Stormwater Management Plan

42-80 Manuka Road Berwick

19 December 2025

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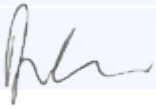
Signature	

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1. Introduction

1.1 Drainage Strategy Objectives

This drainage strategy has been developed to ensure the stormwater for the site not only meets authority requirements but is also integrated into the design to provide functional, attractive, and usable spaces. The proposed features will enable flow conveyance from the site and external catchments to ensure all lots are flood protected, and the catchment function is not compromised.
While the site as noted within Figure 1-2 is not covered within Melbourne Water (MW) Drainage Strategy it is located between MW Manuka Road Drainage Scheme and Cardinia Creek. Water quality treatment features are proposed to protect the receiving waters from the developed catchment. The proposed drainage strategy discussed here intends to meet the following core objectives, as defined in the Melbourne Water Constructed Wetlands Design Manual (refer Figure 1-1).

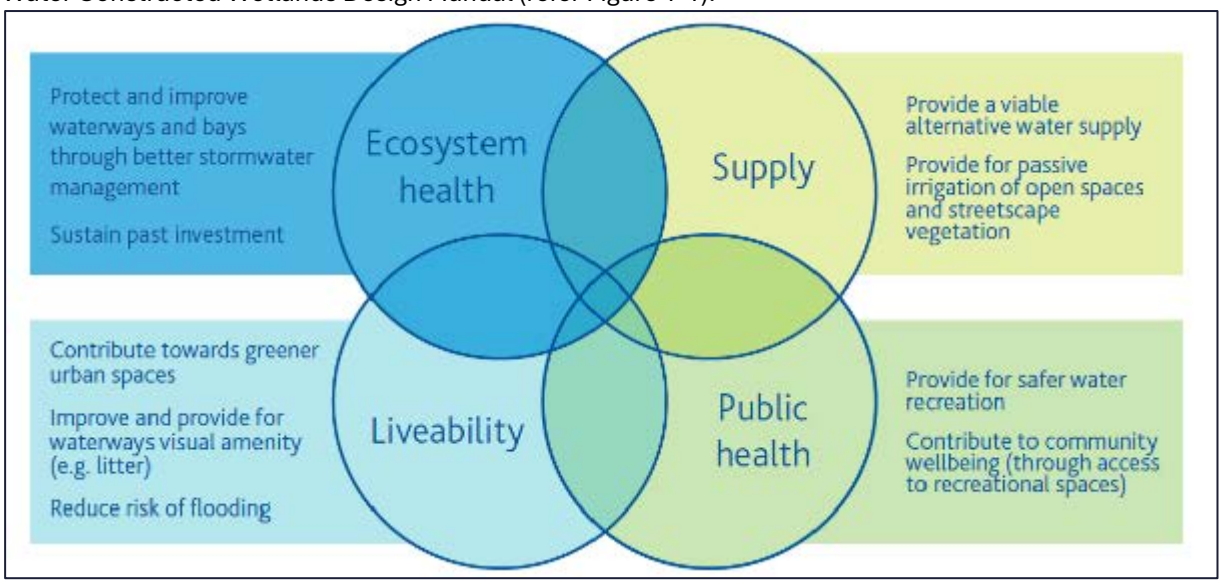


Figure 1-1 Stormwater Management Objectives (Melbourne Water Constructed Wetlands Design Manual)

1.2 Subject Land

The proposed Manuka Road Estate (site) is to be a residential subdivision located to the East of Berwick along Cardinia Creek. Development of the site will occur over three parcels, with a central parcel known as Clover Cottage that is designated future residential but not part of the current development. The subject site is located at 42-80 Manuka Road Berwick and is bounded by Manuka Road to the West, Allan Street to the South, DEECA / Parks Victoria reserve to the North, and Grasmere and Cardinia Creek to the East refer to Figure 1-2. The total area of the site is approximately 16 hectares.

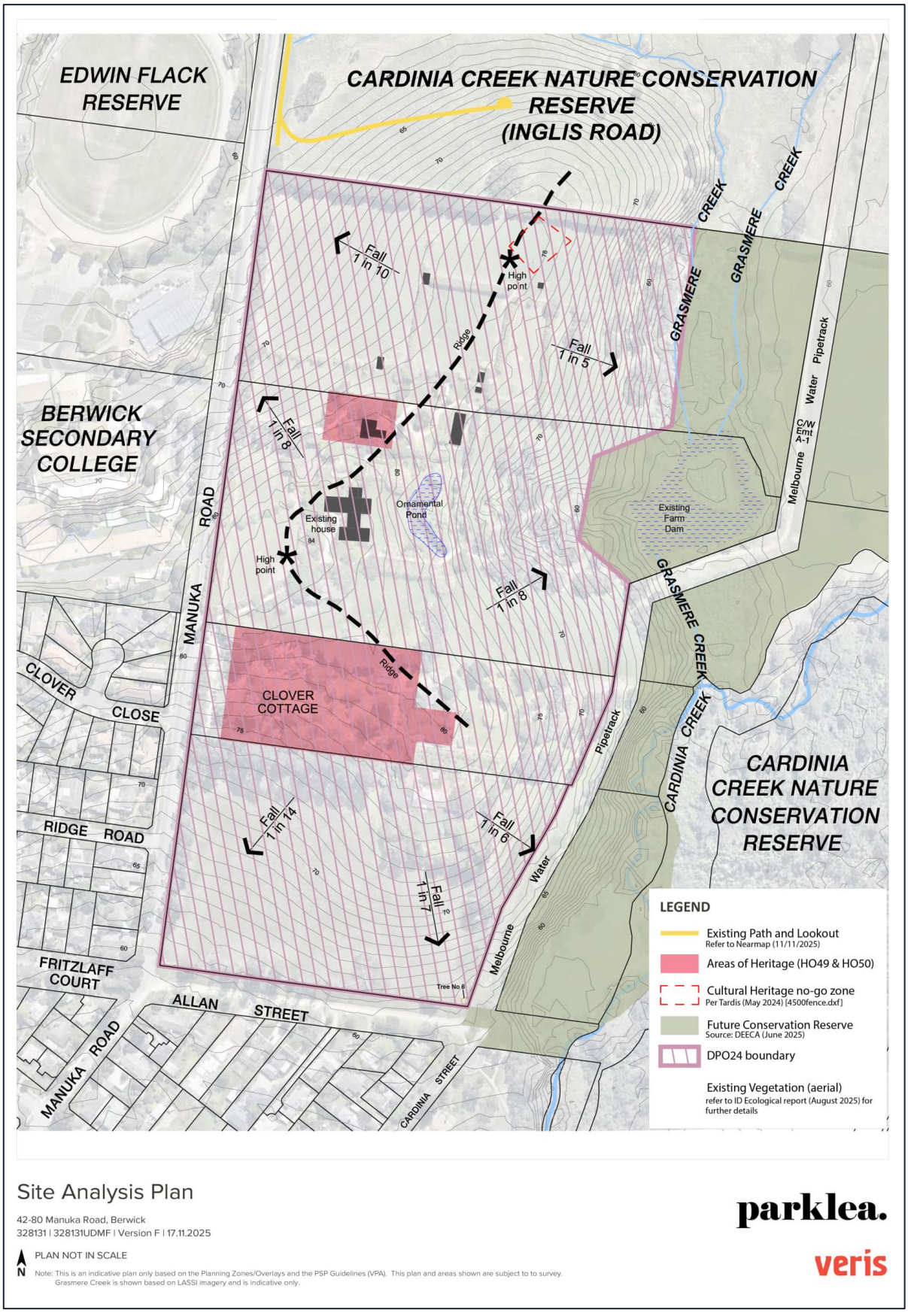


Figure 1-2 Locality Plan

1.2.1 Concept Subdivision

The Concept Master Plan for the site (Figure 1-3) considers the drainage requirements for development. The proposal is to develop the subject site into a residential community, whilst maintaining the relevant green wedge zones and providing public open space reserves. The plan recognises land not suitable for development purposes shown in grey in Figure 1- 3 below.

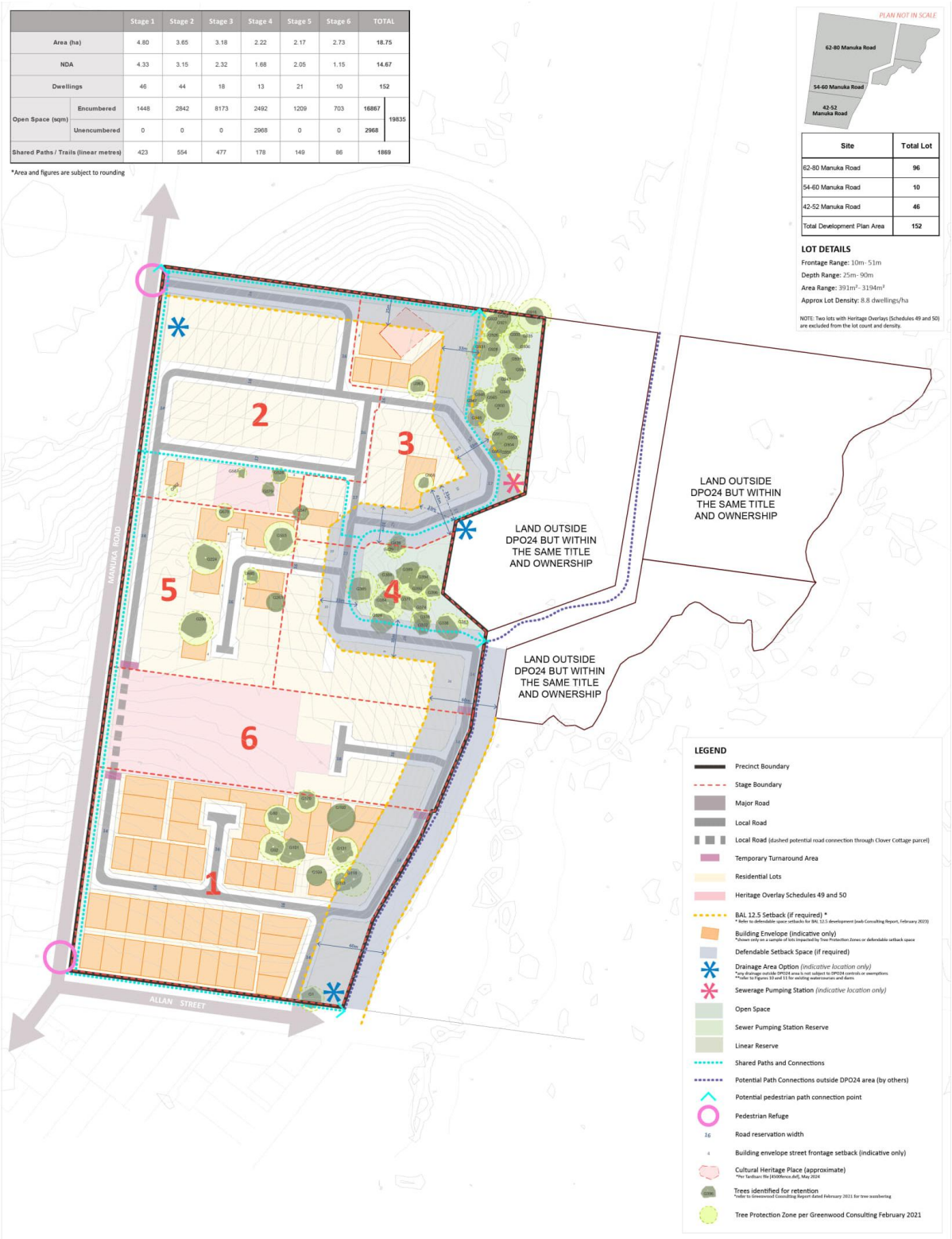


Figure 1-3 Concept Subdivision (Veris, 2025)

1.3 City of Casey Advice (29th September 2025)

This version of the SWMS has been updated to reflect advice from City of Casey as outlined in the development plan application response (City of Casey, 2025). The advice in relation to the drainage strategy are summarised below:

- Onsite retardation is not required for all site catchments due to limited impact to downstream land
- No flow is to be directed southwardly of Manuka Road due to existing downstream flooding risk
- City of Casey recommends utilising pre-treatment, such as proprietary gross pollutant traps (GPT), and bio-retention systems for end-of-line water quality treatment

To incorporate the recommendations from City of Casey, Option 1 is proposed for the drainage strategy. The previous drainage strategy is retained in this report and will be referred to as “Option 2”.

The comments provided by City of Casey is included in Appendix F.

2. Site Characteristics and Constraints

2.1 Developer Services Scheme

The subject site is not located within a MW developer services scheme. There is existing drainage both MW and locally controlled in the surrounding area, however based on the advice received, the existing drainage infrastructure will have limited capacity and onsite retention and stormwater treatment will be required. The adjacent Manuka Road drainage scheme is located to the West of Manuka Road and outlets to the Grasmere Creek north of the site then ultimately Cardinia Creek.

2.1.1 Flooding

A portion of the site is subject to flooding from Grasmere and Cardinia Creeks, with all flows being contained within the waterway during the 1% AEP event. The masterplan layout nominates all lots sit outside the floodway footprint.

Finished floor level of the proposed dwellings adjacent to the creeks will be set with 600mm freeboard from the 1% AEP flood level in accordance with MW requirements. The floodplain will not be restricted by the proposed development of the site and as such no flood modelling is required.

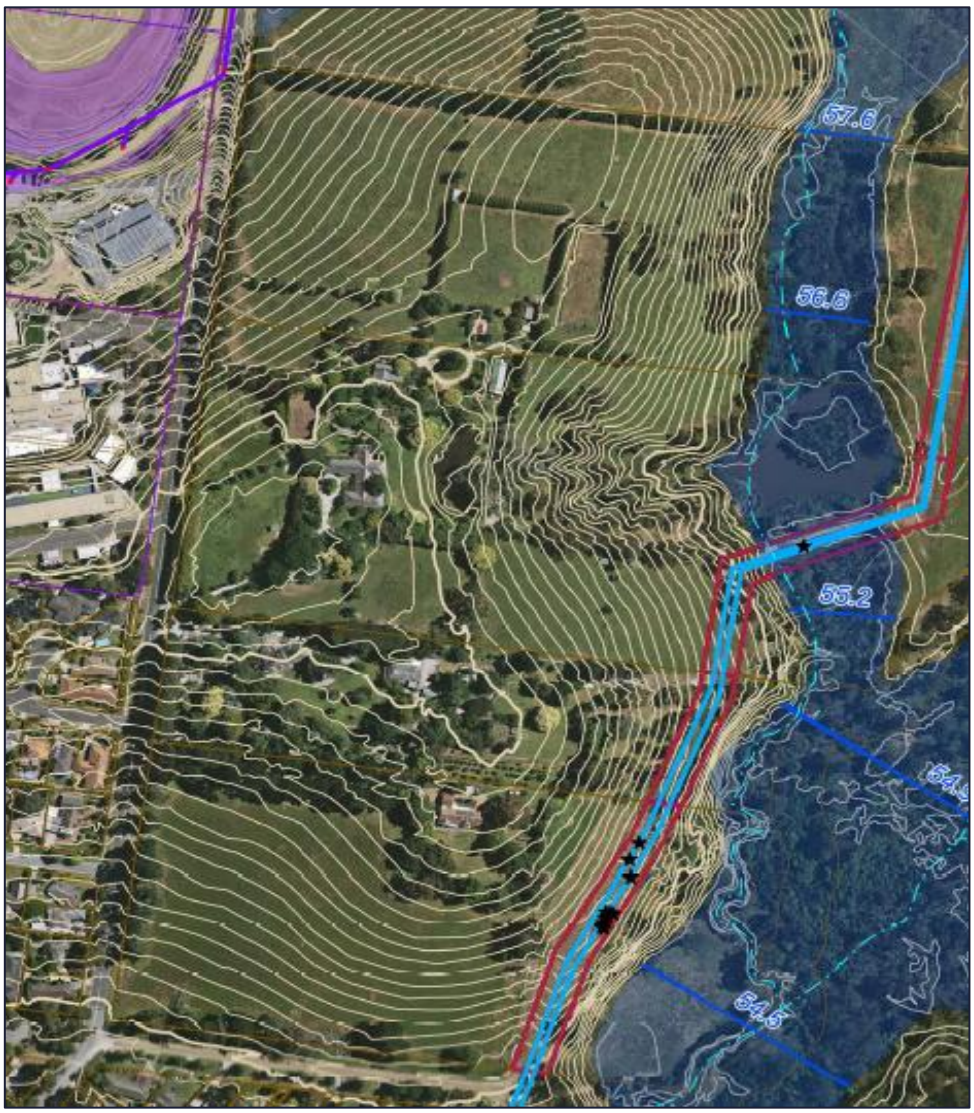


Figure 2-1 Flood Contour Map (Melbourne Water)

2.2 Planning Scheme

The majority of the site has been re-zoned to Neighbourhood Residential Zone – Schedule 2 (NRZ2). The area to the East along Cardinia Creek is zoned Green Wedge and a Public Use Zone (Utility) separates the two, which is a Melbourne Water Pipe Track.

The site is subject to a number of overlays, Figure 2-2 represents the Study site boundaries. The study site is subject to the following overlays (Figure 2-3):

- Development Plan Overlay – Schedule 24 (DPO24)
- Significant Landscape Overlay – Schedule 4 (SLO4) across whole development area
- Heritage Overlay Schedule 49 (HO49) affecting 54-60 Manuka Road and Heritage Overlay – Schedule 50 (HO50) affecting 62-70 Manuka Road
- Vegetation Protection Overlay (VPO2) immediately abuts the development at 72-80 Manuka Road
- Bushfire Management Overlay affecting part of the development area
- Land Subject to Inundation (LSIO) overlay along Grasmere Creek

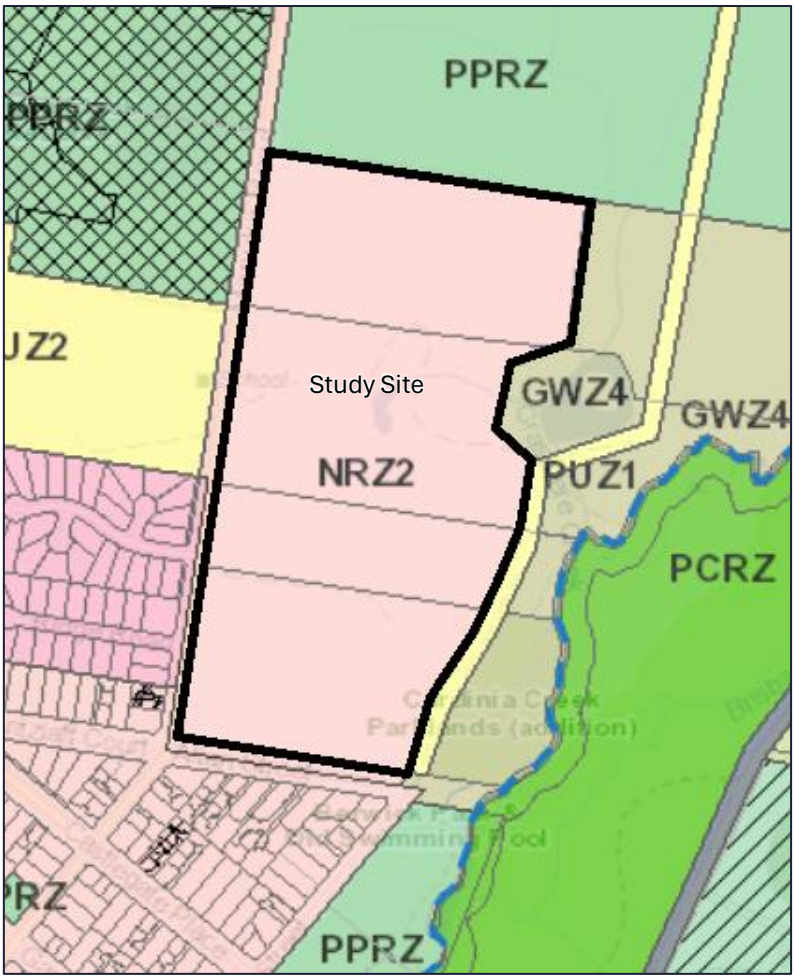


Figure 2-2 Zoning Map

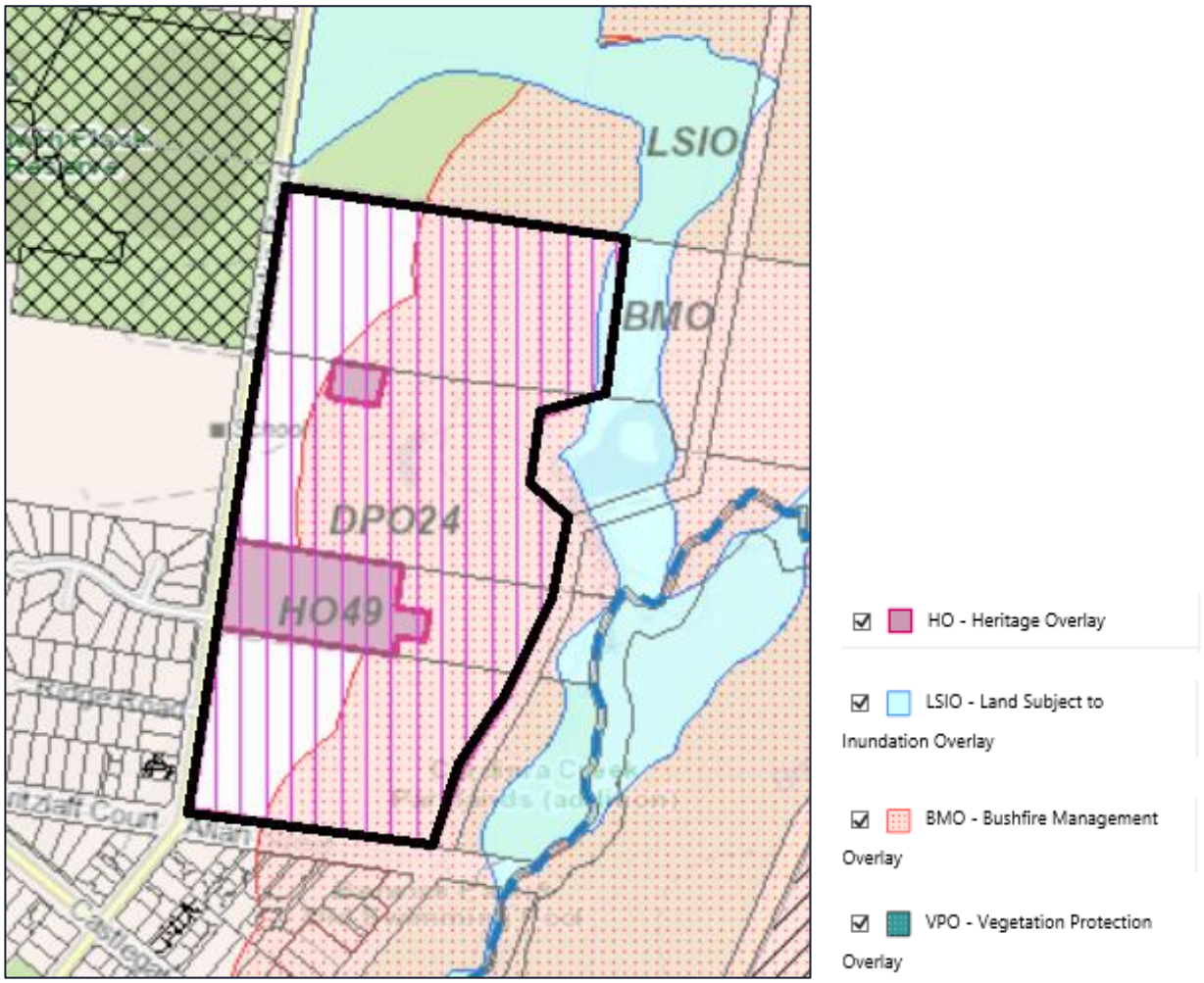


Figure 2-3 Planning Scheme Overlays

2.3 PSP

The subject site is not located within a precinct plan (PSP) area.

2.4 Cultural Heritage

The subject site is affected by an area of Aboriginal Heritage Sensitivity as defined in the Aboriginal Heritage Regulations 2018.

A CHMP has been completed and approved for the site, which will be relevant for future planning applications to subdivide and develop the land.

2.5 Geotechnical

A geotechnical assessment has not been conducted to date, and any detailed design is to take geotechnical information into account.

2.6 Biodiversity

The Dwarf Galaxias Impact Assessment report (draft, 2025) produced by Aquatica Environmental provides recommendations for management of the Dwarf Galaxias fish species within the catchment and affected works area. All works are to be compliant with the recommendations stipulated in the abovementioned report, once finalised following further assessments and engagement with relevant authorities.

The initial flora and fauna assessment was completed by Brett Lane & Associates in September 2012, with a further study completed in April 2022 by Nature and Advisory (formerly known as Brett Lane and Associates). Areas of Swampy Woodland and scattered trees were identified as shown in Figure 2-4. The arboreal report identified the tree (#6) in the South-East corner of 42 Manuka Road as low value, which sits outside the works footprint.

Figure 2-4 Flora Fauna Survey (BL&A, 2012)

2.7 Utilities

A Before You Dig Australia (BYDA) request for the site was undertaken to ascertain the location of existing assets. With the exception of the two assets within the Melbourne Water pipe track, there are no known assets impacting the drainage design for the site. MW has provided the location and details of their asset to ensure there are no clashes in the design.

3. Design Concept

The drainage strategy has been developed to:

- Recognise and aspire to retain existing vegetation by utilising the existing natural conditions of the site;
- Ensure flood protection of all lots;
- Convey flows through the site through the use of appropriately sized pipelines and overland flow paths along roadways;
- Treat low flows that enter Cardinia Creek directly to best practice water quality standards;
- Prevent any detrimental impact to adjacent properties or waterways; and
- Provide features which are functional, easy to maintain, attractive, have a high habitat value, and contributes to increased liveability for the development.

3.1 Catchment

The local terrain has dictated four catchments onsite, flowing to the North-West, North-East, South-West and South-East corners of the development (Figure 3-1). Based on the Rational Method, the following catchment characteristics and flows are relevant to the site, as shown in Table 3-1. Note that the Clover Cottage site has assumed developed flows to ensure proposed assets have the required capacity.

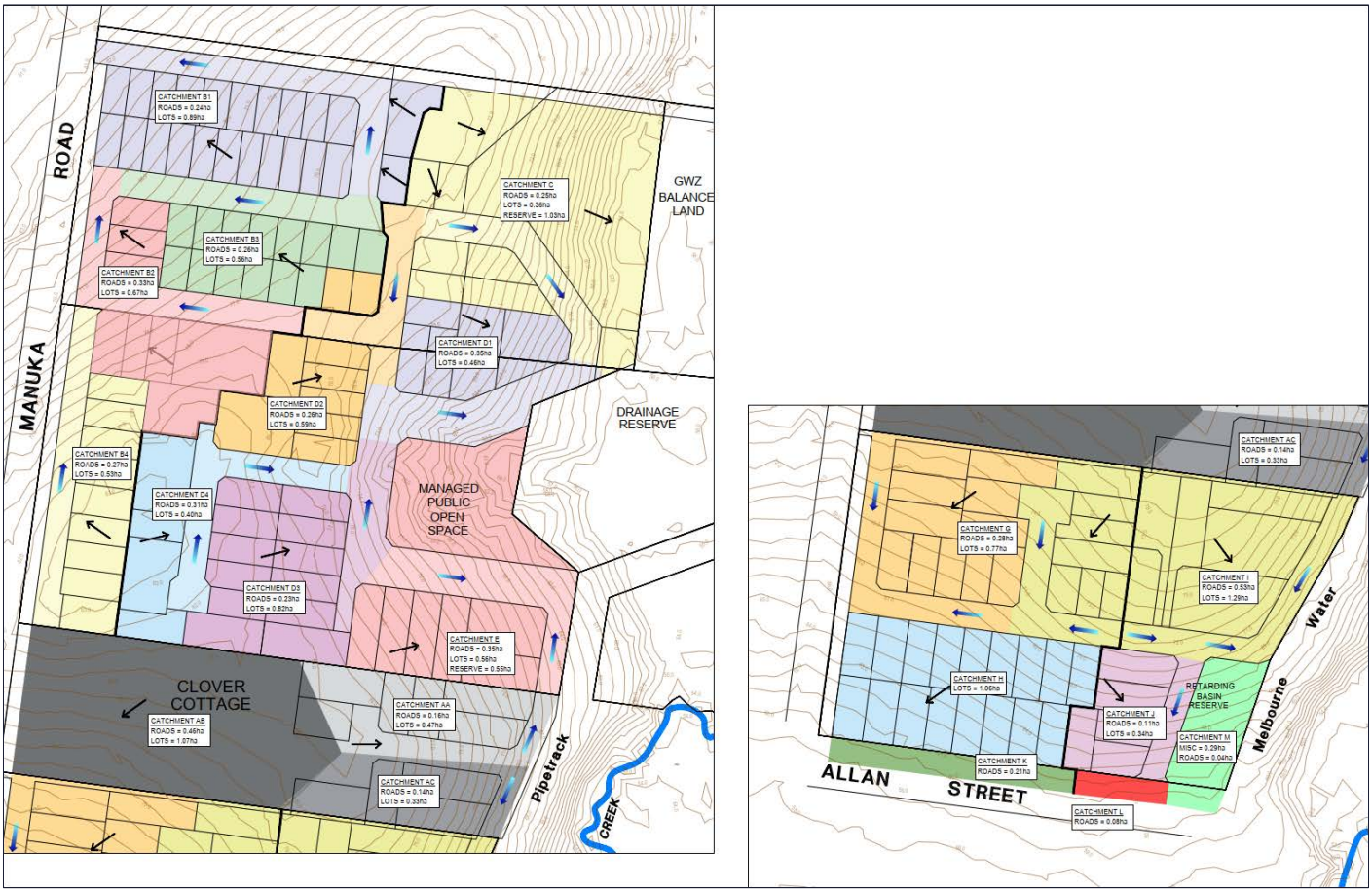


Figure 3-1 Catchment Plan

Table 3-1 Catchment Characteristics and Flows

	North-West	North-East	South-West	South-East
Catchment Area (ha)	4.01	7.35	3.85	3.15
Impervious Fraction (%)	53%	53%	52%	53%
1 in 100 AEP Flow (m^3/s)	0.96	1.66	0.99	0.56
1 in 5 AEP Flow (m^3/s)	0.39	0.66	0.41	0.23
1 in 3-month AEP Flow (m^3/s)	0.08	0.13	0.08	0.05

3.2 Onsite Piped Flows

The City of Casey is the responsible authority for minor local drainage surrounding the site, where underground drainage is to be constructed as part of the development of the site to cater for 1 in 5-year stormwater events. The proposed preliminary drainage layout is shown in Figure 3-2.

Figure 3-2 Proposed Underground Drainage

3.2.1 Option 1

As per council advice and commentary (refer Appendix F), the layout presented in Figure 3-2 would be utilised for the internal drainage layout, however, end of line treatments would be replaced with GPT and bio basins. This will result in some amendments to the internal drainage network alignment prior to discharging to the nominated outlets (Manuka Road swale and Cardina Creek).

Additionally, the storage tank detailed in the SE catchment would be removed, and Allan Street drainage network upsized to take developed Q100 flows to Cardinia Creek.

3.2.2 Option 2

Option 2 will propose no changes to the layout presented in Figure 3-2.

3.3 Overland Flow Conveyance

The 1% AEP flows will be contained and conveyed via the road network, with the general directions shown in Figure 3-3. All proposed lots within the site will be provided with a minimum of 150mm freeboard above the 1% AEP flood levels in the road reserves and 600mm adjacent to MW drainage reserves. Typical road cross sections and water levels have been conceptually modelled with the PC Convey program and are provided in Appendix C. As demonstrated in Appendix C all roadways meet the flood safety criteria.

Figure 3-3 1% AEP Flow Conveyance

4. Mitigation Measures

As discussed in Section 1.3, two mitigation measure options will be presented in this report. Option 1 incorporates recommendations from City of Casey, whereas Option 2 retains the previous drainage strategy present in Revision G of this report.

4.1 Option 1

This option incorporates recommendations from City of Casey), as well as the design proposed by Atlan Stormwater (2025). Refer to Appendix F for associated references.

The following mitigation measures are proposed for each catchment:

Table 4-1 Option 1 Mitigation Measures

Catchment	Mitigation Measure
North-West	It is proposed that flows are to be captured and conveyed to the existing swale located north of the site along Manuka Road. This swale will be upgraded as part of the proposed works, which connects to another swale within the DEECA / Parks Victoria reserve. Modification of the existing swale will be required to accommodate additional flows. Additional vegetation is to be considered within the swale to provide water quality treatment (subject to discussion and agreement with Council and MW).
North-East	Provide water quality treatment using GPT and bio-retention basin.
South-East	Provide water quality treatment using GPT and bio-retention basin.
South-West	Capture and convey flows via pipe alignment within Allan Street, which will connect with the South-East mitigation measure. Provide water quality treatment using GPT and bio-retention basin

4.1.1 Flow Conveyance

Minor flows of the site will be collected via underground pipe and gap flows are conveyed via the internal roads. However, this option will not require any form of onsite retention as it is Council's view that the development will have limited impact to the downstream land.

For the North-West Catchment, the existing dam will not be disturbed as part of the drainage strategy and a wetland and retardation basin system will not be proposed. Furthermore, the outlet of the North-West Catchment will avoid disturbance to the existing dam and discharge directly to Cardinia Creek after water quality treatment. Should Option 1 be pursued for the North-West Catchment, recommendations for works mitigations for this Option will be sought from the ecological experts and assessments updated accordingly. This can only occur at Functional and Detailed design stage once precise works are known, as part of future permit applications.

For the South-West Catchment, all flows will be directed towards Cardinia Creek through Allan Street. No flows will be directed southwardly towards Manuka Road as per Council advice.

For the South-East Catchment, a GPT and bio-retention basin are proposed within the northern verge of Allan Street. Further examination of the precise footprint would occur during Functional and Detailed design phase, noting the existing tree proposed to be retained in this location.

4.1.2 Water Quality Features

It is Council's preference that water quality treatment will be provided through the combination of pre-treatment (eg. GPT or sediment basin) and bio-retention systems. Therefore, this option proposes that 3-month ARI flow will be treated using GPT and bio-retention basin prior to discharging into Grasmere Creek and Cardinia Creek. The proposed pipe connections to incorporate these WSUD features will be further examined during Functional and Detailed design phase.

In partnership with City of Casey, Atlan Stormwater has proposed proprietary products to provide water quality treatment for the site. Atlan Stormwater has completed modelling of these water quality features within MUSIC.

It is noted that while Atlan Stormwater has provided preliminary modelling for this option, there is no obligation to use any specific infrastructure provider. Therefore, the water quality features proposed are indicative and will be further investigated during Functional and Detailed Design.

The technical report completed by Atlan Stormwater is included in Appendix F.

4.1.2.1 Gross Pollutant Control

The following gross pollutant traps are proposed at the outlet for each sub-catchment:

Table 4-2 Option 1 Gross Pollutant Trap

Catchment	Nominated Gross Pollutant Trap
North-West	Atlan Vortceptor IVR.100 (or approved equivalent)
North-East	Atlan Vortceptor IVR.160 (or approved equivalent)
South-East	Atlan Vortceptor IVR.055 (or approved equivalent)
South-West	Atlan Vortceptor IVR.100 (or approved equivalent)

4.1.2.2 Bio-retention

The following bio-retention basins are proposed at the outlet for each sub-catchment. Note sizing has been adopted from the report produced by Atlan for council, and subject to further analysis through detail design phase.

Table 4-3 Option 1 Bio-retention

Catchment	Nominated Bio-retention
North-West	Atlan Basin AMB20 (12m^2) (or approved equivalent)
North-East	Atlan Basin AMB30 (24m^2) (or approved equivalent)
South-East	Atlan Basin AMB20 (12m^2) (or approved equivalent)
South-West	Atlan Basin AMB20 (12m^2) (or approved equivalent)

The matters contained in this Section are subject to further consultation with and approval by the relevant authorities.

4.2 Option 2

The following mitigation measures are proposed for each catchment to provide conveyance of flows ultimately to Cardinia Creek:

Table 4-4 Option 2 Mitigation Measures

Catchment	Mitigation Measure
North-West	Capture and convey flows to the existing swale located north of the site within the DEECA / Parks Victoria reserve. No stormwater retention possible within this catchment due to topography and available space. Modification of the existing swale will be required to accommodate additional flows. Additional vegetation is to be considered within the swale to provide water quality treatment (subject to discussion and agreement with Council and MW).
North-East	Provide flood retention and treatment within the proposed wetland/retarding basin in the existing dam.
South-East	Provide flood retention and treatment in an onsite bioretention/underground storage with GPT.
South-West	Capture and convey flows via an oversized pipe along Allan Street. No flood retention possible within this catchment due to topography and available space however the overland gap flows will be restricted to not to exceed predeveloped flows. A CDS unit is proposed at the corner of the site for water quality purposes.

These measures have been previously discussed with Council as shown in Appendix B.

4.2.1 North-West Catchment

The North-West catchment flows will be conveyed overland and in pipework towards the North-Western corner of the site. Gap flows greater than predeveloped (in addition to the piped flows) will discharge into a proposed swale which will run Northward along Manuka Road and discharge into the existing swale asset (Figure 4-1). The existing swale connects to Grasmere Creek upstream of the proposed RB/wetland.

The existing swale is the outlet for the Manuka Road DSS to Grasmere Creek. The greater catchment area for the existing swale (which assumes the site flow is predeveloped) is 80.7 hectares. The size of the Manuka Road DSS catchment as compared to the North-Western Catchments area indicate the peak flows from each will not combine.

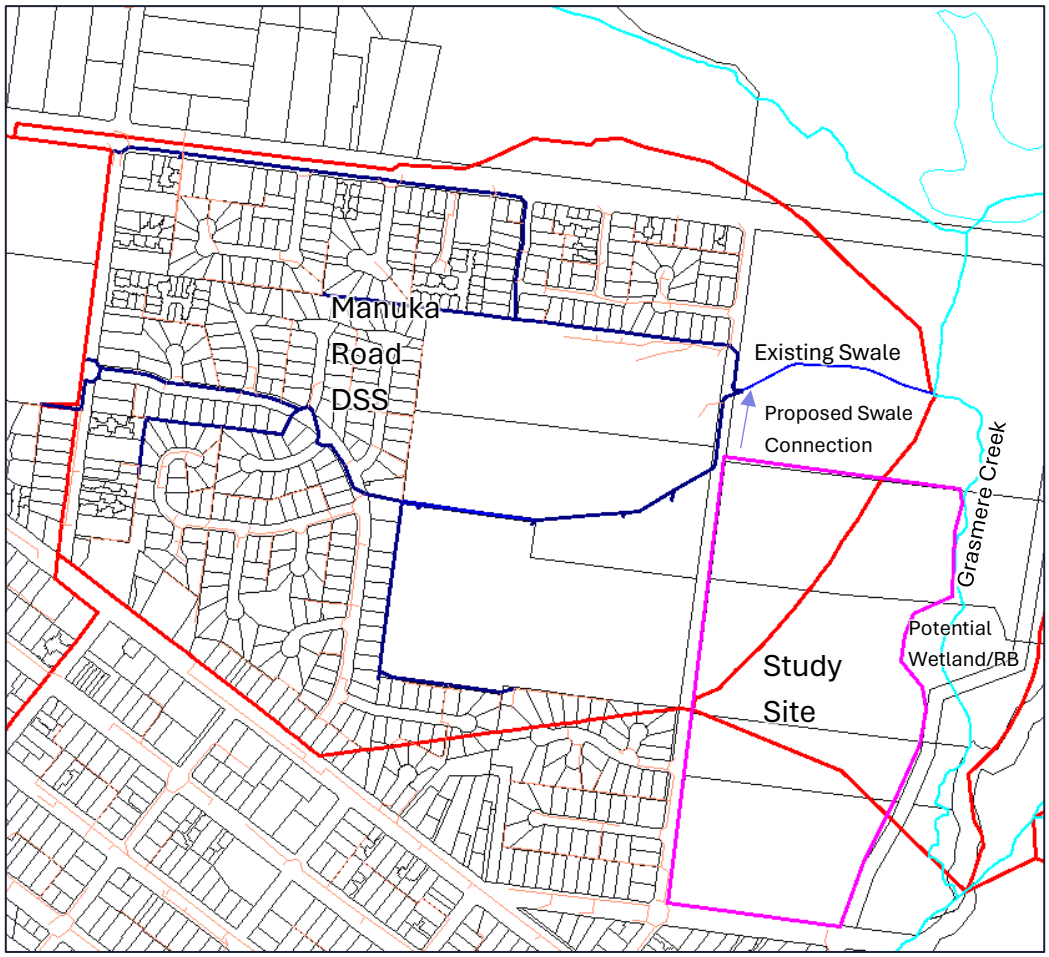


Figure 4-1 Existing Swale Catchment

As shown in Table 4-5 the connecting swale will have capacity for the difference between the developed and predeveloped 1% AEP event. The existing swale also has capacity for the site flow based on approximated calculations, although of note the greater floodplain in the reserve is required for the Manuka Road catchment 1% AEP (channel is only low flows).

Table 4-5 Swale Dimensions

	Connection Swale	Existing Swale
Design Flow (1% AEP) (m^3/s)	0.6	9.5
Grade (%)	2.2	0.18
Depth (m)	0.5	0.5
Base Width (m)	1.5	2.0
Top Width (m)	7.5	4.0
Length (m)	100	285
Velocity (m/s)	1.1	0.6

We note that MW as of February 2022 have cleaned out the existing swale – refer to figure 3.5.

Council will need to be consulted in regard to any potential flood retention (Q100 and/or Q2 flows) where water quality treatment is proposed to occur within the connection swale from the site prior to discharge into the existing swale.

Figure 4-5 Nearmap – Cleaned swale (February 2022)

4.2.2 North-East and South-East Catchments

An onsite retarding basin (On-line Wetland) and underground storage are intended to retard the 1% AEP flow back to predeveloped flows prior to discharge into Cardinia Creek. Details of the retarding basin and underground storage are shown in Table 4-6 and

Table 4-7, the resultant flows are demonstrated in Table 3-5.

Note underground tanks have been nominated as the preferred storage option for the South-East catchment as a result of feedback from council, as steep batters would be required for a retarding basin design. The Functional Design (Appendix C) aims to target the retardation of the 2 Year ARI flow via the diversion of the 3 months ARI flow into the bioretention system. The system acts as a small retarding basin for the low flow events. This design will result in reduced flow velocity at the outlet and minimise the erosion.

Ø 300mm pipe was adopted for the outlet of the storage tank, since pipes smaller than this are prone to blockages. This resulted in the outflow slightly exceeding the predeveloped flow as shown in Table 3-5. Refer to Appendix C for details.

Outlet pipes into the existing waterway for both catchments will be constructed to Melbourne Water specifications, and appropriate rock beaching to be detailed and documented in the detailed design phase. Note final outfall alignment to be confirmed during the detail design phase in consultation with council and MW. Conceptual alignment and MW specifications can be found in Appendix D.

Table 4-6 Retarding Basin Details

	North-East Retarding Basin
Storage Required (m^3)	670
Proposed Depth (m)	0.35
Area (m^2)	4000
Outlet Structures	Grated pit at wetland NWL with controlled outflow via 525mm pipe Existing weir at 54.3mAHD (not activated)

Table 4-7: Underground Storage (SPEL TANKSTOR SERIES 600) or Approved equivalent

	South-East Underground Storage
Storage Required (m^3)	214
SPEL Storage Unit or approved equivalent (Refer appendix E)	215 m^3 (made to order)
Outlet Structure	Controlled outflow via 300mm pipe end Velocity dissipation / bypass required prior to bioretention basin downstream

Table 4-8 Flood Retention Results

	North-East Retarding Basin	South-East Underground Storage
1 in 100 AEP Inflow (m^3/s)	1.66	0.56
1 in 100 AEP Required Outflow (m^3/s)	0.6	0.16
1 in 100 AEP Mitigated Outflow (m^3/s)	0.5	0.27

A HGL analysis has been completed to confirm the pipe sizes required to meet the retardation objective for the South-East underground storage system. The hydraulic features and calculated HGL with the proposed underground tank and Ø300mm pipe outlet are shown in Appendix A. The maximum outflow that can be achieved is 0.27 m3/s in the 1 in 100 AEP event which is consistent with the outcomes intended for the South-East catchment strategy.

4.2.3 South-West Catchment

Preliminary discussions with Council, see Appendix B, noted the South-West catchment is intended to be collected via a pipe and directed eastwards along Allan Street towards Cardinia Creek. This pipe has been sized to ensure the gap flow for this catchment will be discharged into the public drainage system will not exceed the predeveloped flows for the site thus minimising offsite flooding impacts. The pipe size has included the study site and assumed development of the Clover Cottage site to ensure the system is future proofed. As shown in Table 4-9 the pipe (Ø750mm) and associated grated pit (1200mm x 1200mm or equivalent area) has been designed to convey 0.60m^3/s to Cardinia Creek.

Table 4-9 South-West Catchment Design

	South-West Catchment
Design Flow (100 Year AEP) (m^3/s)	0.99
Predeveloped 100 Year AEP Flow (m^3/s)	0.39
Overland Flow Down Manuka Road (m^3/s)	0.39
Piped Flow to Cardinia Creek (m^3/s)	0.60

4.2.4 Water Quality Features

A wetland has been proposed in the existing dam location to treat the flows from North-East catchment in a manner that is sensitive to the existing vegetation. A sediment pond prior to the wetland will increase the lifespan of the asset. The North-West catchment will be conveyed in the existing swale but will also be treated within the wetland as the outlet is upstream of this feature.

The South-East catchment will be treated with a GPT and bioretention basin. Catchment is to be retarded back to predeveloped conditions using an underground storage tank or approved equivalent.

The South-West catchment is proposed to have a CDS unit (or equivalent) to provide water quality treatment.

All water quality features were modelled within MUSIC using the current design standards.

4.2.4.1 Gross Pollutant Control

The proposed residential development is unlikely to produce a significant gross pollutant load, and the intention is to capture any floating litter at the entrance to the underground storage tank using litter traps.

A gross pollutant trap is proposed for the catchment entering the bioretention system and a CDS unit for the South-Western catchment which provides additional water quality treatment.

4.2.4.2 Sediment Pond

A sediment pond will be located prior to North-East catchment flows entering the wetland system. Sizing of the sediment pond is based on Fair & Geyer settling velocity calculations and subsequently modelled within MUSIC. Based on the calculations (

Table 4-10) the following sediment pond is proposed.

Table 4-10 Sediment Pond Dimensions

	Sediment Pond
Surface Area (m^2)	150
Extended Detention (m)	0.35
Permanent Pool Depth (m)	1.5
Permanent Pool Volume (m^3)	100
Sediment Drying Area (m^2)	60

The sediment pond will capture 95% of 125µm particles, with a cleanout frequency of minimum once every 3-5 years. See Appendix A for details.

4.2.4.3 Wetland

A wetland system is proposed for the existing dam for the NE catchment to treat low flows prior to discharge into Cardinia Creek. The following details are relevant to the wetland design, as shown in

Table 4-11. This wetland system has been upsized to provide best practice treatment for the site. Recognising that these works would occur in an ecologically sensitive area, in particular for the Dwarf Galaxias species, the detailed design for these works will occur in conjunction with the ecological experts and in consultation with the relevant authorities. The preliminary Dwarf Galaxias assessment has recommended a number of works mitigation measures, which will need to be compiled with. The assessment also identifies a number of ecological benefits to the greater catchment that can be realised with the design.

Table 4-11 Wetland Dimensions

	Wetland
Surface Area (m^2)	4000
Extended Detention (m)	0.35
Average Depth (m)	0.4
Maximum Depth (m)	1.5
Permanent Pool Volume (m^3)	1600
Detention Time (hours)	72

4.2.4.4 Bioretention

A bioretention system will be in the base of the South-East retarding tank outlet to treat low flows prior to discharge into Cardinia Creek. Details of the proposed bioretention are shown in

Table 4-12.

Table 4-12 Bio-retention Dimensions

	Bioretention
Total Surface Area (m^2)	45
Filter Surface Area (m^2)	30
Extended Detention (m)	0.2
Filter Depth (m)	0.5

4.2.4.5 Existing Swale

An existing swale runs through DEECA / Parks Victoria Reserve and appears to provide limited treatment. As part of the connection works the potential for planting within the swale could provide water quality treatment for the site North-West catchment and the greater catchment. The proposed works within the swale will need to be agreed and further design provided.

Figure 4-6 Existing Swale (Google Street View)

5. MUSIC Modelling

5.1 Option 1

A MUSIC model has been completed by Atlan Stormwater which includes proprietary products as part of the treatment train. The layout of the model is shown in Figure 5-1.

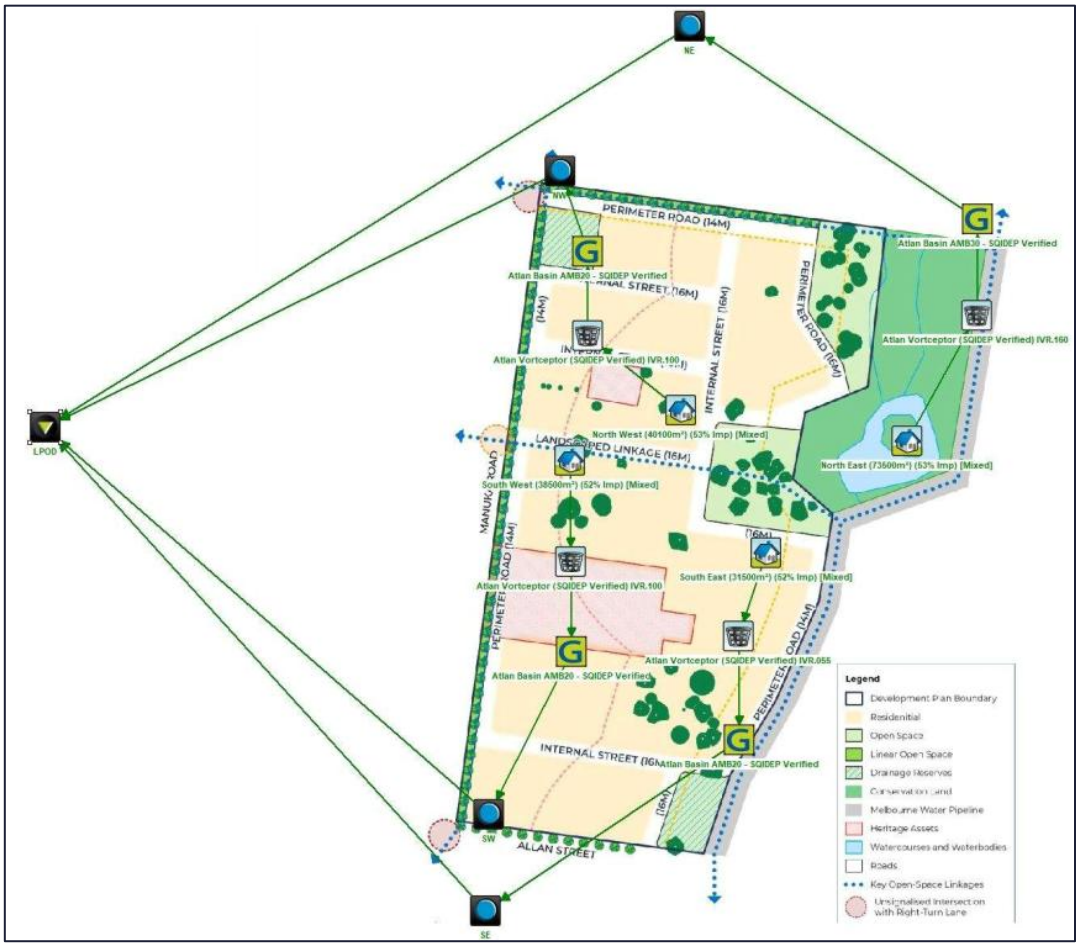


Figure 5-1 Atlan MUSIC Model

5.1.1 Results

The results of the MUSIC Model provided by Atlan Stormwater is provided below.

Table 5-1 MUSIC Modelling Results

	Pollutant Reductions in MUSIC Model	Best Practice
Total Suspended Solids (TSS)	95%	80%
Total Phosphorus (TP)	92%	45%
Total Nitrogen (TN)	53%	45%

The technical report completed by Atlan Stormwater is included in Appendix F.

5.2 Option 2

5.2.1 Model Setup

MUSIC model (Version 6.2.1) was used to assess the performance of the treatment devices. As per the Melbourne Water MUSIC Guidelines (2016) the model was rerun with the following parameters:

- Template 6-minute rainfall for Narre Warren North over a 10-year period (1984-1993)
- Soil store parameters as per the guidelines (Soil Store Capacity 120mm, Field Capacity 50mm)
- Fraction impervious values based on the Melbourne Water MUSIC model.

The layout of the MUSIC model is shown in Figure 5-2. Treatment feature parameters are as per Section 3.5 of this report.

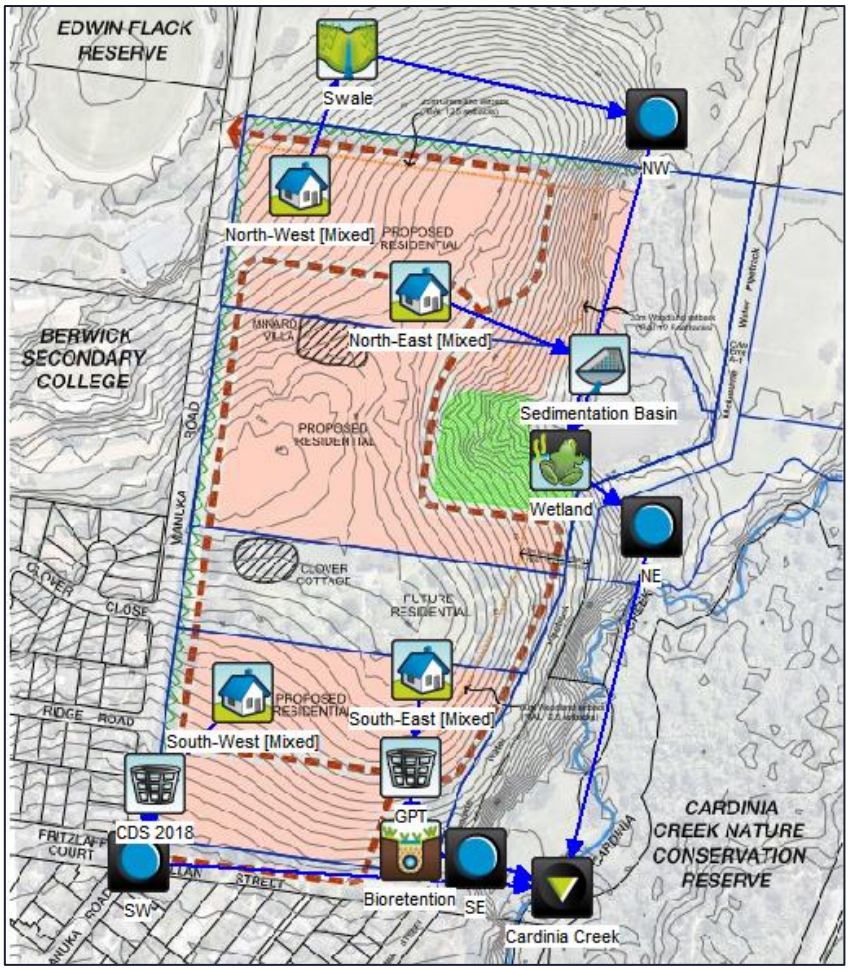


Figure 5-2 MUSIC Model

Note GPT systems and supplier parameters have been utilized as part of the treatment train in the MUSIC Model, to meet best practice requirements for the site.

5.2.2 Results

As shown in Table 5-2, the features modelled within MUSIC meet the required reductions to achieve best practice and the drainage strategy objectives.

Table 5-2 MUSIC Modelling Results

	Pollutant Reductions in MUSIC Model	Best Practice
Total Suspended Solids (TSS)	86%	80%
Total Phosphorus (TP)	66%	45%
Total Nitrogen (TN)	45%	45%

The MUSIC model and Auditor Report have been provided in conjunction with this report.

6. Concept Plan

6.1 Option 1

The WSUD features nominated in Option 1 utilises proprietary products proposed by Atlan Stormwater. Indicative locations of the GPT and bio-retention basin are shown in Figure 6-1. The general arrangement of the Atlan Vortceptor and Atlan Basin are shown in Figure 6-2 and Figure 6-3, respectively. Details such as drainage connections and bio-retention sizing will be further investigated during Functional Design, pending the final layout of the development. City of Casey will maintain these structures as per the maintenance procedures nominated by the supplier.

The concept layout provided by Atlan is included in Appendix F.

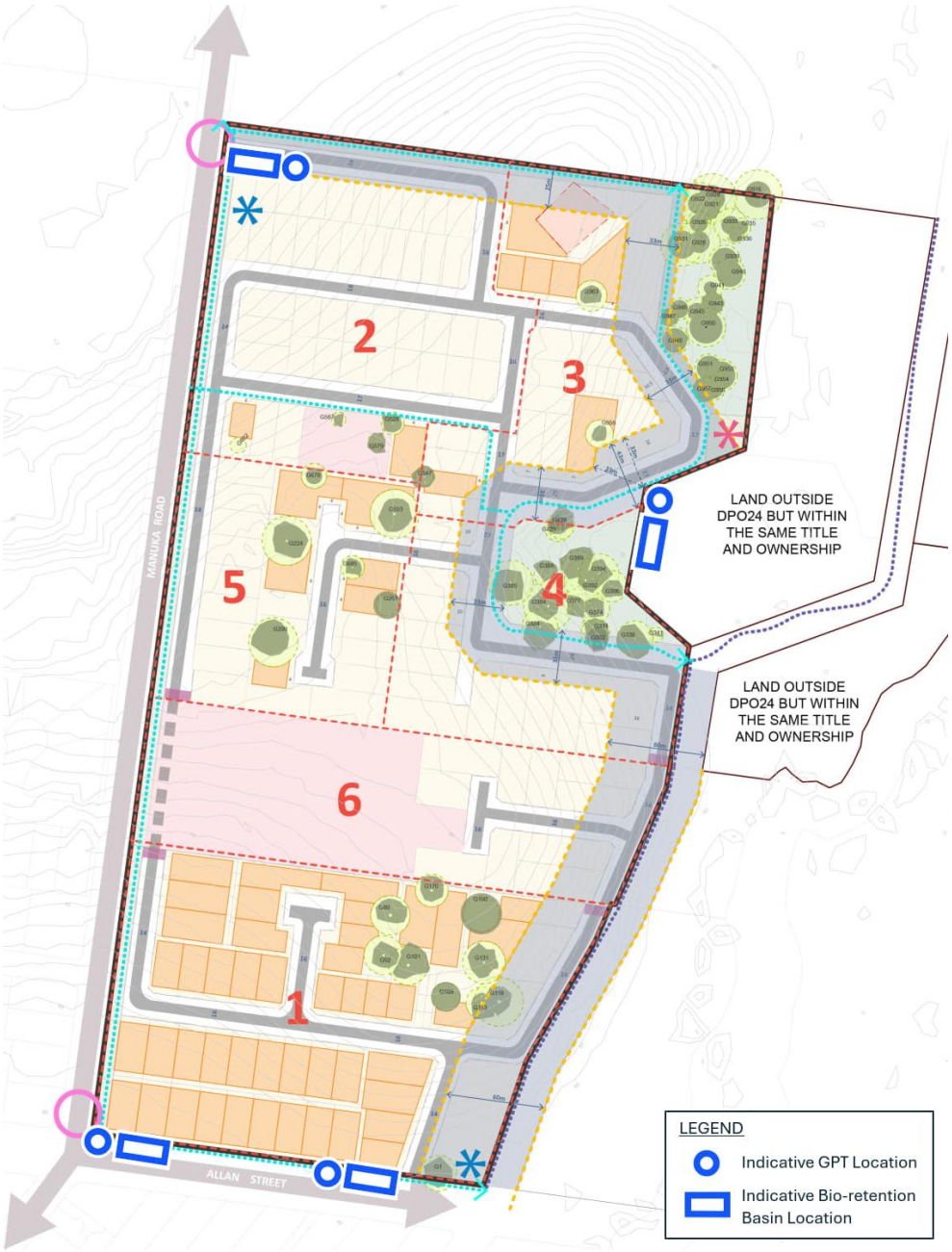


Figure 6-1 Option 1 Concept Plan

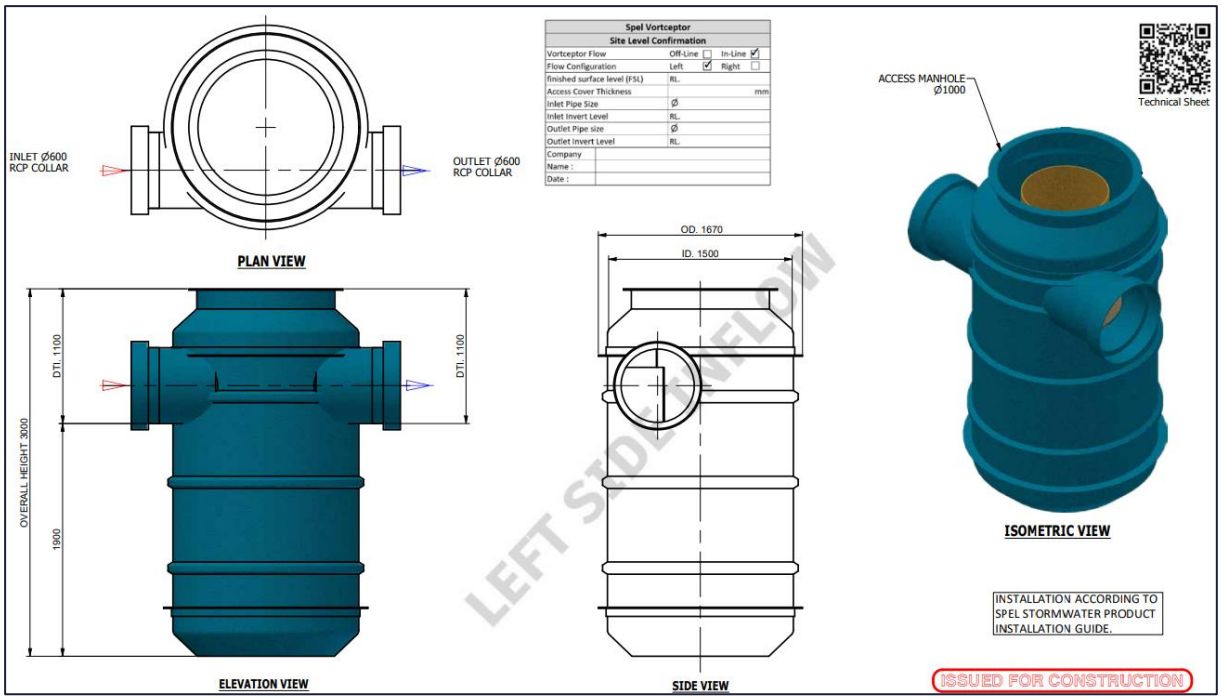
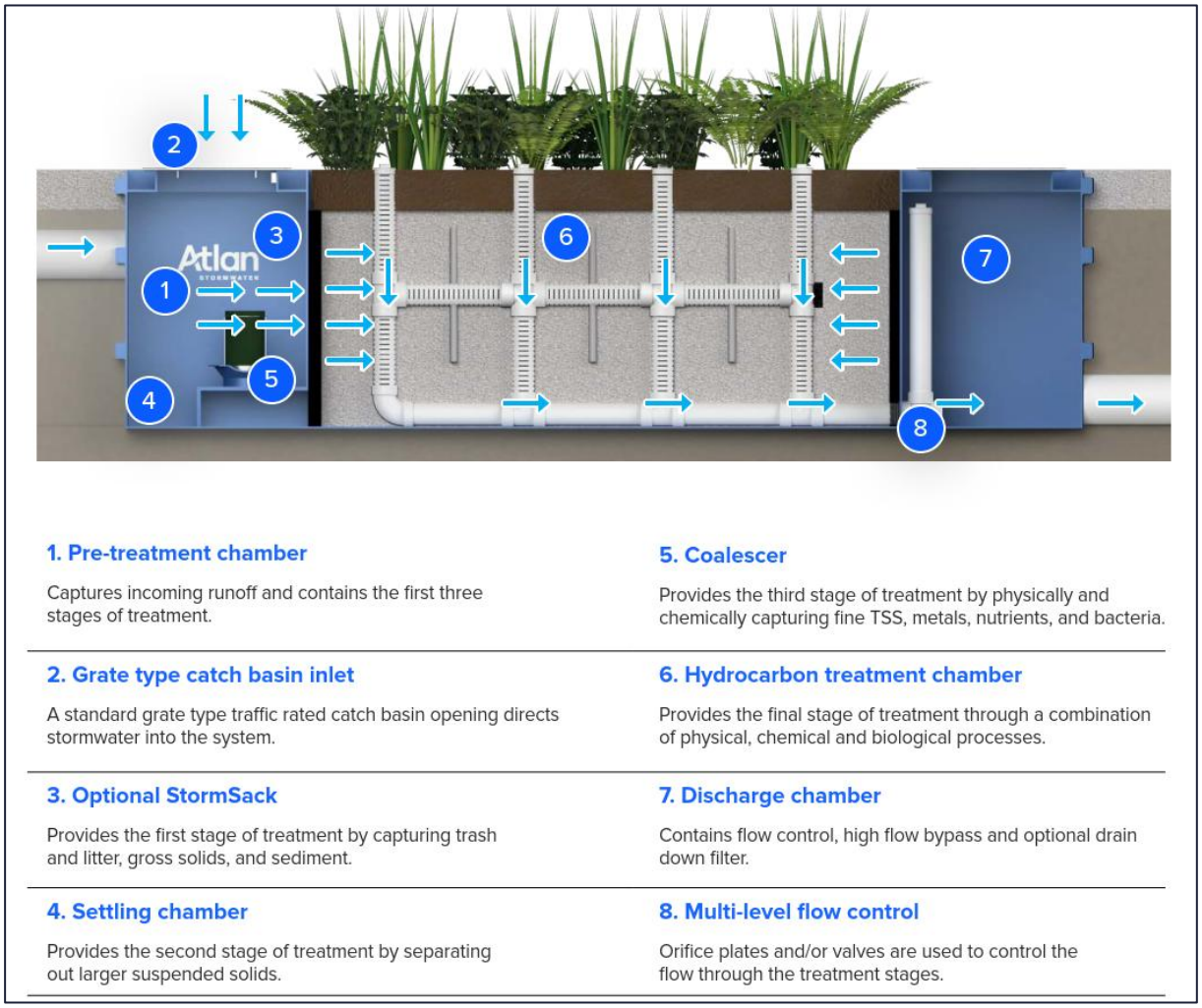


Figure 6-2 Atlan Vortceptor General Arrangement



1. Pre-treatment chamber

Captures incoming runoff and contains the first three stages of treatment.

2. Grate type catch basin inlet

A standard grate type traffic rated catch basin opening directs stormwater into the system.

3. Optional StormSack

Provides the first stage of treatment by capturing trash and litter, gross solids, and sediment.

4. Settling chamber

Provides the second stage of treatment by separating out larger suspended solids.

5. Coalescer

Provides the third stage of treatment by physically and chemically capturing fine TSS, metals, nutrients, and bacteria.

6. Hydrocarbon treatment chamber

Provides the final stage of treatment through a combination of physical, chemical and biological processes.

7. Discharge chamber

Contains flow control, high flow bypass and optional drain down filter.

8. Multi-level flow control

Orifice plates and/or valves are used to control the flow through the treatment stages.

Figure 6-3 Atlan Basin General Arrangement

6.2 Option 2

WSUD features are designed so that only the low flows (Q0.25) are treated. Note in a major storm event, the wetland for the northeast catchment also functions as a retarding basin when flows exceed Q0.25. Flows in the system will retard back to predeveloped conditions in a Q100 event.

Typical layouts of the proposed features are shown in Figures 6-4 to 6-5, with levels subject to change based on any revised outlet details. Further details of the WSUD features including North-East wetland concept plan and preliminary Functional Design for the South-East underground storage & bioretention system can be found in Appendix D.

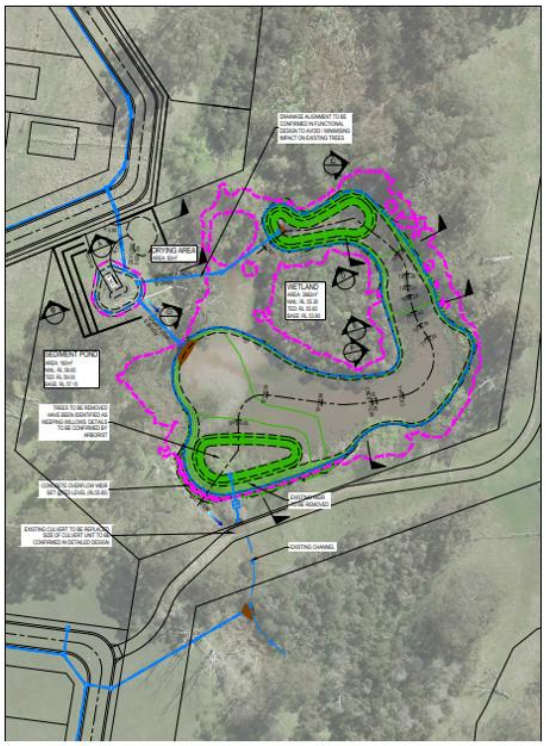


Figure 6-4 Location of North-east Catchment Drainage Features

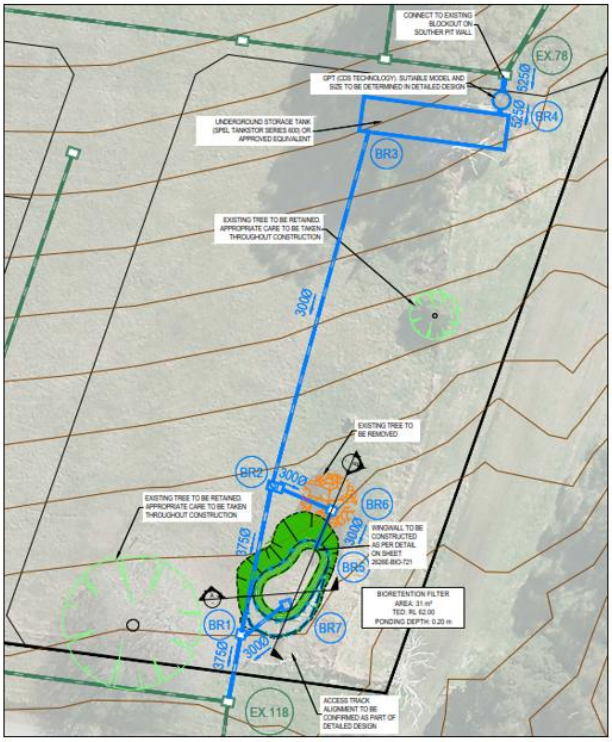


Figure 6-5 Location of South-east Catchment Drainage Features

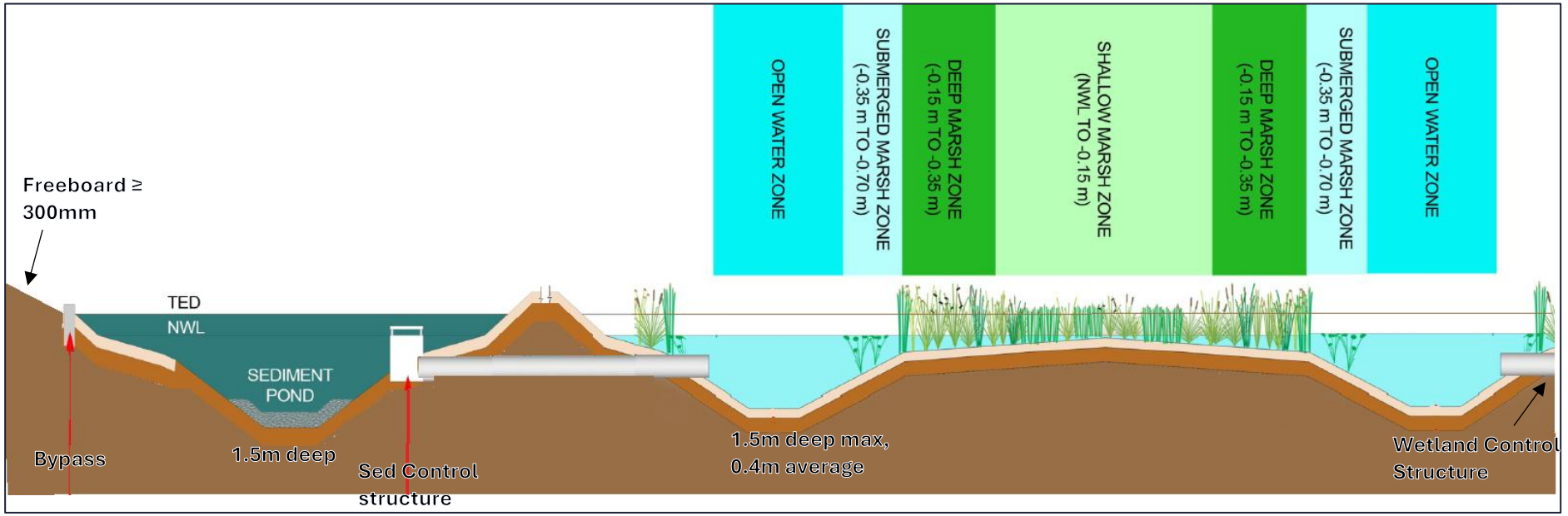


Figure 6-6 Conceptual Long Section of Wetland (adapted from Constructed Wetlands Design Manual)

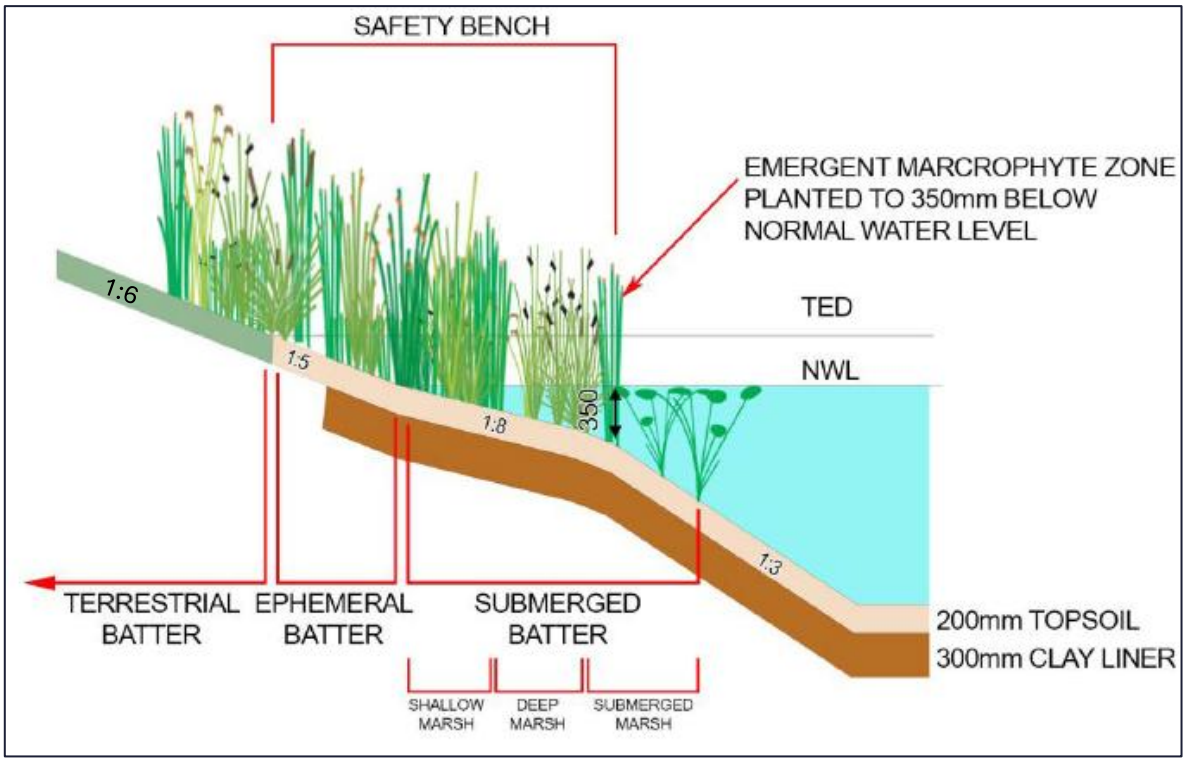


Figure 6-7 Conceptual Cross Section (adapted from Constructed Wetlands Design Manual)

6.2.1 Maintenance

Maintenance of the proposed wetland asset is intended to be carried out from the adjoining maintenance path in the MW pipetrack, access to the sediment drying areas via a 4m wide access track. Maintenance access to the bioretention, storage tanks and GPT are to occur from surrounding roads and access tracks (locations within reserve to be confirmed in detail design).

Access to the CDS unit is via Manuka Road or the internal sites roads, dependant on the final design. The City of Casey will maintain the features following the defects liability period as the catchment areas are less than 60 hectares.

7. Conclusion

Council's nominated alternative solution for Stormwater management across the development has been incorporated into the SWMS and is presented as Option 1, which is an alternative solution which could be adopted subject to all authorities' acceptance.

The drainage features for the site under Option 2 have been designed in accordance with the initial meeting and preliminary design intent as discussed with City of Casey and consider all site opportunities and constraints. This report details the conceptual design, where further analysis and design are to be completed in the Functional Design and Detailed Design phases.

This concept design provides proof that the proposed features are able to be incorporated within the provided reserves and considers the existing vegetation and the ability to maximise retention of the natural environment. The design of the features provides attractive, maintainable and functional green spaces.

Important considerations for the next phases of design include:

- Details of all pipes, pits, structures, treatments, etc.
- Detailing maintenance access
- Full terrain analysis of the swales and proposed WSUD features
- Finalisation of the development pipe network and layout. Key for Allan St to cater for 1% developed flows for protection of existing residents.
- Confirmation by MW on acceptance of council's preferred solution. This will determine the level of treatment required and if appropriate, offset contributions payable.

Appendix A Design Calculations

Rational Method Calculations

Predeveloped

					TIME OF CONCENTRATION		1 in 5 AEP			1 in 100 AEP			PIPE 1 in X AEP	GAP FLOW
			Rural Zone Area	Total Area	Critical Catchment	Adopted tc	A_e	I	Q	A_e	I	Q		EXCESS Q1 - 0.8QPIPE
NODE	DESCRIPTION	CONTRIBUTING CATCHMENTS	ha	ha		min	ha	mm/hr	m^3/s	ha	mm/hr	m^3/s		m^3/s
1		B4	0.8	0.8	1	6.5	0.1	83.08	0.03	0.2	158.63	0.08	1 in 5 AEP	0.05
2		B3	0.82	0.82	2	7.9	0.2	76.53	0.03	0.2	148.43	0.08	1 in 5 AEP	0.05
3		B2 B4	1.8	1.8	3	8.1	0.3	75.50	0.07	0.4	146.74	0.17	1 in 5 AEP	0.11
4	NW Outfall	B1 B2 B3 B4	4.01	4.01	3	8.8	0.7	72.75	0.15	0.9	142.15	0.37	1 in 5 AEP	0.25
5		D4	0.71	0.71	5	6.5	0.1	82.61	0.03	0.2	157.93	0.07	1 in 5 AEP	0.05
6		D2	0.85	0.85	6	7.7	0.2	77.19	0.03	0.2	149.50	0.08	1 in 5 AEP	0.06
7		D3 D4	1.76	1.76	7	8.0	0.3	75.89	0.07	0.4	147.39	0.17	1 in 5 AEP	0.11
8		C	1.84	1.84	8	6.2	0.3	84.19	0.08	0.4	160.25	0.19	1 in 5 AEP	0.13
9		D1 D2 D3 D4	3.42	3.42	7	9.3	0.6	70.92	0.12	0.8	139.01	0.31	1 in 5 AEP	0.21
10	NE Outfall (Wetland)	C D1 D2 D3 D4 E AA	7.35	7.35	9	9.4	1.4	70.60	0.27	1.7	138.44	0.66	1 in 5 AEP	0.44
11	Direct Outfall to Creek	E AA	2.09	2.09	11	7.6	0.4	77.52	0.08	0.5	150.03	0.20	1 in 5 AEP	0.14
12	Overflow/Grated Pit into Q100 pipes	G AB	2.58	2.58	12	9.0	0.5	72.01	0.09	0.6	140.88	0.23	1 in 5 AEP	0.16
13	SW Outfall into Q100 pipes	H K	1.27	1.27	13	7.7	0.2	77.40	0.05	0.3	149.83	0.12	1 in 5 AEP	0.08
14	SE Outfall into U/G Tanks	I AC	2.29	2.29	17	9.3	0.4	71.00	0.08	0.5	139.14	0.21	1 in 5 AEP	0.14
15		J	0.45	0.45	15	6.1	0.1	84.87	0.02	0.1	161.25	0.05	1 in 5 AEP	0.03
16		J L	0.53	0.53	15	6.2	0.1	84.63	0.02	0.1	160.90	0.06	1 in 5 AEP	0.04
17		AC	0.47	0.47	17	7.9	0.1	76.22	0.02	0.1	147.93	0.04	1 in 5 AEP	0.03
18	Outlet towards Cardinia Creek	J L M	0.86	0.86	16	6.6	0.2	82.42	0.04	0.2	157.64	0.09	1 in 5 AEP	0.06

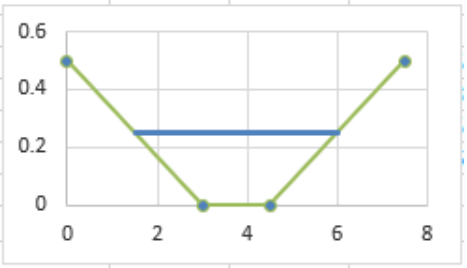
Developed

							TIME OF CONCENTRATION		1 in 5 AEP			1 in 100 AEP			PIPE 1 in X AEP	GAP FLOW	BALANCE TO BE PIPED	ACCUMULATIVE PIPED FLOW
			Road Zone Category 2 Area	Residential normal Area	Public Use Zone - drainage Area	Total Area	Critical Catchment	Adopted tc	A_e	I	Q	A_e	I	Q		EXCESS Q1 - 0.8QPIPE		
NODE	DESCRIPTION	CONTRIBUTING CATCHMENTS	ha	ha	ha	ha		min	ha	mm/hr	m^3/s	ha	mm/hr	m^3/s		m^3/s		
1		B4	0.27	0.53	0	0.8	1	8.5	0.4	74.17	0.08	0.5	144.54	0.21	1 in 5 AEP	0.14		
2		B3	0.26	0.56	0	0.82	2	7.9	0.4	76.53	0.09	0.5	148.43	0.22	1 in 5 AEP	0.15		
3		B2 B4	0.6	1.2	0	1.8	1	9.2	0.9	71.24	0.18	1.2	139.55	0.45	1 in 5 AEP	0.30		
4	NW Outfall	B1 B2 B3 B4	1.2	2.7	0.11	4.01	3	9.9	2.0	68.84	0.39	2.6	135.34	0.96	1 in 5 AEP	0.65		
5		D4	0.31	0.4	0	0.71	5	8.5	0.4	73.81	0.07	0.5	143.93	0.18	1 in 5 AEP	0.12		
6		D2	0.26	0.59	0	0.85	6	7.7	0.4	77.19	0.09	0.5	149.50	0.23	1 in 5 AEP	0.15		
7		D3 D4	0.54	1.22	0	1.76	5	9.8	0.9	69.15	0.17	1.1	135.89	0.42	1 in 5 AEP	0.29		
8		C	0.25	0.36	1.23	1.84	8	8.2	0.9	75.01	0.19	1.1	145.94	0.46	1 in 5 AEP	0.31		
9		D1 D2 D3 D4	1.15	2.27	0	3.42	7	11.2	1.7	65.12	0.31	2.2	128.60	0.78	1 in 5 AEP	0.53		
10	NE Outfall (Wetland)	C D1 D2 D3 D4 E AA	1.91	3.66	1.78	7.35	9	11.2	3.7	64.85	0.66	4.7	128.11	1.66	1 in 5 AEP	1.13		
11	Direct Outfall to Creek	E AA	0.51	1.03	0.55	2.09	11	7.6	1.0	77.52	0.23	1.3	150.03	0.55	1 in 5 AEP	0.37		
12	Overflow/Grated Pit into Q100 pipes	G AB	0.74	1.84	0	2.58	12	9.0	1.3	72.01	0.26	1.6	140.88	0.64	1 in 100	0.39	0.27	
13	SW Outfall into Q100 pipes	H K	0.21	1.06	0	1.27	13	7.7	0.6	77.40	0.14	0.8	149.83	0.33	1 in 100	0.00	0.33	0.6
14	SE Outfall into U/G Tanks	I AC	0.67	1.62	0	2.29	17	9.3	1.2	71.00	0.23	1.5	139.14	0.56	1 in 100	0.00		
15		J	0.11	0.34	0	0.45	15	8.1	0.2	75.53	0.05	0.3	146.80	0.12	1 in 5 AEP	0.08	0.05	0.65
16		J L	0.19	0.34	0	0.53	15	8.2	0.3	75.35	0.06	0.3	146.49	0.14	1 in 5 AEP	0.09	0.05	0.7
17		AC	0.14	0.33	0	0.47	17	7.9	0.2	76.22	0.05	0.3	147.93	0.12	1 in 5 AEP	0.08		
18	Outlet towards Cardinia Creek	J L M	0.23	0.34	0.29	0.86	16	8.6	0.4	73.66	0.09	0.5	143.69	0.22	1 in 5 AEP	0.15	0.08	0.78

Swale Design

New Swale - North-West Catchment

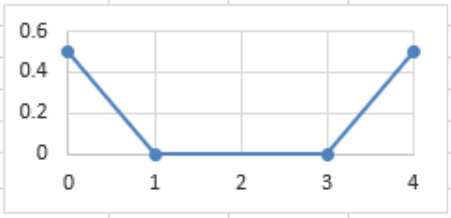
Mannings calculation of capacity of a trapezoidal swale



Drain Depth	0.5	m				
Water Depth	0.2					
Base width	1.5	m				
Slope	0.0222		1 in	45.04505		
side slopes	1 in	6				
Area	0.54	m^2				
ss length	1.22	m				
Vetted Perim	3.93	m				
R	0.14	m			Top Elevation	59.22
mannings n	0.035		want	exist	Bottom Elevation	57
Capacity	0.61	m^3/s	0.6		Length	100
velocity	1.13	m/s	1.5			

Existing Swale - North-West Catchment (estimated)

Mannings calculation of capacity of a trapezoidal swale



Drain Depth	0.5	m				
Base width	2	m				
Slope	0.00175		1 in	571.4		
side slopes	1 in	2				
Area	1.5	m^2				
ss length	1.12	m				
Vetted Perim	4.24	m				
R	0.35	m			Top Elevation	57
mannings n	0.035		want		Bottom Elevation	56.5
Capacity	0.90	m^3/s	9.49		Length	285.7
velocity	0.60	m/s	1.5			

Grated Pit –South-West Catchment

Grated Pit			want			
CAPACITY:	Q=(m3/s)	**0.634643**	0.52			
With Blockage		0.317322				
Tb =		0.04	Tb = Thickness of Bar			
Xb =		0.12	Xb = Distance b/w centres			
C =		0.45	C = Discharge Coefficient (usually 0.45)			
L =		1.2	L = Grate Length (m)			
B =		1.2	B = Grate Width (m)			
g =		9.81	g = 9.81			
v =		0	v = velocity of flow over grate, usually 0			
H =		0.11	H = Depth of water ponding over grate			
Blockage (%)		50				

RB Design

North-East RB

```
Storage: RB NE
Initial water level at elevation  54.95 m
Spillway data:
        Elevation(m)=    54.95    Length(m)=     0.0
        Elevation(m)=    55.30    Length(m)=     9.0
        Elevation(m)=    56.20    Length(m)=   100.0
        Weir coeff. =  1.60
Pipe outlet data:
        Entrance loss coeff.= 0.500     Bend loss coeff.= 0.000
        Length(m)=   26.  Gradient(%)= 0.280 U/S invert el.(m)=   54.10
        No. of pipes= 1.     Diameter (m)= 0.525
Elevation (m) - Storage (m³) table
     54.95        0.000E+00
     55.00        1.872E+02
     55.05        3.769E+02
     55.10        5.689E+02
     55.15        7.632E+02
     55.20        9.600E+02
     55.25        1.159E+03
     55.30        1.361E+03
     56.20        7.532E+03
     56.50        1.000E+04

 *** Calculated hydrograph,  NE dam

                          Hydrograph
                           Calc.
 Peak discharge,m³/s      1.018
 Time to peak,h           0.333
 Volume,m³             2.76E+03
 Time to centroid,h       1.91
 Lag (c.m. to c.m.),h     1.52
 Lag to peak,h          -0.0577

 Calculated  drawdown= 0.000E+00 m³ : RB NE

 Results of routing through special storage RB NE
  Peak elevation=   55.13 m
  Peak outflow =     0.49 m³/s (pipe & spillway flow)
  Peak storage =     6.66E+02 m³
```

South-East Underground Storage -Boyd's Method

Drainage Detention

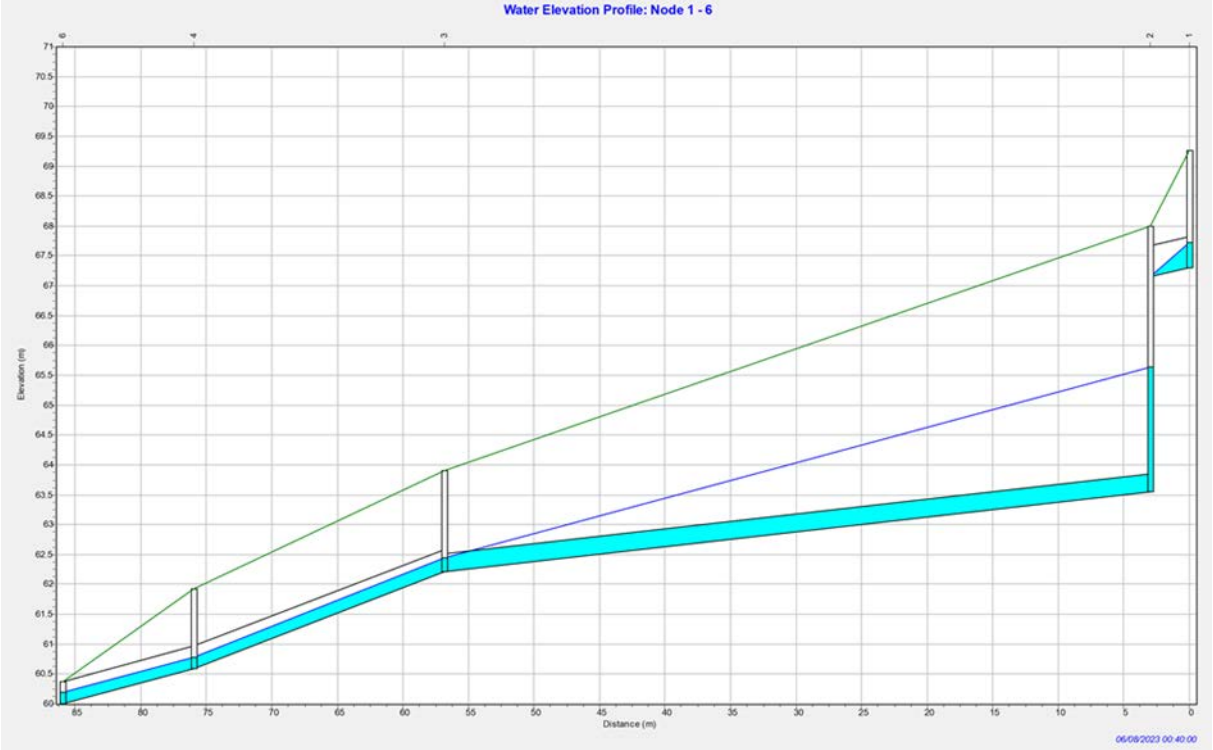
n	n.t_c (min)	INTENSITY (mm/h)	INFLOW Q_{100} (m^3/s)	INFLOW Q_{100} (L/s)	VOLUME IN V_{in} (m^3)	VOLUME OUT V_{out} (m^3)	VOLUME REQ FOR STORAGE (m^3)
1	10.00	137.92	0.547	547	328	162	166
2	20.00	96.03	0.381	381	457	243	214
3	30.00	73.83	0.293	293	527	324	203
4	40.00	60.27	0.239	239	573	405	168
5	50.00	51.17	0.203	203	609	486	123
6	60.00	44.65	0.177	177	637	567	70

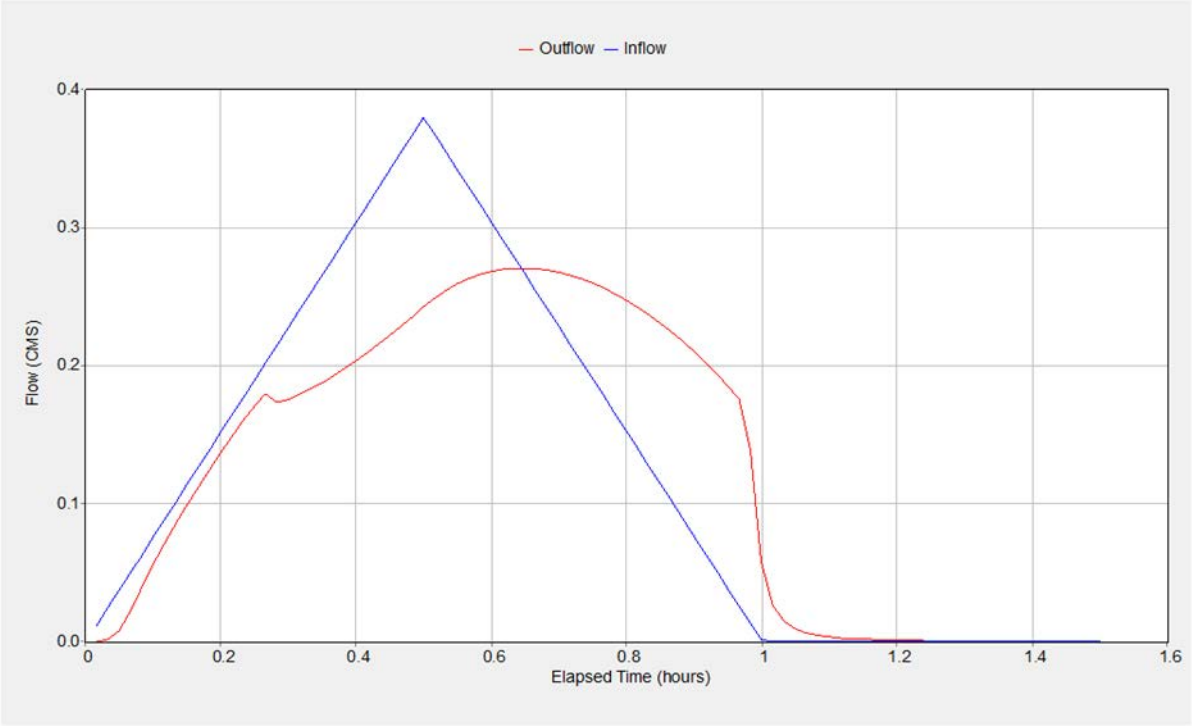
Site Discharge from Catchment	0.270 m3/sec
Maximum Storage Volume for Developed Catchment	214 m3

Underground Storage Outflow Control – 300mm diameter pipe

Diam	**1.8**	**m**	Diam	**0.3**	**m**
Area	2.54	m2	Area	0.07069	m2
Pipe Length	85	m			
Volume	216	m3			
Orifice Flow	Cd	0.6			
	Area	0.07069	m2		
	Head	2	m		
	Q	0.27	m3/s		

Underground Storage & Bioretention System HGL Analysis and Hydrographs





Sediment Pond Sizing

Calculations

							Base	0					
Target = very fine sand							NWL	1.5					
Vs =	0.011	m/s					TED	1.85					
							Ext detent	0.35					
d_e =	0.35	m					Depth	1.5					
d_p =	1.5	m					Total Dept	1.85					
d* =	1.0	m											
(d_e+d_p) =	1.4												
(d_e+d^*)													
Q =	0.12	m^3/s	use rational method to obtain 0.25 Year ARI flow for sub catchment										
A =	150	m^2	Area of sediment pond										
Vpp =	78	m3	Permanent pool volume										
V_s =	13.75												
Q/A													
λ =	0.26	pond shape assumption											
n =	1.35												
Fraction of Initial Solids Removed													
R =	97%												
Requirement: Melbourne Water Requires R = 95% for a 125 micrometer particle													

Cleanout Frequency

Catchment Area =		7.42	ha	Just urban catchment concidered									
Sediment load =		1.60	m^3/ha/yr	(Willing and Partners 1992)									
Gross Pollutant Load =		0.40	m^3/ha/yr (	Alison et al 1998)									
Actual basin depth =		1.9	m										
Actual Basin area =		150	m^2										
Therefore, cleanout frequency required =			$(1.6+0.4)A_{catchment}$ =		0.11	per year		Clean out every		9.3	years		
			$0.5d_{basin}*A_{basin}$							0.106955	times per year		
Assumes cleanout when basin 50% full													
Try to minimise cleanouts - ideally, once every 5 years					OK								
			clean out when sediment level is 500mm below NWL										

Sed drying area

Depth of sed		0.5	m
Volume sed		30	m3
Area		59.76	m2

MUSIC Auditor Results

Melbourne Water

Date Completed: 08-04-22
MUSIC Guideline Audited: 2016 Guidelines
MUSIC Version Audited: 6.2 or 6.3
Filename is ManukaRd_upsizedwetland_cds_20220408.mrt
PDF Download

Source Nodes				
Parameter	User Input	Check	Guideline	Comments
Node North-East does not have any errors. (Node 1)				
Node North-West does not have any errors. (Node 6)				
Node South-West does not have any errors. (Node 7)				
Node South-East does not have any errors. (Node 8)				

Treatment Nodes				
Parameter	User Input	Check	Guideline	Comments
Wetland (Node 2) Music Help				
Overflow weir width (m)	5	<	10	Warning - check is large enough to ensure wetland can overflow freely, if not may result in system filling to unrealistic depths. FAQ
Sedimentation Basin (Node 3) Music Help				
Permanent pool volume (m3)	75	<	1 * 150 = 150	Shallow permanent pool depth given area, wind action may result in sediment being re-entrained. Check sediment storage volume (50% of permanent pool, is sufficient). FAQ
Overflow weir width (m)	2	<	10	Warning - check is large enough to ensure sediment basin can overflow freely, if not may result in system filling to unrealistic depths. FAQ
Swale (Node 12) Music Help				
Extended detention depth (m)	0.5	>	0.35	Deep average depth, check for any safety issues. FAQ
Bed slope	0.007	<	0.01	Very shallow slope, may result in waterlogging or stagnant ponding. It is recommended that shallow underdrains or a thin sand layer is used to reduce this. WSUD Eng Proc
Vegetation height (m)	0.25	>	0.15	Vegetation height greater than 0.15 m. Typical ranges are 10-100mm for mown grass, 100-400mm for other vegetation. Review proposed vegetation and maintenance plan.
Node Bioretention does not have any errors. (Node 13)				

Catchment Details				
Parameter	User Input	Check	Guideline	Comments
Node ManukaRd_upsizedwetland_cds_20220408 does not have any errors. (Node 6 Minutes)				

The permanent pool of the sediment ponds and overflow weirs are appropriate for the site, with input values based on a terrain analysis rather than a depth * area calculation.

Appendix B Correspondence

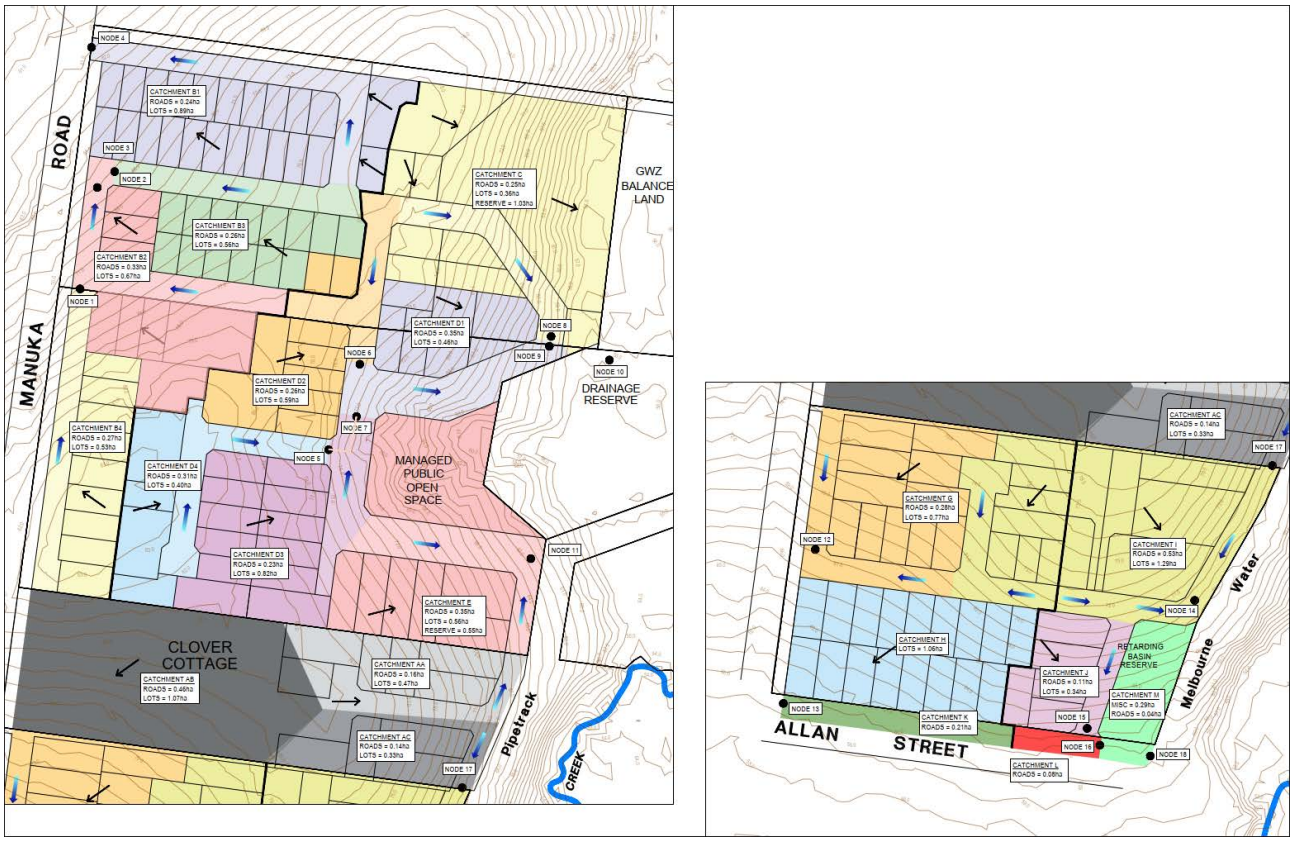
From: Brett SANDERSON
Sent: Friday, 15 March 2019 4:10 PM
To: dfokkens@casey.vic.gov.au; David Dickeson <DDickeso@casey.vic.gov.au>
Cc: Darren POWELL <Darren.Powell@smec.com>; Ben Mahon <b.mahon@veris.com.au>; Don Welsh <dwelsh@parklea.com>; Malcolm Semmens <msemmens@parklea.com>
Subject: [#2626E - General] 2626E: Manuka Road Stormwater & Abutting Infrastructure Roundtable

David, Daniel & Nick (please forward email to Nick),

Thank you for your time this morning. To summarise our discussion we provide the below:

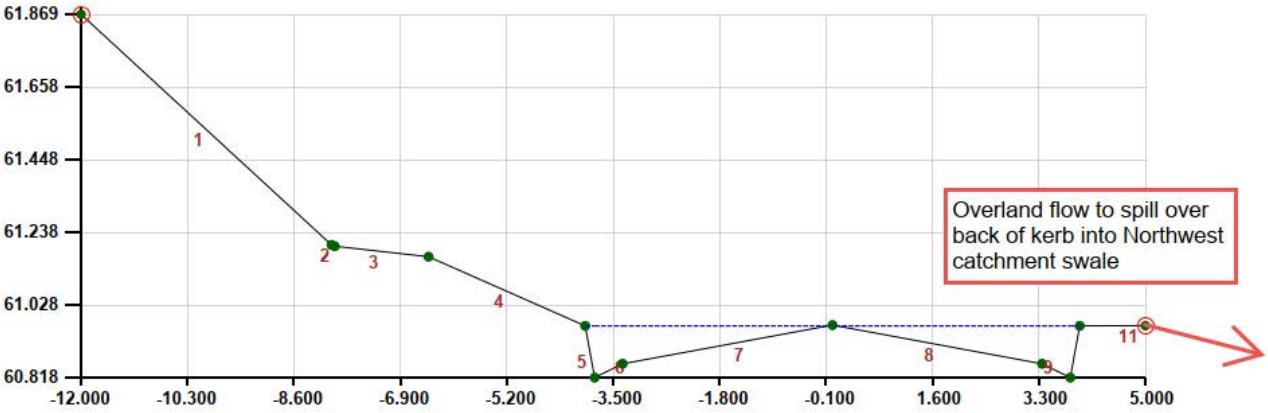
- SMEC outlined the proposed development and challenges associated with stormwater (SW) resulting from topography and location at the bottom end of the area catchment;
- SMEC believes a traditional SW solution can be achieved for the catchments east of the site, from the ridge of the hill to the eastern boundary, the solution will propose to include the repurposing of the existing dam for containment to pre-development flow and treatment.
- Casey raised concerns for any removal of trees around the existing dam to shape the into proposed Wetlands, SMEC acknowledges this and will work to provide a solution to the satisfaction of all stakeholders;
- The western portion of the site i.e. between top of hill and Manuka Road, SMEC outline the topographical challenges with retarding in conventional basins 1 and B as presented in the attached sketch, will result in the loss of significant developable area including the need to retaining walls within basins which ultimately become unusable land for future residents. 2 No. option were table and detailed below;
- The catchment area associated with Basin 1, SMEC proposes to capture, treat and convey flows north along Manuka Road to discharge to the existing vegetated swale adjacent to the electrical transmission towers. Ultimately these flows will discharge to Cardinia Creek with additional treatment within the swale.
- The catchment area associated with Basin C the south western portion of the site would be captured, treated and conveyed to discharge into the Cardinia Creek via Q10 pipe within Allan Street. The gap flow is expected to be minimal and in-line with pre-development flows and allowed to sheet towards the low point downstream of Manuka Road. SMEC will further develop the calculation and present to Casey for acceptance of this option;
- Casey noted the requirement for treatment of SW is key vs the requirement to retard to predevelopment flows. SMEC acknowledged treatment of all stormwater would occur prior to discharge to the environmentally sensitive waterways through means of either bioretention, GPTs etc. A viable option will be explored and presented for the City's assessment. Further treatment and offset will be explored through mandating rainwater tanks for future residents;
- Casey noted the catchment area is >60Ha maintenance of the system will be their responsibility. Discussion and agreement with Melbourne Water will be required where potential offsets to the adjacent Drainage Scheme may be possible or amendments to the scheme boundary to include the Manuka Site. SMEC will liaise with MW to seek agreement;
- SMEC acknowledges the requirement to upgrade Allan Street including sealing and drainage works for the south western catchment however it noted the intersection with Manuka Road should be further developed as an unsignalized T-intersection; and
- Casey noted the amended PSP is due on the 02/04/19.

Appendix C Q100 Road Cross Sections



Node 4 Road A Ch238.609
Print-out date: 16/07/2025 - Time: 4:30
Data File: Node 4 Road A Ch238.609.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 0.65 cumecs

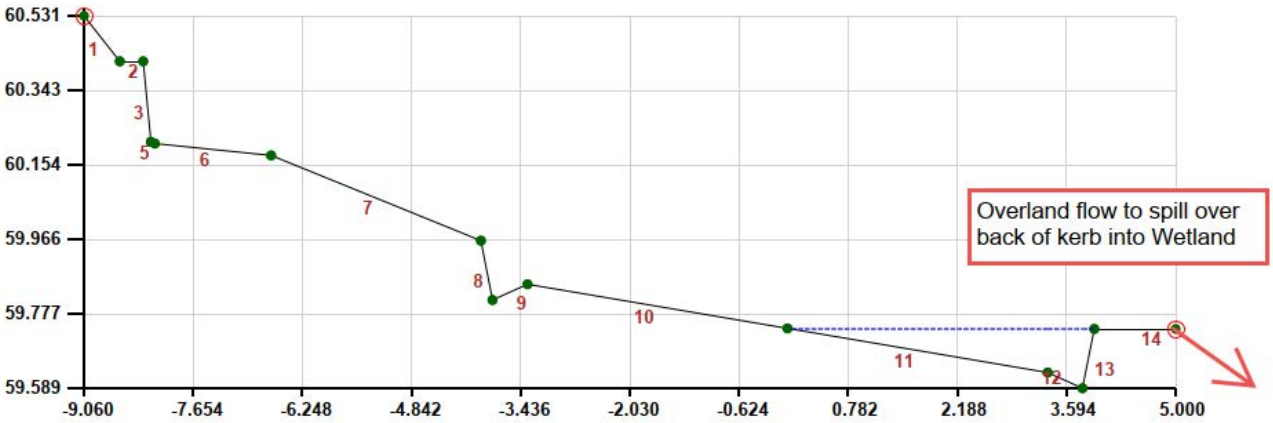
There is no pipe discharge
Overland / Channel / Watercourse discharge = 0.65 cumecs

3. RESULTS: Water surface elevation = 60.968 m

High Flow Channel grade = 1 in 30.000, Main Channel / Low Flow Channel grade = 1 in 30.000.

Node 8_9 Road A Ch103.846
Print-out date: 16/07/2025 - Time: 4:20
Data File: Node 8_9 Road B Ch103.846.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 1.66 cumecs

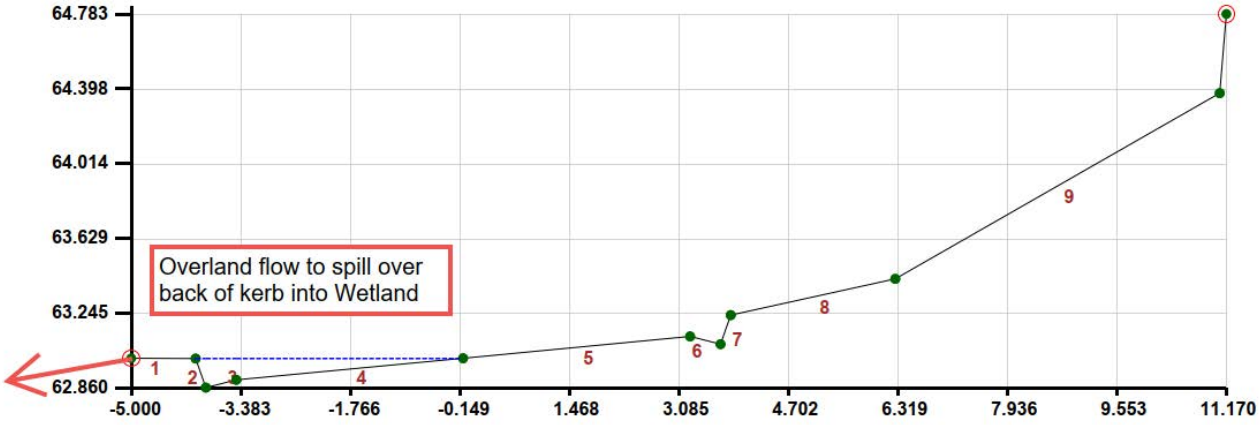
There is no pipe discharge
Overland / Channel / Watercourse discharge = 1.66 cumecs

3. RESULTS: Water surface elevation = 59.739 m

High Flow Channel grade = 1 in 30.000, Main Channel / Low Flow Channel grade = 1 in 30.000.

Node 11 Road E Ch329.984
Print-out date: 16/07/2025 - Time: 6:19
Data File: Node 11 Road E Ch329.984.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 0.37 cumecs

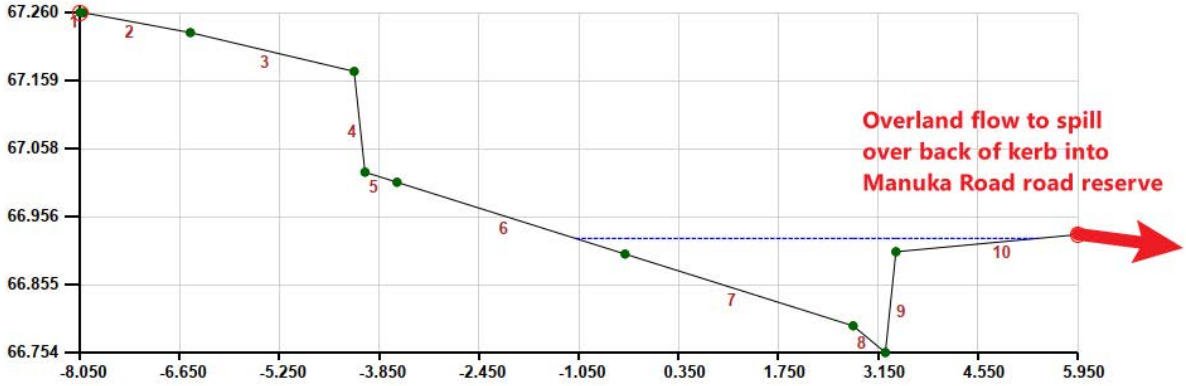
There is no pipe discharge
Overland / Channel / Watercourse discharge = 0.37 cumecs

3. RESULTS: Water surface elevation = 63.010 m

High Flow Channel grade = 1 in 30.000, Main Channel / Low Flow Channel grade = 1 in 30.000.

PROJECT: Manuka Road Feasibility
Node 12 Road AA Ch90.45
Print-out date: 20/06/2025 - Time: 8:45
Data File: Node 12 Road AA Ch90.45.pcc

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 0.55 cumecs

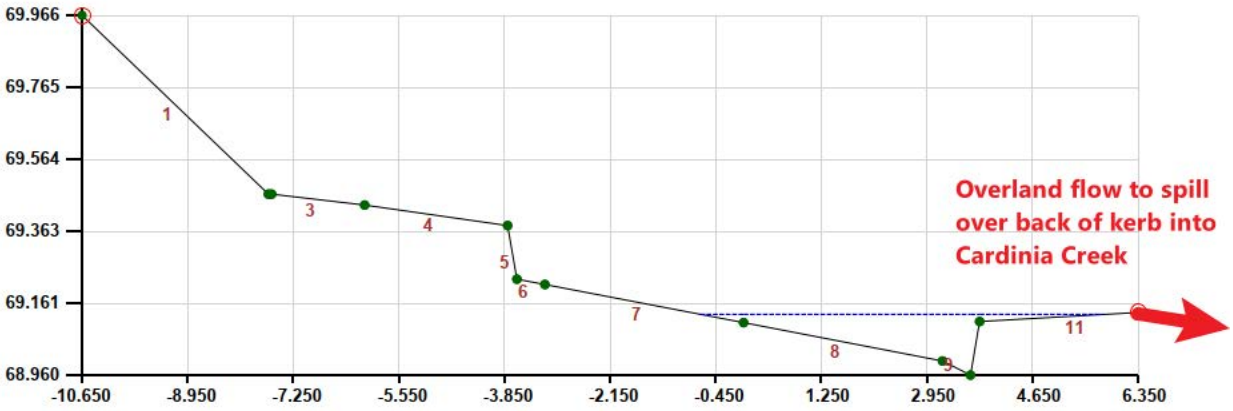
There is no pipe discharge
Overland / Channel / Watercourse discharge = 0.55 cumecs

3. RESULTS: Water surface elevation = 66.924 m

High Flow Channel grade = 1 in 20, Main Channel / Low Flow Channel grade = 1 in 20.

PROJECT: Manuka Road Feasibility
Node 14 Road AA Ch336.71
Print-out date: 20/06/2025 - Time: 8:33
Data File: Node 14 Road AA Ch336.71.pcc

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 0.20 cumecs

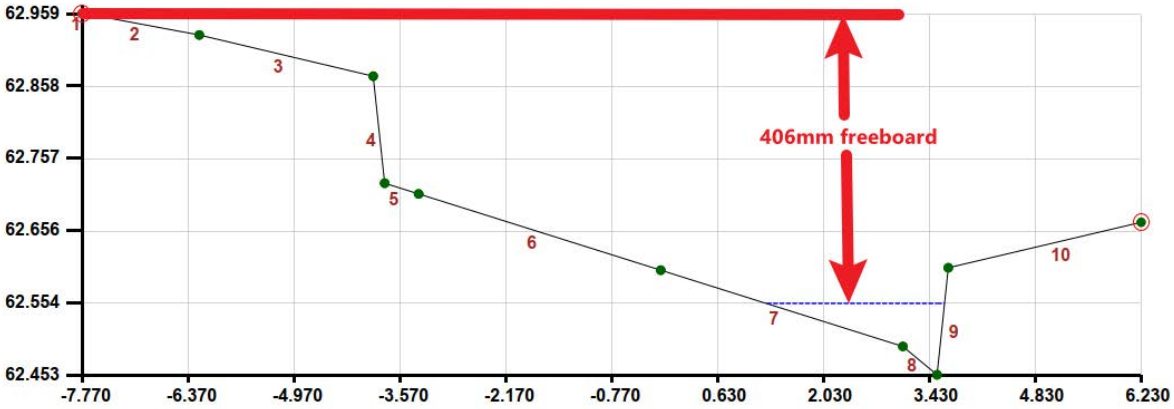
There is no pipe discharge
Overland / Channel / Watercourse discharge = 0.20 cumecs

3. RESULTS: Water surface elevation = 69.130 m

High Flow Channel grade = 1 in 200.000, Main Channel / Low Flow Channel grade = 1 in 200.000.

PROJECT: Manuka Road Feasibility
Node 15 Road CC Ch0
Print-out date: 20/06/2025 - Time: 8:26
Data File: Node 15 Road CC Ch0.pcc

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 0.16 cumecs

There is no pipe discharge
Overland / Channel / Watercourse discharge = 0.16 cumecs

3. RESULTS: Water surface elevation = 62.553 m

High Flow Channel grade = 1 in 9.000, Main Channel / Low Flow Channel grade = 1 in 9.000.

Cross Section	D(ave) <= 0.30m	V(ave) (m/s)	V(ave) x D(ave) <= 0.35m²/s
Node 4	0.06m	1.45m/s	0.09m²/s
Node 8 & 9	0.06m	1.45m/s	0.09m²/s
Node 11	0.06m	1.45m/s	0.09m²/s
Node 12	0.06m	1.60m/s	0.09m²/s
Node 14	0.06m	0.51m/s	0.03m²/s
Node 15	0.04m	1.94m/s	0.08m²/s

Appendix D Retarding System Plans

42-80 Manuka Road, Berwick
North East Wetland
City of Casey

Drawing Index

2626E-WLN-701 Locality Plan
2626E-WLN-721 Layout Plan & Cross Section
2626E-WLN-722 Cross Section
2626E-WLN-851 Longitudinal Section

WARNING
BEWARE OF UNDERGROUND SERVICES
The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown.
Locate all underground services before commencement of works
DIAL 1100 BEFORE YOU DIG
www.1100.com.au

REV	DATE	AMENDMENT / REVISION DESCRIPTION	DRAFTER	DESIGNER	CHECKER	APPROVER
A	28.08.23	ISSUED FOR INFORMATION ONLY	R.AYOBI	S.BAEK	C.CATHCART	D.POWELL
B	11.10.23	ISSUED FOR INFORMATION ONLY	R.AYOBI	S.BAEK	C.CATHCART	D.POWELL

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SMEC DWG REF. 2626E-WLN-701

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Manuka Road, Berwick -
Casey City Council
Main Drainage Plan
Concept Design
Locality Plan

MELWAYS REF	PROJECT / DRAWING No.	SHEET No.	REVISION
	2626E-WLN-701	01 of 04	B

DWG PATH: V:_Vault\Projects_Urban\ENG\2626E-Manuka Road, Berwick\2626E-Masterplanning\2626E-WLN\2626E-WLN-701.dwg PRINTED BY: TP16530 on 11/10/2023 at 11:28:12 AM

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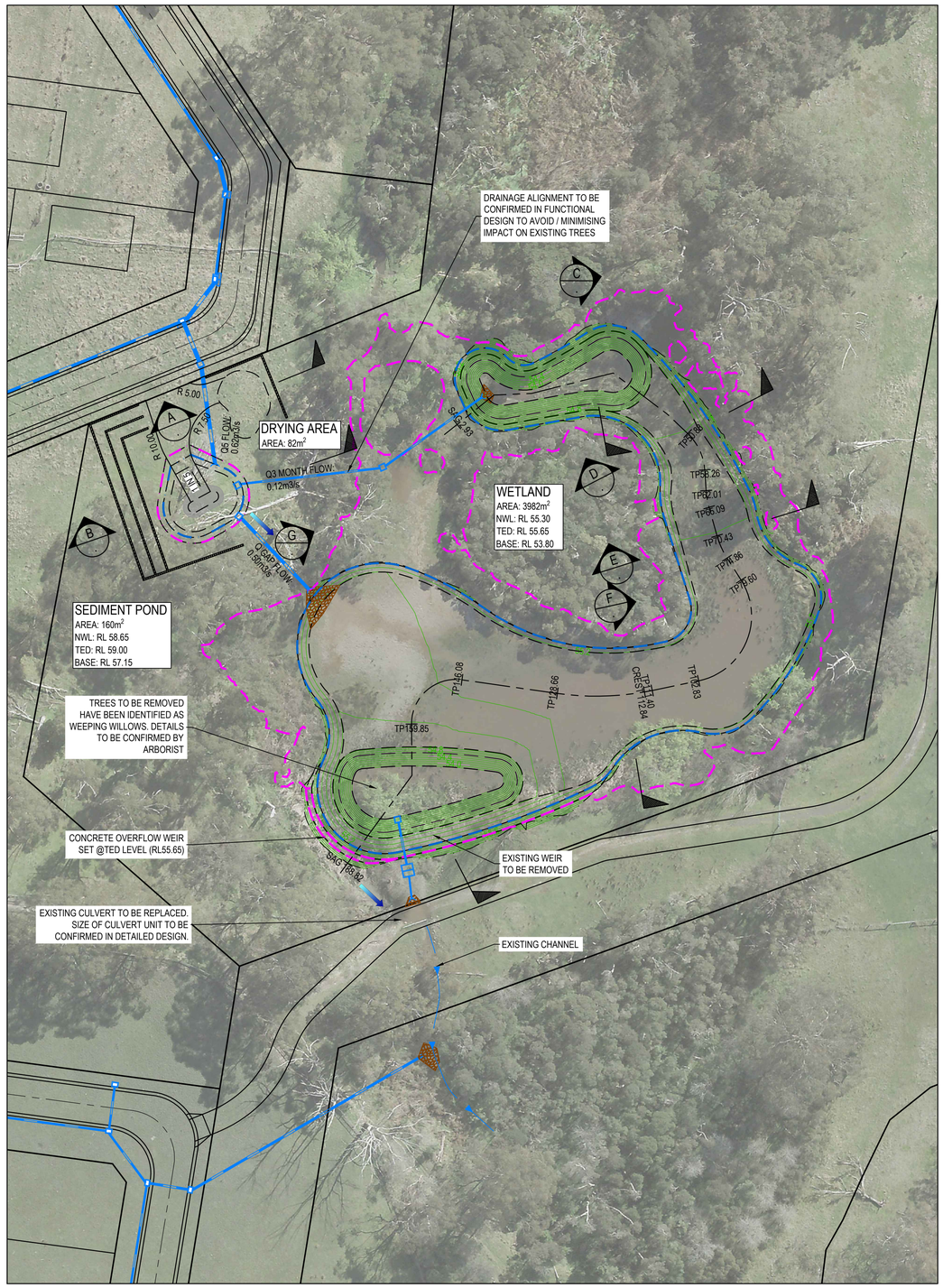

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ALL PROPOSED, FUTURE & EXISTING SERVICE LOCATIONS ARE SHOWN INDICATIVELY

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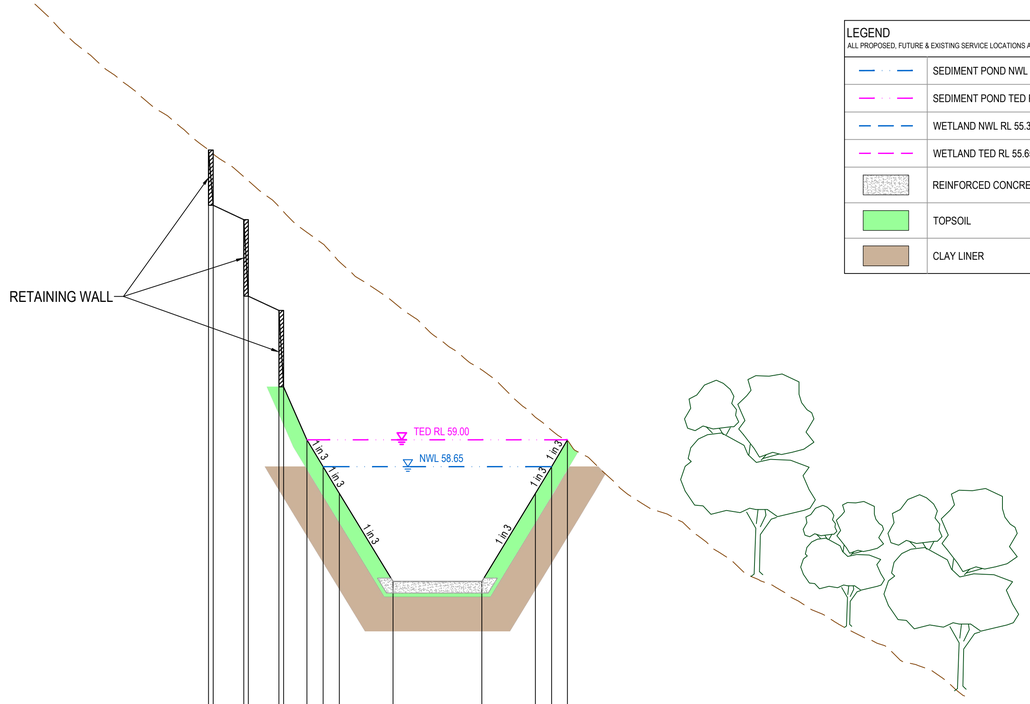
	SEDIMENT POND TED RL 59.00
	WETLAND NWL RL 55.30
	WETLAND TED RL 55.65
	REINFORCED CONCRETE
	TOPSOIL
	CLAY LINER



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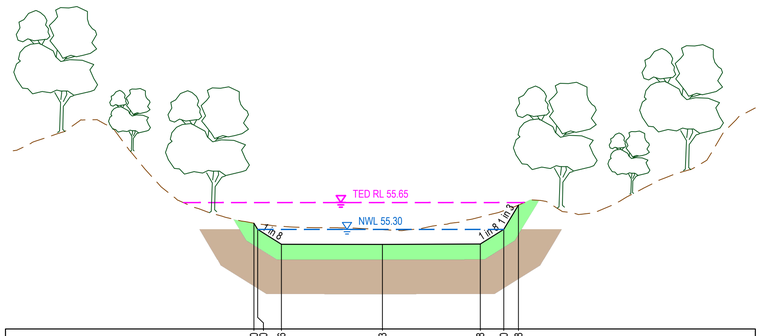
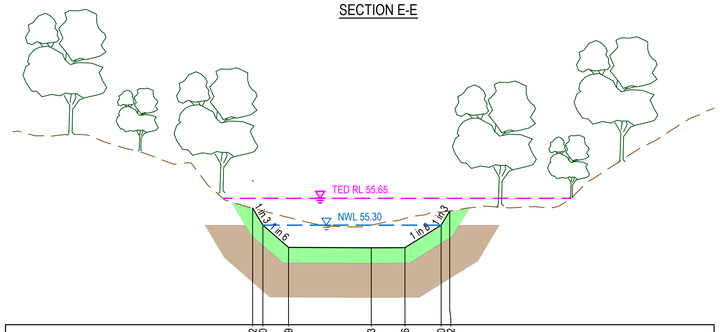
LEGEND
ALL PROPOSED, FUTURE & EXISTING SERVICE LOCATIONS ARE SHOWN INDICATIVELY

	SEDIMENT POND NWL RL 58.65
	SEDIMENT POND TED RL 59.00
	WETLAND NWL RL 55.30
	WETLAND TED RL 55.65
	REINFORCED CONCRETE
	TOPSOIL
	CLAY LINER



DATUM54.0							
DESIGN SURFACE	55.380 55.300	55.106	55.103	55.108	55.300	55.618	
EXISTING SURFACE	55.380 55.372	55.340	55.296	55.462	55.545	55.618	
OFFSET	10.722 10.962	12.512	19.108	25.502	27.036	27.989	

SECTION E-E



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EXISTING SURFACE	55.522 55.486	55.400	55.299	55.386	55.471 55.482		
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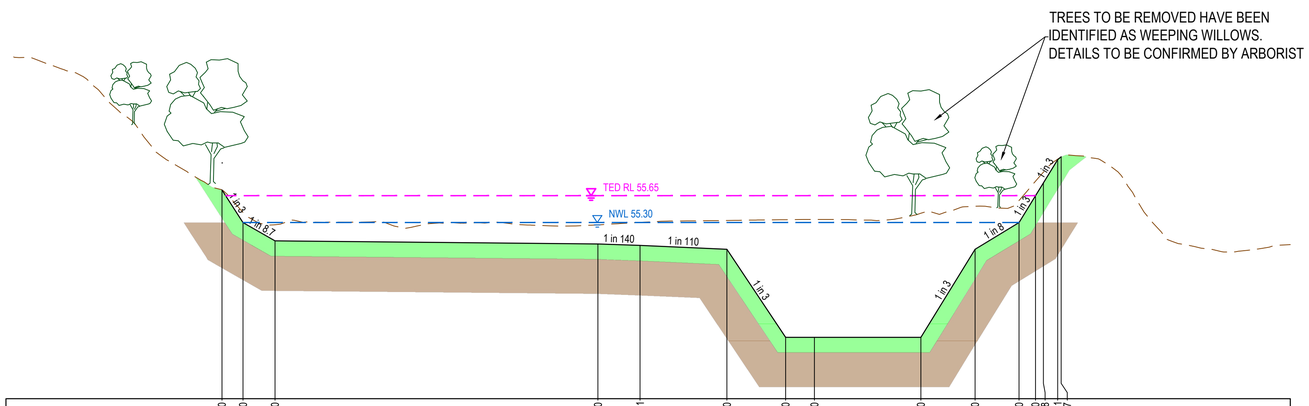

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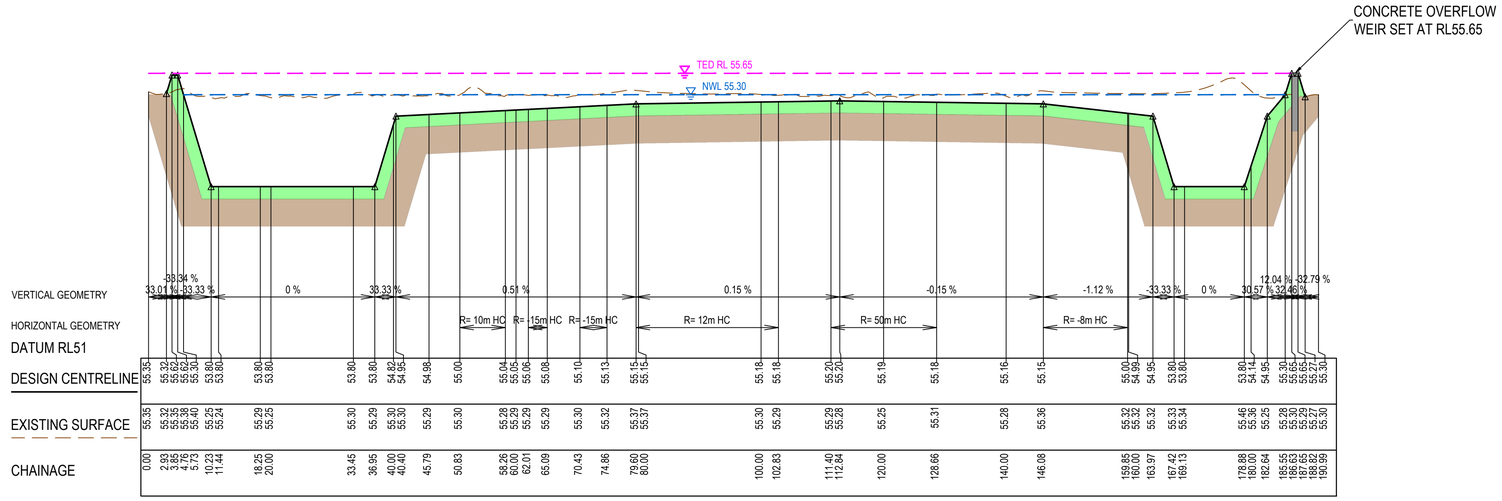
LEGEND

ALL PROPOSED, FUTURE & EXISTING SERVICE LOCATIONS ARE SHOWN INDICATIVELY

	SEDIMENT POND NWL RL 58.65
	SEDIMENT POND TED RL 59.00
	WETLAND NWL RL 55.30
	WETLAND TED RL 55.65
	REINFORCED CONCRETE
	TOPSOIL
	CLAY LINER



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18.25	55.29	53.80
20.00	55.25	53.80
33.45	55.30	53.80
36.95	55.29	53.80
40.00	55.30	54.82
40.40	55.30	54.95
45.79	55.29	54.98
50.83	55.30	55.00
58.26	55.28	55.04
60.00	55.29	55.05
62.01	55.29	55.06
65.09	55.29	55.08
70.43	55.30	55.10
74.86	55.32	55.13
79.60	55.37	55.15
80.00	55.37	55.15
100.00	55.30	55.18
102.83	55.29	55.18
111.40	55.29	55.20
112.84	55.28	55.20
120.00	55.25	55.19
128.66	55.31	55.18
140.00	55.28	55.16
146.08	55.36	55.15
159.85	55.32	55.00
160.00	55.32	54.99
163.97	55.32	54.95
167.42	55.33	53.80
169.13	55.34	53.80
178.88	55.46	53.80
181.00	55.36	54.14
182.64	55.25	54.95
185.55	55.28	55.30
186.63	55.30	55.65
187.65	55.29	55.65
188.82	55.27	55.27
190.89	55.30	55.30

LONGITUDINAL SECTION

REV	DATE	AMENDMENT / REVISION DESCRIPTION	DRAFTER	DESIGNER	CHECKER	APPROVER
A	28.08.23	ISSUED FOR INFORMATION ONLY	R.AYOBI	S.BAEK	C.CATHCART	D.POWELL

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Manuka Road, Berwick - Casey City Council
Main Drainage Plan
Concept Design
Longitudinal Section

MELWAYS REF	PROJECT / DRAWING No.	SHEET No.	REVISION
	2626E-WLN-851	04 of 04	A

DWG PATH: V:_Vault\Projects_Urban\ENG\2626E-Manuka Road, Berwick\2626E-Masterplanning\2626E-WLN\2626E-WLN-851.dwg PRINTED BY: TP16530 on 11/10/2023 at 11:29:33 AM

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LEGEND

- DRAINAGE
- SEWER GRAVITY
- SEWER (RISING MAIN)
- PROPOSED SEWER BORE
- SITE BOUNDARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	DRAFTER	DESIGNER	CHECKER	APPROVER
A	NI	PRELIMINARY ISSUE	M.SANTOS	S.MACLAREN	C.CATHCART	D.POWELL
B	11.10.23	PRELIMINARY ISSUE	R.AYOBI	S.BAEK	C.CATHCART	D.POWELL
C	14.11.24	DEVELOPMENT SITE SPLIT INTO BROWN AND TULLOCH	C.LYONS	S.BAEK	C.CATHCART	D.POWELL

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Manuka Road, Berwick - Casey City Council Masterplanning & Information Documents Masterplanning Drainage and Sewer Layout

MELWAYS REF	PROJECT / DRAWING No.	SHEET No.	REVISION
	2626E-MSP-ID-402	01 of 01	C

DWG PATH: V:_Vault\Projects_Urban\ENG\2626E-Manuka Road, Berwick\2626E-Masterplanning\2626E-MSP-ID-402.dwg PRINTED BY: DB15620 on 21/07/2025 at 02:53:24 PM

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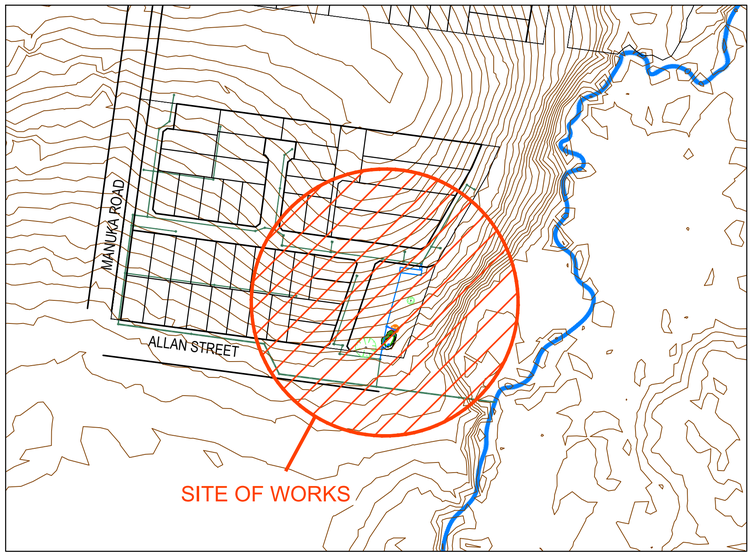
42-80 Manuka Road, Berwick
Bioretention
City of Casey



Drawing Index

2626E-BIO-701 Cover Plan & General Notes
2626E-BIO-721 Layout Plan, Long Sections & Pit Schedule
2626E-BIO-941 Cross Sections, Typical Section & Wingwall Detail
2626E-BIO-971 Pit Details

GENERAL NOTES (CASEY CITY COUNCIL)

1. THESE PLANS DO NOT CONSTITUTE APPROVAL FOR ANY CONSTRUCTION DETAILS NOMINATED, WHICH ARE TO BE APPROVED AS PART OF CIVIL PLAN SUBMISSIONS.
2. THE LOCATION OF THE GPT AND HARDSTAND AREA TO BE CONFIRMED AS PART OF CIVIL PLAN SUBMISSIONS.
3. MELBOURNE WATER WORKS OFFER TO BE PROVIDED AS PART OF CIVIL PLAN SUBMISSIONS.

GENERAL

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH MELBOURNE WATER STANDARD DRAWINGS & SPECIFICATIONS, ANY DISCREPANCY SHALL BE REFERRED TO THE SUPERINTENDENT FOR DECISION BEFORE PROCEEDING WITH THE WORK.
2. ALL PROPRIETRY ITEMS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
3. ALL WORKMANSHIP AND MATERIALS SHALL COMPLY WITH THE RELEVANT S.A.A.CODES, BUILDING CODE OF AUSTRALIA, AND THE VICTORIA BUILDING REGULATIONS.
4. DRAWINGS ARE NOT TO BE SCALED. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORKS OR MAKING ANY SHOP DRAWINGS.
5. THE SUPERINTENDENT SHALL BE NOTIFIED 48 HOURS PRIOR TO ANY INSPECTIONS REQUIRED IN THESE DOCUMENTS.
6. THE CONTRACTOR SHALL LOCATE ALL UNDERGROUND SERVICES PRIOR TO CONSTRUCTION. ALL APPROVALS FROM SERVICE AUTHORITIES SHALL BE OBTAINED BEFORE THE COMMENCEMENT OF WORKS.
7. THESE DRAWINGS ARE TO MAP GRID OF AUSTRALIA (MGA). ALL LEVELS ARE TO A.H.D.
8. ANY VARIATION TO THE DETAILS SHOWN ON THE DRAWING MUST BE AUTHORISED BY THE SUPERINTENDENT PRIOR TO FABRICATION AND/OR CONSTRUCTION.
9. THE CONTRACTOR SHALL DISPOSE OF EXCESS SPOIL AS DIRECTED BY THE SUPERINTENDENT.
10. ALL MATERIAL ASSETS MODIFIED OR DAMAGED BY THE PROPOSED WORKS ARE TO BE REINSTATED TO THE SATISFACTION OF COUNCIL.
11. CONSTRUCTION WORK SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY ACT, 2004.
12. THE CONTRACTOR IS TO SUBMIT A SITE MANAGEMENT PLAN INCLUDING AN ENVIRONMENTAL MANAGEMENT PLAN TO THE SUPERINTENDENT FOR APPROVAL 14 DAYS PRIOR TO THE COMMENCEMENT OF WORKS.
13. ALL TREES AND IDENTIFIED VEGETATION 'NO GO ZONES' MUST BE PRESERVED AND PROTECTED AT ALL TIMES, IN ACCORDANCE WITH COUNCIL PROCEDURES UNLESS OTHERWISE DIRECTED BY THE SUPERINTENDENT.
14. NO BLASTING IS PERMITTED WITHIN WORKS AREA.
15. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS IN E.P.A. GUIDELINES
    15.A. 1996 - "ENVIRONMENTAL GUIDELINES FOR MAJOR CONSTRUCTION SITES"
    15.B. 1991 - "CONSTRUCTION TECHNIQUES FOR SEDIMENT POLLUTION CONTROL"
16. NO TOPSOIL TO BE REMOVED FROM SITE.
17. ROCK WORK TO BE PLACED AS PER MELBOURNE WATER STANDARDS AND TO THE SUPERINTENDENTS SATISFACTION.

ROCK WORK

1. AREAS ON WHICH ROCK IS TO BE PLACED SHALL BE TRIMMED AS REQUIRED TO PROVIDE A FINISHED SURFACE LEVEL OF ROCK IN ACCORDANCE WITH THE DRAWINGS. ANY SCOURS OR HOLLOWS IN THE SURFACE SHALL BE STRIPPED OF ORGANIC MATTER AND ANY UNSUITABLE BASE MATERIAL AND THEN FILLED WITH COMPACTED CRUSHED ROCK
2. THE GENERAL CONCEPT OF ROCKWORK CONSTRUCTION IS:
   - IT SHOULD BE MADE UP OF ANGULAR ROCK (EITHER QUARRIED OR BROKEN UP FIELD ROCK).
   - IT MUST BE MADE UP OF WELL SIZED, WELL GRADED, WELL EMBEDDED, WELL INTERLOCKED ROCK.
   - ALL VOIDS MUST BE SEALED TO PROVIDE STABILITY AND RESISTANCE TO FLOW VELOCITIES AND INFILTRATIONS/ UNDERMINING.
   - IT SHOULD FORM AN INTERLOCKING MASS OF ROCK IN WHICH THE LARGER ROCKS IN THE MIX ARE NOT FREE TO MOVE.
3. ALL ROCKWORK SHALL BE DONE TO THE SATISFACTION OF THE SUPERINTENDENT.
4. TOE AND EDGE ROCKS:
   TOE TO EDGE ROCKS ARE ALSO REFERRED TO AS LEADING EDGE ROCKS OR PERIMETER ROCKS. TOE ROCKS ARE SITUATED AT THE BASE OF A ROCK STRUCTURE AND EDGE ROCKS ARE LOCATED AROUND THE REMAINING PERIMETER. THE FUNCTION OF TOE TO EDGE ROCKS IS TO HOLD THE ROCK STRUCTURE TOGETHER AND PREVENT FLOWS FROM UNDERMINING THE STRUCTURE. WITH TOE AND EDGE ROCKS THE FOLLOWING SHOULD BE CONSIDERED:
   - THE SIZE OF THE TOE AND EDGE ROCKS WILL DEPEND ON THE SITE AND HYDRAULIC CONDITIONS. - EDGE ROCKS ARE GENERALLY SMALLER THAN TOE ROCKS BUT ARE LARGER THAN LINING ROCKS.
   - TOE AND EDGE ROCKS SHOULD BE TRENCHED INTO IN-SITU GROUND. GROUND SHOULD BE BOXED-OUT TO ENABLE TOE AND EDGE ROCKS TO BE PLACED BEFORE FILTER LAYER AND LINING ROCKS.
   - TOE/EDGE ROCKS SHOULD FINISH FLUSH WITH SURROUNDING GROUND.
5. LINING ROCKS:
   LINING ROCK IS THE MASS ROCK MEDIUM CONTAINED BY THE LEADING EDGE ROCK TO ARMOUR/PROTECT THE GIVEN EARTH SURFACE. WITH LINING ROCKS THE FOLLOWING SHOULD BE CONSIDERED:
   - A FILTER/EMBEDMENT LAYER SHOULD BE USED UNDERNEATH (REFER NOTE 6).
   - LINING ROCKS SHOULD BE WELL GRADED TO FORM A TIGHTLY SEALED ROCK LAYER WHICH IS FREE OF VOIDS AND PROVIDES RESISTANCE TO FLOW VELOCITIES AD INFILTRATION/UNDERMINING AS PER THE GENERAL INTENT OF ROCKWORK MENTIONED IN NOTE 2. IN SEALING VOIDS CONSIDERATION SHOULD BE GIVEN TO USING A SMALLER GRADED ROCK MIX (IE. ALSO REFERRED TO AS AN INFILL MIX). DEPENDING ON THE SIZE OF THE VOIDS, A 0-150mm INFILL MIX MAY BE APPROPRIATE. DEPENDING ON ROCK AVAILABILITY AND CONSTRUCTION METHOD ADOPTED, SEALING OF HE ROCKWORK MAY OCCUR AS A PRE-MIX (IE. INFILL MIX IS COMBINED WITH LARGER LINING ROCKS BEFORE PLACEMENT), OR BY WORKING THE INFILL MIX BETWEEN THE LARGER ROCKS AS THEY ARE LAID.
   - THE SIZE OF THE LINING ROCK AND THICKNESS OF THE LINING ROCK LAYER WILL DEPEND ON GENERALLY SMALLER EDGE ROCKS.
   - THE CONTRACTOR SHOULD USE METHODS FOR HANDLING AND PLACEMENT OF LINING ROCK THAT WILL AVOID SEGREGATION OF THE ROCK SIZES. ROCKS SHALL BE CAREFULLY PLACED AND POSITIONED, NOT DUMPED DIRECTLY.
6. FILTER/EMBEDMENT LAYER:
   FILTER/EMBEDMENT LAYER PROVIDE PROTECTION TO THE UNDERLYING SOIL BASE FROM INFILTRATION OF FLOWS AND PROVIDE A SUITABLE MEDIUM FOR THE EMBEDMENT OF THE OVERLAYING ROCK. GRANULAR FILTER/EMBEDMENT LAYERS ARE USUALLY SUFFICIENT, HOWEVER SOME SANDY, DISPERSIVE SOILS MAY WARRANT THE USE OF A GEOTEXTILE FILTER LAYER IN ADDITION TO THE GRANULAR FILTER LAYER.
   WHERE A GEOTEXTILE FILTER LAYER IS USED, SPECIAL CARE NEEDS TO BE EXERCISED IN THE LAYING OF THE ROCKWORK AND CONSIDERATION GIVEN TO A THINKER GRANULAR FILTER/EMBEDMENT LAYER OVER THE GEOTEXTILE LAYER TO PREVENT DAMAGE TO THE FABRIC.
   WITH GRANULAR FILTER/EMBEDMENT LAYERS THE FOLLOWING SHOULD BE CONSIDERED:
   - LAYER THICKNESS - SHOULD GENERALLY BE 100mm OR THINKER - DEPENDS ON TYPE OF UNDERLYING SOIL (IE. MORE OR LESS DISPERSIVE), ROCK SIZE, AND HYDRAULIC CONDITIONS.
   - USE OF GRADED ROCK - SHOULD GENERALLY BE LIMITED TO 0-100mm GRADED ROCK. ONE SIZE BALLAST ROCK IS CONSIDERED INEFFECTIVE AS IT DOES NOT RESIST FLOW INFILTRATION.

DRAINAGE

1. DRAINS AND PITS TO BE CLEANED OUT ON COMPLETION OF ALL SITE WORKS.
2. ALL DRAIN PIPES TO BE RRJ WITH NO LIFTING HOLES.
3. ALL PITS SHALL HAVE MASS CONCRETE SHAPED BASES TO THE SUPERINTENDENTS APPROVAL.
4. DRAINS TO BE INSPECTED AND APPROVED BY THE SUPERINTENDENT PRIOR TO BACKFILLING UNLESS AGREED OTHERWISE.
5. ALL CONSTRUCTED PIPEWORK SHALL BE FLUSHED AND CLEANED AT THE COMPLETION OF WORKS TO THE SUPERINTENDENTS APPROVAL.
6. PIT COVERS AND GRATINGS MUST MATCH FINISHED SURFACE LEVELS UNLESS OTHERWISE SPECIFIED.
7. ALL SETOUT CO-ORDINATES ARE TO PIPE CENTRELINE INTERSECTION UNLESS INDICATED OTHERWISE.
8. FOR INLET CONNECTIONS TO PIPELINES REFER MELBOURNE WATER DWG. NO. 7251/8/425
9. ALL PITS GREATER THAN OR EQUAL TO 900MM DEPTH ARE TO BE PROVIDED WITH STEP IRONS.
10. WHERE PIT DEPTH TO INVERT IS LESS THAN OR EQUAL TO 3.5m, STEP IRONS SHALL BE USED. FOR DEEPER MANHOLES RUNG LADDERS SHALL BE USED, AS MER MW SD 7251/08/416

EARTHWORKS

1. 100mm MIN DEPTH OF TOPSOIL IS TO BE STRIPPED OVER WHOLE OF WORKS AREA AND STOCKPILED. UPON COMPLETION OF EARTHWORKS, TOPSOIL IS TO BE SPREAD OVER ALL THE DISTURBED AREAS TO A DEPTH OF 200MM, UNLESS STATED OTHERWISE ON THE DRAWINGS. TOPSOIL TO MEET MW SPECIFICATION.
2. ALL BATTERS AND DISTURBED AREAS THAT ARE NOT LANDSCAPED SHALL BE HYDRO-SEEDED UPON COMPLETION OF WORKS.
3. AREAS UPON WHICH FILL IS TO BE PLACED SHALL BE TRIMMED AS REQUIRED TO PROVIDE THE FINISHED SURFACE LEVEL IN ACCORDANCE WITH THE DRAWINGS. ANY SCOURS OR HOLLOWS IN THE SURFACE SHALL BE STRIPPED OF ORGANIC MATTER AND ANY UNSUITABLE BASE MATERIAL AND THEN REPLACED WITH APPROVED FILL, AS DETAILED IN THE TONKIN+TAYLOR (T&T) GEOTECHNICAL REPORT 1010770.9000.R1-V2, DATED JULY 2022.
4. ALL FILLING SHALL COMPRISE SELECTED ONSITE CLAY MATERIAL AS DEFINED IN THE TONKIN+TAYLOR (T&T) GEOTECHNICAL REPORT 1010770.9000.R1-V2, DATED JULY 2022, AND COMPACTED TO A MINIMUM DRY DENSITY RATIO OF 98% STANDARD COMPACTION TEST DENSITY, PER AS1289, UNLESS OTHERWISE NOTED. FILLING SHALL BE INSPECTED AND TESTED TO THE REQUIREMENTS OF LEVEL 1 PER AS 3798-2077 ''GUIDELINES ON EARTHWORKS FOR COMMERCIAL AND RESIDENTIAL DEVELOPMENTS''.
5. UPPER BANK BATTERS SHALL BE ROUNDED, TO AVOID THE APPEARANCE OF UNIFORM BATTER INTERSECTION LINES.

CONFIRMATION OF THE SUITABILITY OF POTENTIAL SOURCE MATERIALS IS REQUIRED PRIOR TO CONSTRUCTION.

CONCRETE

1. ALL PIPE FITTING INTO AND OUT OF PIT STRUCTURES MUST BE SEALED BETWEEN PIPE WALL AND CONCRETE WITH HYDROTITE (CJ-0725-3K) OR APPROVED EQUIVALENT. HYDROTITE FITTED TO MANUFACTURERS SPECIFICATION.
2. CONCRETE QUALITY SHALL BE:
   MINIMUM COMPRESSIVE STRENGTH F'C 32MPA
   AT MINIMUM STRENGTH DEVELOPMENT TIME (DAYS) 28
   WATER CEMENT RATIO (MAXIMUM) 0.55
   SLUMP (MAXIMUM) 80mm
   AGGREGATE SIZE (MAXIMUM) 20mm
   CEMENT SHALL BE SULPHATE RESISTANT CEMENT.
   WATER TO BE CLEAN AND POTABLE. AGGREGATE TO BE SHARP, CLEAN AND CONTINUOUSLY GRADED. ALTERNATIVELY AN APPROVED WATER REDUCING AGENT MAY BE USED AND THE SLUMP INCREASED TO 120mm. HOWEVER THE CEMENT CONTENT SHALL NOT BE REDUCED.
3. ADDITIVES SHALL NOT BE USED WITHOUT WRITTEN APPROVAL FROM THE SUPERINTENDENT.
4. ALL CONCRETE SHALL BE THOROUGHLY COMPACTED USING MECHANICAL HIGH FREQUENCY VIBRATORS. SURFACE TREATMENT OF EXPOSED CONCRETE SHALL BE WOODEN TROWEL FINISHED.
5. ALL CONCRETE SHALL BE CURED BY KEEPING MOIST FOR A MINIMUM PERIOD OF SEVEN (7) DAYS AFTER PLACING OR BY APPLICATION OF AN APPROVED CURING COMPOUND. IMMEDIATELY AFTER SURFACE HARDENING APPLY WATER TO THE SURFACE AND THEN COVER THE WHOLE OF THE SURFACE WITH P.V.C SHEETING. EXTEND THE SHEETING BEYOND THE EDGES OF THE NEW CONCRETE AND SEAL THE P.V.C. TO THE OLD CONCRETE AND ALONG ALL EDGES AND ALL JOINTS IN THE P.V.C TO PREVENT ANY LOSS OF MOISTURE.
6. UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS, REINFORCING BARS ARE TO BE SUPPLIED, PLACED, FIXED AND SUPPORTED IN ACCORDANCE WITH AS 3600-2001 - CONCRETE STRUCTURES CODE AND THE SPECIFICATION WITH SUPPORTS AT 400mm CENTRES.
7. COVER TO REINFORCING SHALL BE A MINIMUM 50mm TOP AND BOTTOM. ALL SPLICES IN REINFORCEMENT SHALL BE LAPPED TO DEVELOP FULL TENSILE STRENGTH IN ACCORDANCE WITH AS 3600-2001, CONCRETE STRUCTURES CODE.
8. FORM UP CONTRACTION AND EXPANSION JOINTS AS AND WHERE SHOWN. ALLOW JOINTS TO THOROUGHLY DRY OUT AND SEAL USING AN APPROVED JOINT SEALANT AS SHOWN IN STRICT ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
9. ALL EXPOSED STEEL SECTIONS CAST INTO CONCRETE SHALL BE HOT DIP GALVANISED.
10. ALL EXPOSED CONCRETE CORNERS TO HAVE 25mm CHAMFER.
11. ALL CONSTRUCTION JOINTS (C.J.) SHALL BE THOROUGHLY SCABBLED AND CLEANED BEFORE CONCRETE PLACEMENT.
12. INDUSTRIAL STRENGTH FOOTPATH TO GAA SPECIFICATION STANDARD DRAWING: EDCM 503 WHERE SPECIFIED

WARNING
BEWARE OF UNDERGROUND SERVICES
The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown.
Locate all underground services before commencement of works
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Manuka Road, Berwick -
Casey City Council
Main Drainage Plan
Functional Design
Cover Plan & General Notes

MELWAYS REF	PROJECT / DRAWING No.	SHEET No.	REVISION
111 H8	2626E-BIO-701	01 of 04	A

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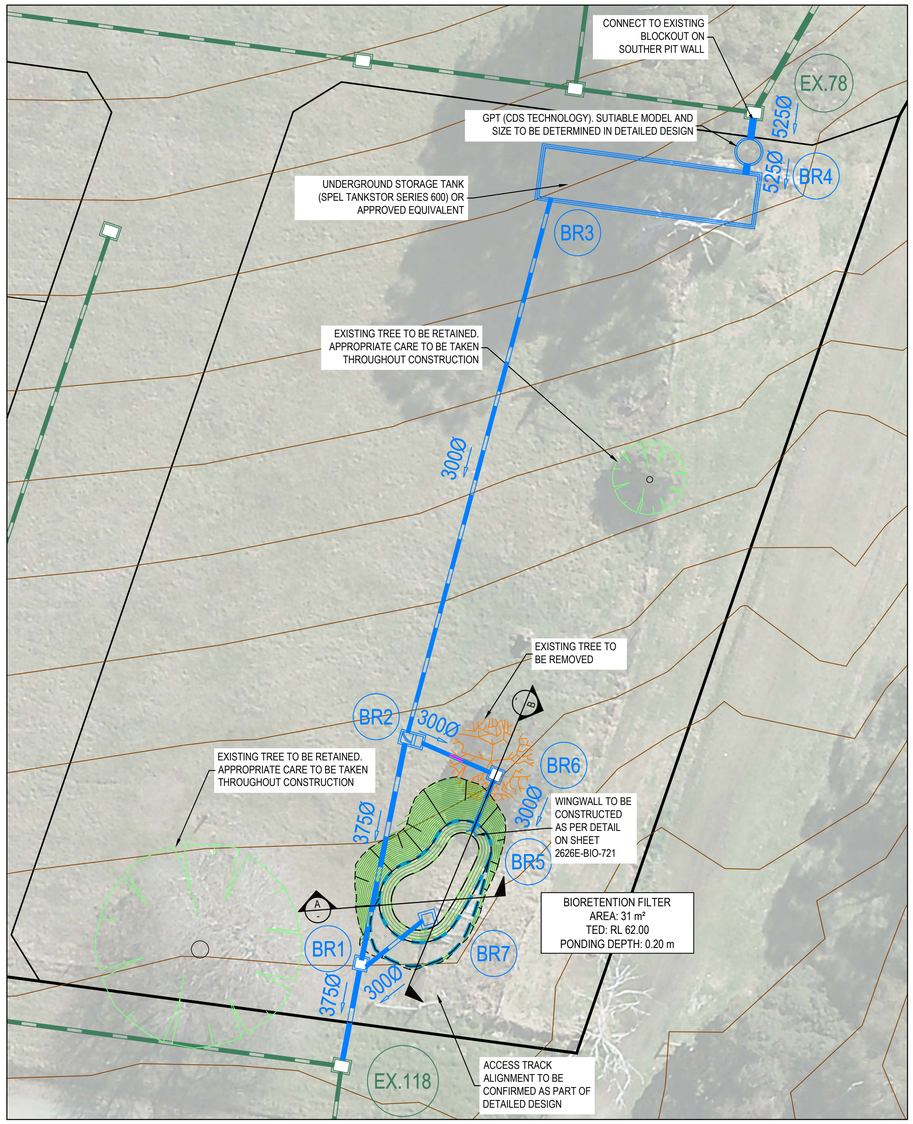
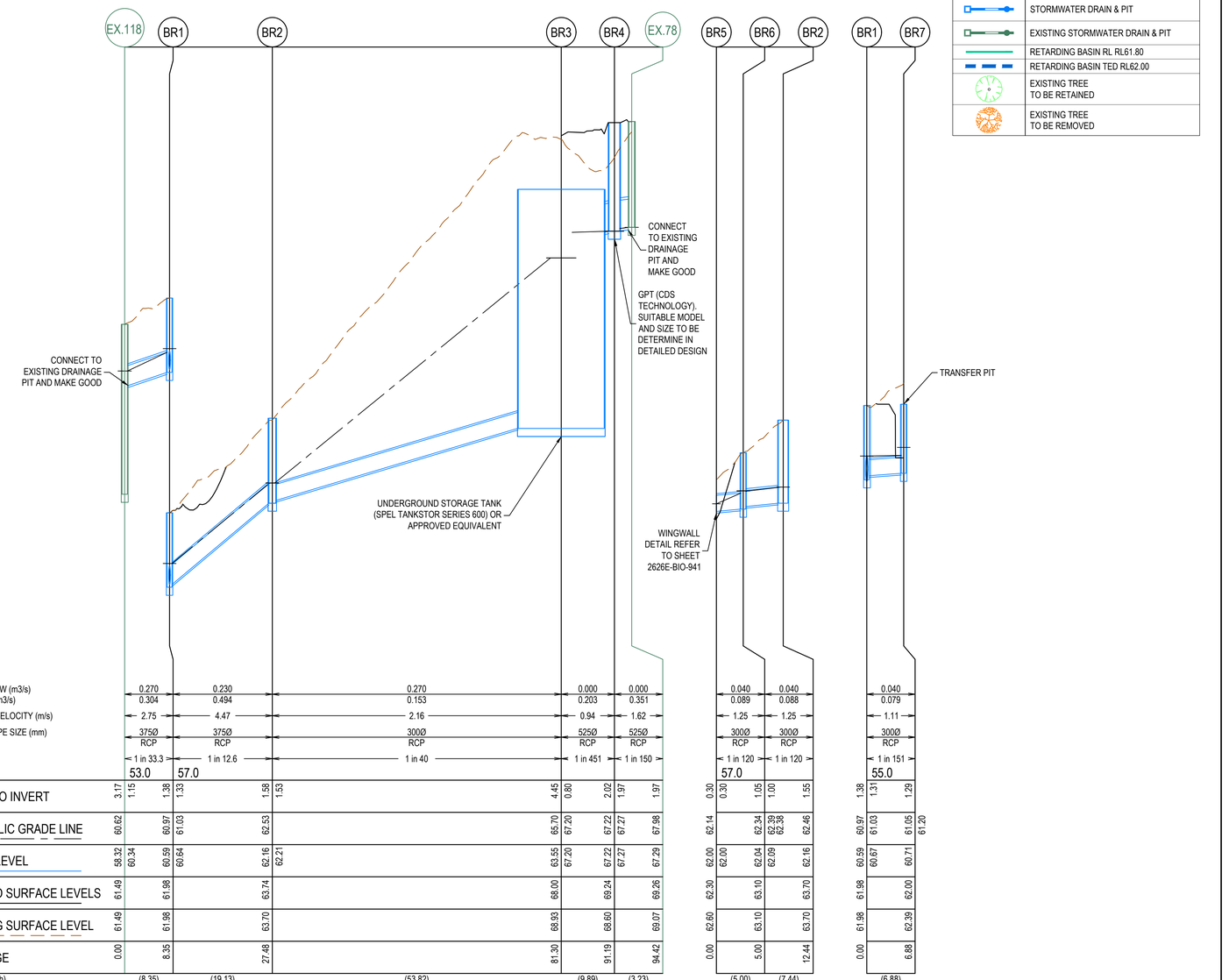
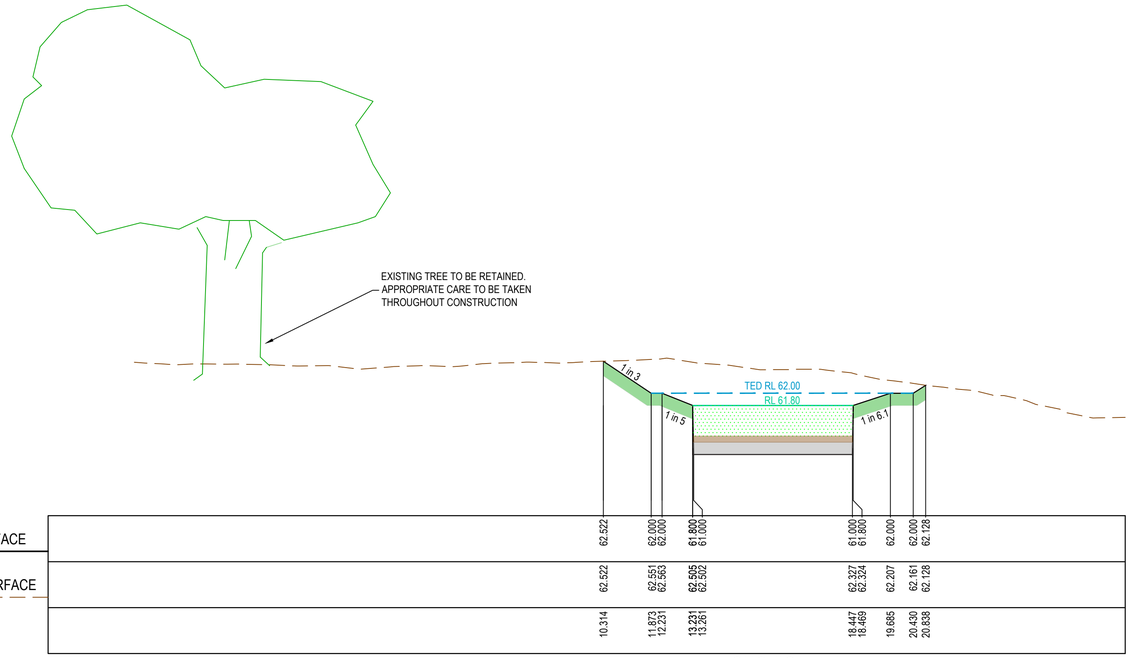

CONNECT TO EXISTING BLOCKOUT ON SOUTHER PIT WALL
EX.78
GPT (CDS TECHNOLOGY). SUTIABLE MODEL AND SIZE TO BE DETERMINED IN DETAILED DESIGN
525Ø
525Ø
BR4
UNDERGROUND STORAGE TANK (SPEL TANKSTOR SERIES 600) OR APPROVED EQUIVALENT
BR3
EXISTING TREE TO BE RETAINED. APPROPRIATE CARE TO BE TAKEN THROUGHOUT CONSTRUCTION
300Ø
EXISTING TREE TO BE REMOVED
BR2
300Ø
EXISTING TREE TO BE RETAINED. APPROPRIATE CARE TO BE TAKEN THROUGHOUT CONSTRUCTION
BR6
WINGWALL TO BE CONSTRUCTED AS PER DETAIL ON SHEET 2626E-BIO-721
375Ø
300Ø
BR5
A
BIORETENTION FILTER
AREA: 31 m²
TED: RL 62.00
PONDING DEPTH: 0.20 m
BR1
BR7
375Ø
300Ø
ACCESS TRACK ALIGNMENT TO BE CONFIRMED AS PART OF DETAILED DESIGN
EX.118


EX.118
BR1
BR2
BR3
BR4
EX.78
BR5
BR6
BR2
BR1
BR7
CONNECT TO EXISTING DRAINAGE PIT AND MAKE GOOD
CONNECT TO EXISTING DRAINAGE PIT AND MAKE GOOD
GPT (CDS TECHNOLOGY). SUITABLE MODEL AND SIZE TO BE DETERMINE IN DETAILED DESIGN
UNDERGROUND STORAGE TANK (SPEL TANKSTOR SERIES 600) OR APPROVED EQUIVALENT
WINGWALL DETAIL REFER TO SHEET 2626E-BIO-941
TRANSFER PIT

| | | |



SECTION A-A

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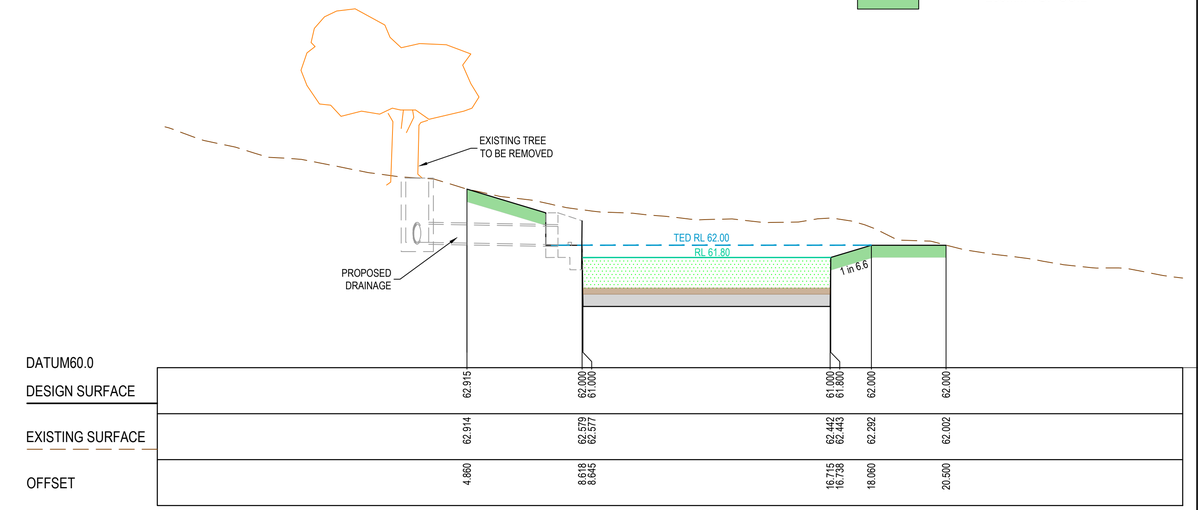

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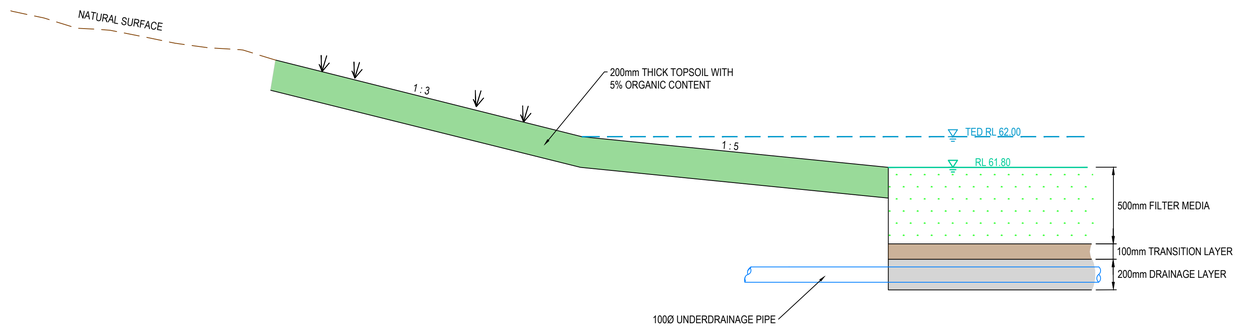

TYPICAL EDGE DETAIL

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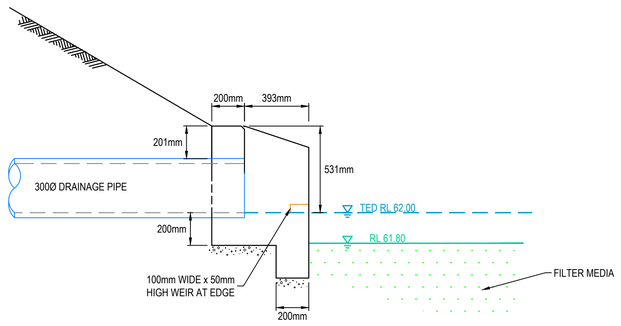

WINGWALL BR5 SECTION VIEW

REINFORCEMENT AS PER VICROADS SD1921
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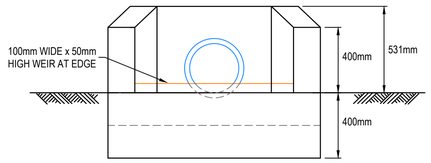

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REINFORCEMENT AS PER VICROADS SD1921
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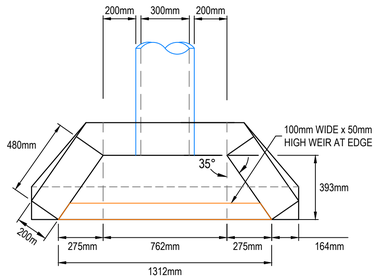

WINGWALL BR5 PLAN VIEW

REINFORCEMENT AS PER VICROADS SD1921
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Manuka Road, Berwick - Casey City Council Main Drainage Plan Functional Design Cross Sections, Typical Section & Wingwall Detail

MELWAYS REF	PROJECT / DRAWING No.	SHEET No.	REVISION
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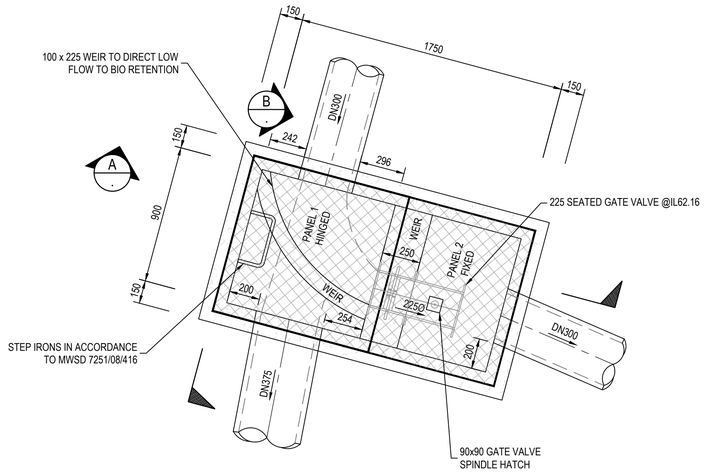

PIT BR2
DIVERSION PIT
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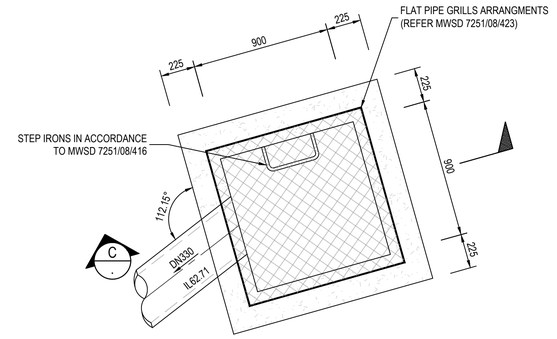

PIT BR7
TRANSFER PIT
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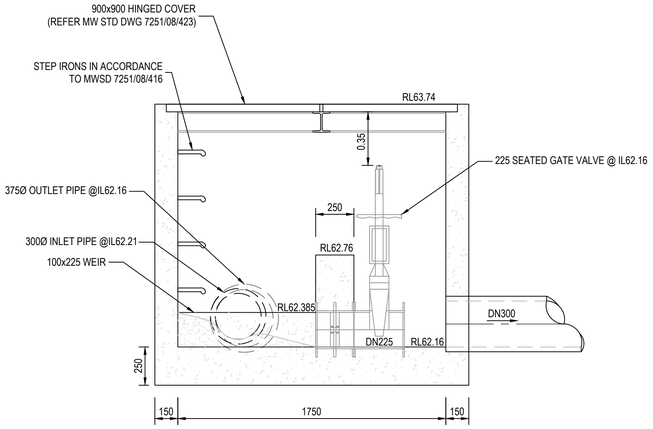
REFER MWSD 7251/12/008



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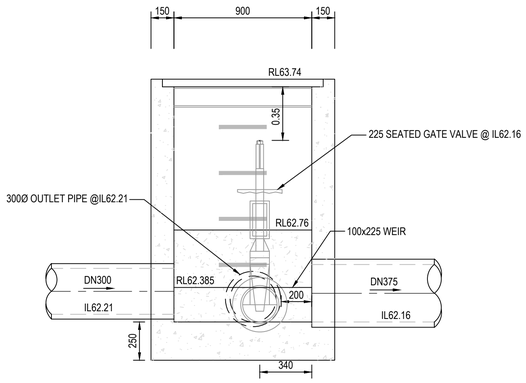

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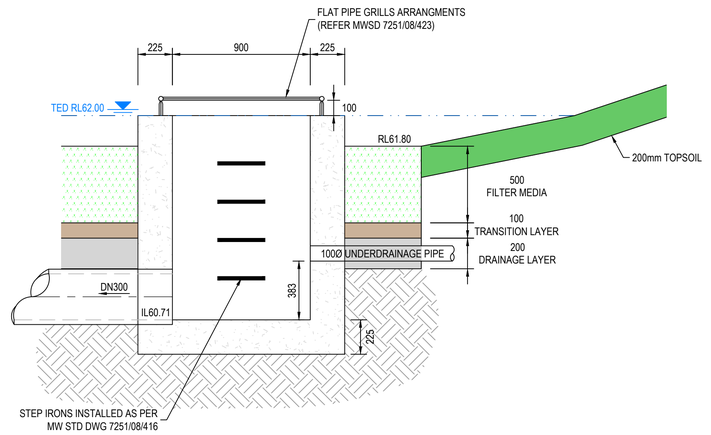

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Manuka Road, Berwick - Casey City Council
Main Drainage Plan
Functional Design
Pit Details

MELWAYS REF	PROJECT / DRAWING No.	SHEET No.	REVISION
111 H8	2626E-BIO-971	04 of 04	A

DISCLAIMER: All setting out should be carried out in accordance with MPA/Council's standard drawings or as nominated on hard copy plans provided by SMEC. Any digital information supplied by this office is for information only. Any discrepancies should be discussed with the superintendent.

Appendix E SPEL Tank Product

spelstormwater
joy in water

SPEL Tankstor®

Underground Water Storage

OVERVIEW

SPEL Tankstor® tanks are manufactured for many applications and in a wide range of specifications to handle such substances as water, sewage, farm effluent, petroleum products and chemicals.

BENEFITS

- Easy to handle and install.
- Not susceptible to rust.
- Corrosion resistant properties.
- Life expectancy in excess of 50 years.

APPLICATIONS

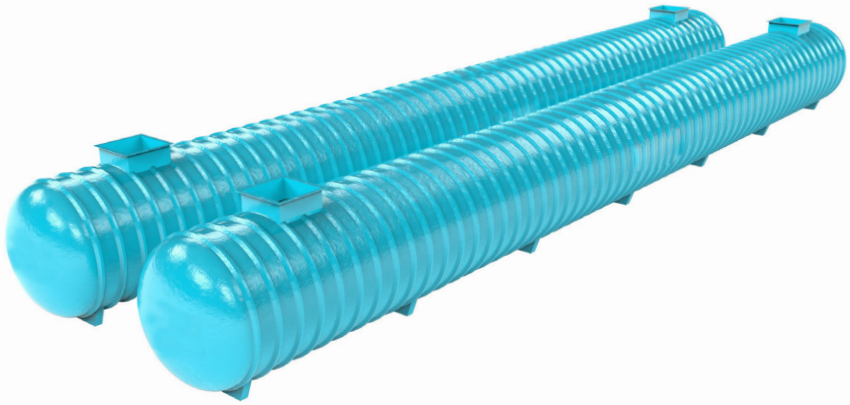
Stormwater attenuation
Fire fighting sprinkler reservoirs
Potable water storage
Septic/settlement tanks
Cesspools & silage effluent holding tanks
SPEL RainSave rainwater reservoirs
Accidental spillage containment
Transformer oil dump tanks
Package pumping chambers
Above ground storage

SPEL Tankstor®

Underground Water Storage

Range of Sizes

- Series 200 (1.2m inside diameter): 1,000 – 10,000 litres capacity
- Series 300 (1.8m inside diameter): 4,000 – 40,000 litres capacity
- Series 400 (2.6m inside diameter): 13,650 – 100,000 litres capacity
- Series 500 (3.5m inside diameter): 60,000 – 200,000 litres capacity
- Series 600 (4.0m inside diameter): 100,000 – 300,000 litres capacity



Run-Off Yield Coefficients

TYPE	RUN-OFF	DEPRESSION STORAGE*
Pitched roof with profiled metal sheeting	0.9	0.1
Pitched roof with tiles	0.8	0.3
Flat roof without gravel	0.8	1.0
Flat roof with gravel	0.8	1.0
Green roof, intensive**	0.5	5.0
Green roof, extensive**	0.7	4.0
Permeable areas, various**	0 – 0.3	2.0 – 4.0

* Volume of water lost from surfaces, eg. by evaporation or absorption before run-off commences.

** The run-off yield is uncertain for these surfaces and depends on their design.

SPEL 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, please check with SPEL Stormwater for confirmation of current specifications.

Appendix F City of Casey Comments

City of Casey

29 September 2025

Claire Doherty
Associate
Ratio Consultants Pty Ltd
Level 5/65 Dover Street
Cremorne VIC 3121

Dear Claire

Re: Development Plan Application for 42-80 Manuka Road Berwick VIC 3806

Please find below for drainage comments on the application for the Manuka Road Development Plan.

Due to the extent and complexity of the comments, it is recommended for a separate meeting to be organised with Council's drainage engineers and the authors of the stormwater management plan.

General Comments

- Council has sought recommendations from a drainage infrastructure provider on the types of drainage treatment systems that would be suitable for the development. Comments from the infrastructure provider and Council's drainage engineers are detailed below.
- The 2025 SWMP prepared by SMEC should not be directly referenced in the text of the Development Plan due to various uncertainties still left to be resolved (i.e. Melbourne Water approval for works to the swale, EPBC approval for the wetlands).
- It is recommended for the following strategic guideline(s) to be inserted to replace the current text in 4.7 Drainage and Stormwater Management. The changes allow flexibility for further assessment and review of drainage solutions at permit stage without ruling out the current proposal should all approval requirements be met.
    - An approved stormwater treatment system should treat stormwater from the north-western catchment to best practice before discharge into the existing swale unless modification of the existing swale is agreed to by Melbourne Water and the Responsible Authority.
    - An approved stormwater treatment system should treat stormwater from the north-eastern catchment to best practice before discharge into Cardinia Creek. The existing farm dam located close to the junction of Grasmere Creek and Cardinia Creek could be enhanced to provide stormwater management for the precinct's north-eastern catchment (subject to further assessment and approval from Melbourne Water and the Responsible Authority).

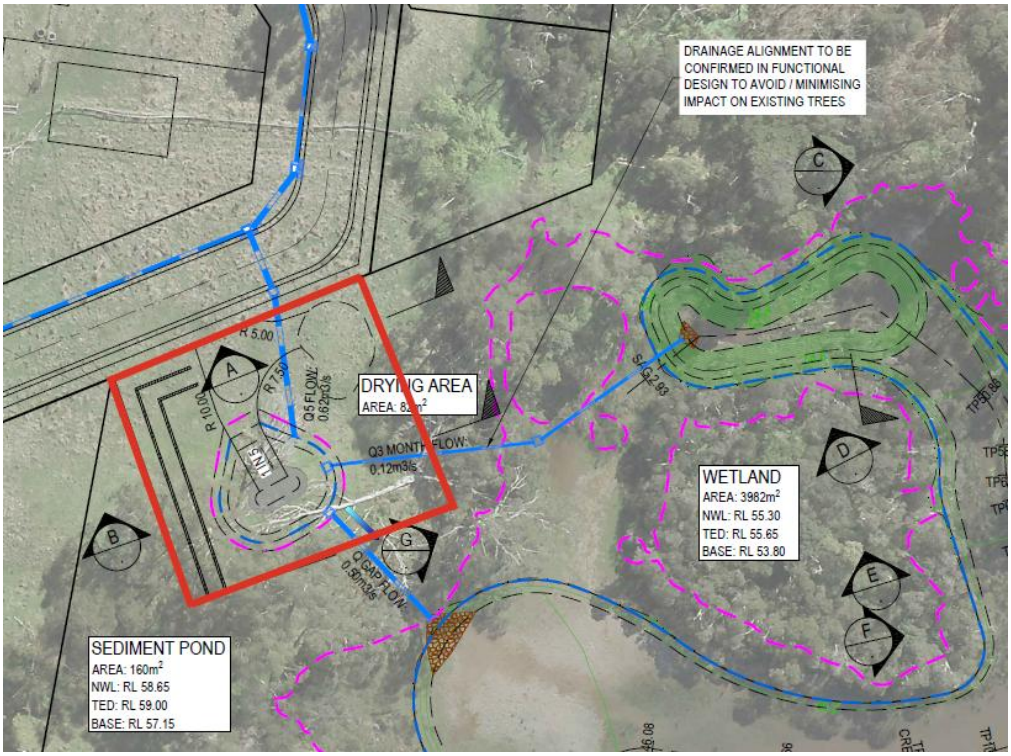
  - An approved stormwater treatment system should treat stormwater from the southern catchment to best practice before discharge into Cardinia Creek.
  - Flows up to 1% AEP from the southern catchment including the south-western corner of the development should be directed / conveyed along Allan Street and treated to best practice before discharge into Cardinia Creek.
- Council's view is that retardation is **not** required for all catchments due to limited impact to downstream land. A combination of pre-treatment (offline GPT or sediment pond) and bio-retention systems would allow treatment of the entire development to best practice with minimal impact on developable land. Pre-treatment is necessary for catchments larger than 5ha.
- The following indicative sizing has been prepared by the drainage infrastructure provider (subject to further MUSIC modelling). This could allow for a net gain in developable area.

Northeast Catchment (7.35ha)	Offline GPT plus approx. 24m2 bioretention system in the area currently identified for sediment pond and drying
Northwest Catchment (4.01ha)	Approx. 48m2 bioretention system in the linear reserve OR improvement to the existing MW swale
Southern Catchments (7.00ha)	Offline GPT plus approx. 24m2 bioretention in the northern verge of Allan Street

- The MUSIC model should be updated with GPTs and / or sediment ponds taken into consideration.

North-east Catchment

- Council has obtained preliminary advice to confirm that an EPBC referral is required for any works to the Grasmere Creek wetland. We have been advised that the Dwarf Galaxia assessment has incorrectly evaluated the species as vulnerable while it is in fact listed as endangered at federal level. The full advice will be circulated once finalised.
- Council recommends a combination of offline GPT and bio-retention system to treat the north-east catchment within the area currently identified for sediment pond and drying. This could help to avoid a lengthy EPBC referral process.



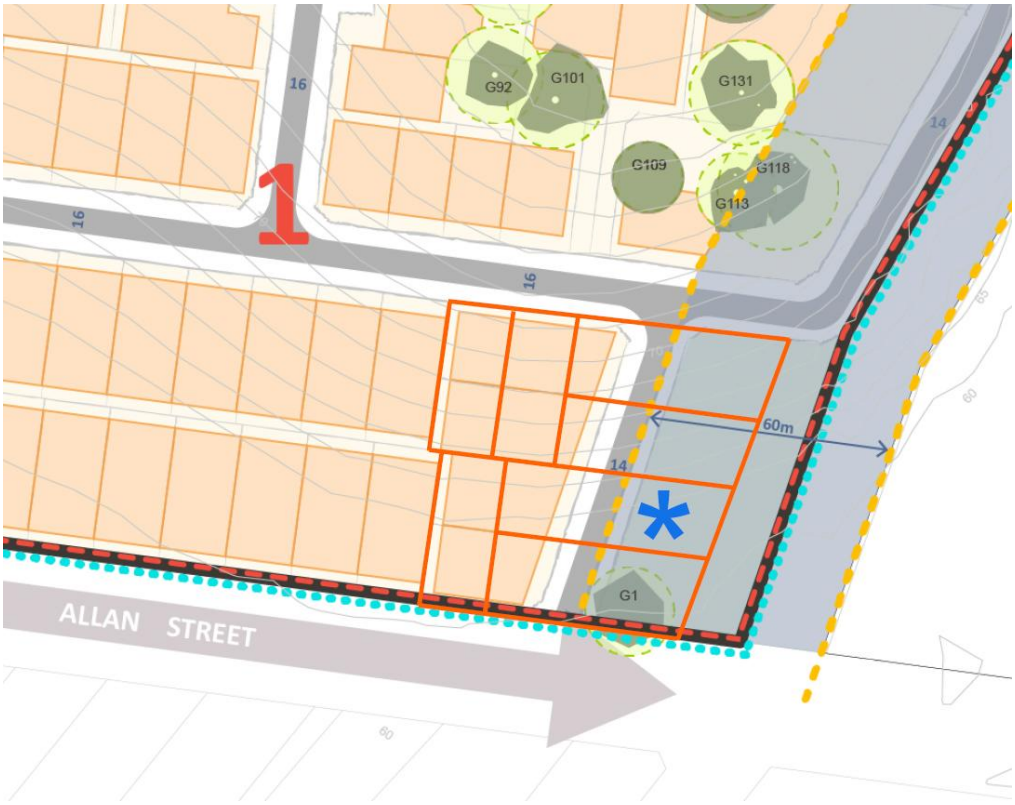
North-west Catchment

- The north-west catchment needs to be treated prior to discharge into the course of Grasmere Creek or Cardinia Creek. A treatment system can be provided either within the DPO24 area or by improving the existing swale within the Cardinia Creek Parklands, subject to agreement with Melbourne Water and Parks Victoria. The recommended strategic guidelines allow both options to be considered at permit stage without requiring revision of the DP.
- Should works to the MW swale not be accepted, Council recommends a bio-retention system to treat the north-west catchment. It is possible for the system to be provided within the linear reserve with no impact to developable land (subject to further modelling).

Southern Catchments

- All flow up to Q100 (not Q10) from the south-west catchment should be diverted and treated together with the south-east catchment. This is due to existing downstream flooding risk further south along Manuka Road.
- The proposed pipe alignment within Allan Street should follow the north of Allan Street with 3-month flow being routed through the combined treatment system.

- Council will not accept an underground detention tank for the south-east catchment. Council recommends a combination of a bio-retention system to treat the entire southern catchment and a sediment basin or offline GPT upstream.
- Should a GPT + bio-retention system be provided, it is possible for the entire catchment to be treated within the northern verge of Allan Street (subject to further modelling). The existing south-eastern reserve could be reallocated for residential use with an asterisk to indicate ‘drainage area option’.



Kind Regards,

Rex Zhang
Senior Strategic Planner

Appendix G Atlan Tech Data Submission

Atlan
STORMWATER

IN PARTNERSHIP WITH

City of Casey Council - VIC

TECH DATA SUBMISSION

Berwick College, Manuka Road, Berwick VIC, Australia

Created by:
Kurt Jensen
Atlan Stormwater

atlan.com.au

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EMAIL: sales@spel.com.au
OFFICE: 897 Wellington Road, Rowville, VIC 3178
ABN: 32 379 724 600
www.atlan.com.au

Submission Date: 19-09-2025

Nausheen Obaid
City of Casey Council - VIC
2 Patrick Northeast Drive
Narre Warren VIC

RE: Project Tech Data for Berwick College, Manuka Road, Berwick VIC, Australia

Dear Nausheen,

This document is to provide relevant tech data to be assessed by the client to prove that the stormwater systems proposed meet and exceed the requirements in the project design for the Berwick College, Manuka Road, Berwick VIC, Australia project.

The information included is as follows:

Appendix – MUSIC Model	3
Appendix – Treatment System Specifications	5
Appendix - Treatment System Drawings	15
Appendix - System Warranty	20

Let me know if you have any questions or queries.

Best regards:
Kurt Jensen
0437 901 144
Atlan Stormwater

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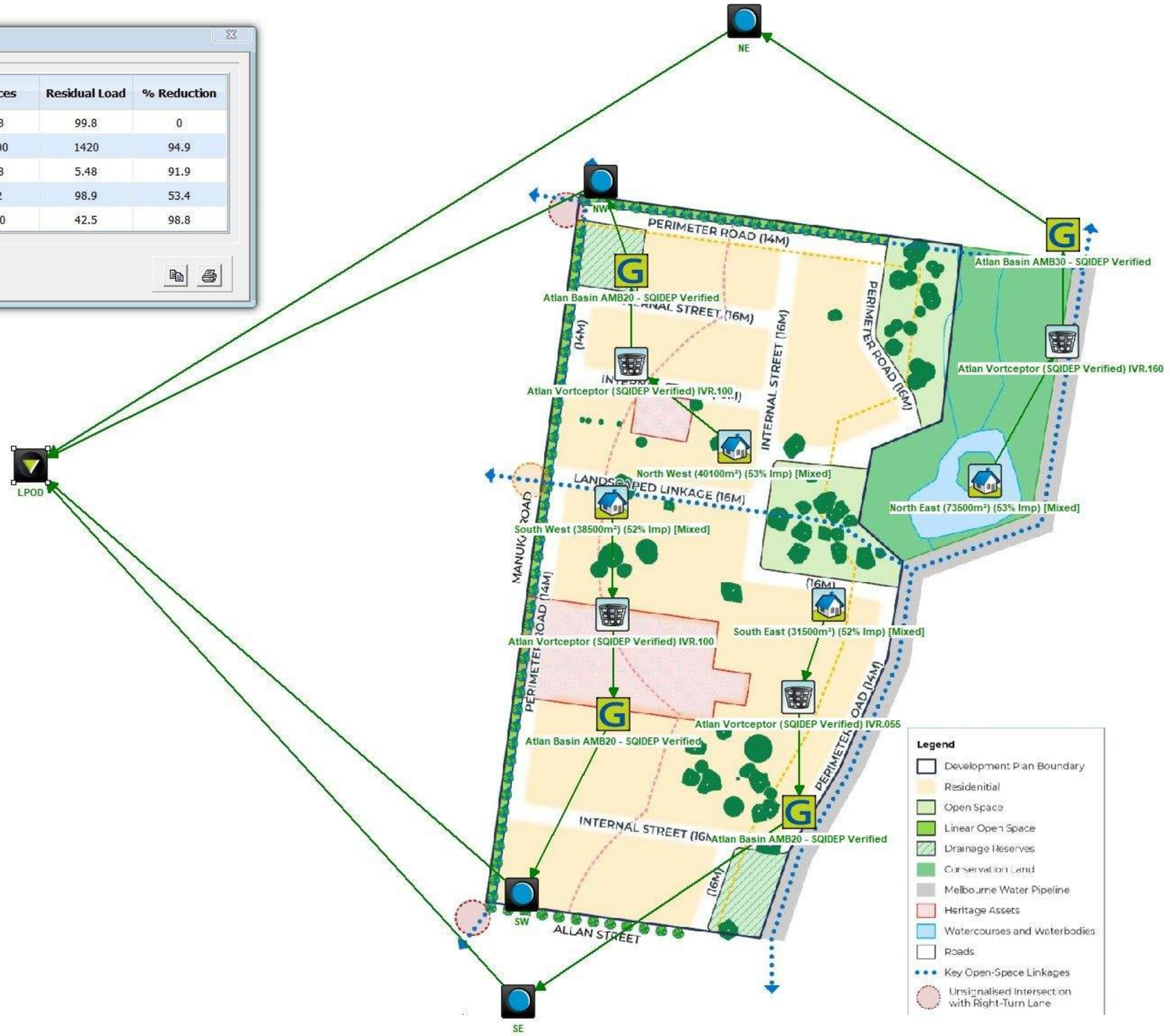
www.atlan.com.au

Appendix – MUSIC Model

Treatment Train Effectiveness - LPOD

	Sources	Residual Load	% Reduction
Flow (ML/yr)	99.8	99.8	0
Total Suspended Solids (kg/yr)	27700	1420	94.9
Total Phosphorus (kg/yr)	67.8	5.48	91.9
Total Nitrogen (kg/yr)	212	98.9	53.4
Gross Pollutants (kg/yr)	3610	42.5	98.8



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

ALL INTERCONNECTING PIPEWORK, PITS AND ASSOCIATED DRAINAGE BY OTHERS

City of Casey

REV	DATE	BY	DESCRIPTION	CHK
3	18-09-2025	OT		

HARTWOOD BERWICK

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Drawn	Date	
Check	Date	
Verified	Date	
Approved	Date	

Atlan STORMWATER

PROJECT
Hartwood Estate, Berwick

TITLE
MUSIC Modelling

SCALE	SIZE	SHEET	REV
N.T.S	A3	1 OF 1	3

CUSTOMER CODE : 25-83708 | DWG No.

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Atlan STORMWATER

Appendix – Treatment System Specifications

SQIDEP VERIFIED
STORMWATER QUALITY IMPROVEMENT DEVICE EVALUATION PROTOCOL
Atlan®
STORMWATER
Vortceptor
Hydrodynamic GPT

High-Efficiency Gross Pollutant Separation

Utilises hydrodynamic vortex technology to capture and separate sediments, silt, oil, grease, and gross pollutants effectively.

Permanent Pool Design

Ensures oil and grease are retained in a dedicated capture zone, preventing re-entrainment during high-flow events.

Optimal Flow Performance

Designed to treat stormwater runoff across a wide range of flow rates while maintaining compliance with Australian statutory water quality guidelines.

Trafficable Installation

Rated for vehicular (Class D) zones with appropriate concrete slab installation, ensuring flexibility for high-traffic areas.

Locally Manufactured

Locally fabricated in our National FRP production facilities to meet ISO9001 Quality Standards.

Offline Model

Inline Model

100 YEAR FIBREGLASS - DESIGN LIFE

25 YEAR WARRANTY

Robust Construction

One-piece fibreglass construction is lightweight, durable, and non-corrosive, ideal for long-term performance in diverse environments.

Cost-Effective Installation

Delivered fully assembled to the site, reducing installation time, crane costs, and overall project expenses.

Stormwater Compliance

Provides reliable solutions for pollutant load reduction in urban and industrial stormwater systems, aligning with Low Impact Development (LID) principles.

Flexible Configurations

Accommodates multiple pipe sizes (standard units up to 2800 LPS for 150mm to 1800mm pipes) and can be customised to meet specific site requirements.

Easy Maintenance

Cylindrical shape and sloped base concentrate sediment at the centre, simplifying cleaning and reducing maintenance efforts.

The Vortceptor Gross Pollutant Trap (GPT) is a non-blocking vortex style separator that has a unique screen and treatment action producing low vortex conditions resulting in excellent pollution removal performance and resulting high water quality outcomes.

It separates and captures gross pollutants, sediments, silt, total suspended solids, some nutrients and oil and grease. Designed with versatility in mind, these GPTs are available in inline and offline configurations.

Inline Model

The Vortceptor Inline series is useful for constrained sites with a treatment flow rate that is relative to the bypass flow rates. The Inline Vortceptor has a flexible pipe configuration with the outlet pipe being able to rotate in excess of 180° around the system. The Inline Vortceptor is available with or without internal bypass to suit installation on low flow diversions.

Offline Model

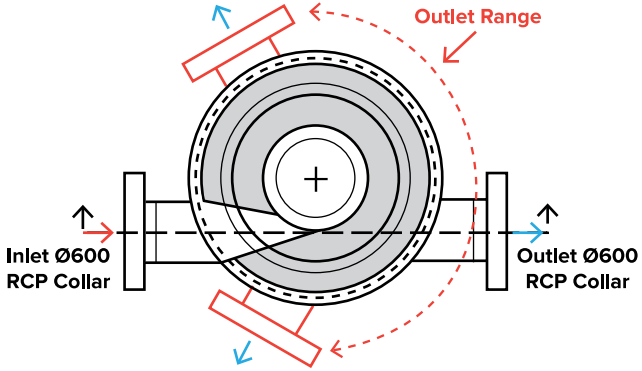
The Vortceptor Offline series is used when the bypass flows are high, or greater than the flows required to pass through the Inline range. Advantages of the Offline series include the ability to divert treated flow water to a tertiary asset independently to the bypassed stormwater and the ability to adjust the system to cater for trailwater and external catchments.

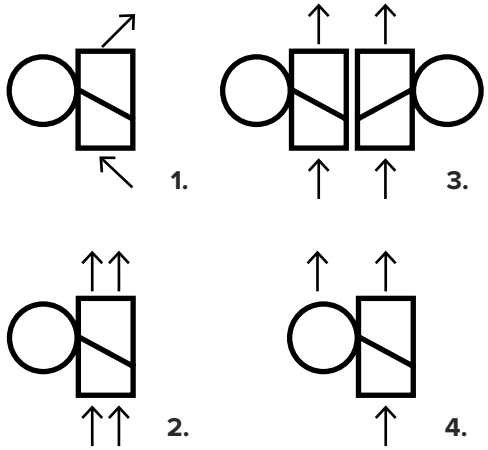
You can also include:

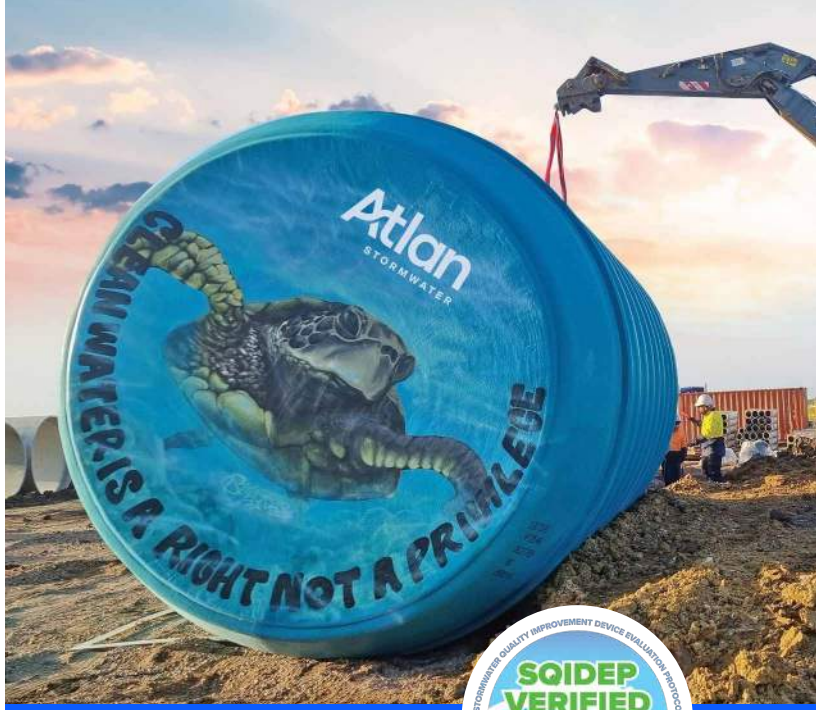
1. Angled inlet/outlet connections
2. Multiple pipes or culverts
3. Back to back twin units - for greater treatment
4. Bifurcation or splitting of flows

Applications

- Shopping Precinct
- Commercial Zones
- Recreational Grounds
- Industrial Areas
- Beaches & Park
- Residential Development







SQIDEP Tested Treatment Efficiencies*

POLLUTANT	EFFICIENCY
Gross Pollutants (GP)	100%
Total Suspended Solids (TSS)	93%
Total Phosphorus (TP)	86%
Total Nitrogen (TN)	49%

*Contact Atlan to confirm approved performance for the project LGA

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

Vortex Style GPT Inline Series

The inline series is manufactured from the standard single tank dia shown. Custom systems are also available.

Models	Dimensions (mm)					Capacities			
	Internal Diameter	Overall Width	Depth Below Invert	Manhole Size (mm)	Max Pipe Size (mm)	Sump Capacity (m^3)	Floatables Volume (m^3)	Treatable Flow Rate (L/s)	Max Flow Rate (L/s)
INLINE SERIES									
SVI.025 (L/R)	1200	1370	1400	600x 600	450	1.2	0.06	26	280
SVI.055 (L/R)	1800	1970	1650	900x 900	525	2.7	0.22	55	380
SVI.055.M (L/R)	2200	2370	1585		525	3.2	0.22	55	750
SVI.100/15 (L/R)	1500	1670	1900		600	3.1	0.20	100	700
SVI.160/22 (L/R)	2200	2370	2400		750	3.4	0.39	160	940
SVI.200/22 (L/R)	2200	2370	2900		750	3.1	0.39	200	990
SVI.300/22 (L/R)	2200	2370	3100	1000 DIA Internal 600x 600	750	4.5	0.83	300	1050
SVI.400/22 (L/R)	2200	2370	3000		750	3.4	0.83	400	1180
SVI.400/25 (L/R)	2500	2670	2900		900	5.5	0.83	400	1650
SVI.400/30 (L/R)	3000	3170	3500		900	10	1.5	400	2500
SVI.500/30 (L/R)	3000	3170	3500		1050	10	1.5	500	1650
SVI.500/35 (L/R)	3500	3670	4000		1050	10	1.5	500	1900

Atlan®
STORMWATER

AtlanBasin®

Modular bioretention basin

Advanced Stormwater Treatment

Combines high-capacity stormwater management with horizontal flow bioretention and multistage pre-treatment for superior pollutant removal, including sediment, gross pollutants, hydrocarbons, and nutrients.

Customisable Configurations

Scalable to diverse site-specific requirements with flexible flow rates, inlet designs, and sizing, including high-flow bypass options.

Compact and Efficient Design

Pre-fabricated, self-contained system ensures a minimal on-site footprint, making it ideal for urban environments and space-constrained projects.

Integrated Pre-Treatment Chambers

Incorporates litter capture, sediment retention, and pre-filter cartridges for enhanced filtration efficiency and performance.

Durable and Long-Lasting

Constructed with robust materials for reliable performance under varied environmental conditions, with minimal maintenance requirements.

Compliance and Optimisation

Meets local water quality standards and environmental regulations, with MUSIC modeling and SQIDEP approval for optimised performance.

Versatile Applications

Suitable for installations in residential, commercial, industrial, and retrofit projects, treating runoff from parking lots, roadways, and hardstand surfaces.

Flexible Installation

Adaptable to both above-ground and below-ground setups, with options for trafficable and non-trafficable zones.

Our AtlanBasin® modular bioretention system is a highly advanced stormwater filtration system. Its size and capacity make it ideal for stormwater treatment scenarios that require high pollutant reduction in a small footprint.

It can be used in place of standard catch basin structures, rain gardens, bioretention cells and media filters. As a self-contained treatment train, it incorporates the following treatment components:

- Screening
- Hydrodynamic separation
- Media filtration
- Bioretention filter

The AtlanBasin is available in various sizes and inlet configurations, including high flow bypass. SQIDEP approved, its innovative design ensures high stormwater treatment performance capabilities in a condensed footprint.

Music Modelling

The AtlanBasin Modular Bioretention System is modeled, typically in MUSIC, for each project based on the site specific requirements.

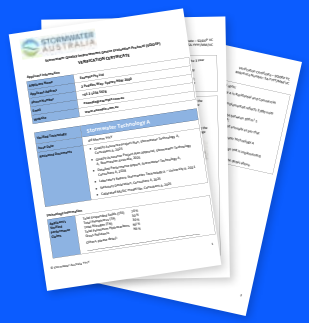
Applications

- Car parks & shopping centres
- Heavy vehicle maintenance areas
- Transport depots & loading bays
- Council depots
- Industrial estates
- Tunnel &, highways
- Recycling yards
- Airport aprons & tarmacs

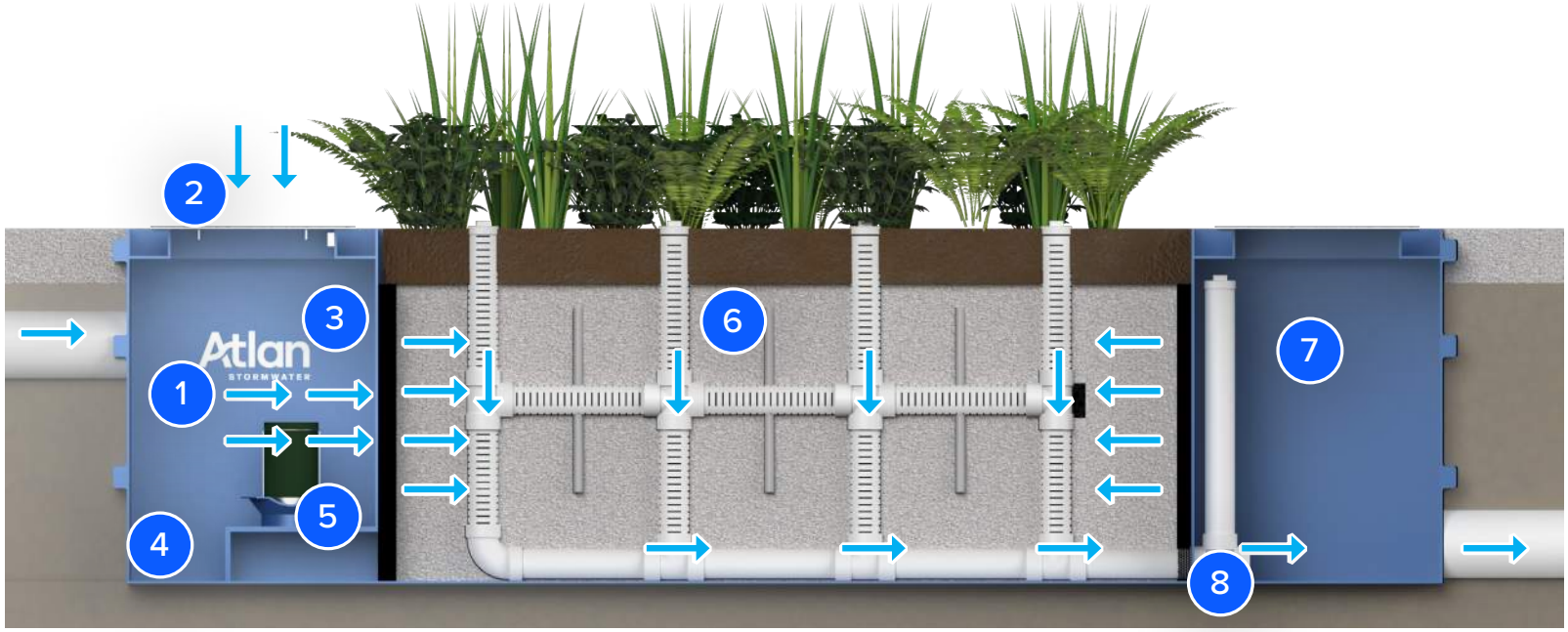
SQIDEP Tested Treatment Efficiencies*

POLLUTANT	EFFICIENCY
Gross Pollutants (GP)	99%
Total Suspended Solids (TSS)	86%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	50%

*Contact Atlan to confirm approved performance for the project LGA



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



1. Pre-treatment chamber

Captures incoming runoff and contains the first three stages of treatment.

2. Grate type catch basin inlet

A standard grate type traffic rated catch basin opening directs stormwater into the system.

3. Optional StormSack

Provides the first stage of treatment by capturing trash and litter, gross solids, and sediment.

4. Settling chamber

Provides the second stage of treatment by separating out larger suspended solids.

5. Coalescer

Provides the third stage of treatment by physically and chemically capturing fine TSS, metals, nutrients, and bacteria.

6. Hydrocarbon treatment chamber

Provides the final stage of treatment through a combination of physical, chemical and biological processes.

7. Discharge chamber

Contains flow control, high flow bypass and optional drain down filter.

8. Multi-level flow control

Orifice plates and/or valves are used to control the flow through the treatment stages.

Atlan

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Appendix - Treatment System Drawings

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Atlan STORMWATER

Appendix - System Warranty

WARRANTY

ATLAN UNDERGROUND TANK SHELLS

We warrant that our Separator and storage underground tank shells, if installed strictly in accordance with the company's relevant installation procedure - having in mind particularly: ground conditions, invert depth, water table depth in winter, external loading, type and quality of backfill material, will

1. meet our published specifications and will be free from material defects in materials and workmanship for a period of one year following date of original delivery.
2. not fail for a period of twenty-five years from date of original purchase due to external corrosion; and
3. not fail for a period of twenty-five years from date of original purchase due to internal corrosion provided the tank is solely used for;

    - Rainwater storage

    - Potable water at ambient temperatures

    - Fuel/oil contaminated surface rainwater Domestic sewage.

For other applications the life expectancy will be determined by the contents, the operating conditions and the resin system/reinforcement specification used.

Our liability under this warranty shall be limited to, at our option,

1. repair of the defective tank
2. delivery of a replacement tank to the original site or
3. refund of the original purchase price.

We shall not be liable for any labour or other installation costs, indirect or consequential loss, damage or other damages in connection with such tanks.

Accessory warranties do not extend beyond the warranty period by our suppliers. This applies to such items as access covers and frames, monitoring equipment, connections for emptying, pumping equipment or any accessories as defined in the company's official order acknowledgement/invoice.

The foregoing constitutes our exclusive obligation and we make no express or implied warranties, or any warranty of merchantability or fitness for any particular purpose whatsoever, except as stated above.

Atlan
STORMWATER

atlan.com.au
1300 773 500 | SALES@ATLAN.COM.AU

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engineering positive change

SMEC simplifies the complex. We unlock the potential of our people to look at infrastructure differently, creating better outcomes for the future.

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