stormwater collected in grated pits from paved and landscaped surfaces around the buildings will be directed to the in-ground On-Site Detention tank. Two of the proposed new pits will replace existing pit connections to the underground culvert. Those pits will bypass the OSD and treatment system on the site and so have been specified to be fitted with a proprietary drop-in filter screen (Atlan Stormsack) to address water quality requirements for those sub-catchments.

The stormwater quality devices and systems have been specified on the stormwater management plans included in **Appendix D**. A schematic of the MUSIC model for the car park catchment is included in Figure 6.

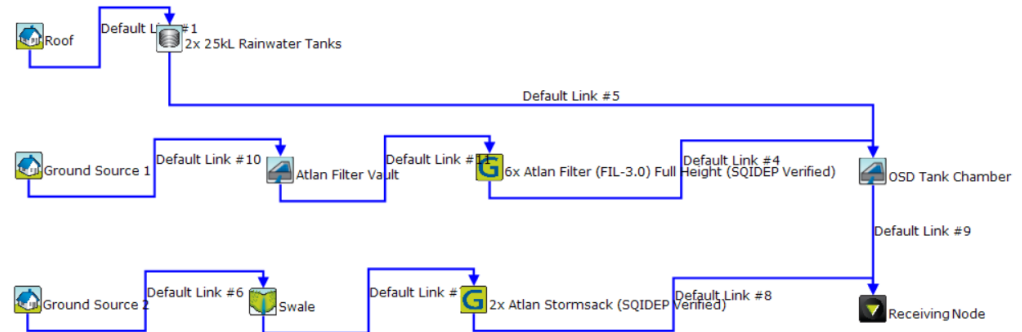


Figure 6: MUSIC Model Schematic

The proposed treatment train achieves the water quality targets listed Table 4, which demonstrates compliance with the targets specified in the DCP.

Table 4: Stormwater Quality Outcome Summary

Pollutant	Target Reduction in annual load	Reduction in annual load Achieved
Total Suspended Solids	80%	94%
Total Phosphorus	45%	81%
Total Nitrogen	45%	72%
Gross Pollutants	90%	100%

A copy of the MUSICLink report is included in **Appendix F**.

4.7 Maintenance of Stormwater Management Facilities

Maintenance of concrete pits, pipes and paved flow paths will be minimal however will still involve occasional cleaning.

- Ideally, pits and pipes should be inspected (and cleaned if necessary) at 3-month intervals and following large rainfall events.
- The Atlan Filters and Atlan Stormsacks should be inspected and cleaned at 3-month intervals and following large rainfall events but should also be maintained in accordance with the product manufacturer's specifications (relevant data sheets included in Appendix F of this report).
- First-flush devices for rainwater re-use tanks should be inspected (and cleaned if necessary) at 3-month intervals and following large rainfall events.

5. Construction Phase Soil and Water Management

The construction phase approach adopted for this site will incorporate principles recommended by the NSW Department of Housing, namely:

- Plan for erosion and sediment control concurrently with engineering design and in advance of earthworks proper assessment of site constraints and integration of the various needs.
- Minimise the area of soil exposure.
- Conserve the topsoil where possible but following any established environmental management plans.
- Control water flow from the top of the development area, through the works and out the bottom of the site, for example,
 - divert clean runoff above denuded areas.
 - minimize slope gradient and length. Excavated batter slopes of 3H:1V are considered acceptable provided they are turfed and landscaped as soon as possible.
 - keep runoff at non-erodible velocities.
 - trap soil and water pollutants.
- Rehabilitate disturbed lands quickly.

A sediment and erosion control plan is included in **Appendix G** of this report.

General controls will be provided on the site prior to and during all earthworks in accordance with EPA Site Work Practices. Features of the construction phase erosion and sediment controls adopted for this site include:

- Prevention of sediment and polluted runoff water from being directed off the construction site.
- Control of actual and potential soil erosion – grassing and stabilization of embankments and drainage outlets where required.
- Stabilised stockpile areas adjacent to existing access roads on the site, to minimise site disturbance required for access to the stockpile areas during initial stages of construction.
- A sediment basin located in the north-west corner of the site (the low point prior to Ashton Avenue).
- Stabilised site access to provide a firm base for vehicle entry/exit and to prevent the main access from becoming a source of sediment.
- Sediment control measures are to be constructed prior to any other site disturbance works.

6. Summary

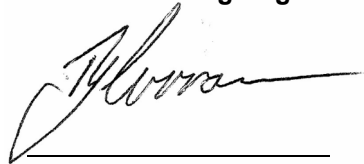
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This report has been prepared to assist with the Development Approval of the proposed stormwater management works. Further detailed design and documentation would be conducted once approval of the Development Approval has been advised and any specific Development Conditions issued by Central Coast Council.

For further information in relation to this stormwater management plan please contact the undersigned.

Signed:

MPC Consulting Engineers

A handwritten signature in black ink, appearing to read 'Ben Curran', written over a horizontal line.

BENJAMIN CURRAN

BE (Civil)(Hons), MIEAust (#1465387)

CPEng, NPER (Civil/Structural) RPEQ

Director, Senior Engineer

Appendix A

Architectural Site Plan

LEGEND
FEN1 - 1800h COLORBOND FENCE
FEN2 - 1800h PALISADE STYLE FENCE

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P:2024\2024-055 PLH Ashton\02 Drawings\02_b Working Files
2024-055_PLH Ashton_260306.pln



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ISSUE	DESCRIPTION	BY	CHK	DATE
B	COORDINATION	AH	AH	18/12/2025
C	COORDINATION	AH	AH	23/01/2026
D	FOR APPROVAL	RM		4/03/2026
E	FOR APPROVAL	AH	AH	6/03/2026
F	FOR APPROVAL	AH	AH	18/03/2026

PROJECT
PLH ASHTON

CLIENT
PACIFIC LINK HOUSING

DRAWING
EXTERNAL PLAN

PROJECT NO.
2024-055

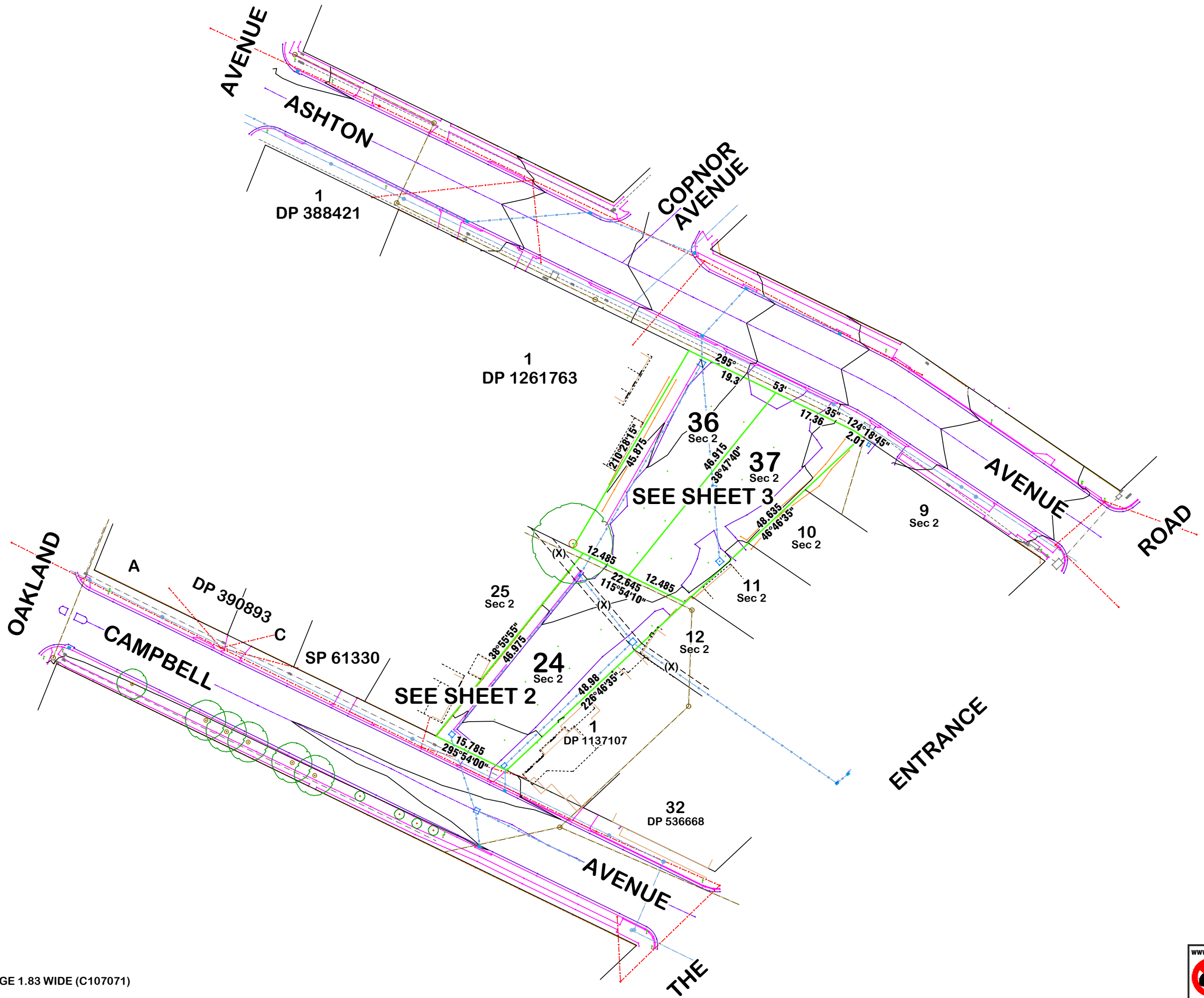
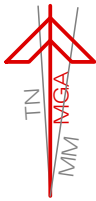
LOCATION
23-25 ASHTON AVENUE THE ENTRANCE
NSW

DRAWING NO. DD103
ISSUE NO. F
SCALE 1:250@A3



Appendix B

Site Survey



(X) - EASEMENT FOR DRAINAGE 1.83 WIDE (C107071)



Origin of Levels : PM 17595 fd.
Location : Oakland Dve, The Entrance.
R.L. : 11.608m A.H.D.

revision	description:	date:
A	Underground Services Updated	05/12/2023

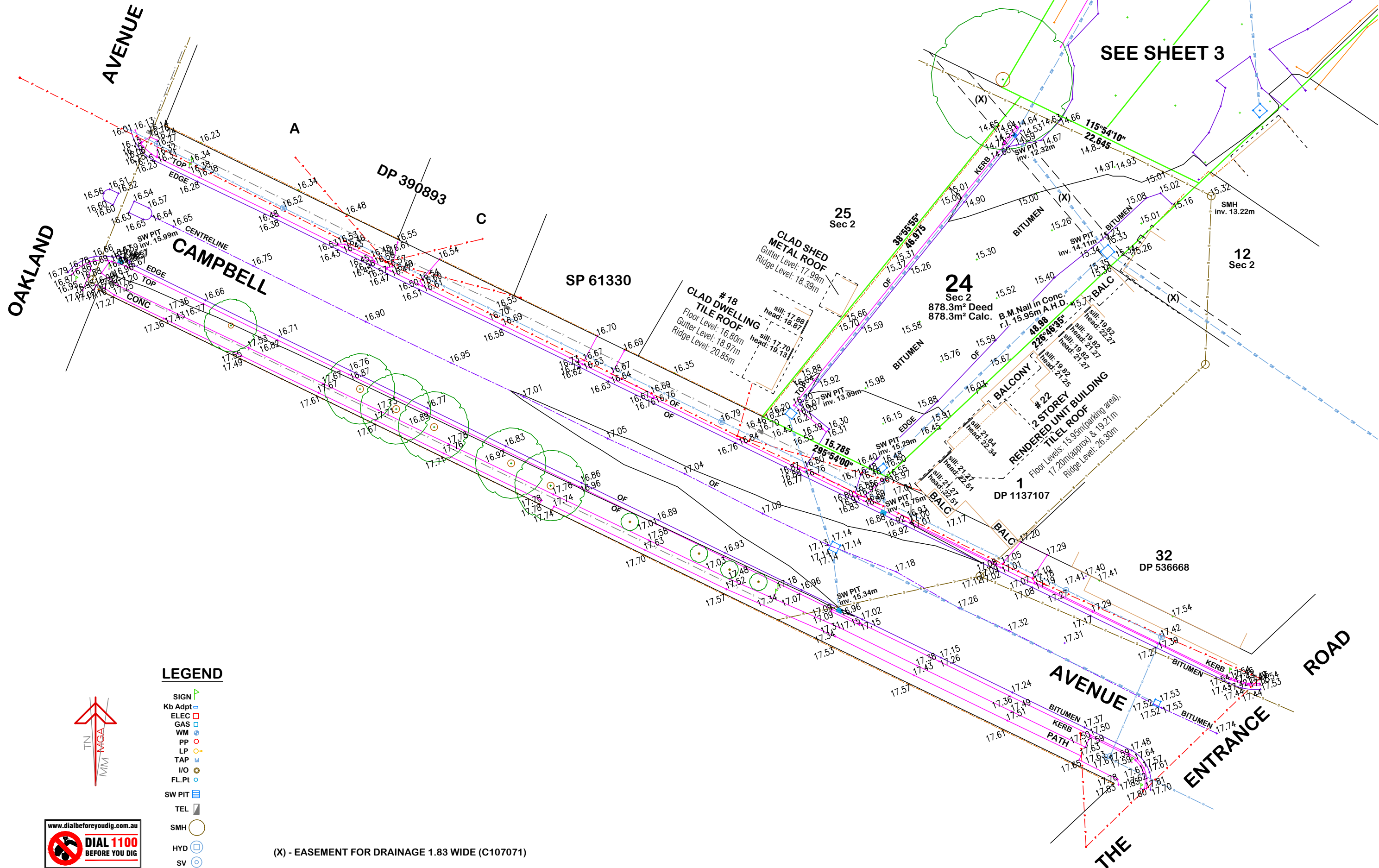
client:	PACIFIC LINK HOUSING LIMITED
assessed:	A.W.C.
drawn:	R.G.
surveyed:	W.Q.
Registered Surveyor	

Clarke Dowdle & Associates
Development Consultants
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UMINA BEACH NSW 2257
ph (02)43443553 fax (02)43446636
email admin@cdasurveys.com.au
Po Box 3122 Umina NSW 2257

project:	#23-25 ASHTON AVENUE, THE ENTRANCE.
details:	Lots 24, 36 & 37 of Sec 2 in DP 14230
drawing:	SITE PLAN

red. ratio:	1:800	datum:	A.H.D.
reference #Go:	25958	ref ext:	
contour interval:	1m	DA #:	
job date:	27/04/2023	number in set:	1 of 3
LGA:	CENTRAL COAST		
Parish:	TUGGERAH		
County:	NORTHUMBERLAND		

-all dimensions are in metres unless otherwise shown.
-check and confirm all areas & dimensions on site prior to the commencement of any works.
-do not scale from face of plan.
-preliminary boundary fixation has been undertaken only.
-if any construction is planned on or close to the boundaries further survey work will be required.
-a complete investigation of services has not been undertaken for this survey.
-services shown hereon have been located by visible features only.
-tree trunk & height dimensions are approximate only.
-tree spreads are approximate only but have been drawn to scale.
-ridge& gutter levels displayed on buildings are approximate only.
-underground utility mains locations are provided by Council diagrams & are approx positions only.



LEGEND

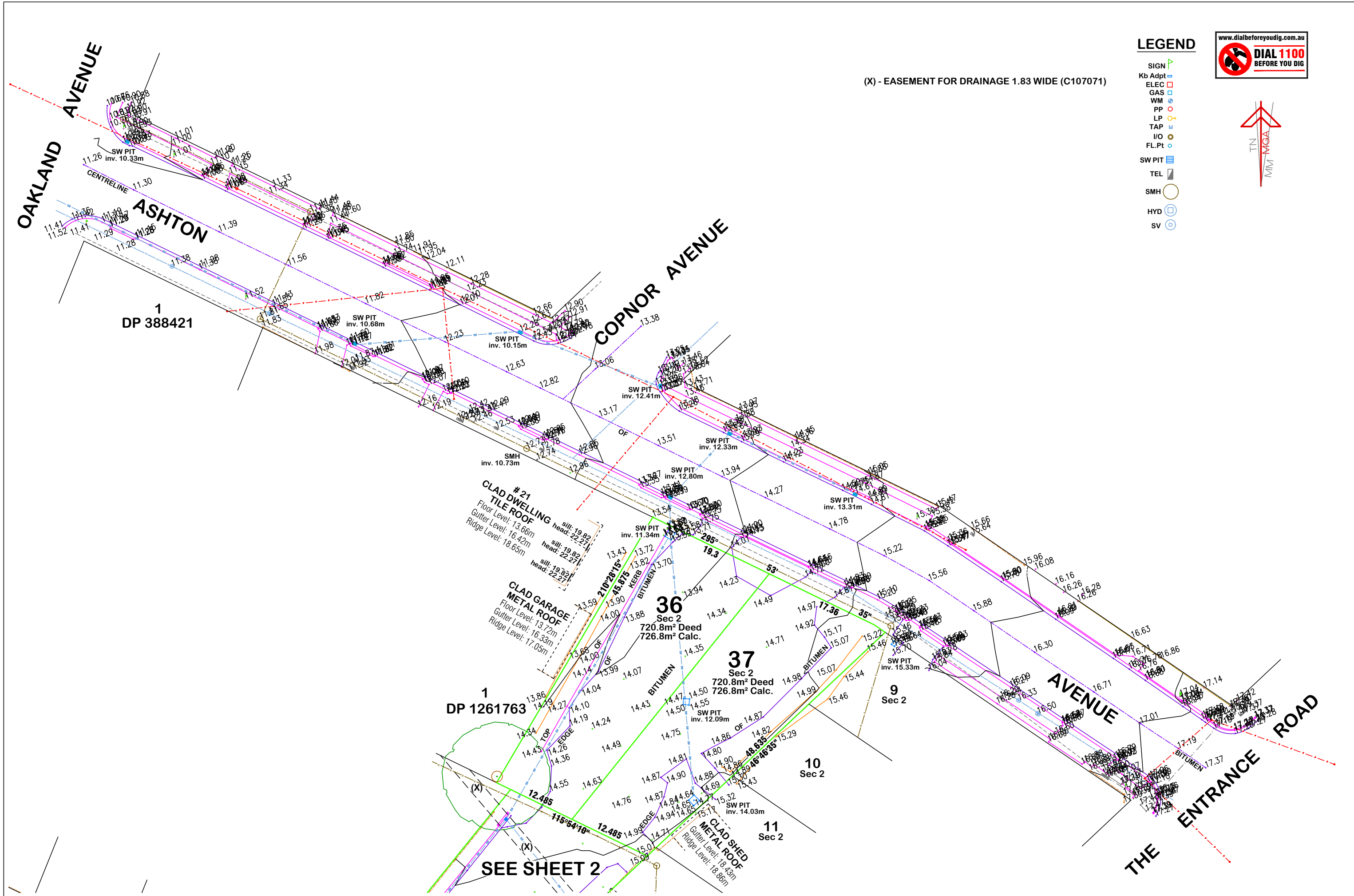


- SIGN
- Kb Adpt
- ELEC
- GAS
- WM
- PP
- LP
- TAP
- I/O
- FL.Pt
- SW PIT
- TEL
- SMH
- HYD
- SV



(X) - EASEMENT FOR DRAINAGE 1.83 WIDE (C107071)

	Origin of Levels : PM 17595 fd. Location : Oakland Dve, The Entrance. R.L. : 11.608m A.H.D.	revision		description:		date:		client:			
		A		Underground Services Updated		05/12/2023		PACIFIC LINK HOUSING LIMITED			
								assessed: A.W.C.			
								drawn: R.G.			
		These Drawings are for the express use of the intended recipient only. These drawings are not to be used / copied or forwarded to any unauthorised parties in part or whole without the express permission of Clarke Dowdle & Associates. Copyright and rights of use remain the property of Clarke Dowdle & Associates.								surveyed: W.Q.	
										Registered Surveyor	



	Origin of Levels : PM 17595 fd. Location : Oakland Dve, The Entrance. R.L. : 11.608m A.H.D.		revision	description:	date:	client:	Clarke Dowdle & Associates Development Consultants surveyors - planners - ecologists - bushfire consultants #1 OSCAR BEACH STREET UMINA NSW 2257 ph (02)43443553 fax (02)43446636 email admin@cdsurveys.com.au Po Box 3122 Umina NSW 2257	project:		red. ratio:	1:500	datum:	A.H.D.	-all dimensions are in metres unless otherwise shown. -check and confirm all areas & dimensions on site prior to the commencement of any works. -do not scale from face of plan. -preliminary boundary fixation has been undertaken only. -if any construction is planned on or close to the boundaries further survey work will be required. -a complete investigation of services has not been undertaken for this survey. -services shown hereon have been located by visible features only. -tree trunk & height dimensions are approximate only. -tree spreads are approximate only but have been drawn to scale. -ridge& gutter levels displayed on buildings are approximate only. -underground utility mains locations are provided by Council diagrams & are approx positions only.			
	assessed: A.W.C.		A	Underground Services Updated	05/12/2023	approved:		details:		reference #Go:	25958	rel ext:					
	drawn: R.G.					assessed:		Lots 24, 36 & 37 of Sec 2 in DP 14230		contour interval:	1m	DA #:					
	surveyed: W.Q.					drawn:		PLAN SHOWING SPOT-LEVELS, CONTOURS & DETAIL.		job date:	27/04/2023	number in set:	3 of 3				
Registered Surveyor											LGA:	CENTRAL COAST					
											Parish:	TUGGERAH					
											County:	NORTHUMBERLAND					

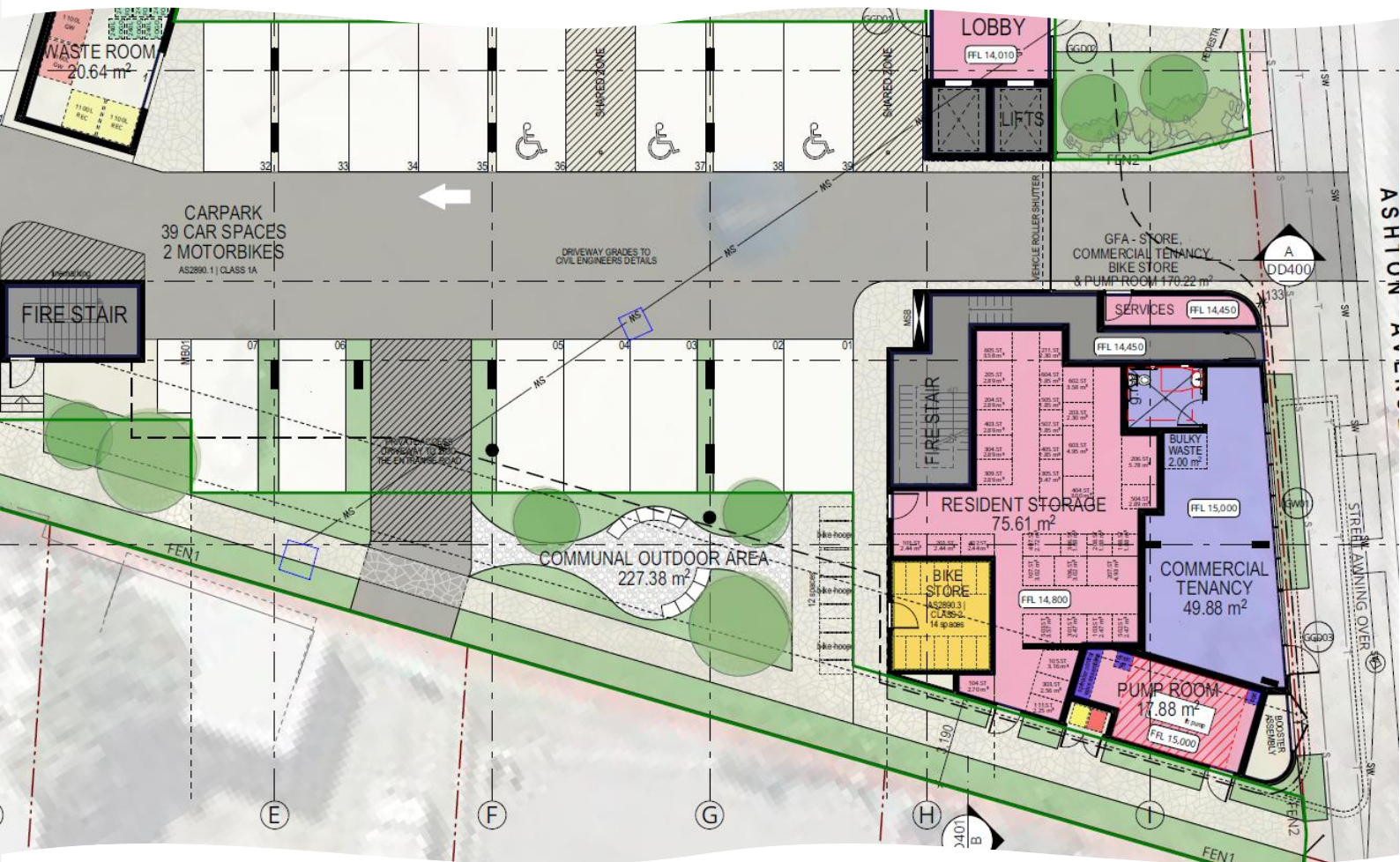
Appendix C

Flood Report

23-25 Ashston Ave, The Entrance NSW

Flood Impact and Risk Assessment

R.T2388.001.02



March 2026

Final

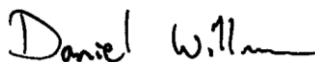
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Synopsis

Flood Impact and Risk Assessment for proposed development of 23-25 Ashton Avenue, The Entrance, NSW.

Revision History

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01	Draft	10/03/2026
02	Final	17/03/2026

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1 Introduction

1.1 Project Overview

Torrent Consulting has been commissioned by Pacific Link Housing Limited to prepare this report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD-84190958) for the proposed development of 23-25 Ashton Avenue, The Entrance, NSW (the Site).

The Site is located towards the central area of the northern end of The Entrance Peninsula (refer to Figure 1-1), within the Central Coast local government area (LGA). The site comprises multiple parcels of land and is legally described as:

- Lot 37 DP14230
- Lot 36 DP14230
- Lot 24 DP14230

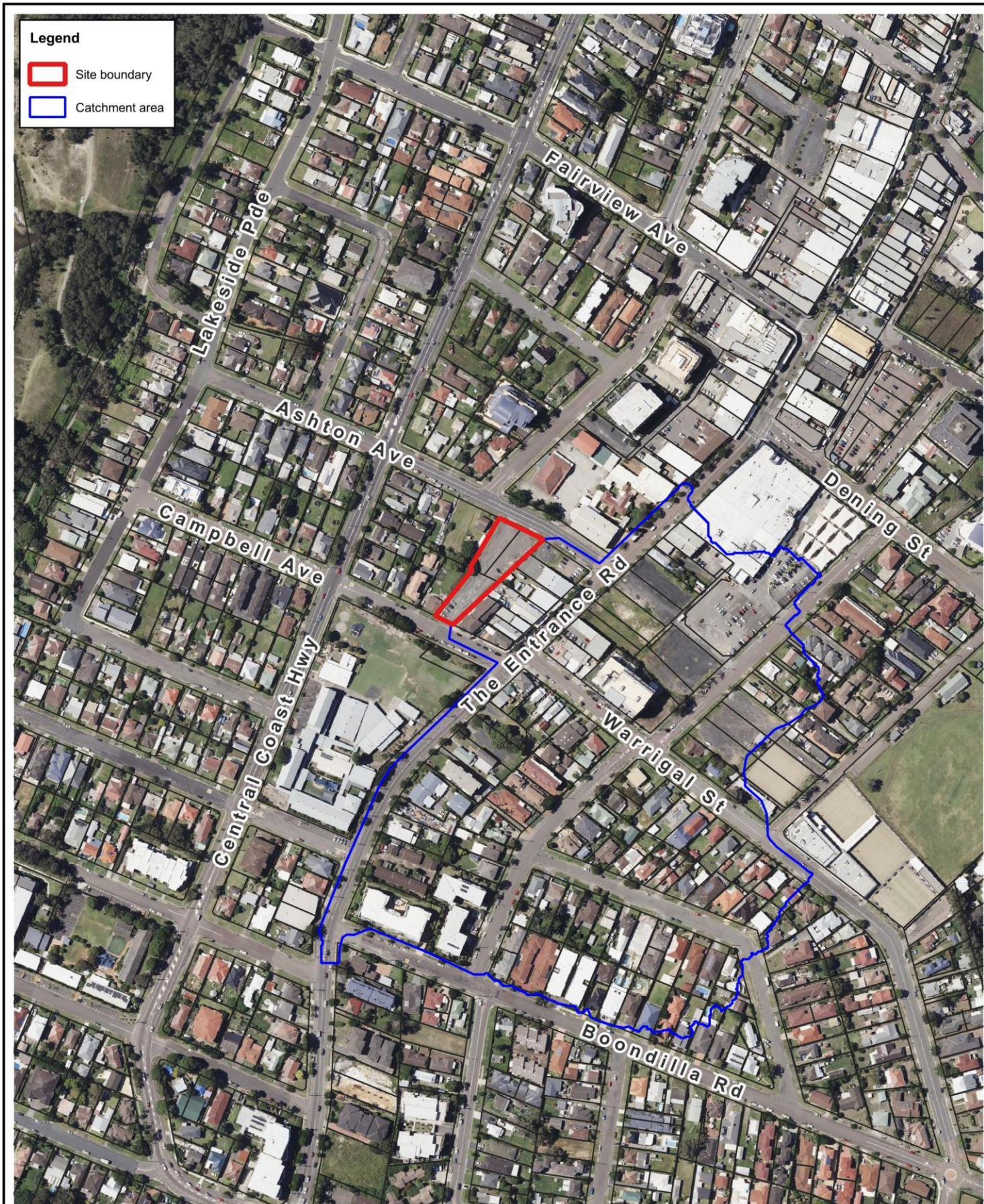
The proposed works include the construction of a seven-storey building comprising residential accommodation (of some 50 dwellings) across the first-to-sixth floors. The ground floor level is principally for car parking and services, with some outdoor communal areas and a commercial tenancy.

The Site is elevated between around 13.5-16.5 m AHD, as shown in Figure 1-2, and is therefore not subject to potential oceanic flood inundation, or from fluvial flooding of Tuggerah Lake. The Site is identified as being flood-affected by local overland flow, as mapped in the Killarney Vale / Long Jetty Catchments Floodplain Risk Management Study and Plan (KV/LJ FRMSP) (Catchment Simulation Solutions, 2021). The catchment area upstream of the Site is only around 10 ha in size.

The TUFLOW modelling undertaken for the KV/LJ FRMSP employs a methodology that models surface water runoff across the entire land surface. Therefore, in addition to representing major overland flood flow paths it also models local inundation that is of a stormwater management scale rather than flooding. However, the mapping in the study has not been screened to remove areas of inundation for which flood planning controls are not appropriate.

A review of the nature of modelled surface water inundation at the Site confirms that it is only affected by overland flow that is of a stormwater management scale, rather than a major overland flood flow scale to which floodplain risk management measures would be applicable. Whilst there is no clear guidance in NSW as to what should be considered a stormwater management surface water condition as opposed to a floodplain risk management condition, it is important to note that legally the Australian Insurance industry classifies inundation at the Site as stormwater rather than flood water, as surface flows at the Site have not escaped the confines of a channel or a dam.

Nevertheless, because the Site is recognised as being flood-affected by Central Coast Council (CCC), this assessment treats the Site as such and addressed the management of flood risk, accordingly.



Legend

- Site boundary
- Catchment area

Title:

Locality Plan

0 100 200 m



approx. scale

Figure:

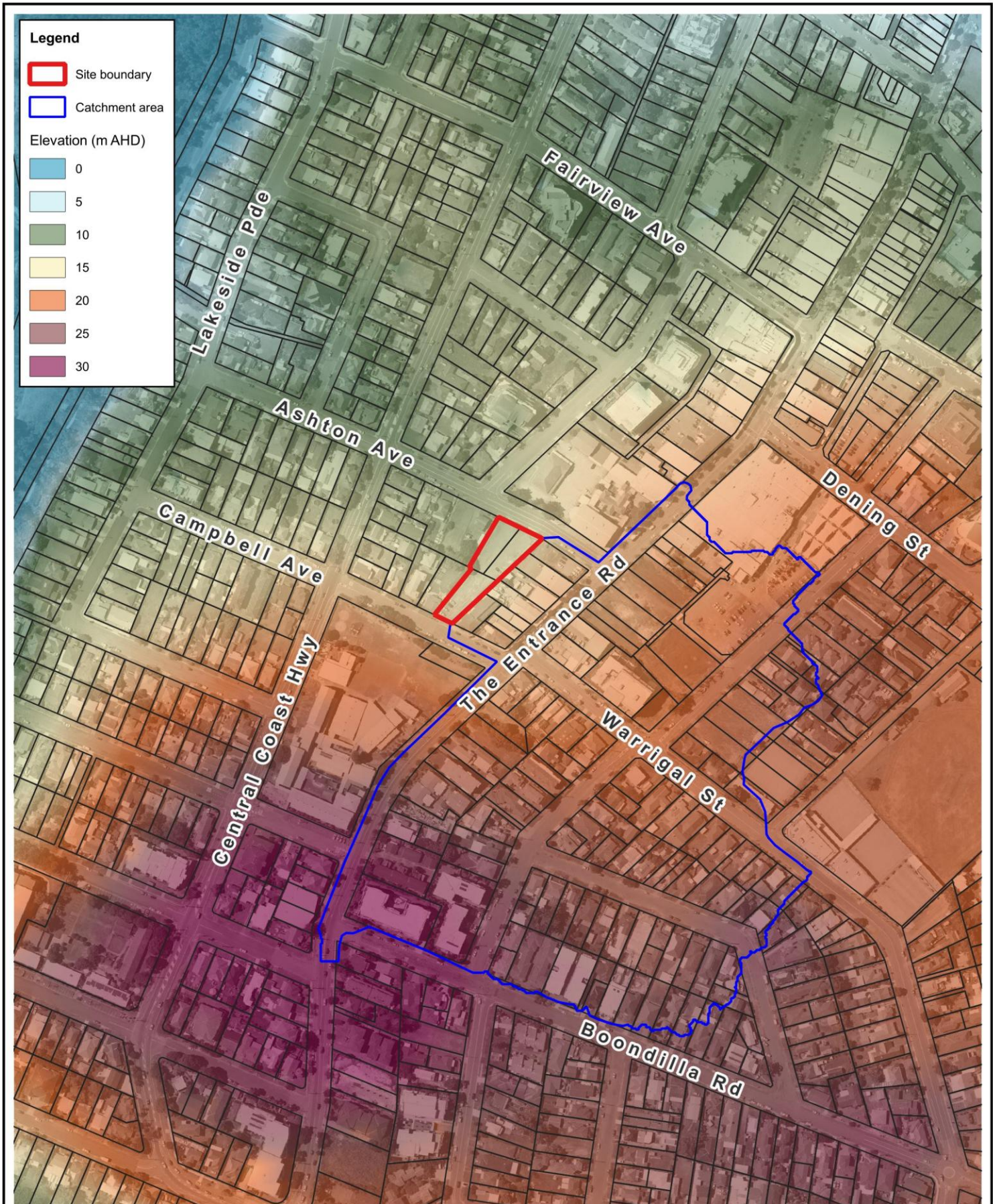
1-1

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Title:

Local Catchment Topography

0 100 200 m



approx. scale

Figure:

1-2

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1.2 Scope of Assessment

This flood impact and risk assessment aims to review the existing design flooding constraints at the Site, investigate Site development potential and associated flood impacts, and identify potential flood mitigation options, if required.

The key components of the assessment summarised in the following document include :

- Review of existing flood risk information including previous studies and available flood mapping.
- Review of relevant flood related planning controls and development guidelines.
- Establishment of numerical hydraulic model to define existing flood risk for the Site and development constraints.
- Flood impact assessment of proposed development using hydraulic model and identify requirement for flood mitigation.
- Review flood warning and emergency response opportunity.
- Assessment of compatibility of proposed development with established flood risk.

2 Flood Planning Requirements

A summary of relevant planning provisions with respect to flood risk management is provided hereunder.

2.1 Planning Secretary's Environmental Assessment Requirements

The Planning Secretary's Environmental Assessment Requirements (SEARs) relating to the proposed State Significant Development (SSD) were issued by the NSW Department of Planning and Environment on 19 May 2025 (SSD-84190958). The requirements relating to flooding are reproduced below.

The EIS must:

- Identify the flood planning area and level as set out in the relevant EPI and other supporting documents to determine:
 - The flood extent and velocity up to the Probable Maximum Flood and risk on-site having regard to adopted flood studies and, floodplain risk management studies and plans
 - The site access and egress routes
 - the potential effects of climate change
 - any relevant provisions of the NSW Flood Risk Management Manual, and any other relevant guidelines
- Where the development is occurring on flood prone land a flood impact and risk assessment (FIRA) must be prepared having regard to the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01. When determining the scope and category of the FIRA the requirements outlined in the FIRA guide must be considered.
- Detail any flood risk management measures that are to be incorporated as part of the development having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).

2.2 Central Coast Local Environmental Plan (2022)

The Central Coast Local Environment Plan (LEP) 2022 provides a framework for development of land and land use in the Central Coast Council (CCC) LGA. Clause 5.21 relates to flood planning which states the following objectives:

- a) to minimise the flood risk to life and property associated with the use of land;*
- b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change;*
- c) to avoid significant adverse impacts on flood behaviour and the environment.*
- d) to enable the safe occupation and efficient evacuation of people in the event of a flood.*

In supporting these objectives, the LEP includes provision that development consent must not be granted unless the consent authority is satisfied that the development:

- (a) is compatible with the flood function and behaviour on the land, and*

(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and

(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and

(d) incorporates appropriate measures to manage risk to life in the event of a flood, and

(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

Clause 5.22 relates to special flood considerations, which because the proposal is not for sensitive and hazardous development, it is subjective as to whether the Clause should be applied. However, as Central Coast Council has not expressed any concerns in relation to flood risk at the Site, it is assumed that Clause 5.22 will not be applicable in this instance. Nevertheless, the proposed development does effectively manage flood risk at the PMF event and so the requirements of Clause 5.22 are inherently satisfied.

2.3 Central Coast Development Control Plan (2022)

The Central Coast Development Control Plan (DCP 2022) supplements the LEP 2022 by outlining controls that apply to various types of development across the LGA. Specifically, the DCP outlines development principles, objectives and standards that are intended to assist in the preparation of development applications by development proponents, and in the assessment of development applications by CCC. Part 3 Chapter 3.1 of the DCP covers requirements for floodplain management and water cycle management. The chapter is structured in a way that is representative of CCC prior to amalgamation in 2016, with Part B covering the former Wyong LGA (within which the Site is located) and Part C covering the former Gosford LGA.

Section 3.1.2.1 outlines the objectives of floodplain management within the LGA, as follows:

- To minimise the risk to human life and damage to property by controlling development on flood prone land
- To apply a performance and merit based approach to all development decisions taking into account ecological, social, engineering safety and environmental considerations to ensure development is appropriate and sustainable
- To ensure that the development or use of floodplains waterways and riparian corridors does not adversely impact upon aesthetic, recreational and ecological values
- To ensure that all land uses and essential services are appropriately sited and designed in recognition of all potential floods
- To promote flood compatible building design that considers requirements for the development of flood prone land and does not adversely impact on adjoining properties
- To establish guidelines for the development of flood prone land that are consistent with the *NSW Flood Policy* and *NSW Floodplain Development Manual (2005)* and as updated by the associated Floodplain Risk Management Guides

The process for demonstrating compliance with the above objectives begins with a Flood Control Matrix, which identifies the applicable controls for a range of development types. There is a set of controls specific to medium to high density residential and another for commercial and industrial

uses, both of which are applicable to the proposed development. The applicable flood planning controls are dependant on the Flood Precinct in which the proposed development is located.

For high hazard areas (Precinct 4) and/or flood storage and flow paths (Precinct 3) a development proposal must provide a performance-based assessment demonstrating that it is compatible with the flooding characteristics of the site, through demonstrating that it:

- is compatible with the established flood hazard of the land. In areas where flood hazard has not been established through previous studies or reports, the flood hazard must be established in accordance with the Floodplain Development Manual.
- will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties;
- incorporates appropriate measures to manage risk to life and property from flood;
- will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses;
- is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.
- is consistent with the principles of Ecologically Sustainable Development.
- adequately considers the impact of climate change.

For land located below the Flood Planning Level (FPL) (Precinct 2) a medium to high density residential development must also provide the performance-based assessment above, whereas for commercial and industrial uses a joint report by a professional engineer who specialises in floodplain management and a professional engineer who specialises in civil engineering is required to certify that the development provides:

- Minimum Habitable Floor Levels = 1% AEP flood level plus 500mm freeboard (Flood Planning Level)
- Minimum Non-Habitable Floor Levels = 5% AEP flood level
- Minimum level requirements for electrical fittings, internal sewer fixtures, and external overflow gully risers apply as per Building Code of Australia
- Minimum levels of open car parking spaces, carports and driveways = 5% AEP flood level
- Mine subsidence allowance to be added to levels (a), (b), (c) & (d) above, if applicable.
- Low flood hazard access and egress for pedestrians during a 1% AEP flood to an appropriate area of refuge located above the Flood Planning Level.
- Low flood hazard emergency vehicle road access (Ambulance, SES, RFS) during a 1% AEP flood event.
- All proposed structural components that can withstand the forces of floodwater including hydrostatic pressure, hydrodynamic pressure, impact of debris and buoyancy forces up to the flood planning level.
- Building materials and surface finishes at or below the flood planning level are all capable of withstanding prolonged immersion in water.
- An Evacuation Plan demonstrating that permanent, failsafe, and maintenance free measures are incorporated into the development to ensure the timely and safe evacuation of people from the development in a 1% AEP Flood event, without significant cost or risk

added to emergency services personnel. Signage of the plan must be prominently displayed around the development.

2.4 Agency Comments

The NSW SES has provided a letter containing recommendations in relation to the proposed development and potential flood risks. The content of this letter has been reviewed and a response is provided in Section 4.4.

3 Design Flood Conditions

3.1 Existing Flood Mapping

Design flood events are theoretical floods that represent a condition attributable to an expected probability of occurrence, which is expressed as a percentage annual exceedance probability (AEP). An event with a 10% AEP is expected to be exceeded on average (over a very long timeframe) once in every ten years, with a 1% AEP event expected to be exceeded on average once in every 100 years.

The Probable Maximum Flood (PMF) is a representation of the worst-case scenario, i.e. an occurrence of the most water that is physically capable as being precipitated as rainfall and is typically used in floodplain risk management to avoid locating critical infrastructure such as hospitals within the floodplain and for critical dam failure assessments. There is much uncertainty in assigning an expected probability to the PMF. However, ARR provides a best estimate of probability for the probable maximum precipitation (PMP) in Figure 8.3.2, reproduced in Figure 3-1.

Figure 3-1 shows that for catchments of 100 km² or smaller (i.e. at the Site) the best estimate of the AEP of the PMP (and hence PMF) is 1-in-10,000,000, with a 75% confidence that it lies between an AEP of 1-in-1,000,000 to 1-in-100,000,000 and within the upper and lower bounds of 1-in-100,000 and 1-in-1,000,000,000.

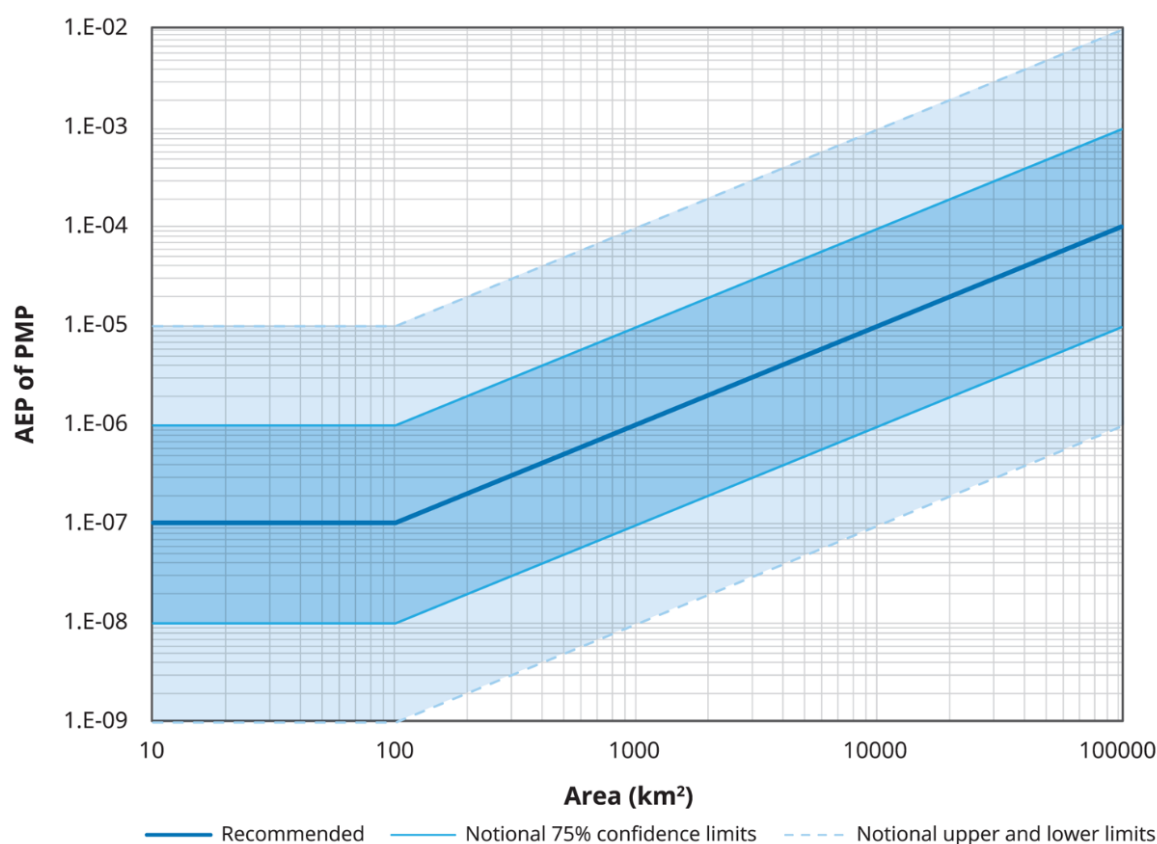
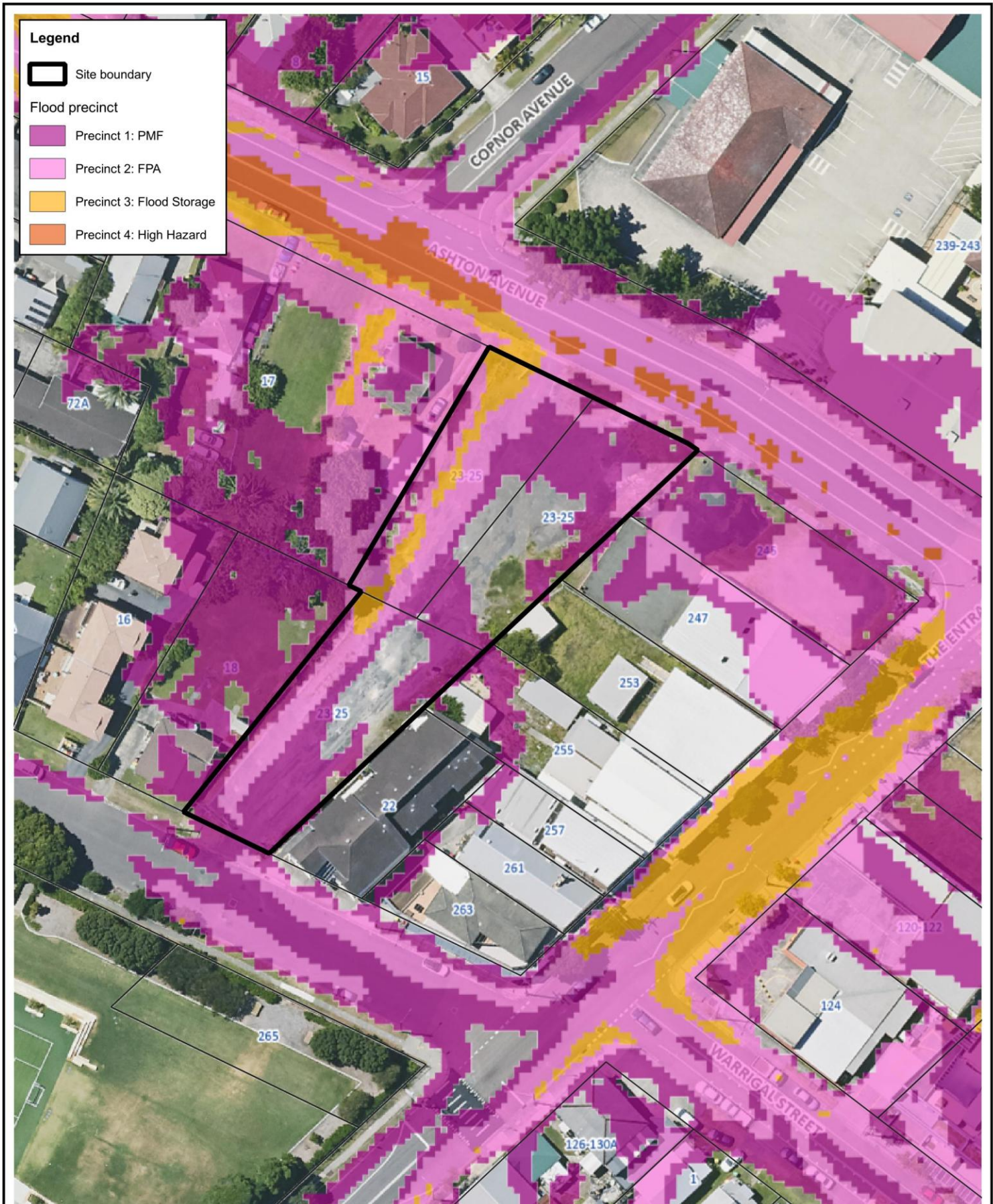


Figure 3-1 Estimated AEP of the PMP

The CCC online mapping portal provides a range of flood planning layers derived from the KV/LJ FRMSP. Local Flood Precinct mapping from the online portal has been reproduced in Figure 3-2.



Title:

CCC Online Flood Mapping Flood Precincts

0 20 40 m



approx. scale

Figure:

3-2

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The mapping in Figure 3-2 confirms that the Site is not subject to any high hazard flooding. It is mapped as containing a limited area of flood storage; however, this is an arbitrary construct, and the KV/LJ FRMSP adopted a very low threshold of a 150 mm modelled flood depth to define areas of flood storage.

The extent of the Flood Planning Area (FPA) is largely confined to the overland flow path along the western boundary of the Site, although there is also some patchy coverage of the north-east corner. The FPA was defined in the KV/LJ FRMSP through simulation of the 1% AEP event with a 30% increase in rainfall to derive an appropriate extent.

The PMF covers most of the Site, as would be expected for the simulation of surface water runoff for a 1-in-10,000,000 AEP design condition.

3.2 Model Development

A data sharing agreement was signed with CCC for the provision of the TUFLOW model developed for the KV/LJ FRMSP. With surface water flows being principally a stormwater management scale rather than floodplain risk management at the Site, the existing TUFLOW model was found to be less detailed than ideally required to resolve the local catchment runoff hydraulics. New TUFLOW hydrological and hydraulic models were therefore developed for use in this assessment.

For the derivation of design rainfall-runoff conditions, a hydrological model was developed in TUFLOW covering the catchment area upstream of the Site. The model has a 2 m horizontal grid cell resolution and samples elevation data from an underlying 1 m resolution gridded Digital Elevation Model (DEM) derived from the 2020 LiDAR survey data product, using the sub-grid sampling (SGS) functionality of TUFLOW.

Soil losses were modelled using the Green-Ampt infiltration method, with the catchment being spatially classified as either pervious or impervious surfaces, using the aerial imagery accordingly. However, with such a high impervious surface coverage in the catchment and with very short critical storm durations, these losses are effectively negligible.

A more detailed TUFLOW hydraulic model was developed covering the area from just upslope of The Entrance Road to a little downslope of the Central Coast Highway. The TUFLOW hydraulic model has a 1 m grid cell resolution, fully utilising the available detail in the LiDAR survey DEM. The kerb and gutter profile along Campbell Avenue were enforced in the model, using data captured in the detail site survey. Buildings were also represented in the model as physical obstructions to surface water runoff.

Details of the sub-surface stormwater drainage network were modelled as 1D elements, dynamically linked to the 2D model domain of the surface geometry at the stormwater inlet pit locations. The local trunk drainage alignment takes water from the trapped low point in The Entrance Road, west along Campbell Avenue, north through the Site and then west again on Ashton Avenue. The trunk drain is an 1800 mm wide RCBC, of either a 600 mm or 750 mm height.

Details of the stormwater drainage system local to the Site were captured in the detail survey and incorporated into the model accordingly. This found the representation within the KV/LJ FRMSP model to be in error, significantly underestimating the conveyance capacity of the sub-surface drainage. Beyond the extent of detail survey data, the modelled drainage network was reviewed, and invert levels were updated to provide a better consistency with the ground surface levels.

For the proposed development scenario, the modifications to the ground surface levels and stormwater drainage networks identified in the civil plans (MPC, dated 16 December 2025) were incorporated into the TUFLOW model, together with the proposed building footprints.

The rainfall-runoff hydrographs simulated in the hydrological model were appropriately distributed to the stormwater drainage network in the hydraulic model. Design flows are input to the stormwater pits, which then surcharge to produce surface water runoff once the capacity of the drainage infrastructure is exceeded.

3.3 Model Results

The ensemble approach to design rainfall-runoff hydrology outlined in ARR was adopted, with the 20-minute storm duration being identified as critical at the 10% Annual Exceedance Probability (AEP) event and the 10-minute storm duration being critical at the 1% AEP event. The modelled peak flows for the mean of the ten temporal patterns upslope of the Site are 3.9 m³/s and 7.9 m³/s for the 10% AEP and 1% AEP events, respectively.

Figure 3-3 shows the modelled 1% AEP design storm event conditions for the existing case scenario. This shows localised flooding within The Entrance Road, where surface water runoff is trapped in a low point. Excess catchment runoff pools within The Entrance Road once the stormwater drainage capacity is reached, with the principal overland escape path being along Ashton Avenue. Mapping for the full range of simulated design conditions for the existing case scenario is provided in Appendix A.

The results of the 1% AEP event for the post-development scenario conditions are shown in Figure 3-4. The impact of the proposed developed to the existing surface water flow regime is largely negligible. The main difference is that the proposed development better manages flow through the Site, resulting in a reduction of surface water downslope along Campbell Avenue and the Central Coast Highway. Surface water flows within the Site are also conveyed through to Ashton Avenue, rather than flowing uncontrolled through the neighbouring allotment to the west. Mapping for the full range of simulated design conditions for the post-development scenario is provided in Appendix B.

Figure 3-5 shows the relative impact between the modelled 1 % peak water surface levels of the post-development and existing scenarios. The reduction in overland flow extent within the neighbouring property is evident, with peak levels along the southern side of Ashton Avenue also reduced. There is a minor increase in levels modelled along the northern side of Ashton Avenue, representative of the additional runoff being directed there rather than into the neighbouring allotment. However, this localised increase does not present an adverse impact that would require mitigation, with the impacts being confined to the road corridor. Also, multiple road works would be undertaken annually across the LGA that have a similar degree of impact, without being required to undertake a modelling-based flood impact assessment. Mapping for the full range of simulated peak flood level impacts is provided in Appendix C.

Flood hazard mapping of the model results has been determined in accordance with Guideline 7-3 of the Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR, 2017). This produces a six-tier hazard classification, based on modelled flood depths, velocities, and velocity-depth product. The hazard classes relate directly to the potential risk posed to people, vehicles, and buildings, as presented in Figure 3-6.



Title:

Modelled 1% AEP Design Storm Condition Existing Scenario

0 40 80 m



approx. scale

Figure:

3-3

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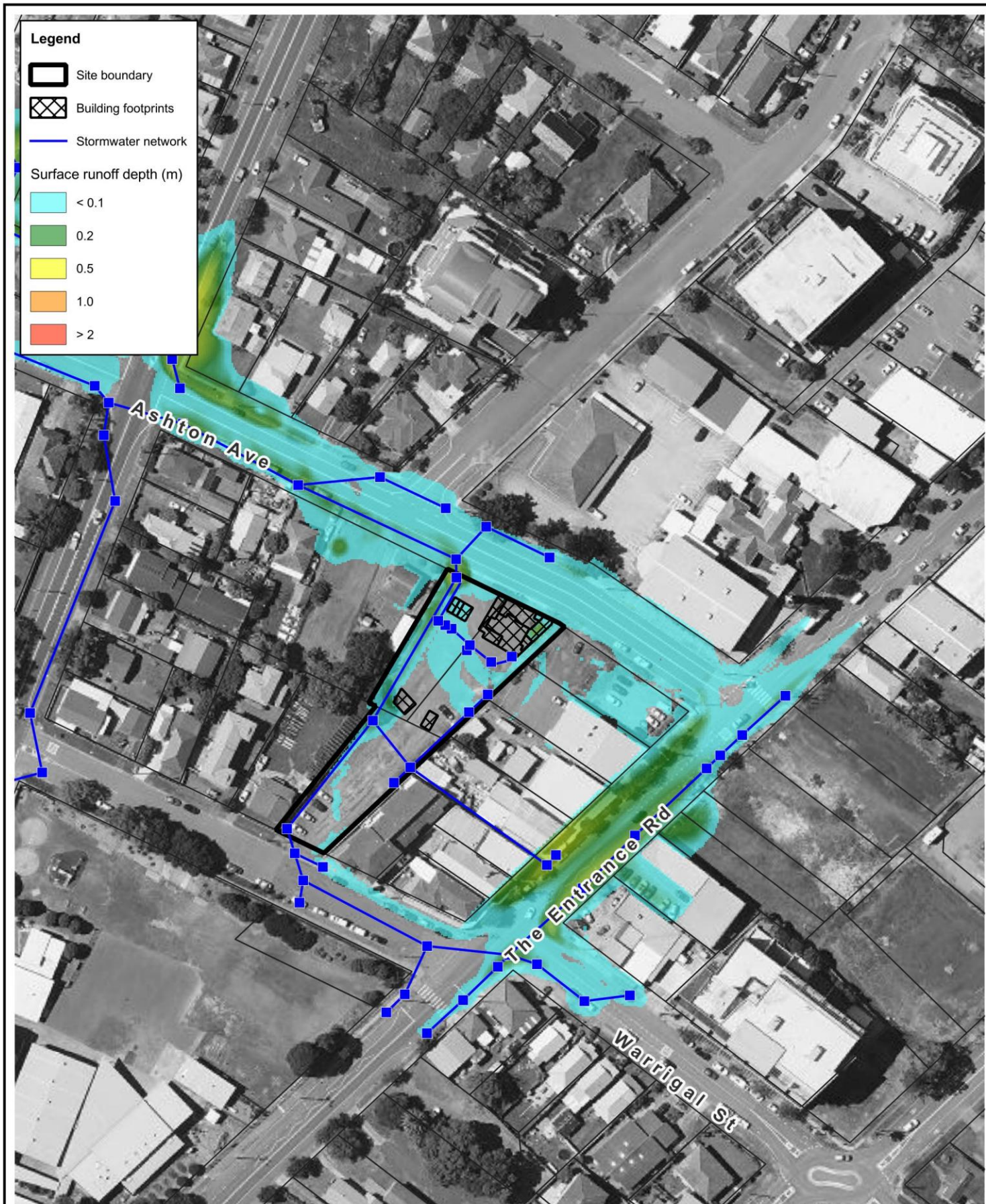
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Title:

Modelled 1% AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

3-4

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Title:

Modelled 1% AEP Design Storm Condition Post-development Flood Level Impact

0 40 80 m



approx. scale

Figure:

3-5

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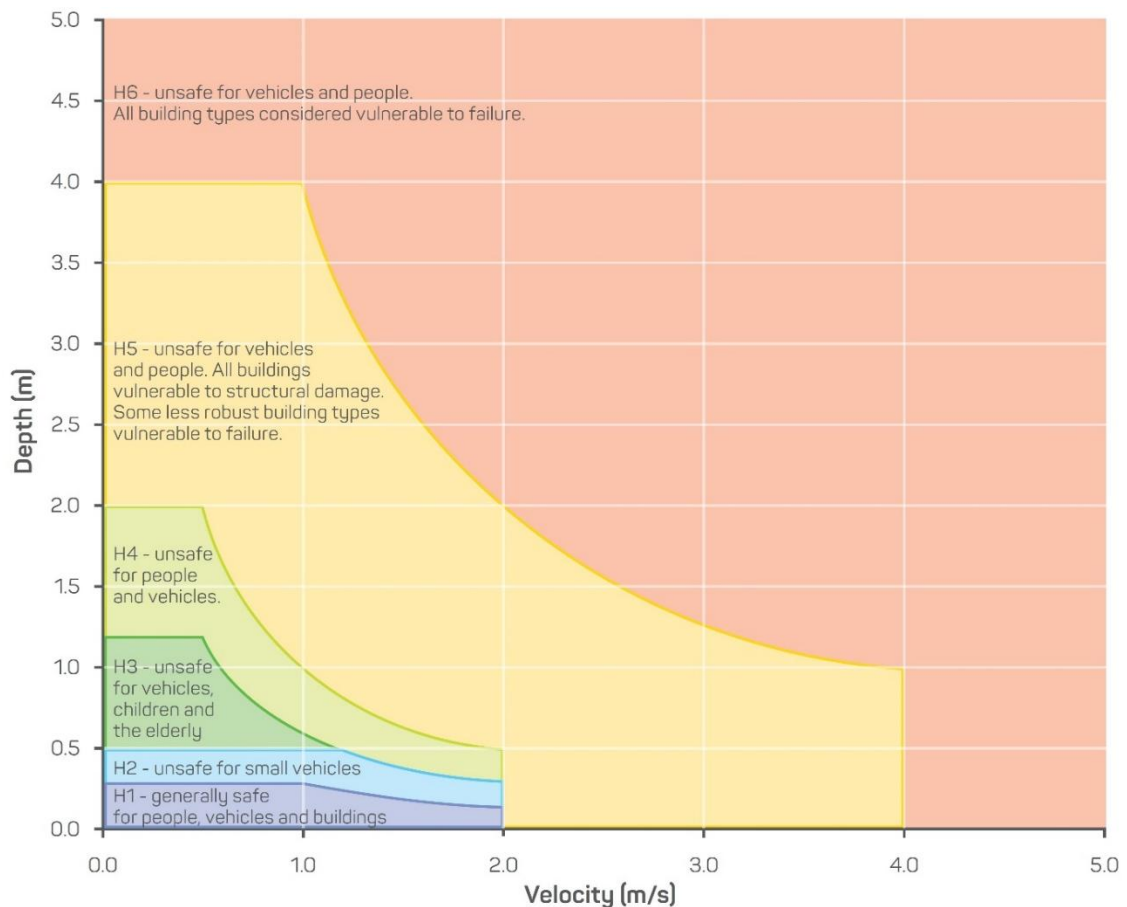


Figure 3-6 General Flood Hazard Vulnerability Curves (AIDR, 2017)

The hazard classification for the post-development scenario at the 1% AEP and PMF events is shown in Figure 3-7 and Figure 3-8, respectively, with hazard mapping for the full range of events provided in Appendix D. This shows that the modelled surface water is essentially a low hazard (H1-H2) environment across the entire Site at the 1% AEP event. There is however a minor, localised blip of up to an H5 hazard, where the modelled peak flood velocities just exceed the 2.0 m/s threshold (to less than 2.1 m/s) but this isn't sufficient to be considered as a genuine risk. The Site is still predominantly an H1 hazard at the PMF event. However, there is a path of high hazard (H5) modelled along the western boundary of the Site, where overland flow is concentrated.

The modelled high hazard classification is triggered by an exceedance of the flow velocity threshold of 2.0 m/s, as the flow depths are relatively shallow, being around 0.1 m at the southern end and 0.4 m at the northern end of the flow path. Peak velocities of 2.0-2.5 m/s are modelled. The same occurs within Ashton Avenue, where again depths range between 0.1-0.4 m, but the velocities are as high as 2.5-3.5 m/s. Whilst these modelled conditions are hazardous, the risk of exposure is negligible, lasting for a period of under ten minutes in a 1-in-10,000,000 AEP event.



Title:

1% AEP Flood Hazard Classification Post-development Scenario

0 40 80 m



approx. scale

Figure:

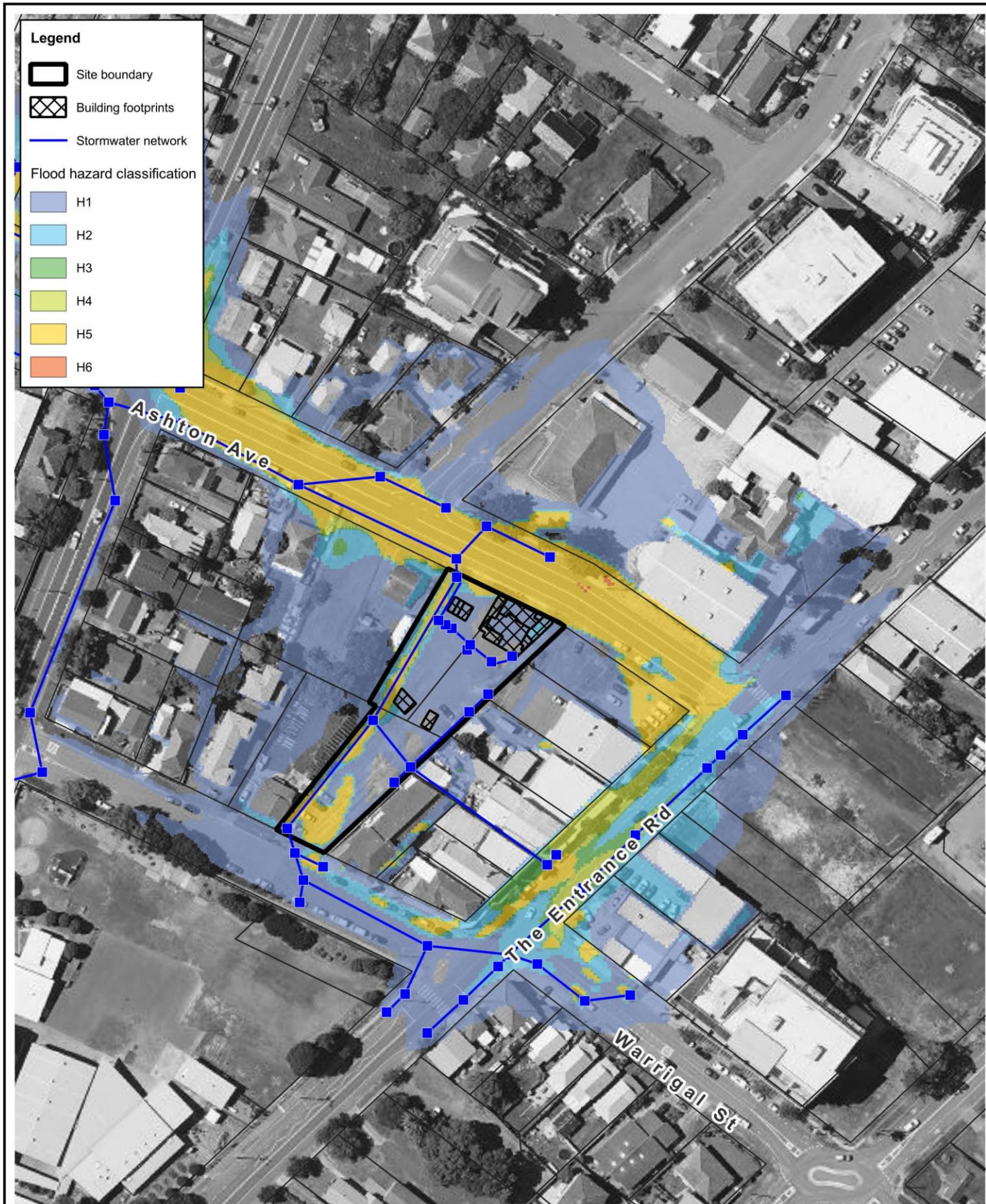
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Title:

PMF Flood Hazard Classification Post-development Scenario

0 40 80 m



approx. scale

Figure:

3-8

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4 Flood Risk Management

4.1 SEARs

The SEARs require that the EIS must:

- Identify the flood planning area and level as set out in the relevant EPI and other supporting documents to determine:
 - The flood extent and velocity up to the Probable Maximum Flood and risk on-site having regard to adopted flood studies and, floodplain risk management studies and plans
 - The site access and egress routes
 - the potential effects of climate change
 - any relevant provisions of the NSW Flood Risk Management Manual, and any other relevant guidelines
- Where the development is occurring on flood prone land a flood impact and risk assessment (FIRA) must be prepared having regard to the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01. When determining the scope and category of the FIRA the requirements outlined in the FIRA guide must be considered.
- Detail any flood risk management measures that are to be incorporated as part of the development having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).

The Flood Planning Area (FPA) as defined by CCC in the KV/LJ FRMSP is shown in Figure 3-2. However, the TUFLOW modelling use for that study is of an insufficient detail to accurately resolve the local surface flow hydraulics. It also underestimated the capacity of the trunk stormwater drain due to a data error. However, an FPA covering the overland flow path along the western edge of the Site is reasonable to adopt.

The extent of the PMF surface water is shown in Figure 3-6. It is better to discuss the extent of the PMF where the modelled conditions exceed an H1 hazard, as H1 hazard conditions would occur across the entire landscape in such an extreme event, from the intensity of rainfall alone. Essentially, the extent of the PMF at the Site is largely contained within the overland flow path along the western edge but is a bit more extensive where overland flows enter the Site from Campbell Avenue and Ashton Avenue.

Site access and egress routes are effectively not impacted by flooding because the duration of any high hazard conditions within the Campbell Avenue and Ashton Avenue corridors is so short-lived (less than ten minutes).

With future climate, the intensity of design rainfall is expected to increase, as per recent guidance in Australian Rainfall and Runoff version 4.2. However, as even the existing PMF conditions do not present a constraint to development of the Site, future climate change also does not present any constraint.

Both the Central Coast LEP and DCP reflect the provisions of the NSW Flood Risk Management Manual and so addressing the specific requirements of those is considered to satisfy this requirement.

A FIRA has been undertaken for the proposed development and provides an appropriate level of detail for the nature of the proposed development and the floodplain environment (which is essentially a stormwater management issue).

The civil design for the external surface levels and stormwater management has been developed in conjunction with this FIRA to better manage the minor overland flow path through the Site. This has contained the surface flows within the Site rather than the existing scenario in which they flow uncontrolled across the western boundary into the neighbouring allotment. The resultant surface water conditions at the 1% AEP represent a low flood hazard (H1) environment, minimising the potential risk exposure to both people and vehicles. The residential dwellings are all located significantly higher than the PMF level, so the risk to life is also readily managed. Consideration of an appropriate flood emergency response for the future development is provided in Section 5.

4.2 Central Coast LEP

As established in Section 2.2 from Clause 5.21 of the LEP, development consent must not be granted unless the consent authority is satisfied that the development:

- (a) is compatible with the flood function and behaviour on the land, and*
- (b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and*
- (c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and*
- (d) incorporates appropriate measures to manage risk to life in the event of a flood, and*
- (e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.*

Items (a), (b) and (d) are closely related, as to demonstrate compatibility of development with the flood function and behaviour of the land requires both the off-site flood impacts and the management of flood risk to be adequately addressed. Item (c) is dependent on a suitable flood emergency response. Item (e) relates to natural watercourses and so is not applicable to the Site given the nature of the local floodplain environment.

The flood planning requirements of the Central Coast LEP are largely addressed to a greater level of detail in the Central Coast DCP. Therefore, adherence with the specific requirements of the DCP inherently addressed those of the LEP, as documented in Section 4.3.

4.3 Central Coast DCP

As established in Section 2.3, the Central Coast DCP specifies controls which are to be met for the development of flood-prone land, depending on the nature of the proposed development and the Flood Precinct within which it is located.

Although the classification of part of the Site within the CCC mapping as flood storage is questionable, it is still valid to consider that part of the Site as a flow path, given that it will be subject to surface water flows when the capacity of the trunk drainage culvert beneath it is exceeded. Therefore, the proposed development is being assessed on a performance basis, as per the flood control matrix of the DCP, which provides for the most conservative assessment.

The performance-based assessment must demonstrate that the proposed development is compatible with the flooding characteristics of the site, through demonstrating that it:

- is compatible with the established flood hazard of the land. In areas where flood hazard has not been established through previous studies or reports, the flood hazard must be established in accordance with the Floodplain Development Manual.
- will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties;
- incorporates appropriate measures to manage risk to life and property from flood;
- will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses;
- is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.
- is consistent with the principles of Ecologically Sustainable Development.
- adequately considers the impact of climate change.

The flood hazard conditions at the Site are mapped for the 1% AEP and PMF events in Figure 3-7 and Figure 3-8, respectively. This confirms that the proposed development is compatible with the flood hazard of the land, which is predominantly a low hazard environment. Whilst there is some localised high hazard (H5) conditions modelled at the PMF event, such conditions would persist for a very short period (less than ten minutes) and they also do not impact the proposed building structures.

A relative flood impact assessment has been undertaken and confirmed that the proposed development does not adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties. As shown in Figure 3-5 for the 1% AEP event, the proposed development reduces the impact of overland flow within the neighbouring property to the west and does not increase the impact for other properties. As discussed in Section 4.2, the local urban stormwater environment means that the clause regarding to the environment and riparian areas is not applicable (or alternatively, potential impacts are negligible). The same is applicable to the ecologically sustainable development requirement. With the proposed development resulting in negligible impacts to the existing flood conditions, there are also no unsustainable social or economic costs to the community because of flooding.

The management of risk to life from flooding considers the full range of potential flood conditions, including the PMF event. This is readily addressed given the minimal flood hazard exposure at the Site but is discussed in detail in Section 5.

The principal management measure for the risk to property from flooding is through the setting of appropriate finished floor levels (FFLs). For habitable rooms of residential dwellings, the standard in NSW is to use the FPL, which is derived from the 1% AEP flood level plus a 0.5 m freeboard. The maximum peak level of the surface water modelled anywhere within the Site (at the entrance from Campbell Avenue) is around 16.6 m AHD (which would give an FPL of 17.1 m AHD). The maximum PMF level is around 17.0 m AHD. The lowest level of any proposed FFL for residential dwellings is 20.1 m AHD, which is significantly higher than any potential flood risk exposure.

The setting of appropriate FFLs at the ground floor level is more complex. The modelled hydraulic gradients across the Site are substantial, due to the nature of shallow runoff and relatively steep

gradients of the existing ground surface. Defining specific levels is therefore difficult and it is most appropriate to approach it from a stormwater management perspective, whereby the interface between internal and external spaces is designed to direct surface water away from building entrances and into the sub-surface pipe drainage and/or dedicated overland flow paths. CCC nominated a 1% AEP FFL as being acceptable for the commercial tenancy, with the DCP specifying a 5% AEP FFL for non-habitable rooms of residential development.

The results of the flood modelling have been considered in the development of the civil design surface, stormwater drainage and FFLs of the ground floor rooms. As shown in Figure 3-7, the surface water flows of the 1% AEP event are largely exclusive of internal inundation. However, internal ingress of surface water was unable to be prevented within the pump room, booster assembly, commercial tenancy and lobby area for lift access.

At the booster assembly and pump room water escapes from the Ashton Avenue corridor and flows along the eastern side of the proposed building. The FFL of the resident storage has been raised to prevent ingress of water but the building materials and fit-out of the booster assembly and pump room will be resilient to minor inundation of water. However, any electrical services or equipment within these two rooms should be elevated at least 0.3 m above the FFL.

With the accessible access requirements for the commercial tenancy, the entrance door needs to be at the level of the footpath. Therefore, whilst the FFL of the room is raised to be free from inundation, some minor inundation could occur within the entrance area, where a small ramp transitions between the external surface and the FFL. This area will be constructed and fit out to be flood resilient.

Again, the accessible access requirements for the lifts and associated lobby area mean that potential surface water ingress cannot be readily prevented. However, doors will be installed with a watertight seal to prevent ingress of water.

It is important to consider that the scale of overland flow within the Site is at a stormwater scale rather than one of floodplain management. Therefore, despite developing a detailed TUFLOW model of the Site and local catchment, nuances of the shallow surface water flow will be dictated by hydraulic controls at a scale and level of detail that cannot be accurately resolved in flood modelling. Also, the external doors have been modelled as holes within the external walls of the building. With the very short duration of overland flow in the catchment, the potential for ingress of water into buildings through closed doors is limited.

As per Section 4.1, with future climate, the intensity of design rainfall is expected to increase, as per recent guidance in Australian Rainfall and Runoff version 4.2. However, as even the existing PMF conditions do not present a constraint to development of the Site, future climate change also does not present any constraint.

4.4 Agency Comments

The NSW SES has provided a letter containing recommendations in relation to the proposed development and potential flood risks, dated 13 January 2026. The principal recommendation was that a FIRA be undertaken, as this was not included within the submission at the time of their review. This has now been addressed through the development of this FIRA report.

Because no FIRA was available at the time of writing the recommendations letter, the NSW SES included a set of overarching principles in relation to emergency management (EM) planning:

- That any proposed EM strategy should be compatible with any existing community EM strategy.
- That decisions should be informed by understanding the full range of risks to the community.
- That development of the floodplain does not impact on the ability of the existing community to safely and effectively respond to a flood.
- That decisions on development within the floodplain do not increase the risk to life from flooding.
- That risks faced by the itinerant population need to be managed.
- To recognise the need for effective flood warning and associated limitations.
- That ongoing community awareness of flooding is critical to assist effective emergency response.

A FIRA was not included within the original submission, as Central Coast Council had indicated that flood risk was not a concern at the Site. This is because the local overland flows at the Site are of a stormwater management scale rather than that of a broader floodplain risk management concern. Nevertheless, this FIRA has been undertaken on the basis that the Site is flood-affected, with floodplain risk management requirements being considered accordingly.

Whilst the preferred EM strategy is for flood evacuation, it is not always feasible. This is particularly the case in urban flash flood environments. This FIRA has found the proposed development to be consistent with the requirements of the NSW DPHI Shelter in Place Guidelines for Flash Flooding.

This FIRA has included conditions up to the PMF to ensure that any potential flood risk can be adequately managed, no matter how improbable. Because residents at the Site will be able to safely remain within their homes even for a PMF event, the last five of the principles outlined by the NSW SES are inherently satisfied. There is a negligible risk to life from flooding associated with the proposed development and no broader actions or awareness are required to ensure as such.

5 Flood Emergency Management

This section addresses the key requirements of an effective Flood Emergency Response Plan (FERP). The development and adoption of an FERP requires full integration with the site management, health and safety and incident management structures and is typically required prior to occupation. However, the overall flood emergency response strategy is outlined below.

The FFLs of the proposed dwellings are elevated at least 3 m above the PMF level and therefore residents are not placed at direct risk to flood inundation by remaining onsite during a flood event.

5.1 Suitability of a Shelter in Place Strategy

Given the short duration of local flood inundation and potentially hazardous conditions within some of the local roadways, a shelter in place flood emergency response is preferable to flood evacuation.

In 2025 NSW DPHI established a set of guidelines for a shelter in place emergency response to flash flooding. This identifies a list of important considerations for confirming whether a shelter in place is an appropriate emergency management strategy, as follows:

- does shelter in place align with existing emergency management strategies for the area, as determined through the flood risk management process and by the NSW SES
- has evacuation off-site (the primary emergency management strategy) been investigated and determined to be unachievable
- does the development include medical centres, emergency service and community facilities, and sensitive and hazardous land uses, some of which may not be suitable for shelter in place
- shelter in place for greenfield development is not supported
- whether there is existing government developed flood warning systems that give advanced detailed forecasts of flash flooding to allow sufficient time to evacuate to the proposed refuge locations
- can the community effectively be informed of the risks associated with the emergency management strategy.

The KV/JL FRMSP identifies a shelter in place strategy as being appropriate for the local catchment flood conditions, and notes that it is endorsed as the appropriate strategy within the SES Wyong Local Flood Plan. Shelter in place is considered a pragmatic approach because of the short period of warning time, short period of potential isolation and relatively low flood hazard exposure to buildings, even at the PMF event.

Because of the short duration of critical flood conditions for the local catchment (< 15 minutes), evacuation off-site as a flood emergency response is unachievable, as there would be insufficient warning time to affect a safe evacuation. Further, potentially hazardous conditions in the local roadways would present a far greater risk to residents attempting to evacuate rather than remaining within their homes.

The development does not include sensitive and hazardous land uses that would not be suitable for shelter in place. Further, any potential isolation would be very short lived, minimising the risks associated with a shelter in place strategy.

The Site is not a greenfield location, and no warning system is required because there is no dedicated flood refuge area that residents would need to relocate to, with all FFLs set above the PMF level. The effectiveness of a shelter in place strategy for this location is not dependant on the effective communication of any associated risks to the residents. This is because the duration of affectation would be so short and no action is required from residents to respond and act to a flood event; they can simply remain in their homes. They would be inclined to do this in any case, due to the weather conditions that would be prevalent during any inundation of the external surfaces and local roadways at the Site.

With these initial considerations being satisfied, the FIRA is required to include:

- detailed assessment of evacuation off-site (the primary emergency management strategy) to determine that evacuation off-site is not achievable.
- the flood behaviour at the site, with consideration of climate change and assessment of the potential maximum duration of isolation up to and including the PMF to identify that:
 - flash flooding is the only flood risk present at the site, whether it be from overland flooding, local creek or riverine flooding, and
 - the flooding occurs within less than 6 hours from the commencement of causative rain and the duration of shelter in place due to isolation by floodwaters is less than 12 hours from the commencement of rainfall, and
 - the development is not subject to high hazard flooding (e.g. floodways, high hazard H5 or H6 areas) or surrounding roadways are not subject to high hazard flooding.

Flood inundation within Ashton Avenue at the PMF event begins within 5-6 minutes of the onset of flood-producing rainfall and then subsides again within another 10 minutes. The visibility during this time would be minimal because of the intensity of rainfall. Evacuation off site is simply not a viable option given these constraints. It is also not required, as residents are placed at no risk by simply remaining within their homes.

With the Site being elevated above at around 13.5-16.5 m AHD, flash flooding is the only flood risk at the Site, being elevated above potential flooding from oceanic inundation (including sea level rise) or from catchment inflows to Tuggerah Lake.

Figure 3-8 shows that the Site is principally a low flood hazard (H1) environment. Whilst there is some localised high hazard (H5), it is largely confined to the dedicated overland flow path along the western side of the Site and does not impact the safety of the building as a flood refuge for shelter in place. Whilst high hazard (H5) flood conditions are modelled within Ashton Avenue at the PMF event, the conditions are largely free from high hazard in the other surrounding roadways.

5.2 Implementation of a Shelter in Place Strategy

5.2.1 Requirements of the Shelter in Place Guidelines

With the flood behaviour at the Site being consistent with the requirements for shelter in place, and if the consent authority considers shelter in place is an appropriate emergency response strategy, the following items must also be considered through a FIRA:

- how shelter in place will be used as part of the site's emergency management response, including actions before, during and after sheltering in place

- how shelter in place will be communicated to occupants and visitors of the building and how this communication will be maintained for the life of the development.
- an understanding of the secondary risks and how the proponent proposes they will be managed is outlined in the FIRA. Secondary risks include medical emergencies, building fire, health and wellbeing. Table 12 of EM01 should be used to consider whether the risks could be effectively managed.

The consent authority should reflect the following design criteria in relevant conditions of consent:

- the floor level of the shelter in place part of the development be above the PMF, and
- structural soundness for conditions in a PMF event, considering flood and debris forces, be verified by a suitably qualified structural engineer, and
- area and access to the area does not rely on access to electricity, is self-directing, and have clearly marked internal access for all people on site, including consideration of access for potential occupants and/or visitors.

The consent authority may also consider the following design criteria when setting relevant conditions of consent depending on the scale and type of development:

- protection from weather and appropriate heating and cooling
- access to personal hygiene facilities such as a toilet
- a minimum floor space of 2 m² per person
- items for self-sufficiency that are stored, maintained and are regularly updated in an accessible location above the PMF, including sufficient drinking water and food for occupants, fire extinguishers, radios and torches with spare batteries, and a first aid kit with an automated external defibrillator (AED)
- centralised communal shelters may be considered but must be freely accessible internally at all times and externally accessible during events
- access is provided to onsite systems that generate power of the shelter in place location during and after the event for a full range of flood events up to the PMF
- detail how these requirements will be maintained and enforced for the life of the development.

5.2.2 Provision of the Requirements

An FERP shouldn't be required for the proposed development as the residents are not required to undertake any specific actions in preparation for, or in response to, a flood event. They can safely remain in their home with no significant exposure to either direct or secondary impacts of flooding. However, if the consent authority believes that an FERP is required then the details of the proposed flood emergency response can be addressed in a Flood Emergency Response Plan (FERP) and incorporated within the broader risk management and emergency management for the Site. Whilst this is typically required at the Occupation Certificate stage, the overall strategy that would be implemented in an FERP is outlined in Section 5.3 for development approval.

With the proposed development having FFLs set above the PMF level, the flood emergency response becomes much more straightforward. There is no requirement to relocate residents to a specific refuge within the building, as the entire building provides appropriate refuge. The flood hazard conditions, even at the PMF event, do not present a risk to the structural integrity of the building.

Because the entire building is suitable for flood refuge, the specific flood refuge requirements such as shelter, toilet facilities, available floor space and access to supplies are inherently satisfied.

5.3 Flood Emergency Response Strategy

5.3.1 Flood Emergency Response Actions

There are no actions that need to be undertaken in preparation for a potential flood event. Any period of isolation at the Site would be very short-lived, with hazardous inundation of Ashton Avenue only expected to last for a period of several (< 10) minutes. Residents are more likely to be confined to their homes through inclement weather associated with a flood event than flood inundation itself. As there is no extended period of isolation associated with flooding, there is no need to prepare for such a scenario.

During a flood event, residents should remain within their homes, where they are safe. Inclement weather conditions would deter this in any case, as the rainfall intensity would limit visibility and the storm system could also be associated with dangerous wind conditions. Leaving the safety of the building would present a greater risk to life than remaining indoors.

There are no specific actions required by residents following a flood event.

5.3.2 Flood Emergency Response Communication

There is no requirement to communicate a flood emergency response to residents of the Site because all dwellings are located above the PMF level. They are not required to mobilise in response to a flood event to relocate to a dedicated flood refuge area.

5.3.3 Management of Secondary Risks

Secondary risks include incidents such as a fire or medical emergency. Because any period of potential isolation during a flood event is so short, there is no significant increase in exposure or response to secondary risks.

6 Conclusions

Torrent Consulting was commissioned by Pacific Link Housing Limited to prepare this report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD-84190958) for the proposed development of 23-25 Ashton Avenue, The Entrance, NSW (the Site).

The nature of modelled surface water inundation at the Site is of a stormwater management scale, rather than a major overland flood flow scale to which floodplain risk management measures would be applicable. Whilst there is no clear guidance in NSW as to what should be considered a stormwater management surface water condition as opposed to a floodplain risk management condition, it is important to note that legally the Australian Insurance industry classifies inundation at the Site as stormwater rather than flood water, as surface flows at the Site have not escaped the confines of a channel or a dam.

Nevertheless, because the Site is recognised as being flood-affected by Central Coast Council (CCC), this assessment treats the Site as such and addressed the management of flood risk, accordingly. A detailed TUFLOW model has been developed for this assessment to simulate local catchment runoff and drainage.

The proposed development has been assessed against the flood planning requirements of the SEARs, Central Coast LEP and Central Coast DCP. This has found the proposed development to satisfy these requirements. There is a minor exposure of risk from ingress of external surface water runoff to some of the ground floor non-habitable spaces, which have been mitigated as far as practical.

The appropriate flood emergency response is for residents to shelter in place within their dwellings. The flood risk exposure has been reviewed against the requirements of the DPHI Shelter-in-place guidelines and found to be consistent with these. There are no actions that need to be undertaken by residents in preparation for, during, or after a potential flood event. Any period of isolation at the Site would be very short-lived, with hazardous inundation of Ashton Avenue only expected to last for a period of several (< 10) minutes.

During a flood event, residents should remain within their homes, where they are safe. Inclement weather conditions would deter this in any case, as the rainfall intensity would limit visibility and the storm system could also be associated with dangerous wind conditions. Leaving the safety of the building would present a greater risk to life than remaining indoors.

7 References

AIDR (2017) *Guideline 7-3, Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia*

Catchment Simulation Solutions (2021) *Killarney Vale / Long Jetty Catchments Floodplain Risk Management Study and Plan*

Central Coast Council (2023) *Development Control Plan*

Central Coast Council (2022) *Local Environment Plan*

DPHI (2025) *Shelter in Place Guideline for Flash Flooding*

Geoscience Australia (2019) *Australian Rainfall and Runoff: A Guide to Flood Estimation*

Appendix A Existing Conditions Flood Mapping



Title:

Modelled 20% AEP Design Storm Condition Existing Scenario

0 40 80 m



approx. scale

Figure:

A-1

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Title:
**Modelled 10% AEP Design Storm Condition
 Existing Scenario**

0 40 80 m
 approx. scale

Figure: **A-2** Information shown on this figure is compiled from numerous sources and may not be complete or accurate. Torrent Consulting cannot be held responsible for the misuse or misinterpretation of any information and offers no warranty guarantees or representations of any kind in connection to its accuracy or completeness. Torrent Consulting accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the information.

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Title:

Modelled 5% AEP Design Storm Condition Existing Scenario

0 40 80 m



approx. scale

Figure:

A-3

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Title:

Modelled 2% AEP Design Storm Condition Existing Scenario

0 40 80 m



approx. scale

Figure:

A-4

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Title:

Modelled 1% AEP Design Storm Condition Existing Scenario

0 40 80 m



approx. scale

Figure:

A-5

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Title:
**Modelled 1-in-200 AEP Design Storm Condition
 Existing Scenario**

0 40 80 m
 approx. scale

Figure: **A-6** Information shown on this figure is compiled from numerous sources and may not be complete or accurate. Torrent Consulting cannot be held responsible for the misuse or misinterpretation of any information and offers no warranty guarantees or representations of any kind in connection to its accuracy or completeness. Torrent Consulting accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the information.

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Title:

Modelled 1-in-500 AEP Design Storm Condition Existing Scenario

0 40 80 m



approx. scale

Figure:

A-7

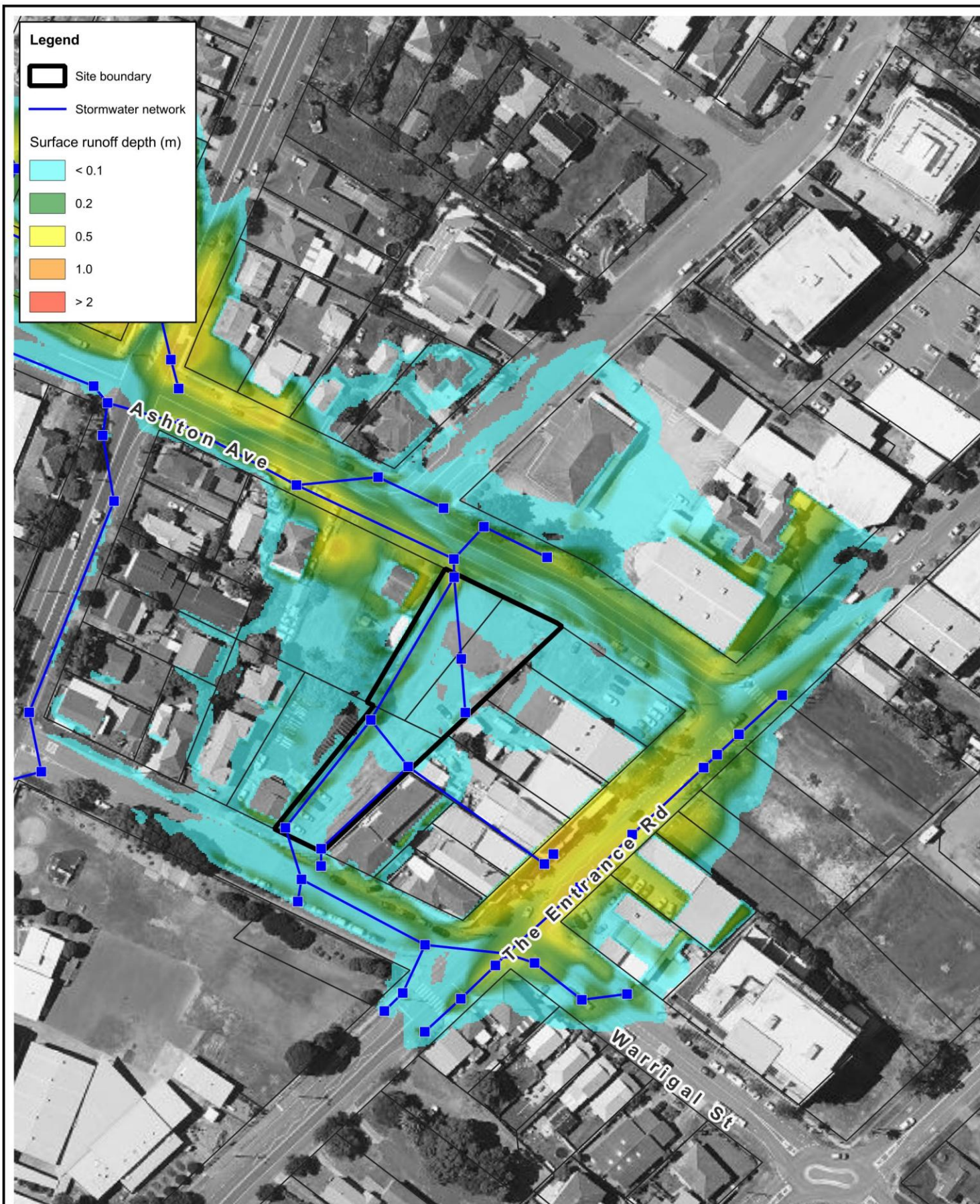
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Title: Modelled PMF Design Storm Condition Existing Scenario		0 40 80 m approx. scale	
Figure:	A-8	Information shown on this figure is compiled from numerous sources and may not be complete or accurate. Torrent Consulting cannot be held responsible for the misuse or misinterpretation of any information and offers no warranty guarantees or representations of any kind in connection to its accuracy or completeness. Torrent Consulting accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the information.	
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Appendix B Post-Development Flood Mapping



Title:

Modelled 20% AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-1

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Title:

Modelled 10% AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-2

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Title:
**Modelled 5% AEP Design Storm Condition
 Post-development Scenario**

0 40 80 m
 approx. scale

Figure: **B-3**
 Revision: **A**

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Title:

Modelled 2% AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-4

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Title:

Modelled 1% AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-5

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Title:

Modelled 1-in-200 AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-6

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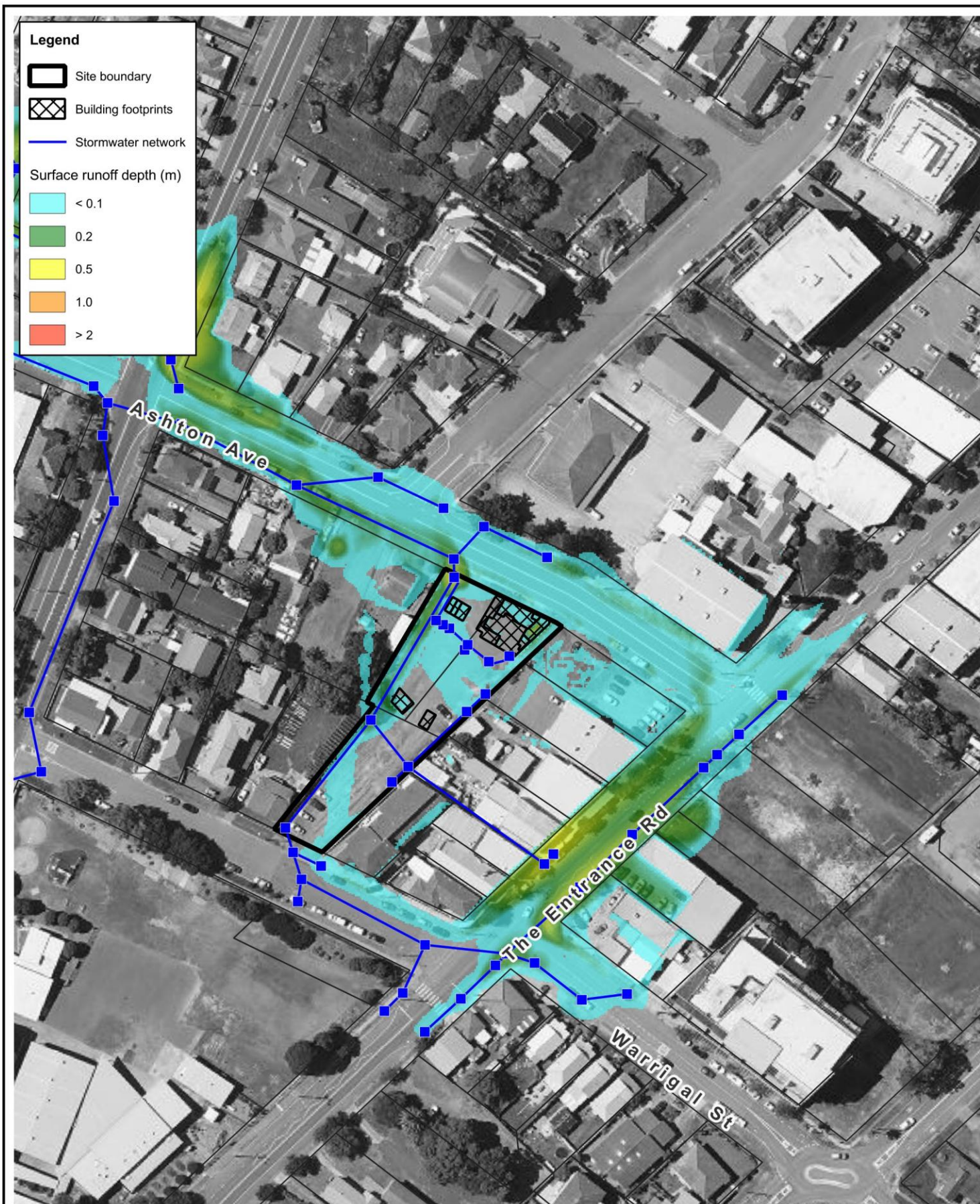
Revision:

A



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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_206_251217_200y_dev.qgz



Title:

Modelled 1-in-500 AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-7

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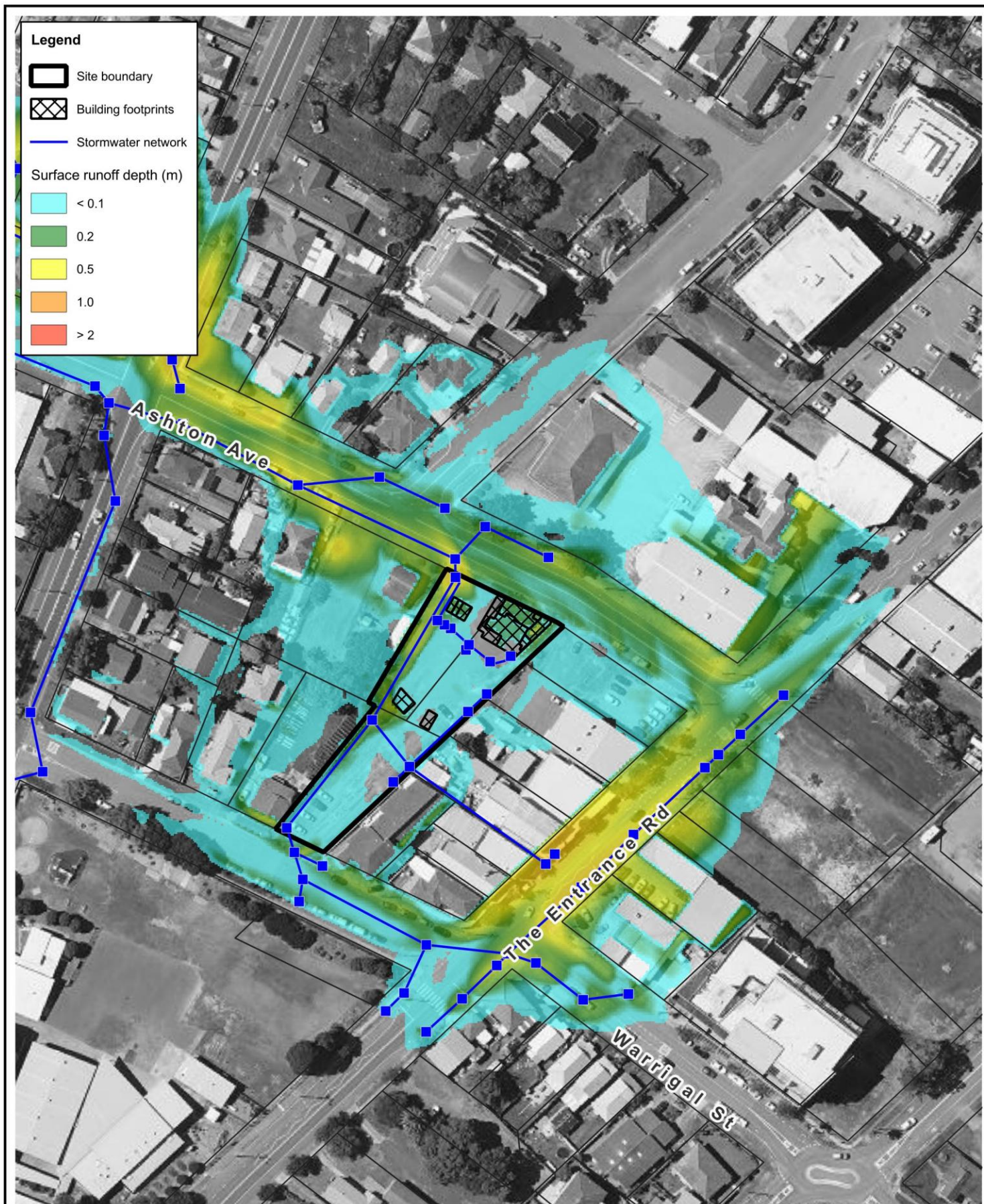
Revision:

A



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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_207_251217_500y_dev.qgz



Title:

Modelled PMF Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-8

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_208_251217_pmf_dev.qgz

Appendix C Peak Flood Level Impact Mapping



Title:

Modelled 20% AEP Peak Flood Level Impact

0 40 80 m



approx. scale

Figure:

C-1

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_301_251217_5y_h_impact.gqz



Title:

Modelled 10% AEP Design Storm Condition Post-development Scenario

0 40 80 m



approx. scale

Figure:

B-2

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_202_251217_10y_dev.qgz



Title:

Modelled 5% AEP Peak Flood Level Impact

0 40 80 m

approx. scale

Figure:

C-3

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_303_251217_20y_h_impact.qgz





Title:

Modelled 2% AEP Peak Flood Level Impact

0 40 80 m

approx. scale

Figure:

C-4

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_304_251217_50y_h_impact.qgz







Title:

Modelled 1-in-200 AEP Peak Flood Level Impact

0 40 80 m

approx. scale

Figure:

C-6

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_306_251217_200y_h_impact.qgz





Title:

Modelled 1-in-500 AEP Peak Flood Level Impact

0 40 80 m

approx. scale

Figure:

C-7

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Appendix D Post-Development Flood Hazard Mapping



Title:

20% AEP Flood Hazard Classification Post-development Scenario

0 40 80 m

approx. scale

Figure:

D-1

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_401_251217_5y_haz.qgz



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Title:

10% AEP Flood Hazard Classification Post-development Scenario

0 40 80 m



approx. scale

Figure:

D-2

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_402_251217_10y_haz.qgz



Title:

5% AEP Flood Hazard Classification Post-development Scenario

0 40 80 m

approx. scale

Figure:

D-3

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Title:
**2% AEP Flood Hazard Classification
 Post-development Scenario**

0 40 80 m
 approx. scale

Figure: **D-4** Information shown on this figure is compiled from numerous sources and may not be complete or accurate. Torrent Consulting cannot be held responsible for the misuse or misinterpretation of any information and offers no warranty guarantees or representations of any kind in connection to its accuracy or completeness. Torrent Consulting accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the information.

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_404_251217_50y_haz.qgz



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Title:

1% AEP Flood Hazard Classification Post-development Scenario

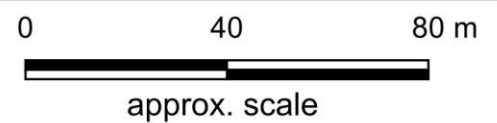


Figure: **D-5**

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Revision: **A**





Title:

1-in-200 AEP Flood Hazard Classification Post-development Scenario

0 40 80 m

approx. scale

Figure: **D-6**

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Filepath: Z:\Projects\T2388_Ashton_Ave\GIS\T2388_406_251217_200y_haz.qgz



Title:

1-in-500 AEP Flood Hazard Classification Post-development Scenario

0 40 80 m



approx. scale

Figure:

D-7

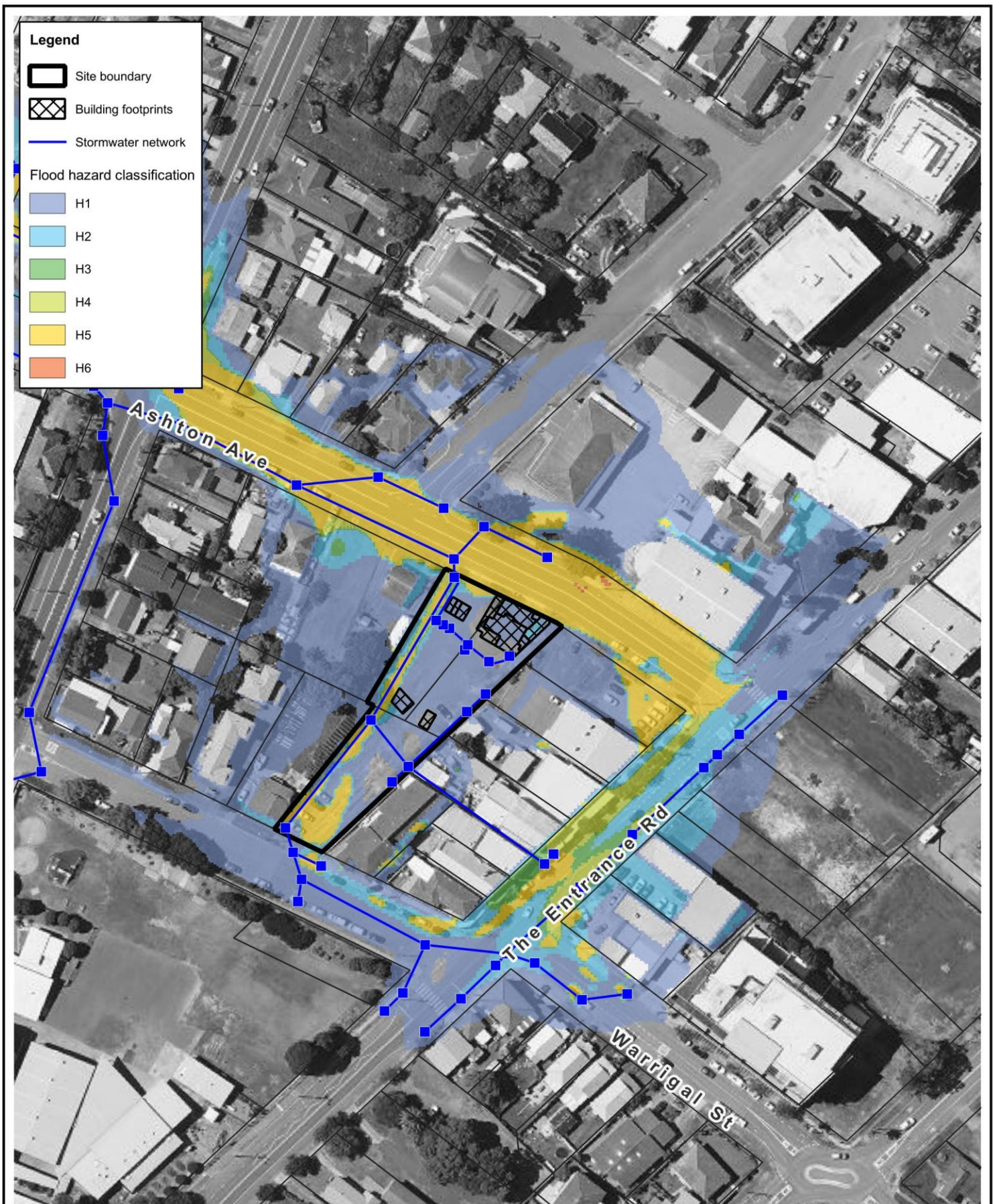
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Title:

PMF Flood Hazard Classification Post-development Scenario

0 40 80 m



approx. scale

Figure:

D-8

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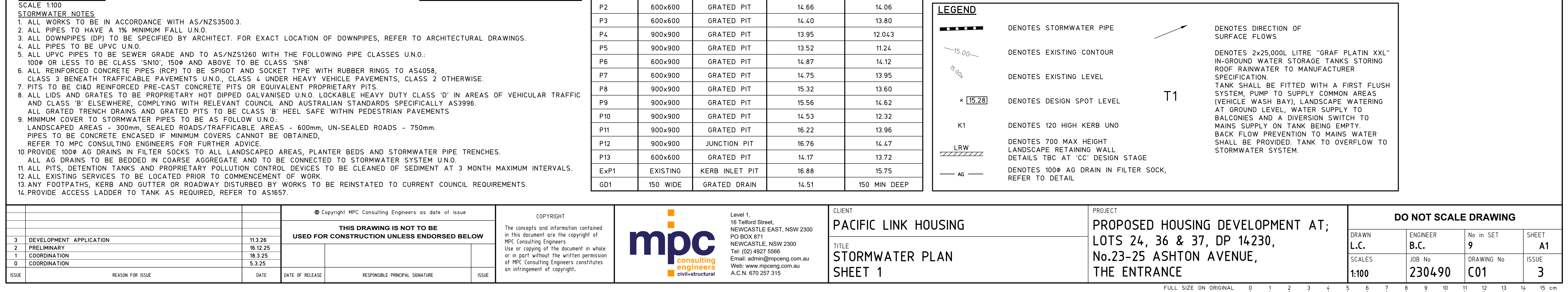


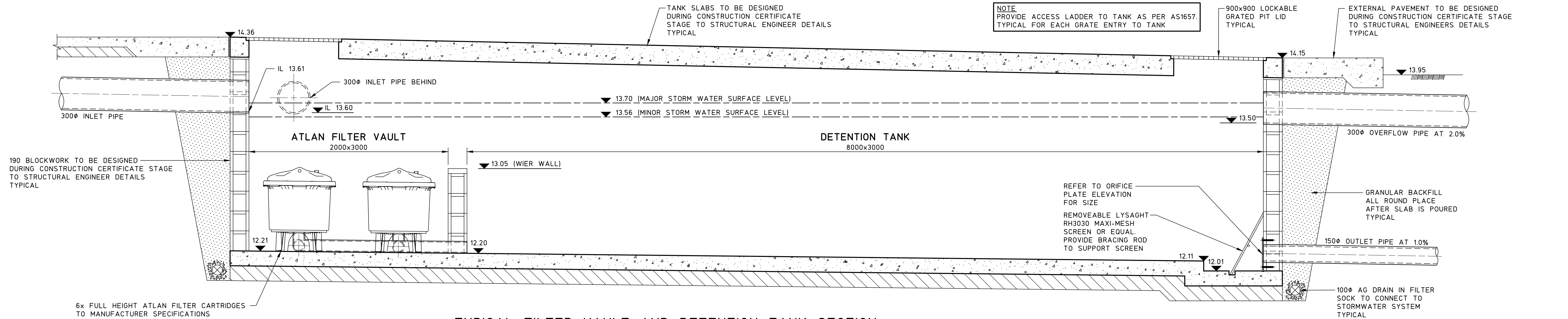
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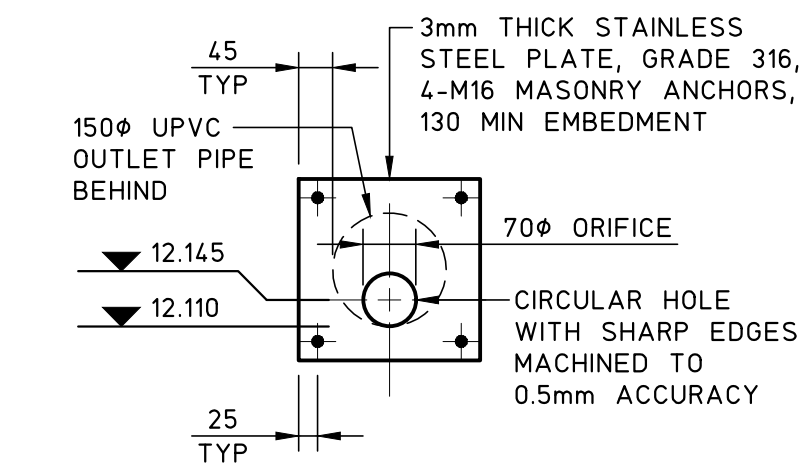
Appendix D

Stormwater Management Plans



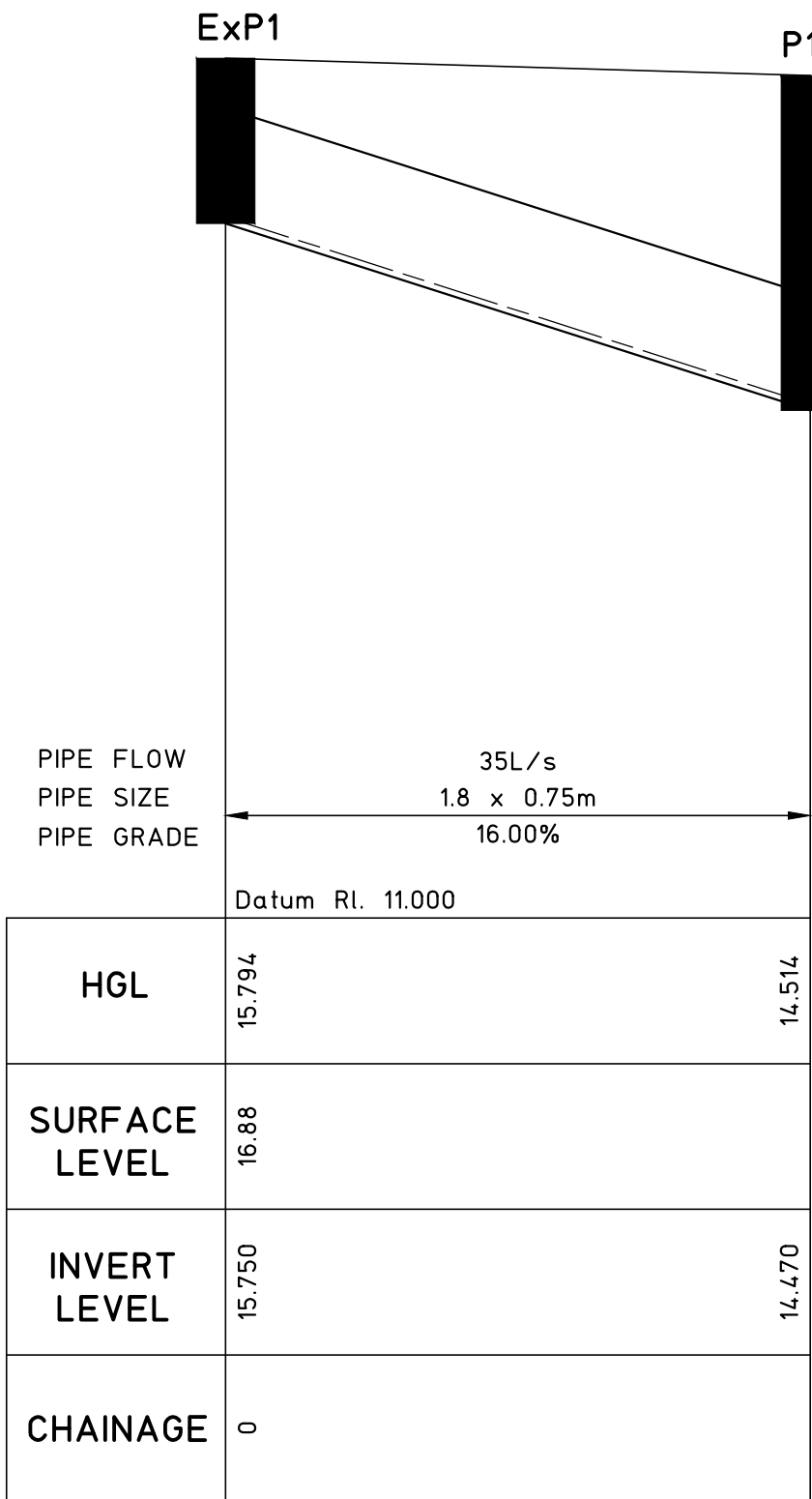


TYPICAL FILTER VAULT AND DETENTION TANK SECTION
SCALE 1:20

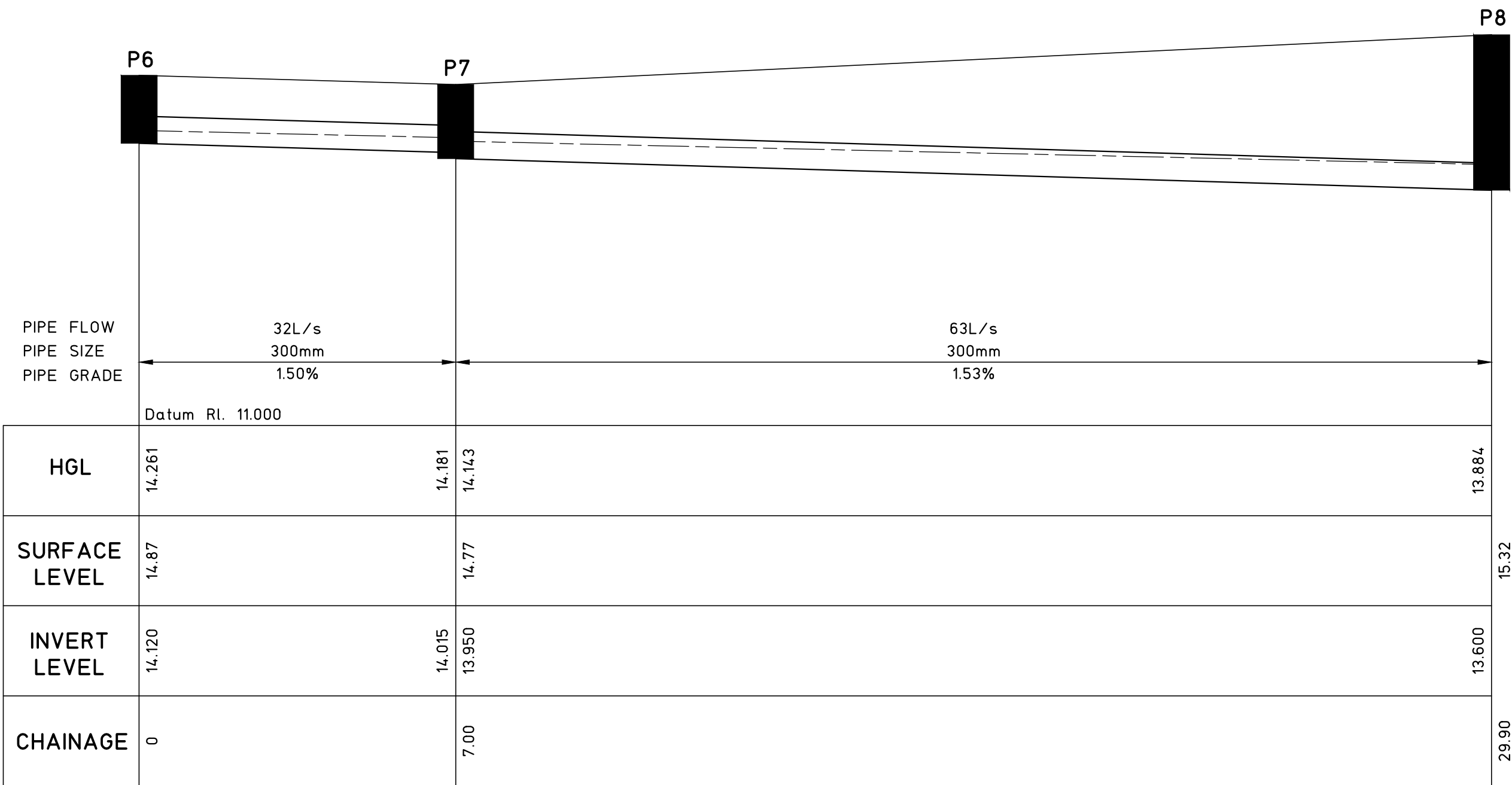


ORIFICE PLATE ELEVATION
SCALE 1:10

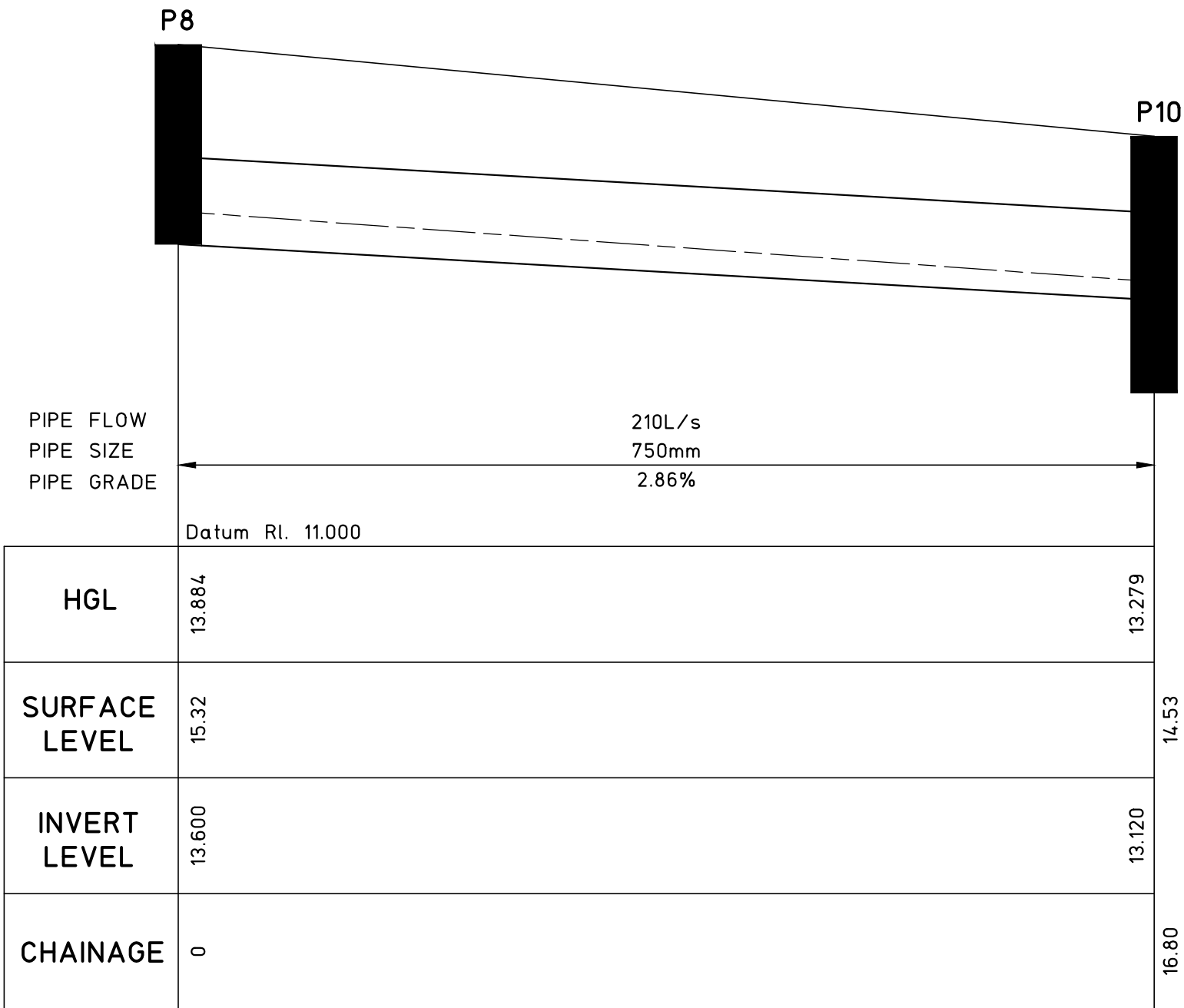
NOT FOR CONSTRUCTION



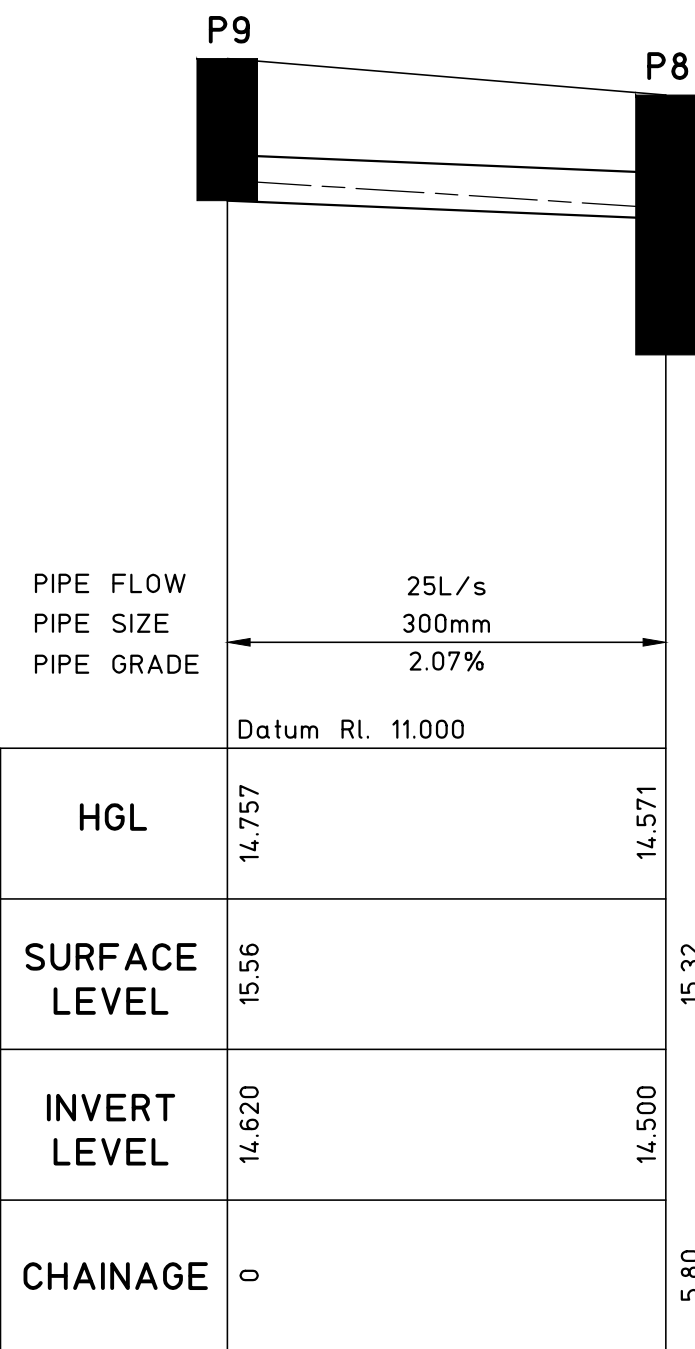
ExP1 TO P12
SCALE HORIZONTAL 1:100, VERTICAL 1:200



P6 TO P8
SCALE HORIZONTAL 1:100, VERTICAL 1:200



P8 TO P10
SCALE HORIZONTAL 1:100, VERTICAL 1:200



P9 TO P8
SCALE HORIZONTAL 1:100, VERTICAL 1:200

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3	DEVELOPMENT APPLICATION	11.3.26								Level 1, 16 Talford Street, NEWCASTLE EAST, NSW 2300 PO BOX 871 NEWCASTLE, NSW 2300 Tel: (02) 4927 5566 Email: admin@mpceng.com.au Web: www.mpceng.com.au A.C.N. 670 257 315		TITLE STORMWATER DETAILS		SCALES AS NOTED		JOB No 230490		DRAWING No C03		ISSUE 3	
2	PRELIMINARY	16.12.25																			
1	COORDINATION	18.3.25																			
0	COORDINATION	5.3.25																			
ISSUE		REASON FOR ISSUE		DATE		DATE OF RELEASE		RESPONSIBLE PRINCIPAL SIGNATURE		ISSUE											

Appendix E

Pre-Developed Flow Calculations

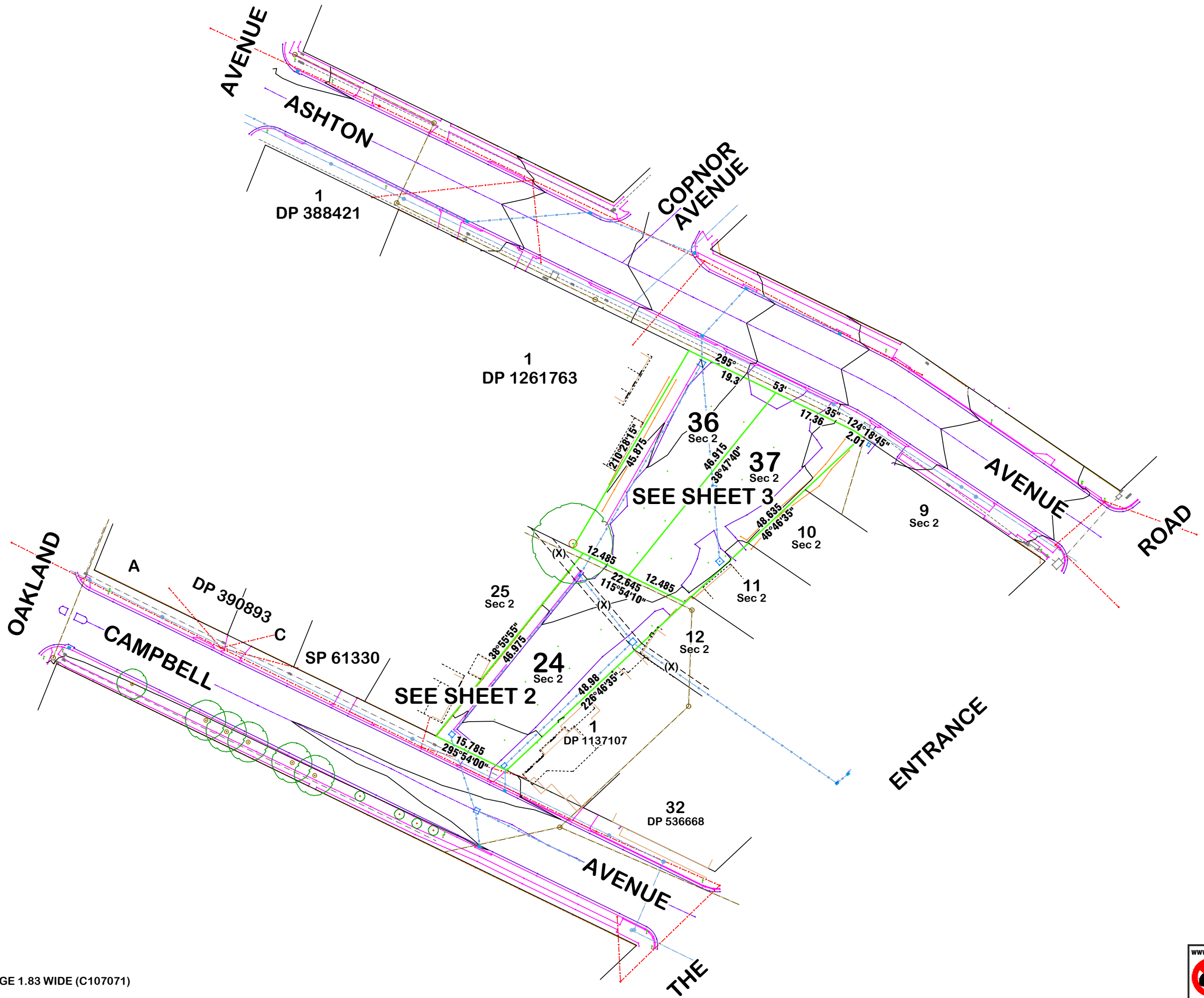
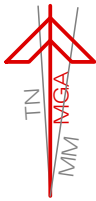
Site Catchment Area = 2336m²
Major Storm:
 $t_c = 3\text{min (sheet flow)} + 2\text{mins (concentrated flow)} = 5\text{min}$
 $Q_{100_predev} = 124 \text{ L/s}$
Minor Storm:
 $t_c = 4\text{min (sheet flow)} + 3\text{mins (concentrated flow)} = 7\text{min}$
 $Q_{10_predev} = 53 \text{ L/s}$

Concentrated flow length 49.0m
Height diff. = 14.50 - 13.50 = 1.0m
Slope = 2.0%
Flow duration = 1min

Concentrated flow length 13.4m
Height diff. = 15.00 - 14.50 = 0.50m
Slope = 3.7%
Flow duration < 1min

30m sheet flow length.
Height diff. = 16.92 - 15.00 = 1.92m
Slope = 6.4%
Flow time = 3min (major storm)
Flow time = 4min (minor storm)

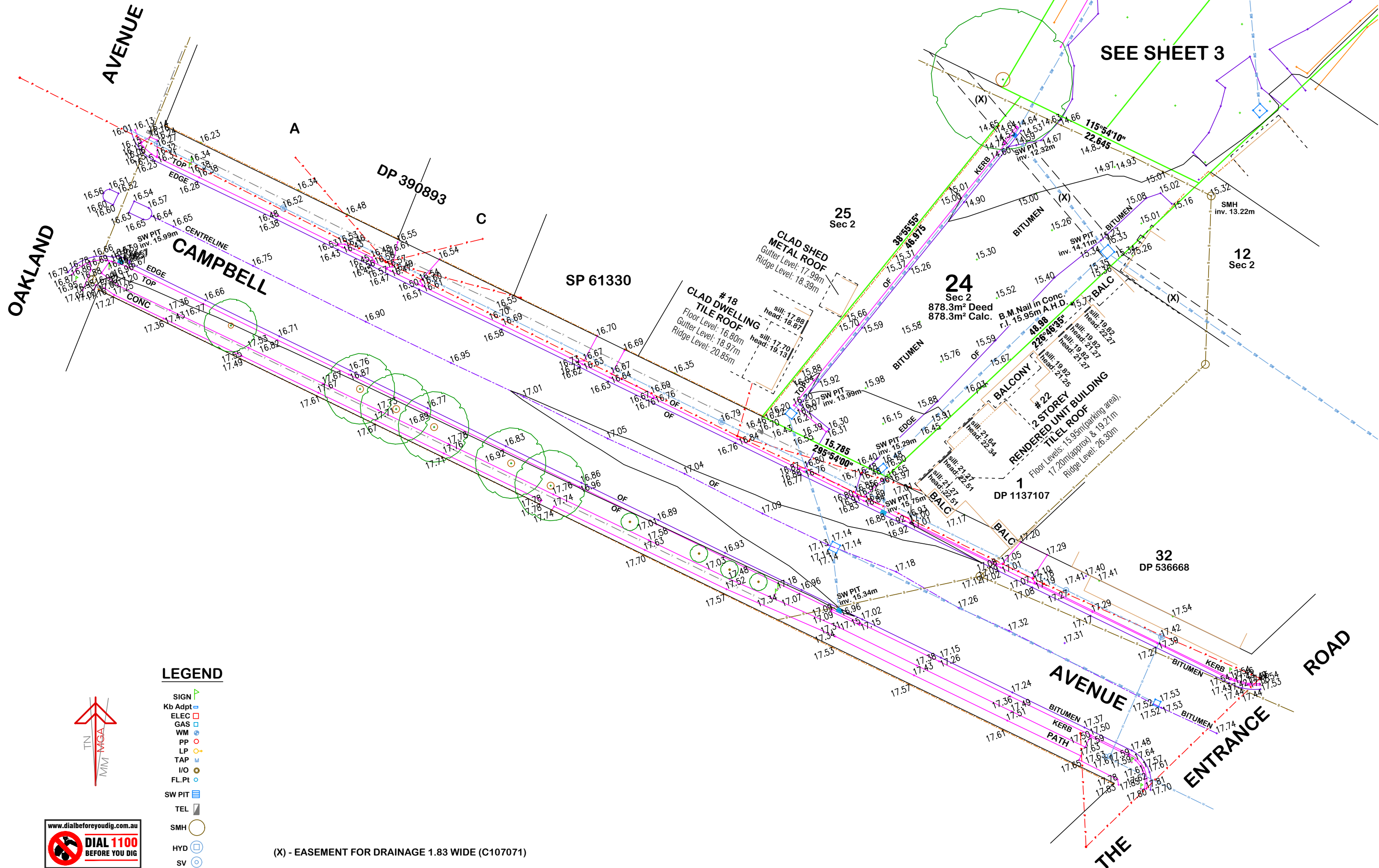
266.5 sq m



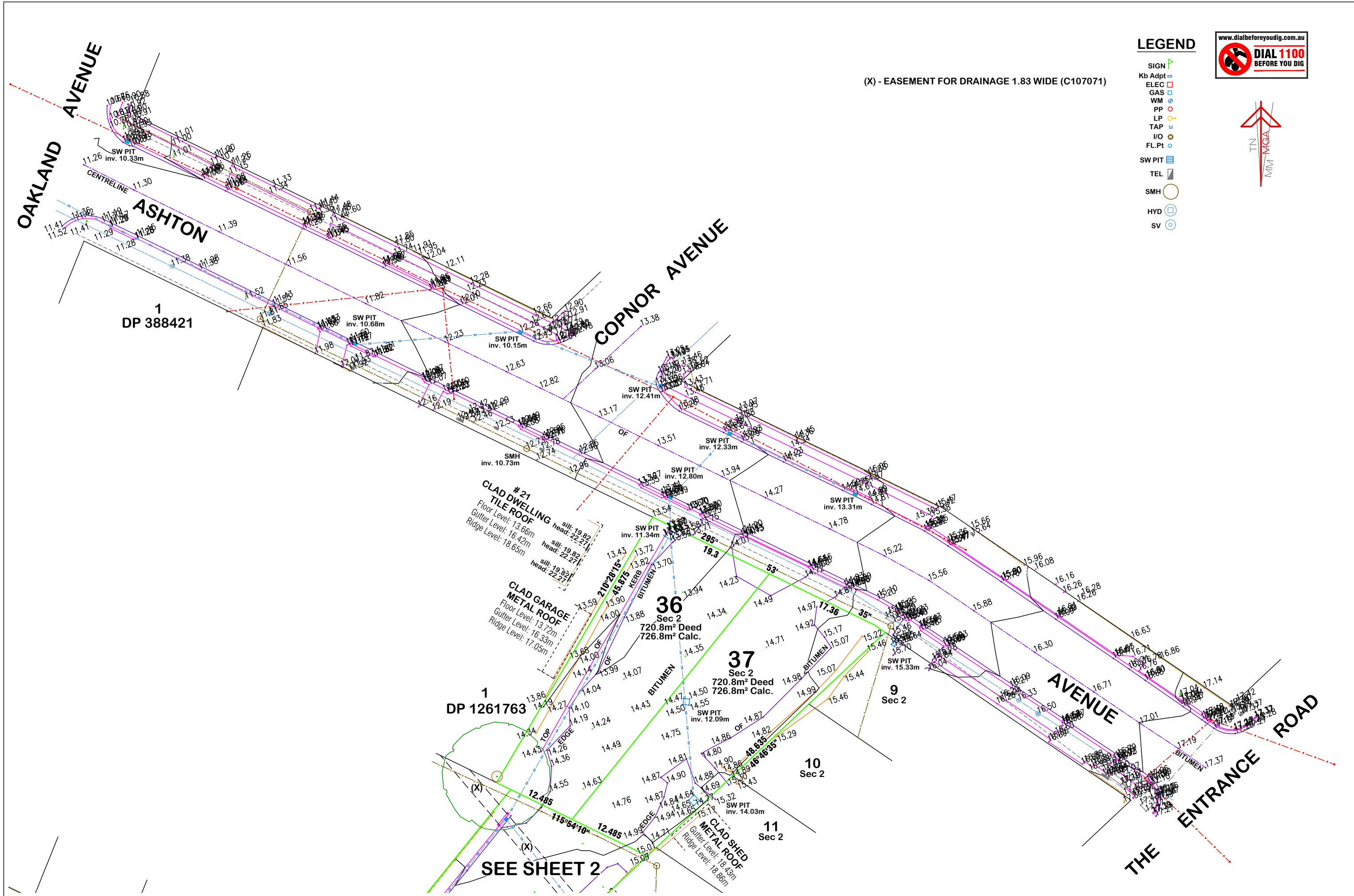
(X) - EASEMENT FOR DRAINAGE 1.83 WIDE (C107071)



	Origin of Levels : PM 17595 fd. Location : Oakland Dve, The Entrance. R.L. : 11.608m A.H.D.		revision: A	description: Underground Services Updated		date: 05/12/2023	client: PACIFIC LINK HOUSING LIMITED	 Clarke Dowdle & Associates Development Consultants surveyors - planners - ecologists - bushfire consultants #1 OSCAR STREET UMINA BEACH NSW 2257 ph (02)43443553 fax (02)43446636 email admin@cdasurveys.com.au Po Box 3122 Umina NSW 2257	project: #23-25 ASHTON AVENUE, THE ENTRANCE. details: Lots 24, 36 & 37 of Sec 2 in DP 14230 drawing: SITE PLAN	red. ratio: 1:800	datum: A.H.D.	-all dimensions are in metres unless otherwise shown. -check and confirm all areas & dimensions on site prior to the commencement of any works. -do not scale from face of plan. -preliminary boundary fixation has been undertaken only. -if any construction is planned on or close to the boundaries further survey work will be required. -a complete investigation of services has not been undertaken for this survey. -services shown hereon have been located by visible features only. -tree trunk & height dimensions are approximate only. -tree spreads are approximate only but have been drawn to scale. -ridge& gutter levels displayed on buildings are approximate only. -underground utility mains locations are provided by Council diagrams & are approx positions only.
			assessed: A.W.C.	reference #Go: 25958	ref ext:							
			drawn: R.G.	contour interval: 1m	DA #:							
	These Drawings are for the express use of the intended recipient only. These drawings are not to be used / copied or forwarded to any unauthorised parties in part or whole without the express permission of Clarke Dowdle & Associates. Copyright and rights of use remain the property of Clarke Dowdle & Associates.		surveyed: W.Q.	job date: 27/04/2023	number in set: 1 of 3							
approved:						LGA: CENTRAL COAST						
Registered Surveyor						Parish: TUGGERAH						
						County: NORTHUMBERLAND						



	Origin of Levels : PM 17595 fd. Location : Oakland Dve, The Entrance. R.L. : 11.608m A.H.D.	revision		description:		date:		client:			
		A		Underground Services Updated		05/12/2023		PACIFIC LINK HOUSING LIMITED			
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				drawn:		R.G.					
				surveyed:		W.Q.					
		Registered Surveyor									



LEGEND

- SIGN
Kb Adpt
ELEC
GAS
WM
PP
LP
TAP
I/O
FL.Pt
SW PIT
TEL
SMH
HYD
SV



(X) - EASEMENT FOR DRAINAGE 1.83 WIDE (C107071)

	Origin of Levels : PM 17595 fd. Location : Oakland Dve, The Entrance. R.L. : 11.608m A.H.D.	revision	description:	date:	client:		Development Consultants surveyors - planners - ecologists - bushfire consultants #1 OSCAR BEACH STREET UMINA NSW 2257 ph (02)43443553 fax (02)43446636 email admin@cdasurveys.com.au Po Box 3122 Umina NSW 2257	project: #23-25 ASHTON AVENUE, THE ENTRANCE. details: Lots 24, 36 & 37 of Sec 2 in DP 14230 drawing: PLAN SHOWING SPOT-LEVELS, CONTOURS & DETAIL.	red. ratio:	1:500	datum:	A.H.D.	-all dimensions are in metres unless otherwise shown. -check and confirm all areas & dimensions on site prior to the commencement of any works. -do not scale from face of plan. -preliminary boundary fixation has been undertaken only. -if any construction is planned on or close to the boundaries further survey work will be required. -a complete investigation of services has not been undertaken for this survey. -services shown hereon have been located by visible features only. -tree trunk & height dimensions are approximate only. -tree spreads are approximate only but have been drawn to scale. -ridge& gutter levels displayed on buildings are approximate only. -underground utility mains locations are provided by Council diagrams & are approx positions only.		
		A	Underground Services Updated	05/12/2023	assessed:				A.W.C.	reference #Go:	25958	rel ext:			
					drawn:				R.G.	contour interval:	1m	DA #:			
					surveyed:				W.Q.	job date:	27/04/2023	number in set:		3 of 3	
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OAKLAND AVENUE

THE ENTRANCE

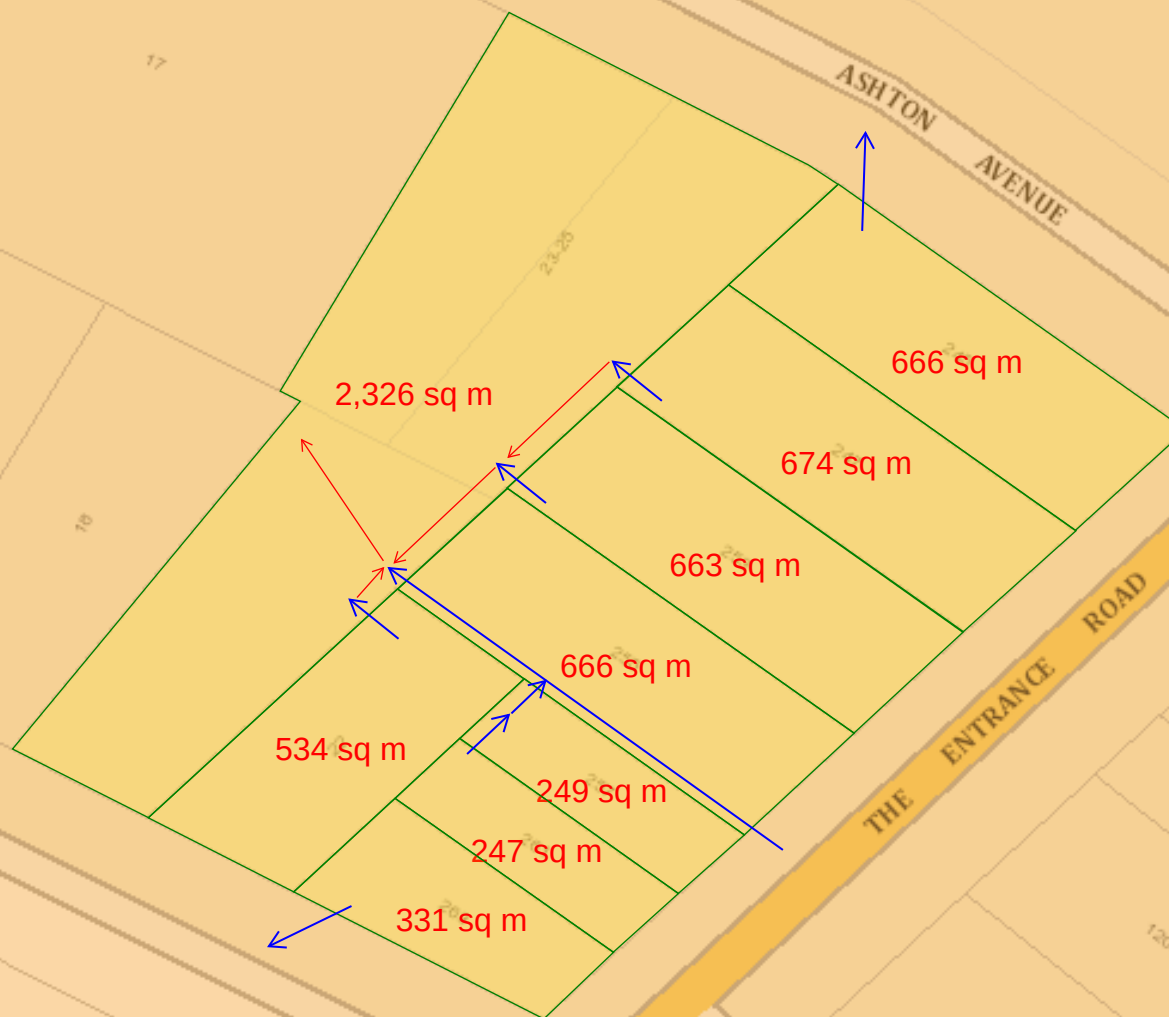
CATHOLIC CHURCH

ASHTON AVENUE

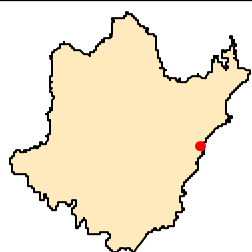
THE ENTRANCE ROAD

THE ENTRANCE
PUBLIC SCHOOL
PRESCHOOL

1:1,128
0 15 30m



The Entrance Map 2



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Date Printed: 9/15/2023

Scale - 1:500



Source: Central Coast Council
Projection: GDA 1994 Transverse Mercator; GCS_GDA_1994



Appendix F

MusicLink Report

MUSIC-link Report

Project Details		Company Details	
Project:	PLH Development, The Entrance	Company:	MPC Consulting Engineers
Report Export Date:	2/03/2026	Contact:	Benjamin Curran
Catchment Name:	Receiving Node	Address:	Lots 24, 36 & 37, DP 14230 No.23-25 ashton Avenue The Entrance NSW
Catchment Area:	0.2337ha	Phone:	0249275566
Impervious Area*:	75.2353444587077%	Email:	benjaminc@mpceng.com.au
Rainfall Station:	66062 SYDNEY		
Modelling Time-step:	Six minutes		
Modelling Period:	01/01/74 - 31/12/1993 11:54:00 PM		
Mean Annual Rainfall:	1296.513mm		
Evapotranspiration:	1261.468mm		
MUSICX Version:	1.50.1.14015 (5.50.0.14015)		
MUSIC-link data Version:	5.5		
Study Area:	Central Coast Council		
Scenario:	Central Coast Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node:	Reduction	Node Type	Number	Node Type	Number
Flow	52.132%	Rainwater Tank Nodes	1	Urban_Roof Nodes	1
TSS	94.255%	Swale Nodes	1	Urban_Mixed Nodes	2
TP	80.973%	Generic Treatment Nodes	4		
TN	71.809%	Detention Basin Nodes	2		
GP	100%				

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Generic	2xAtlan Stormsack (SQIDEP Verified)	High Flow Bypass	None	99	0.078 m³/s
Generic	6xAtlan Filter (FIL-3.0) Full Height (SQIDEP Verified)	High Flow Bypass	None	99	0.002 m³/s
Generic	Atlan Spillceptor Class 1	High Flow Bypass	None	99	0.1 m³/s
Generic	Generic Treatment 7	High Flow Bypass	None	99	0.1 m³/s
Receiving	Receiving Node	Flow Reduction	None	None	52.132 %
Receiving	Receiving Node	GP Reduction	90	None	100 %
Receiving	Receiving Node	TN Reduction	45	None	71.809 %
Receiving	Receiving Node	TP Reduction	45	None	80.973 %
Receiving	Receiving Node	TSS Reduction	80	None	94.255 %
Swale	Swale	Bed Slope	0.02	0.05	0.03 proportion
Urban_Mixed	Ground Source 1	Nitrogen Constituents.Base Flow.Mean	0.11	0.11	0.11
Urban_Mixed	Ground Source 1	Nitrogen Constituents.Storm Flow.Mean	0.3	0.3	0.3
Urban_Mixed	Ground Source 1	Phosphorus Constituents.Base Flow.Mean	-0.85	-0.85	-0.85
Urban_Mixed	Ground Source 1	Phosphorus Constituents.Storm Flow.Mean	-0.6	-0.6	-0.6
Urban_Mixed	Ground Source 1	Total Suspended Solids Constituents.Base Flow.Mean	1.2	1.2	1.2
Urban_Mixed	Ground Source 1	Total Suspended Solids Constituents.Storm Flow.Mean	2.15	2.15	2.15
Urban_Mixed	Ground Source 2	Nitrogen Constituents.Base Flow.Mean	0.11	0.11	0.11
Urban_Mixed	Ground Source 2	Nitrogen Constituents.Storm Flow.Mean	0.3	0.3	0.3
Urban_Mixed	Ground Source 2	Phosphorus Constituents.Base Flow.Mean	-0.85	-0.85	-0.85
Urban_Mixed	Ground Source 2	Phosphorus Constituents.Storm Flow.Mean	-0.6	-0.6	-0.6
Urban_Mixed	Ground Source 2	Total Suspended Solids Constituents.Base Flow.Mean	1.2	1.2	1.2
Urban_Mixed	Ground Source 2	Total Suspended Solids Constituents.Storm Flow.Mean	2.15	2.15	2.15
Urban_Roof	Roof	Nitrogen Constituents.Base Flow.Mean	0.32	0.32	0.32
Urban_Roof	Roof	Nitrogen Constituents.Storm Flow.Mean	0.3	0.3	0.3
Urban_Roof	Roof	Phosphorus Constituents.Base Flow.Mean	-0.82	-0.82	-0.82
Urban_Roof	Roof	Phosphorus Constituents.Storm Flow.Mean	-0.89	-0.89	-0.89
Urban_Roof	Roof	Total Suspended Solids Constituents.Base Flow.Mean	1.1	1.1	1.1
Urban_Roof	Roof	Total Suspended Solids Constituents.Storm Flow.Mean	1.3	1.3	1.3

Only certain parameters are reported when they pass validation

NOTE: A successful self-validation check of your model does not constitute an approved model by Central Coast Council
MUSIC-*link* now in MUSICX by eWater – leading software for modelling stormwater solutions



Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP)

VERIFICATION CERTIFICATE

Applicant Information

Applicant Name	Atlan Stormwater
Applicant Address	130 Sandstone Place, Parkinson, QLD 4115
Website	www.atlan.com.au
Contact Email	Andy.hornbuckle@atlan.com.au

Verified Technology

Product Title	Atlan Stormsack
SQIDEP Pathway	Field Evaluation via reviewed QAPP
Reviewed Documents	The following documents form the basis of this independent evaluation: - Stormsack detailed performance report (Stormsack DPR) (Issue 2) Drapper, D., Waldron, S., & Nyakas, L. (2024). SQIDEP Detailed Performance Report – Stormsack (Issue 2), Drapper Environmental Consultants, Crestmead, Queensland, Australia - Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1), 5 July 2024 Drapper, D., Nyakas, L. (2024). Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1), Drapper Environmental Consultants, Crestmead, Queensland, Australia - ATLAN Stormsack Device Lab Testing Report (Issue 3), 5 July 2024 Drapper, D.; Nyakas, L. ATLAN Stormsack Device Lab Testing Report (Issue 3); Drapper Environmental Consultants: Crestmead, Queensland, Australia, 2024. - StormSack Performance Assessment, Report Number: MHL2325, Manly Hydraulics Laboratory, November 2014.

Technology Information

Applicant's Verified Performance Claims (ER)	<table border="1" data-bbox="480 136 1121 360"> <thead> <tr> <th colspan="2">Parameter</th></tr> </thead> <tbody> <tr> <td>Total suspended solids</td><td>45%</td></tr> <tr> <td>Total phosphorus</td><td>47%</td></tr> <tr> <td>Total nitrogen</td><td>25%</td></tr> <tr> <td>Total petroleum hydrocarbons</td><td>Not claimed</td></tr> <tr> <td>Gross pollutants</td><td>100 %</td></tr> </tbody> </table> IEP's comments: Nil. IEP's recommendations: All performance claims are considered compliant up to the treatment flow rate for the applicable device. Verified flow rates are included in the table below: <table border="1" data-bbox="480 539 1236 795"> <thead> <tr> <th>Size of Stormsack (Pit dimensions) (mm)</th><th>TFR for MUSIC modelling – high flow bypass in litres per second</th></tr> </thead> <tbody> <tr> <td>450 x 450</td><td>10</td></tr> <tr> <td>600 x 600</td><td>25</td></tr> <tr> <td>600 x 900</td><td>32</td></tr> <tr> <td>900 x 900</td><td>39</td></tr> <tr> <td>1200 x 900</td><td>50</td></tr> <tr> <td>1200 x 1200</td><td>65</td></tr> </tbody> </table>	Parameter		Total suspended solids	45%	Total phosphorus	47%	Total nitrogen	25%	Total petroleum hydrocarbons	Not claimed	Gross pollutants	100 %	Size of Stormsack (Pit dimensions) (mm)	TFR for MUSIC modelling – high flow bypass in litres per second	450 x 450	10	600 x 600	25	600 x 900	32	900 x 900	39	1200 x 900	50	1200 x 1200	65
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Test Stormwater Runoff	21 compliant stormwater events. Water chemistry was compliant with Table 1 in SQIDEP v1.3. Minimum number of aliquots collected, and samples were representative.																										
Test Catchment	- The field testing for the ATLAN Stormsack (200) was carried out at Griffith University, Carpark H, Parkland Campus, Griffith Way, Southport, QLD, 4215. - The catchment area draining to the device was reported to be 1,181 m² directly connected to the Stormsack. The catchment was reported to be 66% impervious with the remainder including a eucalyptus forested area which drains to the Stormsack.																										
Maintenance Performed during monitoring	The Stormsack should be cleaned/maintained when accumulated pollutants reach the trigger level of 150mm depth in the bag, or 50% capacity by volume. The monitored Stormsack was maintained twice during the SQIDEP monitoring program due to construction loads received from earthworks undertaken in the upstream catchment. Regular inspection of the Stormsack is recommended, as per the manufacturer's O&M manual.																										

STORMWATER
AUSTRALIA

Verified method:

The Reviewers have verified that the method undertaken complies with the intent and specifics of SQIDEP v1.3.

A more detailed Independent Evaluatores Report is available to get an understanding of what was checked and how the claim was verified.

Conditions/Notes	MUSIC modelling shall be carried out as follows:		
	A generic node is to be used in MUSIC with a high flow bypass set to the applicable TFR (see table below) for the size of the Atlan Stormsack proposed and with inlet and outlet concentrations as follows:		
	Pollutant	Inlet concentration	Outlet Concentration
	TSS	100	55
	TP	100	53
	TN	10	7.5
	Size of Stormsack (Pit dimensions) (mm)	TFR for MUSIC modelling – high flow bypass in litres per second	
	450 x 450	10	
	600 x 600	25	
	600 x 900	32	
	900 x 900	39	
	1200 x 900	50	
	1200 x 1200	65	

Independent Reviewers

Evaluator Name	Evaluator Signature
Mark Liebman	
Baden Myers	

Issue of Verification Certificate

Acceptance by SQIDEP Governance Panel	
Acceptance by Stormwater Australia Board of Directors	
Verification Issued	
Stormwater Australia Verification Certificate Number Reference	SA-2024/12-VC

Verified under SQIDEP Version 1.3

Body of Evidence Pathway



OPERATION & MAINTENANCE MANUAL

AtlanFilter



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INTRODUCTION

Understanding how to correctly and safely maintain the AtlanFilter is essential for the preservation of the filter's condition and its operational effectiveness. The AtlanFilter 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 AtlanFilter 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 AtlanFilter product.



Figure 1 - AtlanFilters in a concrete chamber / vault

FEATURES

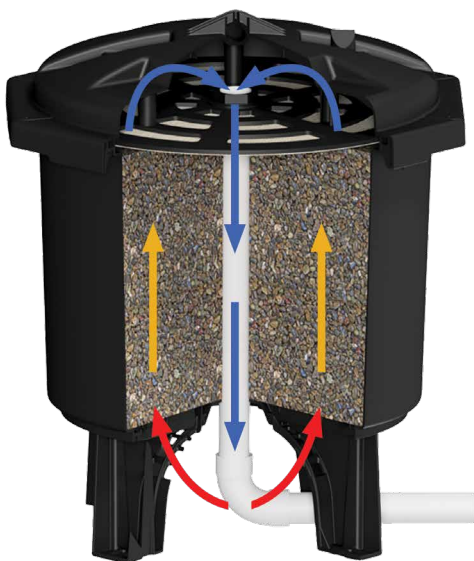


Figure 2 - Diagram of water flow through the AtlanFilter

The AtlanFilter 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 AtlanFilter 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 AtlanFilter cartridges to assist in sizing the weir.

The water to be treated enters the AtlanFilter cartridge via an upwards direction as the water level builds up around the AtlanFilter. 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.

AtlanFilter 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 AtlanFilter 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 AtlanFilter cartridge is higher than the surrounding water level.

The water inside the AtlanFilter 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 AtlanFilter 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 AtlanFilter cartridge system, which does not need replacement for at least 5 years, and typically will achieve up to 5-8 years of service (depending on catchment loading), subject to the AtlanFilter 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 AtlanFilter 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 AtlanFilter from sediment buildup. It is for this reason that Atlan recommended the sediment buildup not exceed 150mm above the vault floor, so as to avoid blocking the inlet ports of the AtlanFilter. Blockage of the inlet ports due to sediment accumulation in the vault floor will cause the AtlanFilter to go into bypass and be ineffective. Hence it is important to keep up to date with monitoring and maintaining the AtlanFilter vault.



Figure 4 - AtlanFilter feet.

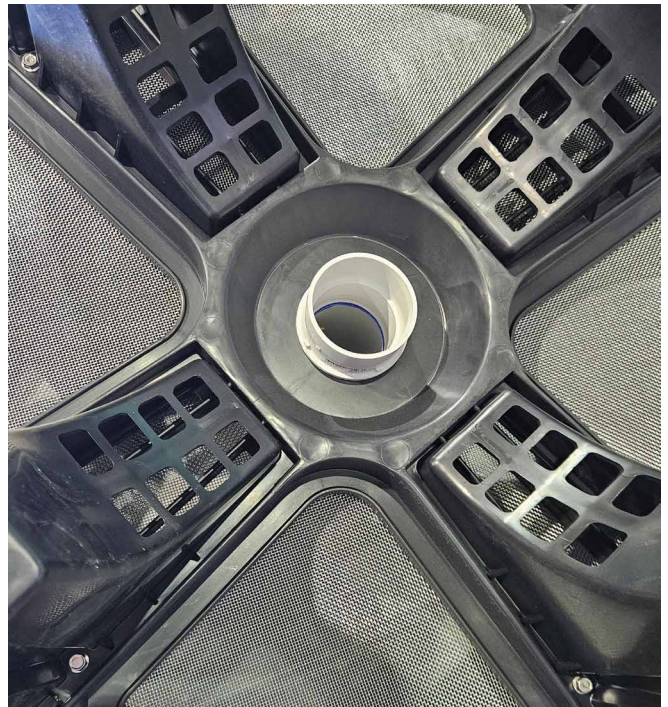


Figure 5 - Underside of the AtlanFilter showing the screened inlet ports and the connection for the outlet pipe in the middle.

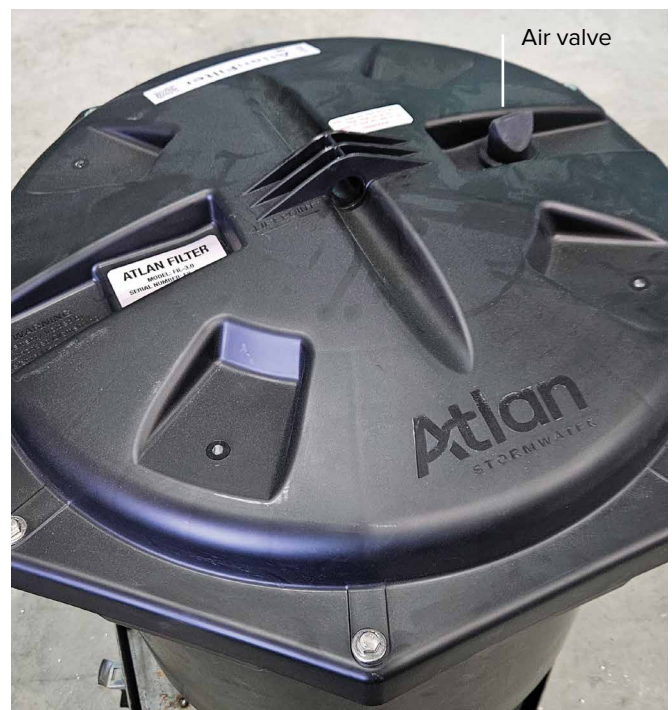


Figure 6 - the top of the AtlanFilter showing the location of the one way air valve.



SIZES

Atlan Stormwater manufactures two height cartridges for varying site constraints as shown below. Each cartridge is designed to treat stormwater at a flow rate of 1.5 litres per second and 3.0 litres per second for the half height cartridge (model no. FIL-1.5) and full-height cartridge (model no. FIL-3.0) respectively.



ATLANFILTER	STANDARD HEIGHT FIL-3.0	STANDARD HEIGHT - SHORT LEGS FIL-3.0.SF	HALF HEIGHT FIL-1.5	HALF HEIGHT - SHORT LEGS FIL-1.5.SF
Overall height	850mm	750mm	615mm	515mm
Diameter	726mm	726mm	726mm	726mm
Minimum head required	850mm	750mm	550mm	450mm
Treatment flow rate	3.0L/s	3.0L/s	1.5 L/s	1.5 L/s
Filter outlet diameter	50mm	50mm	50mm	50mm

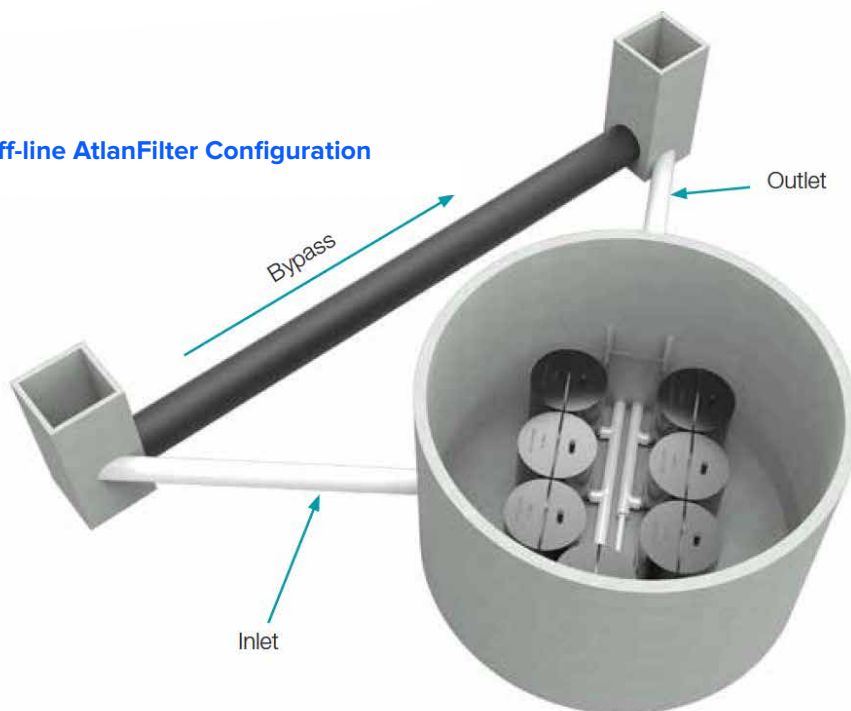
SYSTEM CONFIGURATION

AtlanFilter 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 AtlanFilter models. Typical AtlanFilter system configurations are shown below.

In-line AtlanFilter Configuration



Off-line AtlanFilter Configuration



HEALTH AND SAFETY

A. Personal health & safety

When carrying out the necessary installation operations of the AtlanFilter 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 AtlanFilter, 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 Atlan 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.



Hi-Vis Vest



Hard Hat



Boots



Gloves



Safety Glasses



Ear Protection



Harness



Respirator

MAINTENANCE FREQUENCY

The AtlanFilter's design allows for a greater life span when frequently maintenance. Maintenance is broken up into three categories which include:

- Standard inspection
- General cleaning
- Cartridge replacement.

Standard Inspection

Standard inspections are conducted at regular four month intervals. At this time, an approved trained maintenance officer or Atlan 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 AtlanFilter 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 AtlanFilter cartridge system. As the AtlanFilter ages, pollutants will inundate the cartridge and ultimately reduce the treatment flow rate. At this point, a AtlanFilter 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 AtlanFilter to be between 5 - 8 years (depending on catchment loading). As a minimum requirement, each AtlanFilter cartridge should be replaced within 10 years.

The life cycle of the AtlanFilter 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 AtlanFilter 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 Atlan StormSack.
- Unforeseen environmental hazards affecting the AtlanFilter functionality.

MAINTENANCE PROCEDURES

Stormwater pollutants captured and retained by the AtlanFilter 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 AtlanFilter 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 Atlan products to visual inspection the vault and filter conditions.

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

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

Confined space requirements may not be required if a full inspection and assessment of each AtlanFilter 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 tripod 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 Atlan Filters.

Perform safety procedures ie. Attach harnesses etc. (if confined space).

3. Open manhole lid

Once you have set 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. AtlanFilter system assessment

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

7. Reinstate AtlanFilter 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 Atlan 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 tripod above manhole

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Perform safety procedures ie. attach harnesses etc. (if confined space).

3. Open manhole lid

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6. AtlanFilter system assessment

Perform a review of the AtlanFilter system using the AtlanFilter 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 AtlanFilter 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 Atlan representative

CARTRIDGE RECYCLING AND REPLACEMENT

AtlanFilter cartridges can be swapped out for new cartridges. The spent AtlanFilter cartridges can be collected from site and sent to Atlan 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 AtlanFilter cartridge will be recharged with new media, thereby recycling and repurposing the cartridge.

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

At the completion of a standard inspection, AtlanFilter 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.

2. Set-up gantry tripod 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 AtlanFilters.

Perform safety procedures ie. attach harnesses etc. (if confined space).

3. Open manhole lid

Once you have set 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. Remove exhausted cartridges

Disconnect all internal pipe work from inside the vault. Unbolt anti-floatation measures and remove cartridges from the vault using Gantry Tripod method.

7. Pollutant removal

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

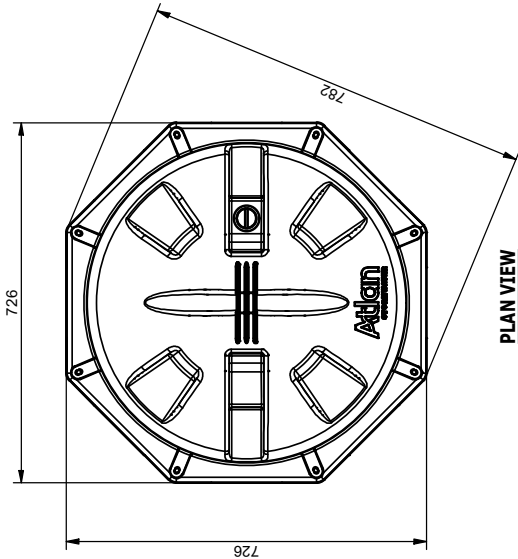
8. Install pipework and AtlanFilters

Please refer to the below standard install diagrams for the AtlanFilters. 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.

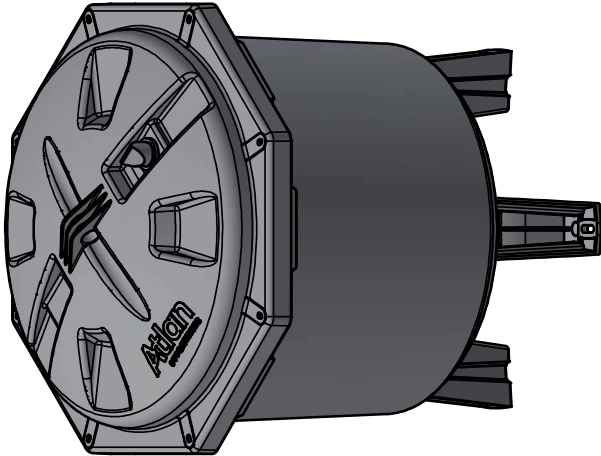
9. Install anti-floatation system

Please refer to the detailed drawings showing how the anti-floatation (anchor) bars are to be installed.

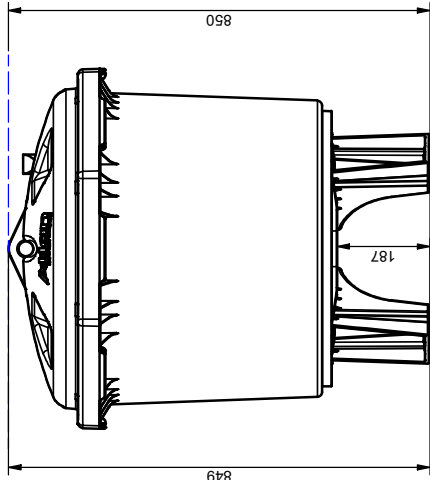
10. Sign off and forward a copy of the report to property manager and Atlan representative



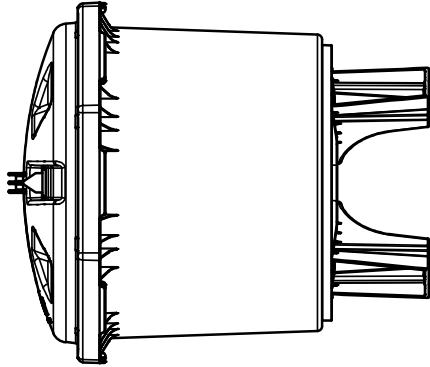
ATLAN FILTER - FIL-3.0
STANDARD HEIGHT



ISOMETRIC VIEW



ELEVATION VIEW



SIDE VIEW

TOLERANCE: All Dimensions to Closest 10 mm & +/- 30 mm

ALL INTERCONNECTING PIPEWORK, PITS AND ASSOCIATED DRAINAGE BY OTHERS

CLIENT:

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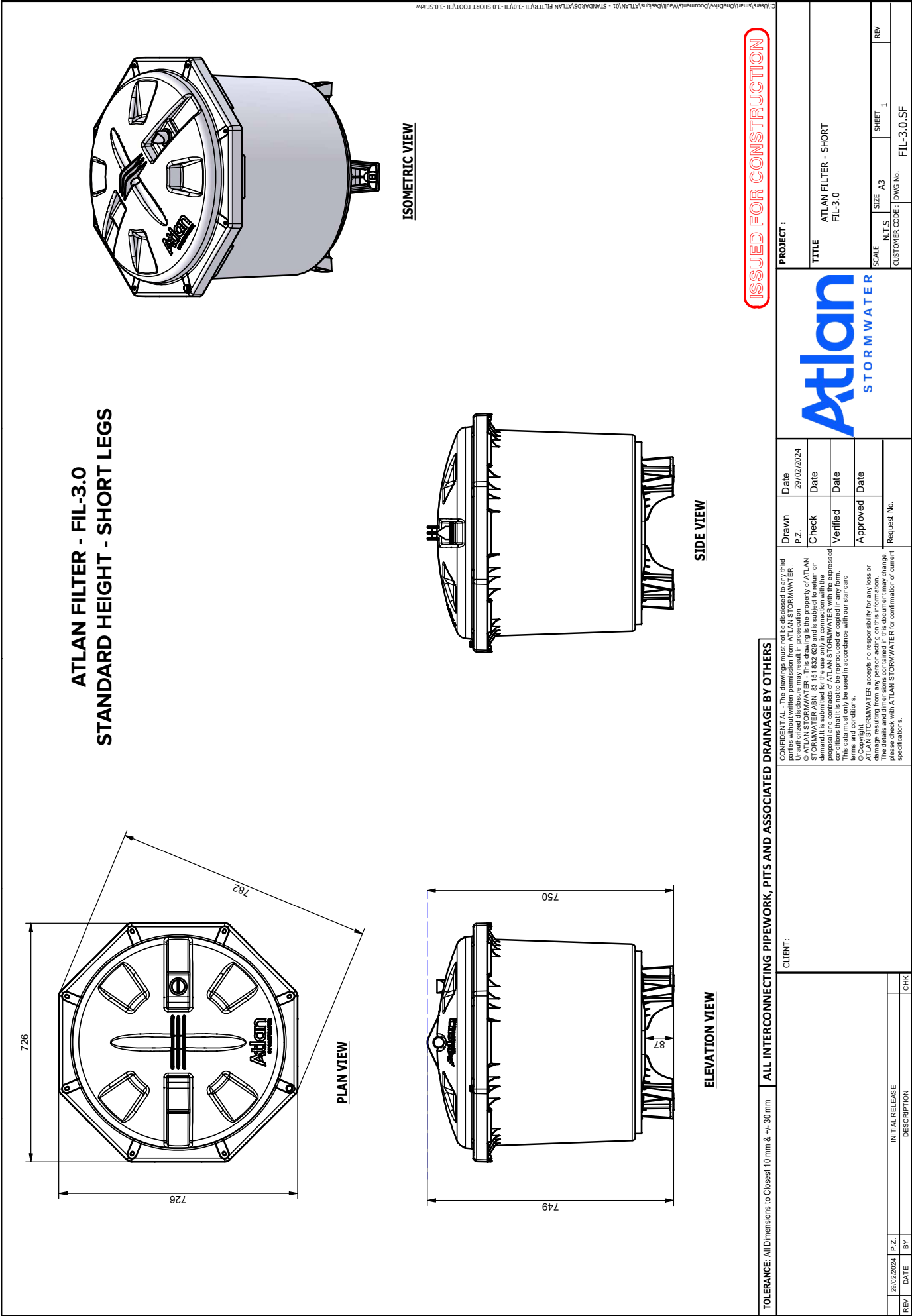
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Check	Date
Verified	Date
Approved	Date
Request No.	

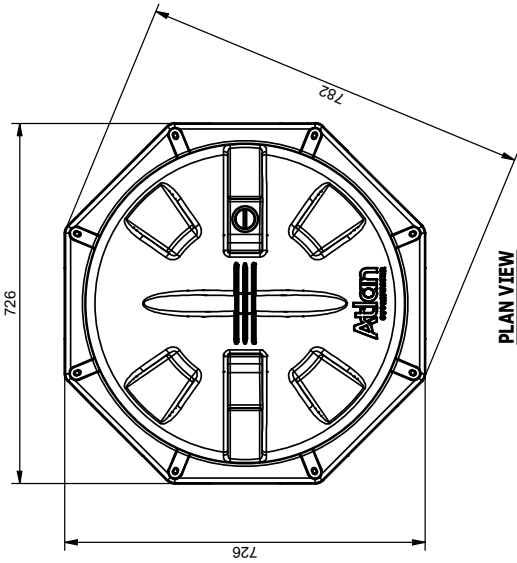
REV	DATE	P.Z.	BY	INITIAL RELEASE	DESCRIPTION	CHK

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CUSTOMER CODE : DWG No.		FIL-3.0	

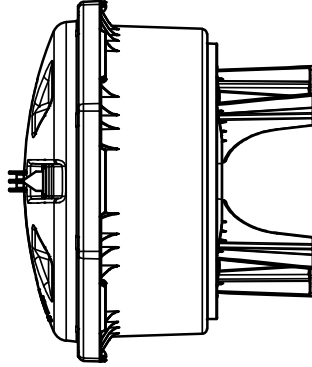
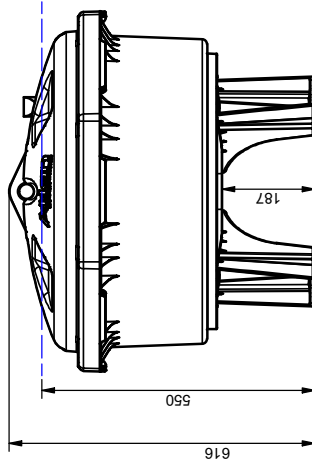
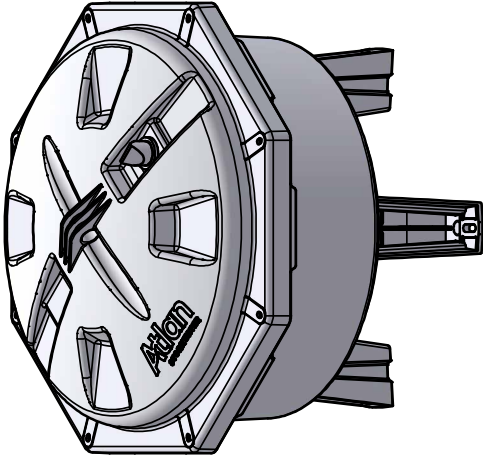


ISSUED FOR CONSTRUCTION





ATLAN FILTER - FIL-1.5 HALF HEIGHT



TOLERANCE: All Dimensions to Closest 10 mm & +/- 30 mm

ALL INTERCONNECTING PIPEWORK, PITS AND ASSOCIATED DRAINAGE BY OTHERS

CLIENT:

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DATE

BY

INITIAL RELEASE

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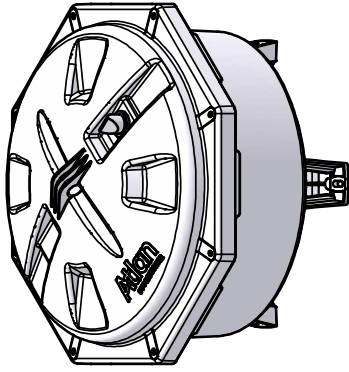
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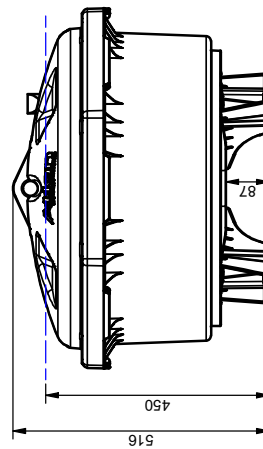
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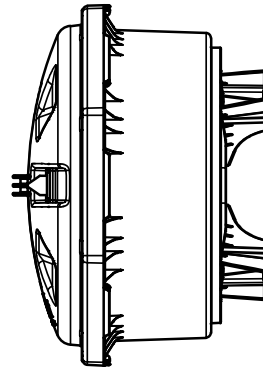
PLAN VIEW



ISOMETRIC VIEW



ELEVATION VIEW



SIDE VIEW

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

CLIENT:

	29/02/2024	P.Z.	INITIAL RELEASE	
REV	DATE	BY	DESCRIPTION	CHK

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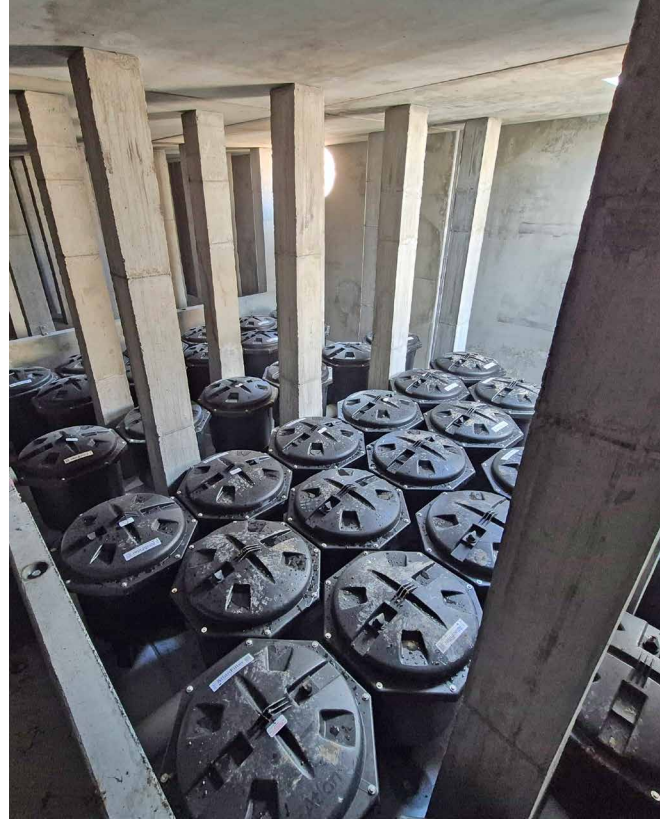
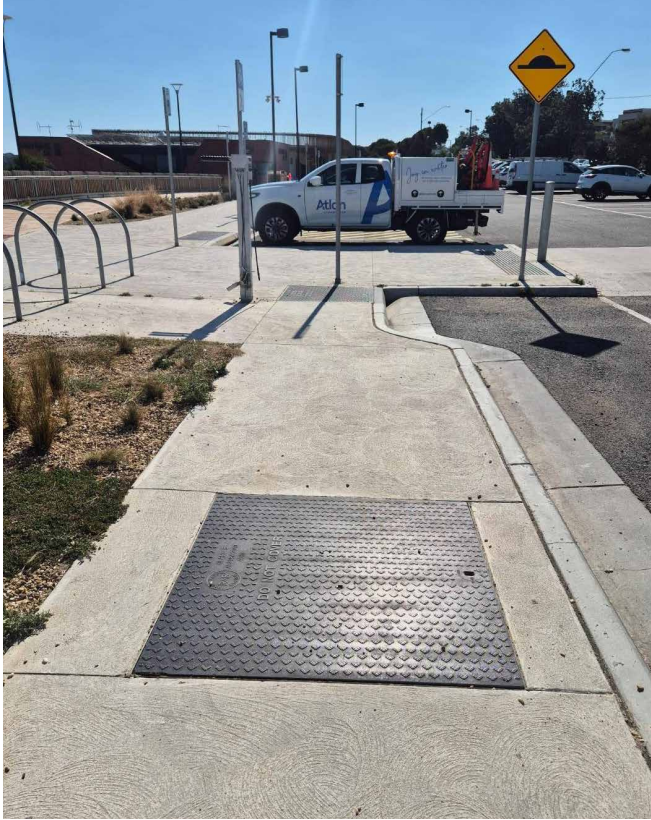
ATLAN STORMWATER accepts no responsibility for any loss or damage resulting from any person acting on this information. The details and dimensions contained in this document may change without notice. Please check with ATLAN STORMWATER for confirmation of current specifications.

Drawn P.Z.	Date 29/02/2024
Check	Date
Verified	Date
Approved	Date
Request No.	

PROJECT :

Atlan
STORMWATER

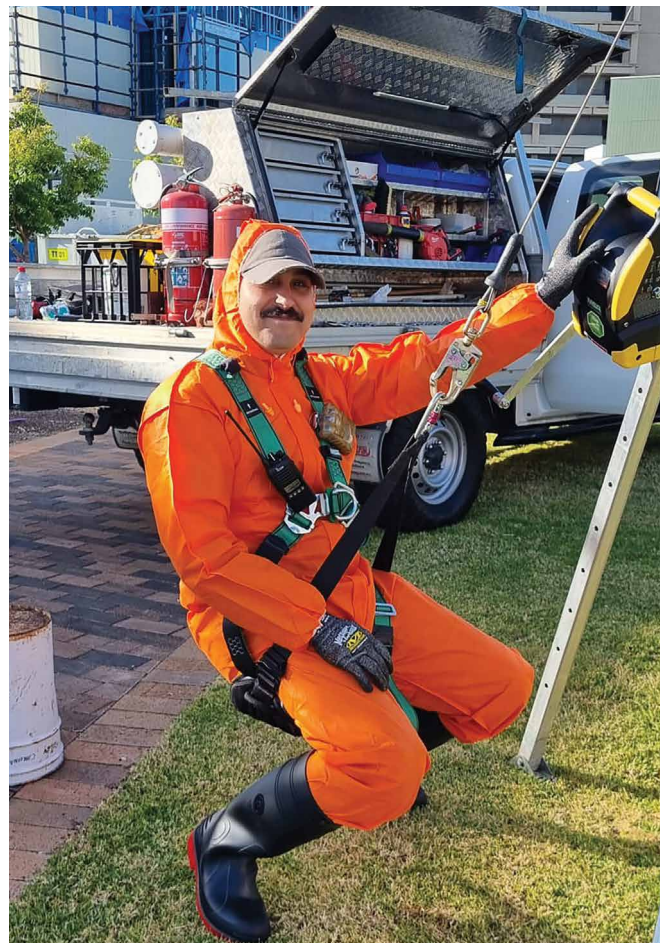
SCALE	SIZE	SHEET	REV
	N.T.S	A3	1
CUSTOMER CODE : DWG No.			FIL-1.5.SF



SITE EXIT & CLEAN UP

At the end of the scheduled maintenance, approved contractors or Atlan 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 Atlan products to Atlan Stormwater to begin recycling program.



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, with your children and grandchildren.'

Andy Hornbuckle

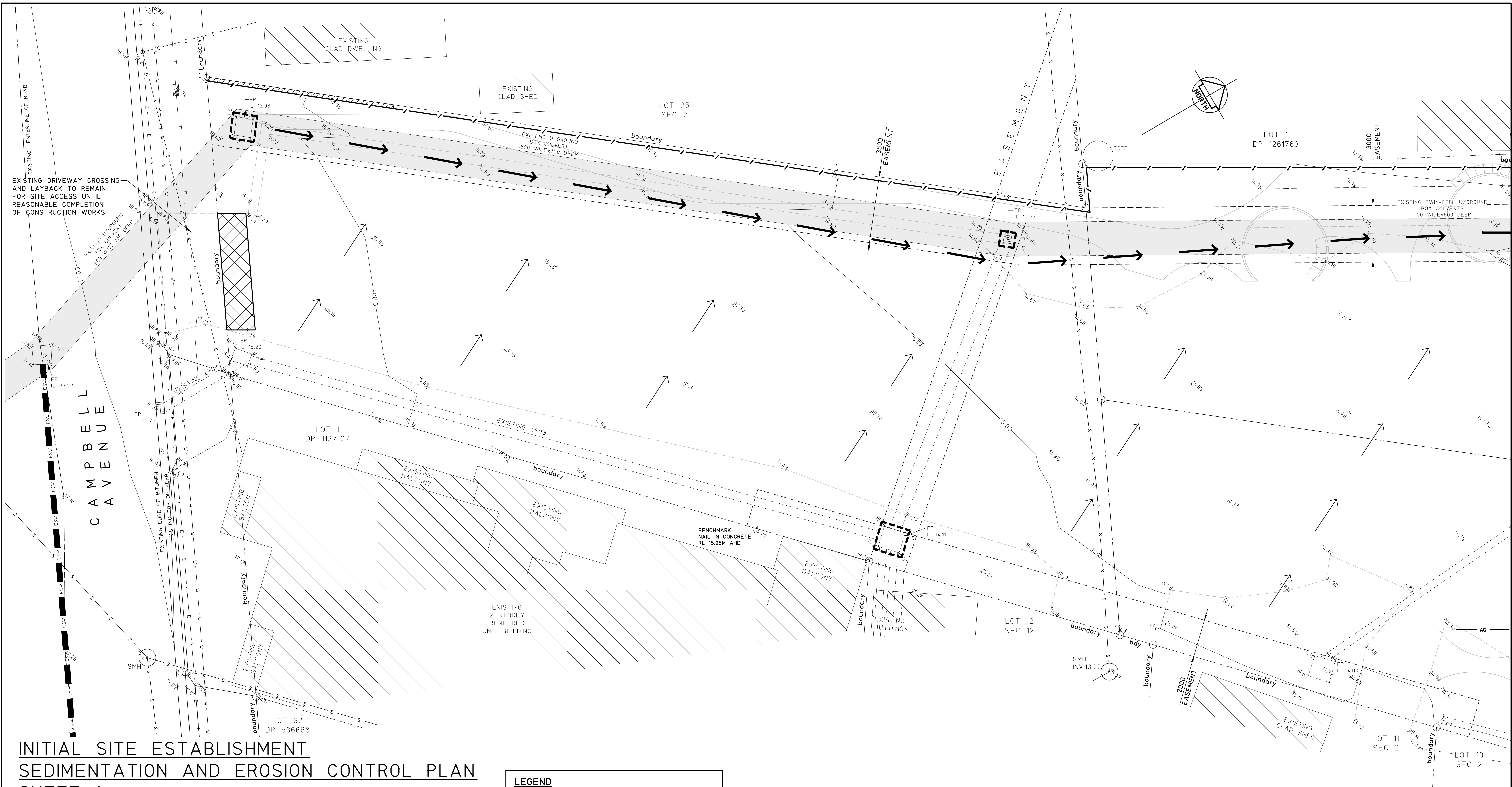


Atlan
STORMWATER

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

Appendix G

Sediment & Erosion Control Plans



INITIAL SITE ESTABLISHMENT
SEDIMENTATION AND EROSION CONTROL PLAN
SHEET 1

- SCALE 1:100
SEDIMENTATION AND EROSION CONTROL NOTES.
1. SELECTIVE CLEARING OF VEGETATION TO BE RESTRICTED TO NOMINATED AREAS WITH CLEARED VEGETATION WIND ROWED ON THE CONTOUR.
 2. ALL EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED PRIOR TO SITE DISTURBANCE.
 3. TOPSOIL FROM ALL AREAS THAT WILL BE DISTURBED TO BE STRIPPED AND STOCKPILED AT THE NOMINATED SITE.
 4. NO MORE THAN 150m OF TRENCH TO BE OPEN AT ANY ONE TIME.
 5. CUT AND FILL BATTER GRADIENTS OF 1:2 (MAXIMUM).
 6. A STRIP OF TURF 450mm WIDE IS TO BE PLACED IMMEDIATELY BEHIND THE KERB ON ALL NEW ROAD TO ACT AS A FILTER TRAP. REFER TO DETAIL SD6-13.
 7. ALL SEDIMENT CONTROL STRUCTURES TO BE INSPECTED BY SITE SUPERVISOR AFTER EACH RAINFALL EVENT FOR STRUCTURAL DAMAGE AND ALL TRAPPED SEDIMENT TO BE REMOVED TO A NOMINATED STOCKPILE SITE.
 8. THE PROJECT MANAGER TO INFORM ALL CONTRACTORS AND SUB-CONTRACTORS OF THEIR OBLIGATIONS UNDER THE EROSION AND SEDIMENT CONTROL PLAN.
 9. NO DISTURBED AREA IS TO REMAIN DENUDEED LONGER THAN 14 DAYS.
 10. ALL FILLS ARE TO BE LEFT WITH A LIP AT THE TOP OF THE SLOPE AT THE END OF EACH DAY'S OPERATION.
 11. THE CONTRACTOR MUST ENSURE THE SUITABILITY AND INTEGRITY OF ALL WORKS AT THE END OF EACH DAY'S WORK.
 12. ORANGE BARRIER TAPE TO BE AFFIXED TO TOP OF SEDIMENT CONTROL BARRIER TO IDENTIFY WORK AREA.
 13. ALL SEDIMENTATION & EROSION CONTROL MEASURES ARE TO STRICTLY COMPLY WITH THE GUIDELINES DETAILED IN THE DEPARTMENT OF HOUSING PUBLICATION, "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION", 4TH EDITION.
 14. WATER TRUCKS TO BE USED AS REQUIRED TO PREVENT WIND EROSION.
 15. SUBGRADE MATERIAL TO BE CONSTRUCTED IMMEDIATELY FOLLOWING FILL.

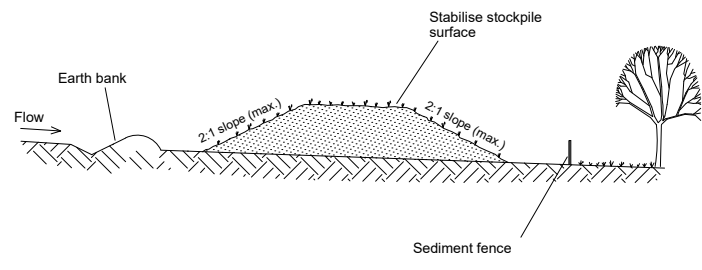
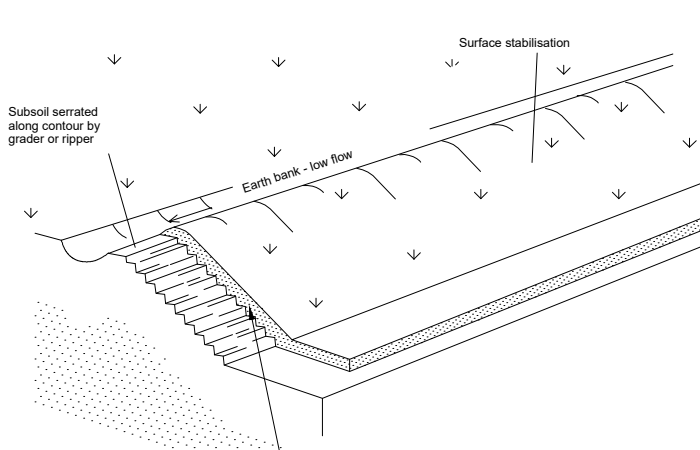
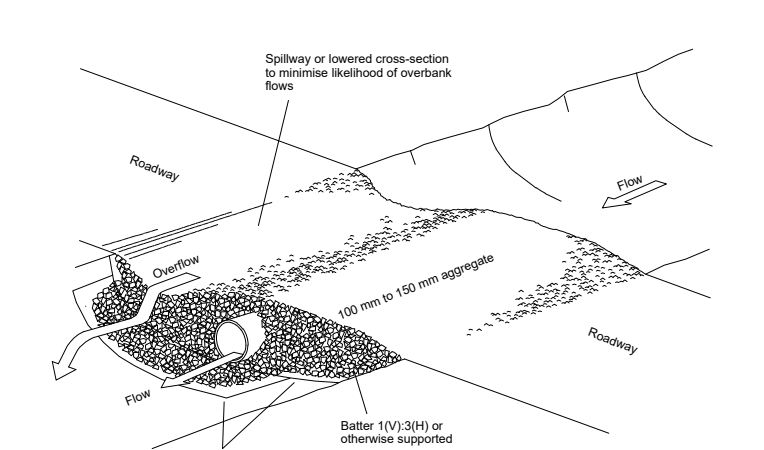
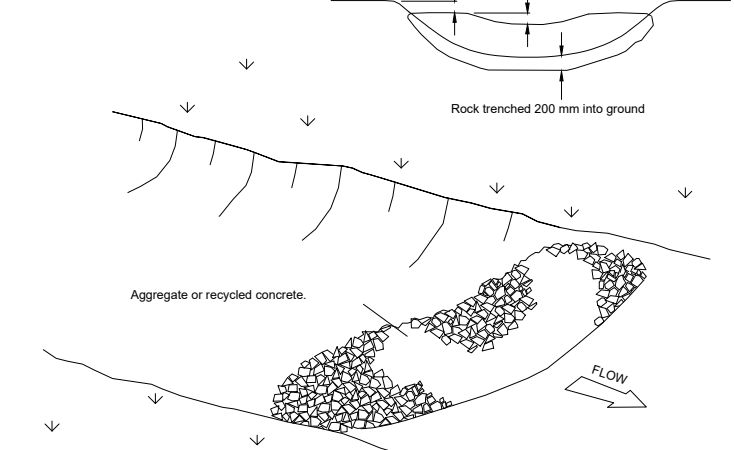
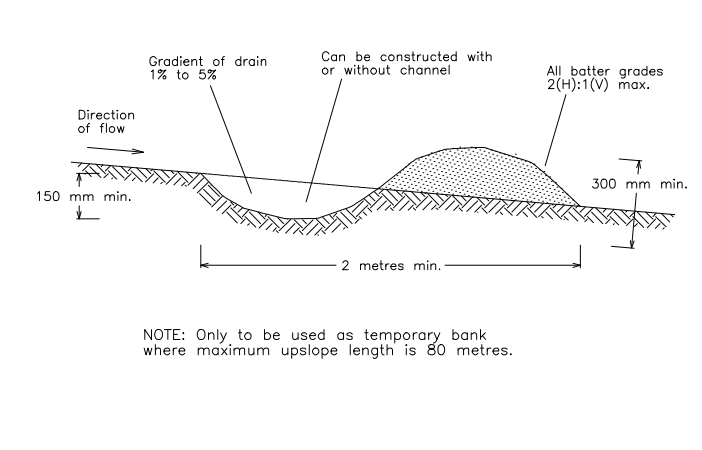
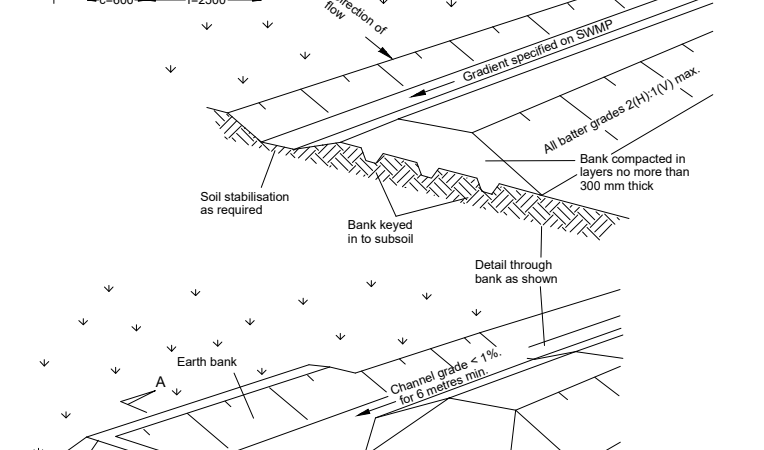
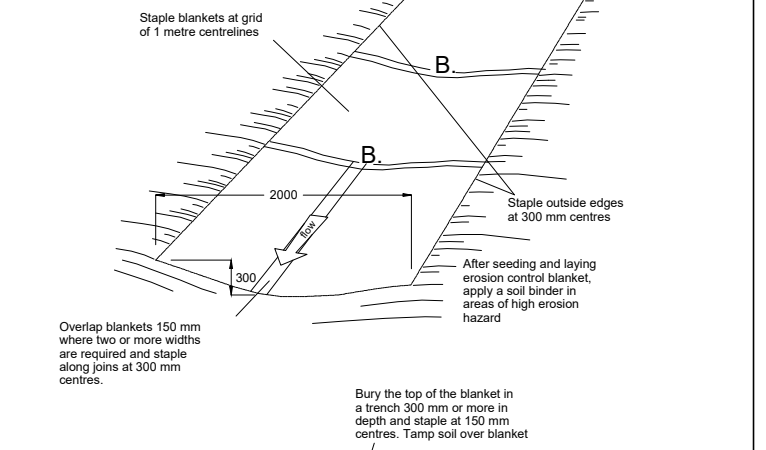
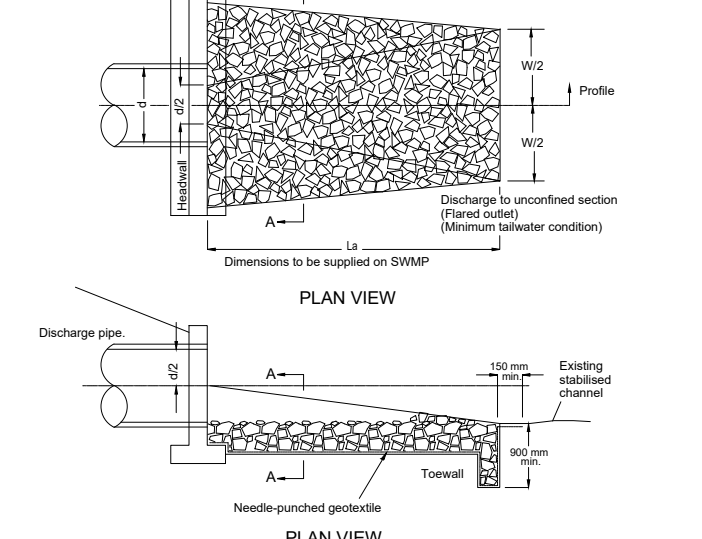
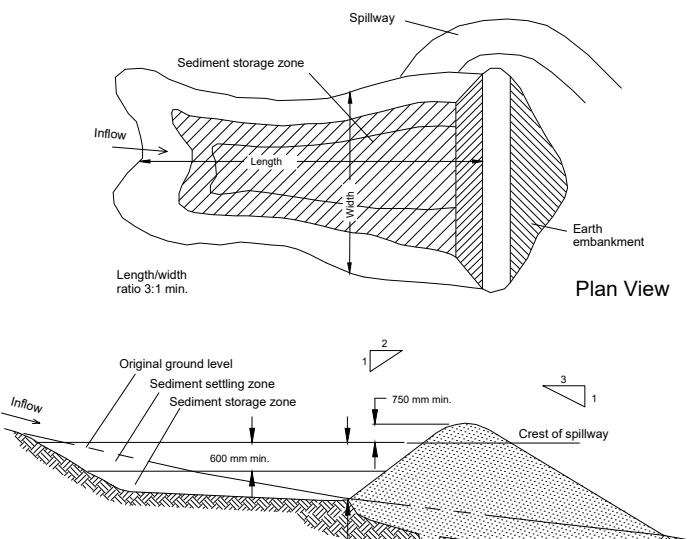
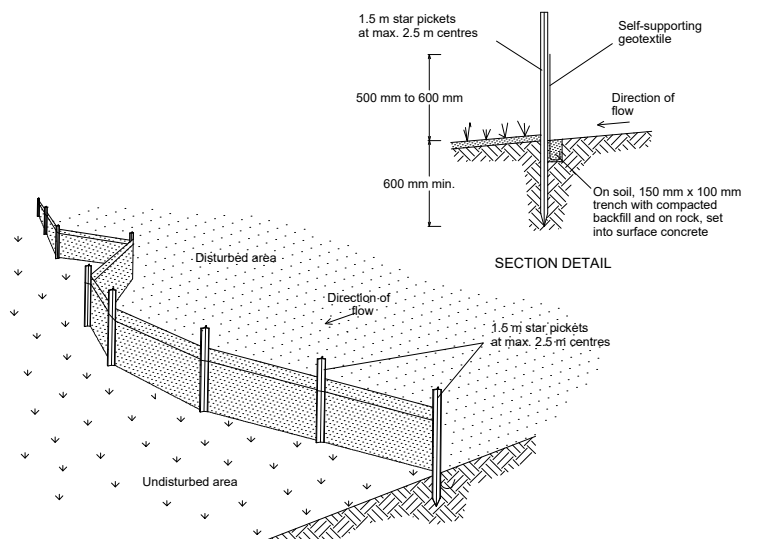
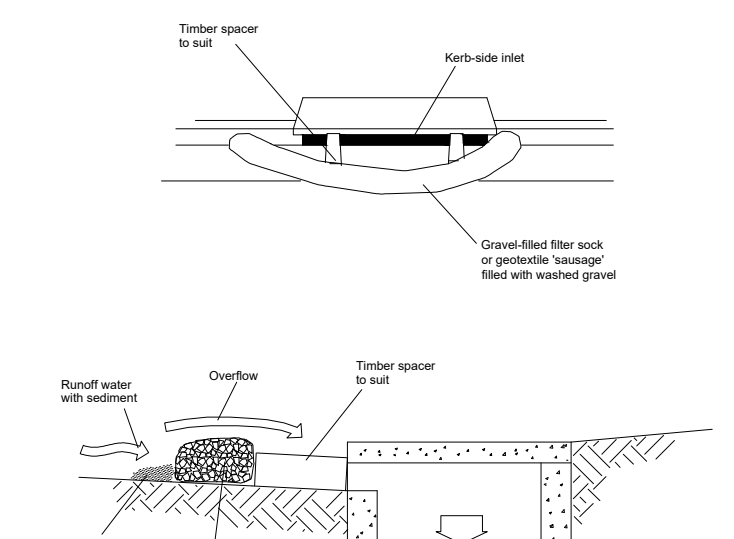
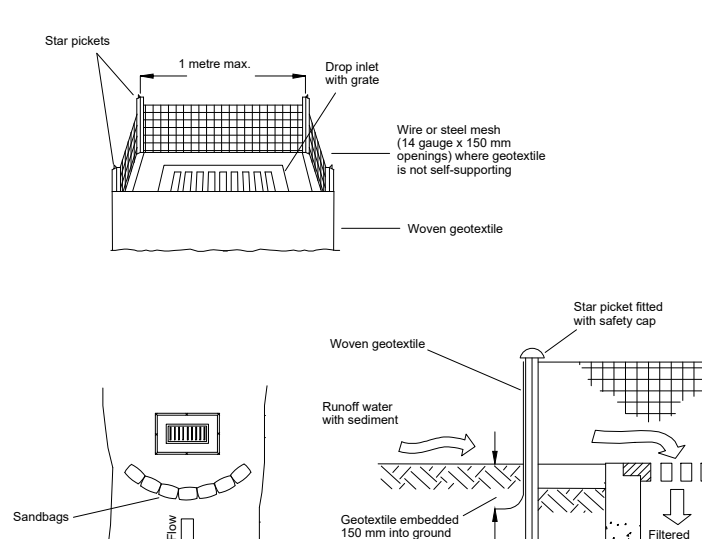
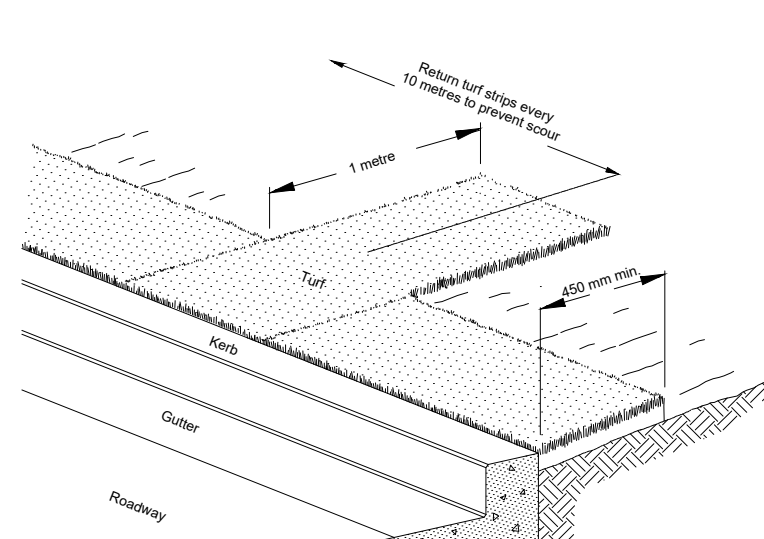
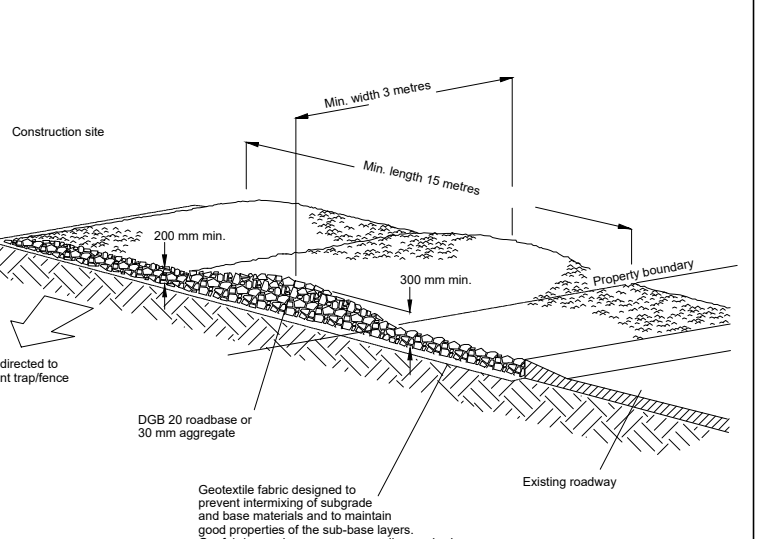
LEGEND

- DENOTES SURFACE FLOW DIRECTION
- DENOTES EARTH BANK (LOW FLOW), REFER TO DETAIL SD5-5
- DENOTES ENERGY DISSIPATER, REFER TO DETAIL SD5-8
- DENOTES SEDIMENT BASIN 1, (REFER TO PLAN) REFER TO DETAIL SD6-4
- /— DENOTES SEDIMENT FENCE, REFER TO DETAIL SD6-8
- DENOTES STABILISED SITE ACCESS, REFER TO DETAIL SD6-14

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			THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS ENDORSED BELOW			The concepts and information contained in this document are the copyright of MPC Consulting Engineers. Use or copying of the document in whole or in part without the written permission of MPC Consulting Engineers constitutes an infringement of copyright.			PACIFIC LINK HOUSING			PROPOSED HOUSING DEVELOPMENT AT; LOTS 24, 36 & 37, DP 14230, No.23-25 ASHTON AVENUE, THE ENTRANCE			DRAWN L.C.		
1 DEVELOPMENT APPLICATION			11.3.26			mpc consulting engineers civil+structural			TITLE			No in SET			ENGINEER B.C.		
0 PRELIMINARY			16.12.25			Level 1, 16 Telford Street, NEWCASTLE EAST, NSW 2300 PO BOX 871 NEWCASTLE, NSW 2300 Tel: (02) 4927 5566 Email: admin@mpceng.com.au Web: www.mpceng.com.au A.C.N. 670 257 315			SEDIMENTATION AND EROSION CONTROL PLAN SHEET 1			JOB No			230490		
ISSUE			DATE									DRAWING No			C04		
REASON FOR ISSUE			DATE OF RELEASE			RESPONSIBLE PRINCIPAL SIGNATURE						ISSUE			1		

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

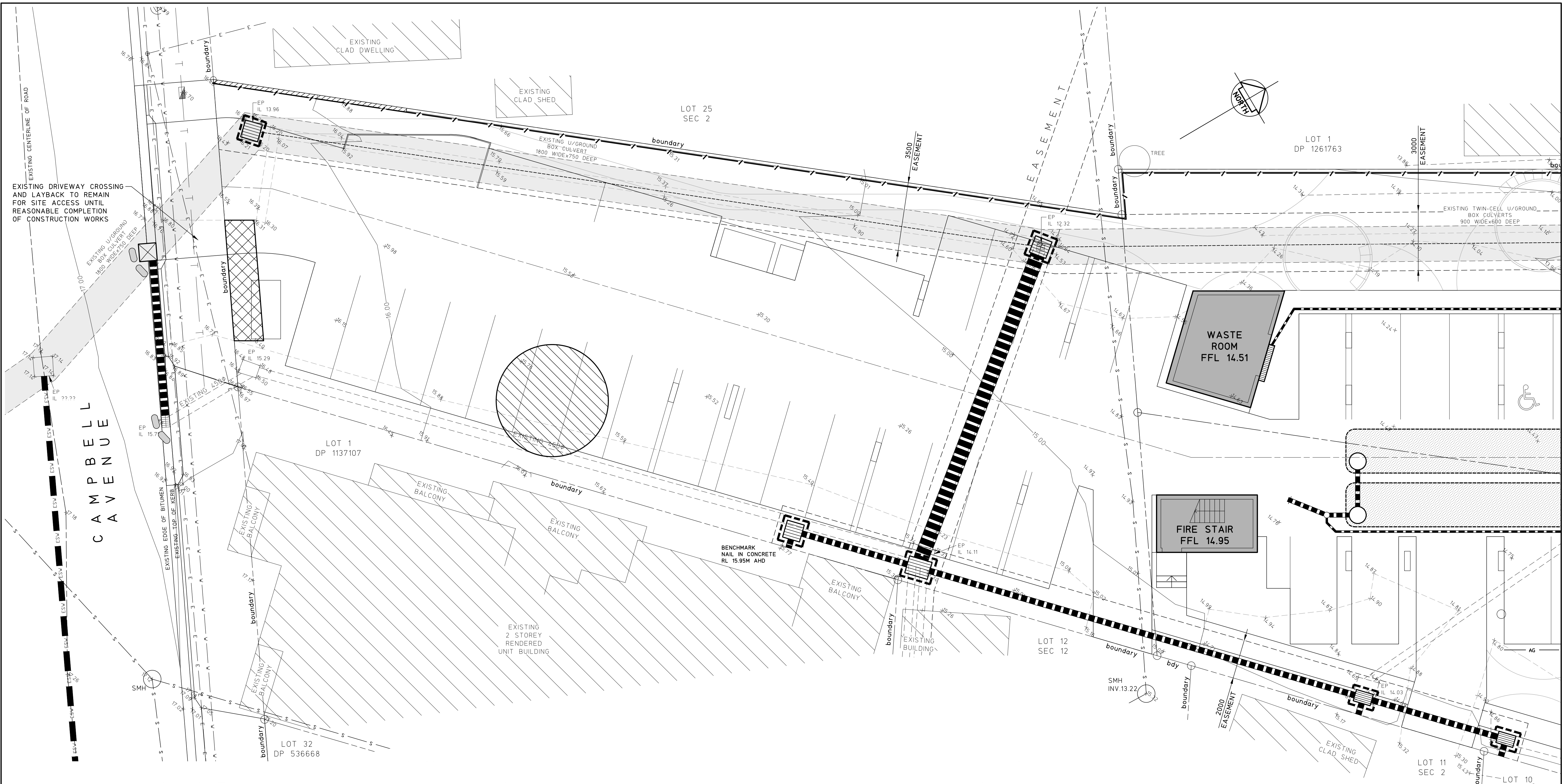
 Construction Notes - Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas. - Construct on the contour as low, flat, elongated mounds. - Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height. - Where 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. - 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.	 Construction Notes - Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any handsetting surfaces and to provide a good bond between the respread material and subsoil. - Add soil ameliorants as required by the ESCP or SWMP. - Rip to a depth of 300 mm if compacted layers occur. - Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.	 Construction Notes - Prohibit all traffic until the access way is constructed. - Strip any topsoil and place a needle-punctured textile over the base of the crossing. - Place clean, rigid, non-polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm. - Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3 (H):1 (V) slope on side batters. - Install a lower section to act as an emergency spillway in greater than design storm event. - Ensure that culvert outlets extend beyond the toe of fill embankments.	 Construction Notes - 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. - 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. - Normally, their maximum height should not exceed 500 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges. - Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.	 Construction Notes - Build with gradients between 1 percent and 5 percent. - Avoid removing trees and shrubs if possible - work around them. - Ensure the structures are free of projections or other irregularities that could impede water flow. - Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped. - Ensure the banks are properly compacted to prevent failure. - Complete permanent or temporary stabilisation within 10 days of construction.	 Construction Notes - Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent - Avoid removing trees and shrubs if possible - work around them. - Ensure the structures are free of projections or other irregularities that could impede water flow. - Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP. - Ensure the banks are properly compacted to prevent failure. - Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004). - Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader. - Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level. - Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.	 Construction Notes - Remove any rocks, sticks, clods or grass from the surface before laying matting - Ensure that topsoil is at least 75 mm deep. - Complete fertilising and seeding before laying the matting. - Ensure fabric will be continuously in contact with the soil by grading the surface carefully first. - Lay the fabric in "single-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end. - Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI line of concentration storm event. - Divert water from the structure until vegetation is stabilised properly.
STOCKPILES	REPLACING TOPSOIL	TEMPORARY WATERWAY CROSSING	ROCK CHECK DAM	EARTH BANK (LOW FLOW)	EARTH BANK (HIGH FLOWS)	RECP : CONCENTRATED FLOW
SD 4-1	SD 4-2	SD 5-1	SD 5-4	SD 5-5	SD 5-6	SD 5-7
 Construction Notes - Compact the subgrade fill to the density of the surrounding undisturbed material. - Prepare a smooth, even foundation for the structure that will ensure that the needle-punctured geotextile does not sustain serious damage when covered with rock. - Should any minor damage to the geotextile occur, repair it 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. - Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm. - Ensure that any concrete or riprap used for the energy dissipator or the outlet protection conforms to the grading limits specified on the SWMP.	 Construction Notes - Remove all vegetation and topsoil from under the dam wall and from within the storage area. - Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest. - Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density. - Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material. - Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate. - Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP. - Construct the emergency spillway. - Rehabilitate the structure following the SWMP.	 Construction Notes - 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-year event. - Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched. - Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps. - Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile 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. - Join sections of fabric at a support post with a 150-mm overlap. - Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.	 Construction Notes - Install filters to kerb inlets only at sag points. - Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel. - Form an elliptical cross-section about 150 mm high x 400 mm wide. - Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks. - Form a seal with the kerb to prevent sediment bypassing the filter. - Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.	 Construction Notes - Fabricate a sediment barrier made from geotextile or straw bales. - Follow Standard Drawing 6-8 for installation procedures for the straw bales or geotextile. Reduce the picket spacing to 1 metre centres. - In waterways, artificial sag points can be created with sandbags or earth banks as shown in the drawing. - Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it.	 Construction Notes - Install a 450 mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb. - Lay 1.4 metre long turf strips normal to the kerb every 10 metres. - Rehabilitate disturbed soil behind the turf strip following the ESCP/SWMP.	 Construction Notes - Strip the topsoil, level the site and compact the subgrade. - Cover the area with needle-punctured geotextile. - Construct a 200 mm thick pad over the geotextile using road base or 30 mm aggregate. - Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide. - Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence
ENERGY DISSIPATER	EARTH BASIN - WET	SEDIMENT FENCE	MESH AND GRAVEL INLET FILTER	GEOTEXTILE INLET FILTER	KERBSIDE TURF STRIP	STABILISED SITE ACCESS
SD 5-8	(APPLIES TO TYPE 'D' AND TYPE 'F' SOILS ONLY)	SD 6-8	SD 6-11	SD 6-12	SD 6-13	SD 6-14

SEDIMENTATION AND EROSION CONTROL DETAILS

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1		DEVELOPMENT APPLICATION		11.3.26				TITLE				L.C.		B.C.		9		A1	
0		PRELIMINARY		16.12.25				SEDIMENTATION AND EROSION CONTROL DETAILS				SCALES		JOB No		DRAWING No		ISSUE	
ISSUE		REASON FOR ISSUE		DATE		DATE OF RELEASE		RESPONSIBLE PRINCIPAL SIGNATURE				N.T.S.		230490		C06		1	

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



CONSTRUCTION PHASE
SEDIMENTATION AND EROSION CONTROL PLAN
SHEET 1

SCALE 1:100
SEDIMENTATION AND EROSION CONTROL NOTES
1. REFER TO DRAWING C06 FOR SEDIMENTATION AND EROSION CONTROL DETAILS.

LEGEND

DENOTES ALLOWABLE AREA FOR TEMPORARY STOCKPILING OF CUT SOIL MATERIAL, REFER TO DETAIL SD4-1

DENOTES SEDIMENT FENCE, REFER TO DETAIL SD6-8

DENOTES MESH AND GRAVEL INLET FILTER, REFER TO DETAIL SD6-11

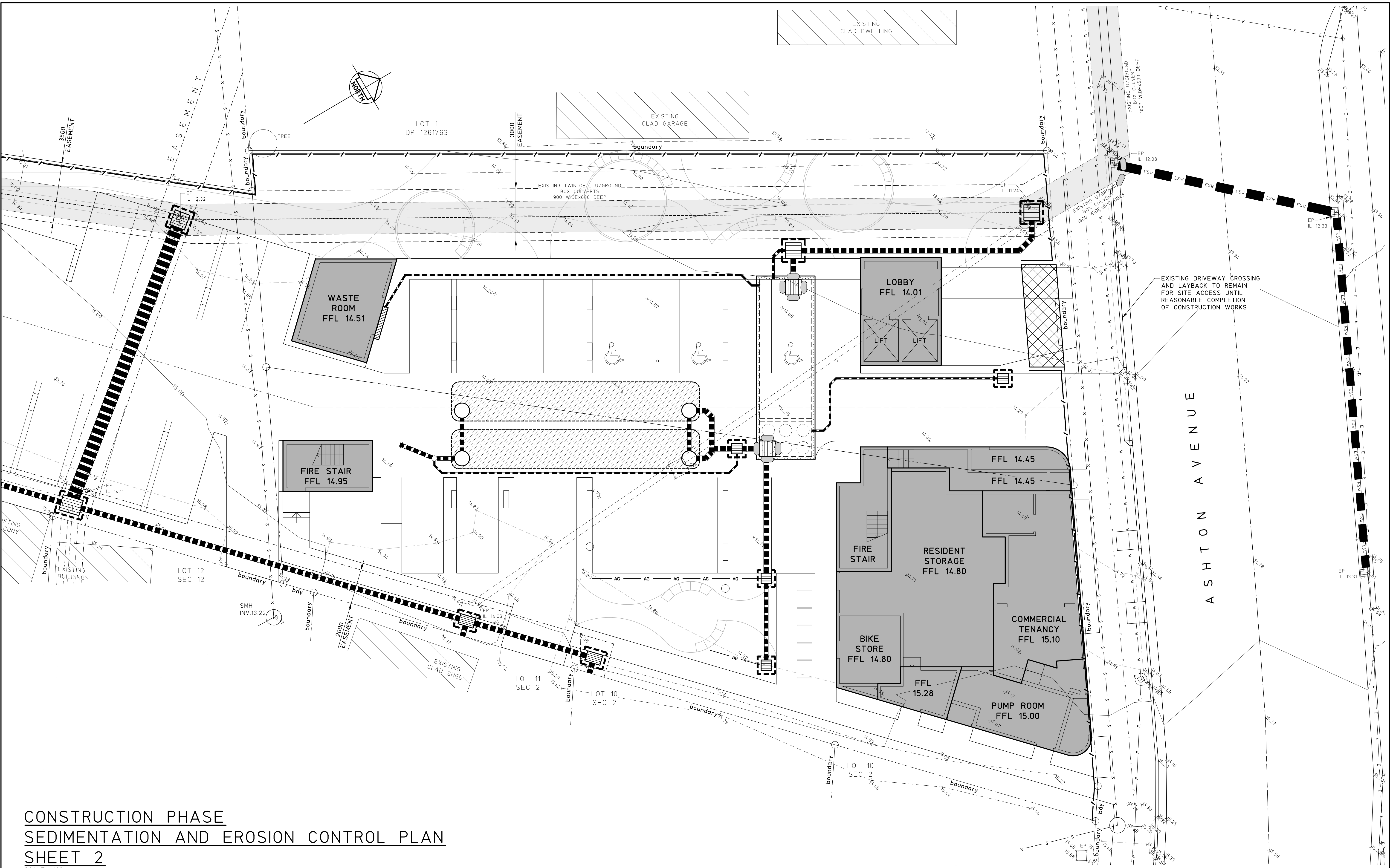
DENOTES GEOTEXTILE INLET FILTER, REFER TO DETAIL SD6-12

DENOTES STABILISED SITE ACCESS, REFER TO DETAIL SD6-14

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ISSUE	REASON FOR ISSUE	DATE	DATE OF RELEASE	RESPONSIBLE PRINCIPAL SIGNATURE									

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



CONSTRUCTION PHASE
SEDIMENTATION AND EROSION CONTROL PLAN
SHEET 2

SCALE 1:100
SEDIMENTATION AND EROSION CONTROL NOTES
1. REFER TO DRAWING C07 FOR SEDIMENTATION AND EROSION CONTROL LEGEND.

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		THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS ENDORSED BELOW		The concepts and information contained in this document are the copyright of MPC Consulting Engineers Use or copying of the document in whole or in part without the written permission of MPC Consulting Engineers constitutes an infringement of copyright.		PACIFIC LINK HOUSING		PROPOSED HOUSING DEVELOPMENT AT; LOTS 24, 36 & 37, DP 14230, No.23-25 ASHTON AVENUE, THE ENTRANCE		DRAWN L.C.	ENGINEER B.C.	No in SET 9	SHEET A1
1 DEVELOPMENT APPLICATION		11.3.26				TITLE				SCALES	JOB No	DRAWING No	ISSUE
0 PRELIMINARY		16.12.25				CONSTRUCTION PHASE SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2				1:100	230490	C08	1
ISSUE		REASON FOR ISSUE		DATE		DATE OF RELEASE		RESPONSIBLE PRINCIPAL SIGNATURE					

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

SWMP Commentary, Standard Calculation

Note: These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

1. Site Data Sheet

Site name: PLH Ashton

Site location: 23-25 Ashton Ave The Entrance

Precinct: The Entrance, NSW

Description of site: Sandy Gravel and Sandy Clay (fill) - with fine-grained sand

Site area	Site						Remarks
	1						
Total catchment area (ha)	0.2336						
Disturbed catchment area (ha)	0.2336						

Soil analysis

Soil landscape	Wyong						DIPNR mapping (if relevant)
Soil Texture Group	C						Sections 6.3.3(c), (d) and (e)

Rainfall data

Design rainfall depth (days)	5						See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	75						See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	26.8						See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	10.6						See IFD chart for the site
Rainfall erosivity (R-factor)	2460						Automatic calculation from above data

Comments:

2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{y,tc} \times A$$

where:

- Q_y is peak flow rate (m^3/sec) of average recurrence interval (ARI) of "Y" years
- C_{10} is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
- F_y is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
- A is the catchment area in hectares (ha)
- $I_{y,tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration (t_c) = $0.76 \times (A/100)^{0.38}$ hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

Peak flow calculations, 1

Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			1 _{yr,tc}	5 _{yr,tc}	10 _{yr,tc}	20 _{yr,tc}	50 _{yr,tc}	100 _{yr,tc}	
1	0.2336	5	94.5	153	187	224	278	324	0.47

Peak flow calculations, 2

ARI yrs	Frequency factor (F_y)	Peak flows						Comment
		1						
		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	
1 _{yr,tc}	0.8	0.023						
5 _{yr,tc}	0.95	0.044						
10 _{yr,tc}	1	0.057						
20 _{yr,tc}	1.05	0.072						
50 _{yr,tc}	1.1	0.093						
100 _{yr,tc}	1.2	0.119						

3. Volume of Sediment Basins: Type C Soils

Basin volume = settling zone volume + sediment storage volume

Settling Zone Volume

The settling zone volume for Type C soils is calculated to provide capacity to allow the design particle (e.g. 0.02 mm in diameter) to settle in the peak flow expected from the design storm (e.g. 0.25-year ARI). The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle. Peak flow/discharge for the 0.25-year, ARI storm is given by the Rational Formula:

$$Q_{tc, 0.25} = 0.5 \times [0.00278 \times C_{10} \times F_y \times I_{1yr, tc} \times A] \text{ (m}^3\text{/sec)}$$

where:

$Q_{tc, 0.25}$ = flow rate (m³/sec) for the 0.25 ARI storm event

C_{10} = runoff coefficient (dimensionless for ARI of 10 years)

F_y = frequency factor for 1 year ARI storm

$I_{1yr, tc}$ = average rainfall intensity (mm/hr) for the 1-year ARI storm

A = area of catchment in hectares (ha)

$$\text{Basin surface area (A)} = \text{area factor} \times Q_{tc, 0.25} \text{ m}^2$$

Particle settling velocities under ideal conditions (Section 6.3.5(e))

Particle Size	Area Factor
0.100	170
0.050	635
0.020	4100

Volume of settling zone = basin surface area x depth (Section 6.3.5(e)(ii))

Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 100 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.5(e)(iv)), in which case the "Detailed Calculation" spreadsheets should be used.

Total Basin Volume

Site	$Q_{tc, 0.25}$ (m ³ /s)	Area factor	Basin surface area (m ²)	Depth of settling zone (m)	Settling zone volume (m ³)	Sediment storage volume (m ³)	Total basin volume (m ³)	Basin shape		
								L:W Ratio	Length (m)	Width (m)
1	0.012	170	2	0.6	1	1	2	3	2.4	0.8