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Westlink Industrial Estate, Kemps Creek

Stage 1 Water and Stormwater Management Plan

ESR Development (Australia) Pty Ltd

MAY 2024

20-748

Commercial in Confidence

Document Registration

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1. Response to Conditions of Consent

This Water and Stormwater Management Plan (WSMP) has been prepared to respond to Conditions B25 and B30 of the Westlink Stage 1 (SSD-9138102) consent. Comments and Recommendations were received from the Department of Planning and Environment (DPE) and Environment and Heritage Group (EHG) within a letter dated 10th August 2023. Table 1 below responds to this letter and highlights how all conditions within B25 and B30 are addressed for this application.

Table 1- Response to Conditions to B25 & B30

Condition	Response/Comments	Addressed
B25 (a) Within two months of the date of this consent, the Applicant must design the stormwater management system to the satisfaction of the Planning Secretary . The stormwater management system design must be prepared in consultation with the Environment & Heritage Group, Sydney Water and Council	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans have also been prepared in consultation with the nominated Authorities post August 2023 and deemed compliant	Yes
B25 (b) ATL letter states Tim Michel (CPEng NER 2333079) of AT&L prepared the report and drawings. Tim needs to certify the report and drawings in a letter and sign the design drawings confirming Conditions B25 and B30 is achieved.	Certification letter provided. Reference CER002-01-20-748 Condition B25b B30a Certificate dated 24th April 2024	Yes
B25 (c) Be consistent with the plan shown on Figure 2 in Appendix 1 and the updated Stormwater Management Plan required by Condition B30	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans are still consistent with Figure 2 so deemed compliant	Yes
B25 (d) Include all private, Council and trunk drainage infrastructure within the site including connections to adjacent landholdings	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans include all private, Council and trunk drainage infrastructure within the site and deemed compliant	Yes
B25 (e) Be designed in accordance with the Technical Guidance for Achieving Wianamatta South Creek Stormwater Management Targets (Technical Guidance) (NSW Government, 2022) and detail: i)the requirements and objectives of the IWCM controls of the DCP will be achieved. ii)the waterway health objectives and targets set out in the Technical Guidance will be achieved	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. All updated plans have still been designed in accordance with the Technical Guidance for Achieving Wianamatta South Creek Stormwater Management Targets	Yes

B25 (e) iii) levels are resolved to demonstrate the system functions effectively *DPE comment (10th August 2023) - Details of level and function have been provided on the AT&L drawings which seems appropriate. However, the levels are not the same as the levels provided on the JWP trunk drain drawings. Furthermore, a range of details relating to drainage and levels on the AT&L drawings require review and update*	AT&L drawings issued January 2024 updated to suit comments and coordinated with JWP trunk drainage drawings.	Yes
B25 (e) iv) the development will ultimately connect to the MRP Stormwater Scheme and interim measures to meet the waterway health objectives and targets will be decommissioned	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans are indicated to still ultimately connect to the MRP Stormwater scheme with interim measures. As such deemed compliant	Yes
B25 (e) v) all stormwater management devices will contain an impermeable liner and all naturalised trunk drainage (or other open drainage) is either lined with an impermeable liner, or ameliorated (ie gypsum) and compacted to a suitable depth and topsoiled (AS44119) to limit infiltration to soils	Refer to Civil Drawings 20-748 C13070, 13071 and 13072 for details and specification of impermeable liner	Yes
B25 (f) Demonstrate the on-site stormwater detention design is free draining	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans still demonstrate the OSD basin is free draining. Refer to Civil Drawings 20-748 C13070, 13071 and 13072.	Yes
B25 (g) Demonstrate maintenance access driveways to water storage or bio-retention basins are designed in accordance with Council's specifications	Refer Drawing 20-748 C13072 for cross section through basins. Refer Drawing 20-748 C13121 to C13128 (Pavement and Surface Treatment Plans) for pavement specification of access to basin Refer Drawing 20-748-C13175 for vehicle turn paths for 8.8m long service vehicle to access the basin to meet Penrith City Council's specifications. All driveways designed to Council's industrial driveway specification (PCC DWG SD1004).	Yes
B25 (h) Demonstrate that sufficient land is reserved on site for stormwater management purposes (such as irrigation areas and undeveloped areas) as	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans still indicate sufficient land is	Yes

shown on Figure 2 in Appendix 1, to ensure the development meets the controls in the DCP and the waterway health targets in the Technical Guidance, unless an alterative stormwater management strategy has been approved by the Planning Secretary	reserved on site for stormwater management purposes and deemed compliant.	
B25 (i) Include civil design drawings that define the design of the WSUD system in accordance with the Technical Guidance and the requirements of Sydney Water and Council *DPE Comment (10th August 2023) The drawings are a functional design level only. Suitable civil design drawings to facilitate civil construction have not been provided.* *As noted by JWP, further design details will be developed and presented in the detailed construction stage documentation for these works*	Refer to all Civil Drawings 20-748 C13000 series issued in January 2024 for all details. Of note refer to Drawings 20-748 - C13070, 13071, 13072, 54435.C.02.10.GA and 54534.F.01.10.GA for WSUD details	Yes
B25 (j) Include landscape drawings that include planting and hardscape details of the WSUD systems *DPE Comment (10th August 2023) Landscape drawings are planting only and do not include mulch details. Also the plans are missing the pump, disinfection treatment (if required), irrigated land and any irrigation details, soil and landscape treatments that are required for that zone*	Landscape drawings provided by Site Image Pump and pressure main specification provided on Drawing 20-748 C13070 and Sparks and Partners Drawings C-SK-Pump Plan and Section Mark up (PG 1/5 to 5/5) dated 15/04/2024 Soil Assessment Report Westlink Stage 1 Soil Assessment J004954 April 2024 prepared by SESL Aust provides advice on suitability of irrigating the existing topsoil and Lot 5 area.	Yes
B25 (k) Include certification (and appropriate designed checklists) of the civil and landscape drawings by suitably qualified chartered professional engineer with experience in modelling, design and supervision of SWUD systems that the design drawings comply with the Technical Guide requirements and the stormwater targets are achieved. *DPE Comments (10th August 2023) JWP have provided a certification that the drawings are appropriate to facilitate bulk earthworks. This is agreed.* *However further development of the drawings is required (as noted by JWP) and the drawings need*	Refer to all Civil Drawings 20-748 C13000 series issued in January 2024 for development of drawings.	Yes

to be certified and signed by the engineers or landscape architects		
B25 (l) Include evidence that the design and mix of WSUD infrastructure has considered on going operation and maintenance, including a detailed lifecycle cost assessment (including capital, operation/ maintenance and renewal costs over 30 years)	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans haven't altered the WSUD infrastructure proposed from the original plans. All operation and maintenance procedures are still the same as described within this report.	Yes
B30 (a) Within four months of the date of this consent, the Applicant must prepare a separate Water and Stormwater Plan (WSMP) to the satisfaction of the Planning Secretary. The WSMP must be prepared by a suitably qualified chartered professional engineer with experience in modelling, design and supervision of WSUD systems, whose appointment has been endorsed by the Planning Secretary	Certification letter provided. Reference CER002-01-20-748 Condition B25b B30a Certificate dated 18th January 2024	Yes
B30 (b) Comply with the requirements of the Technical Guidance	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. All updated plans maintain compliance with the requirements of the Technical Guidance	Yes
B30 (c) Be consistent with the plan shown in Figure 2 in Appendix 1	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. All updated plans are still consistent with the plan shown in Figure 2.	Yes
B30 (d) Be prepared in consultation with the Environment & Heritage Group, Sydney Water, Council and the Department	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans have been prepared in consultation with the nominated Authorities post August 2023 and deemed compliant	Yes
B30 (e) Describe the baseline soil, surface water and groundwater conditions at the site	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans still describe these conditions as per this report.	Yes
B30 (f) Define how the development will comply with the stormwater targets, including connection to the regional scheme	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans still define how the development will comply with stormwater targets.	Yes

B30 (g) Include MUSIC modelling for each stage of the development in accordance with the Technical Guidance	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. All updated plans include Music modelling for each stage.	Yes
B30 (h) Provide catchment plans, tables and all stormwater management details as per the Technical Guidance	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. All updated plans provide catchment plans and tables as per the original approved plans.	Yes
B30 (i) I. Proprietary devices are located on private land and only include sediment and nutrient removal if certified under SQIDEP ii. Ensure external catchments are drained to trunk drainage iii. ensure all catchment areas are accounted for in the MUSIC modelling and post processing tool and there are no inconsistencies iv. the strategy and stormwater elements are consistent with the design drawings required by Conditions B25 to B27 (including the detailed drawings in appendices to the report)	This condition was satisfied in the previous approved plans as per letter dated 10th August 2023. The updated plans indicate all proprietary devices are located on private lands and external catchments drain to the trunk drainage as per the original approved plans.	Yes
B30 (j) Include a protocol for investigation of any non-compliances of the stormwater management system with the IWCM controls in the MRP DCP and waterway health objectives and targets in the Technical Guidance	Refer Section 8 (Inspection and Maintenance) and 9 (Contingency Management) of this report for details	Yes
B30 (k) Detail the contingency measures that would be implemented should issues arise	Refer Section 8 (Inspection and Maintenance) and 9 (Contingency Management) of this report for details	Yes
B30 (l) Include a Maintenance Plan for the WSUD measures	Refer Section 8 (Inspection and Maintenance) and 9 (Contingency Management) of this report for details	Yes
B30 (m) Detail triggers for a review of the plan, including, but not limited to a review of the plan within 6 months of the Stormwater Scheme being available for the site to connect to	Refer Section 8 (Inspection and Maintenance) and 9 (Contingency Management) of this report for details	Yes

2. Introduction

This Water and Stormwater Management Plan (WSMP) has been prepared by AT&L on behalf of ESR Australia in support of a State Significant Development Application (SSD-9138102) MOD 1 for the proposed development of the site located at 290-308 Aldington Road and 59-63 Abbotts Road, Kemps Creek (the Site).

2.1. Site Description

The extent of the site is presented in Figure 1.

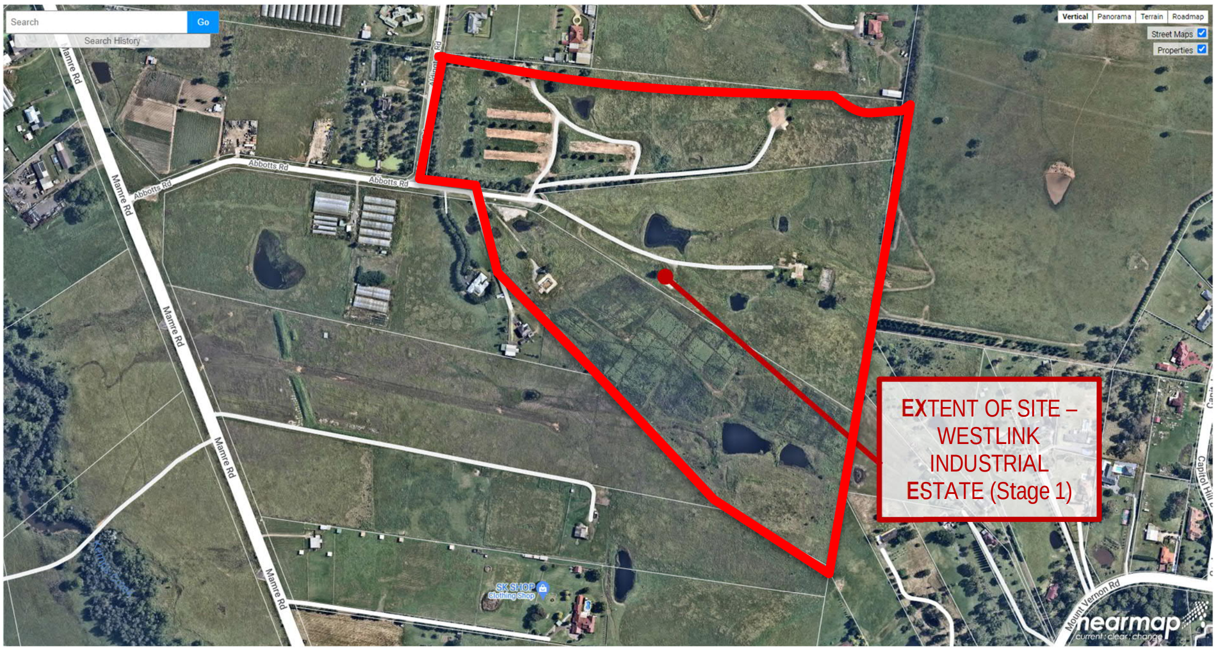


Figure 1: Site Extent (imagery from nearmap, dated 17 February 2022)

The site is located in the suburb of Kemps Creek, within the Penrith Local Government Area (LGA), and approximately 15 km south-east of the Penrith CBD and 5 km north-east of the under-construction Western Sydney Airport. The site is made up of the following allotments:

- Lot 11 DP253503 (63 Abbotts Road, Kemps Creek)
- Lot 12 DP253503 (59-62 Abbotts Road, Kemps Creek)
- Lot 13 DP253503 (290-308 Aldington Road, Kemps Creek)
- Lots 3 and 4 DP250002 (1030-1064 Mamre Road, Kemps Creek)

The total area of the site is approximately 53.8 hectares, including the residual land to the east and south not being developed as part of this SSD.

The site is currently characterised as rural land and comprises residential dwellings, agricultural areas, sheds, greenhouses and some farm dams.

In June 2020, the site was rezoned *IN1 – General Industrial* under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009*. The site is also located in the Mamre Road Precinct and is therefore subject to controls outlined in the *Mamre Road Precinct Development Control Plan 2021*.

2.2. Supporting Documentation

The following documentation is referred to throughout and should be read in conjunction with this report:

- Civil Drawings (AT&L), 20-748-C11000 (Infrastructure) submitted separately
- Stormwater Management Layout Plan 20-748-C11075 in Appendix 1
- Pre-Development hydrology parameters and assumptions letter (LTR007-02)- refer to Appendix 2
- Life Cycle Costings , and O&M Manuals from Landcon & SPEL - refer to Appendix 3
- CPESC Report by LENECO Environmental Management
- Trunk Drainage Drawings and associated report by J.Wyndham Prince
- Westlink Industry Park – Response to Agency Comments Condition B25 and B30 Table August 2023

3. Site Characteristics

3.1. Existing Topography and Catchments

The Site in its existing condition is characterised by undulating topography. The ground slope across most of the site has a general fall from the east to west towards Abbotts Road with existing levels ranging from RL92.5 in the southeast, RL 87.5 in the north-east, RL 58.5 in the north west and RL51.0 at the intersection of Abbotts Road and Aldington Road.

The eastern portion of the site consists of four ridgelines that are generally aligned in an east-west direction. Ground slopes off these ridgelines towards local gullies within the site are typically between 10% and 15%. The western portion of the site adjacent to Aldington Road and Abbotts Road is generally flatter than the eastern portion, with ground slopes typically in the range of between 2% and 8%.

Most of the site in its existing condition is pervious, other than some residential dwellings, sheds and access driveways.

Delineation of the existing internal drainage catchments and external catchment that drain through the site is presented as Figure 2.

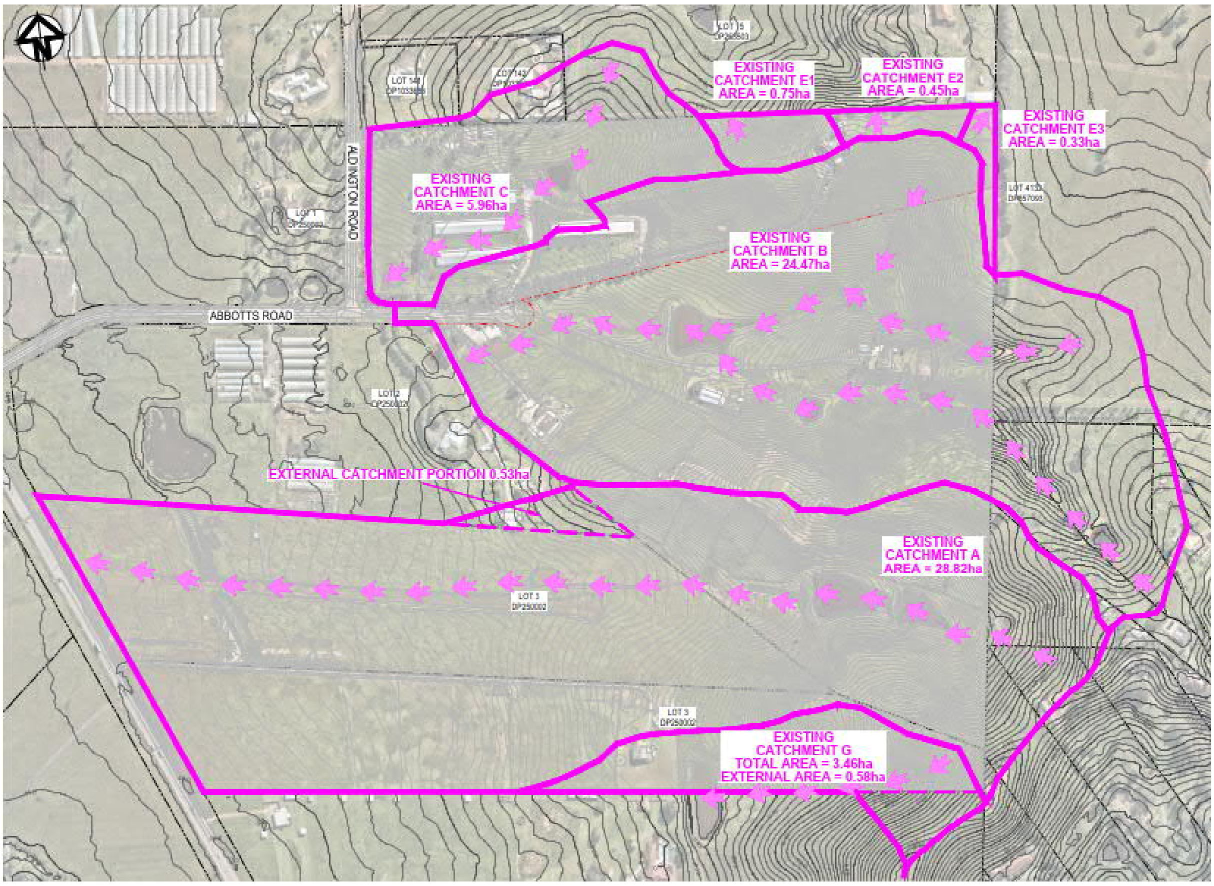


Figure 2: Catchment extents under existing conditions

A summary of the internal catchments under existing conditions is presented in Table 2. The total catchment area internal to the site boundaries is 53.80ha.

Table 2: Description of internal and external catchments under existing conditions

Catchment ID	Area (ha)	Description
A	28.82	Discharges towards Mamre Road via residual land 1030-1064 Mamre Rd.
B	24.47	Discharges towards the eastern boundary of 1016-1028 Mamre Road (Lot 2 DP250002) and ultimately into a catch drain that runs along the southern edge of Abbotts Road.
C	6.09	Discharges towards the intersection of Abbotts Road and Aldington Road.
D	0.33	Discharges in a north-easterly direction towards 19-105 Capitol Hill Drive Mount Vernon (Lot 4132 DP857093)
E	0.45	Discharges in a northerly direction towards 272 Aldington Road (Lot 15 DP253053)
F	0.75	
G	3.46	Discharges into a shared existing farm dam, which overflows into the 1066-1074 Mamre Rd property to the south.

3.2. Existing Drainage Lines

Based on large-scale topographic mapping (1:25,000 from NSW Six Maps), there are two mapped overland drainage lines within the site, refer to Figure 3.

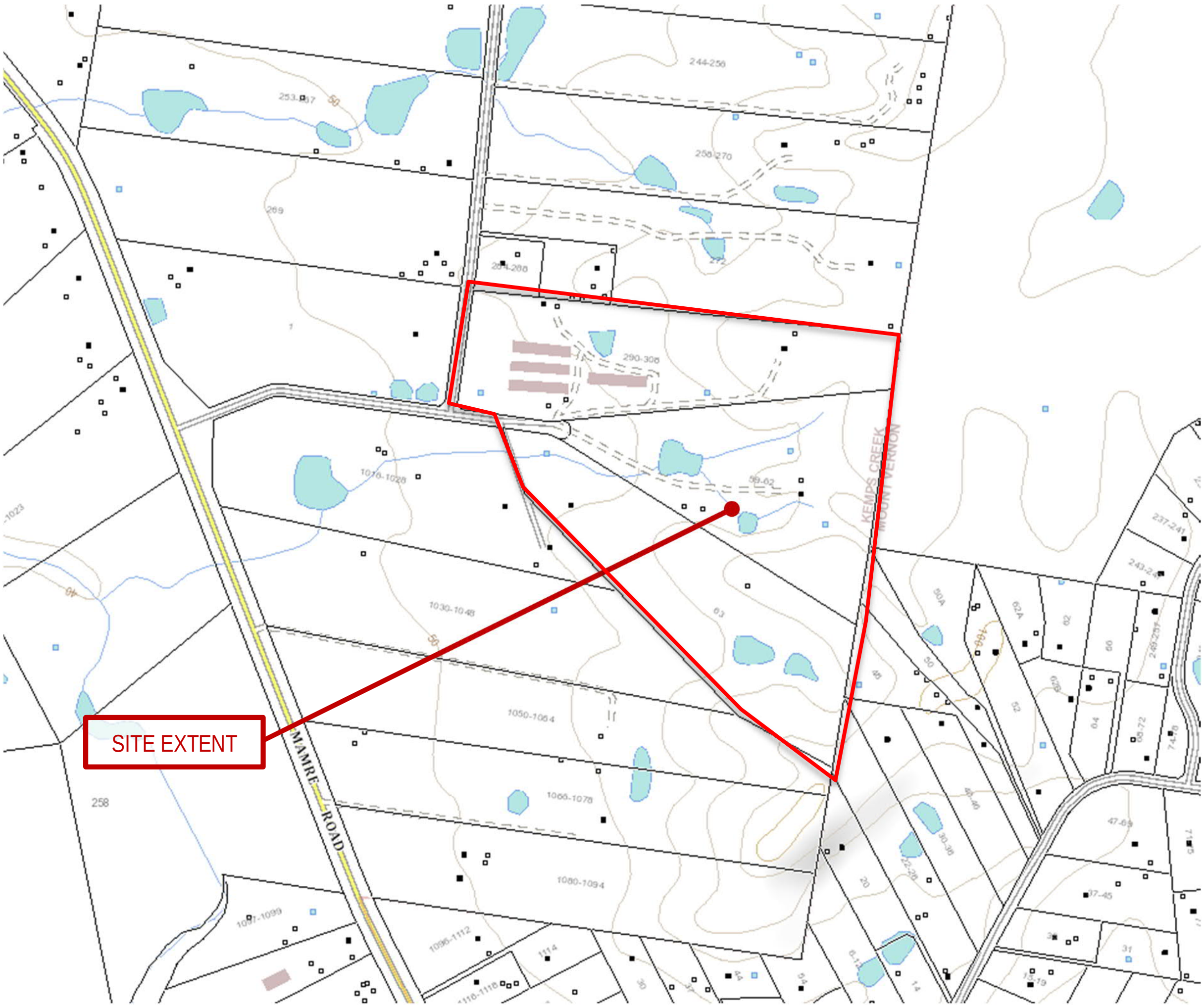


Figure 3: Topographic mapping showing drainage lines in the vicinity of the site (Source: NSW SIX Maps)

The *Mamre Road Precinct Waterway Assessment* (CTEnvironmental, April 2020), contained in the *Mamre Road Flood, Riparian Corridor, and Integrated Water Cycle Management Strategy* (Sydney Water, October 2020) presents the extents of waterways in the Mamre Road Precinct that have been the subject of a desktop review and field assessment to confirm the presence of mapped and unmapped waterways. An extract of mapping showing the extents of waterways in the Mamre Road Precinct is presented as Figure 4. This shows an unnamed tributary of Kemps Creek within the site.

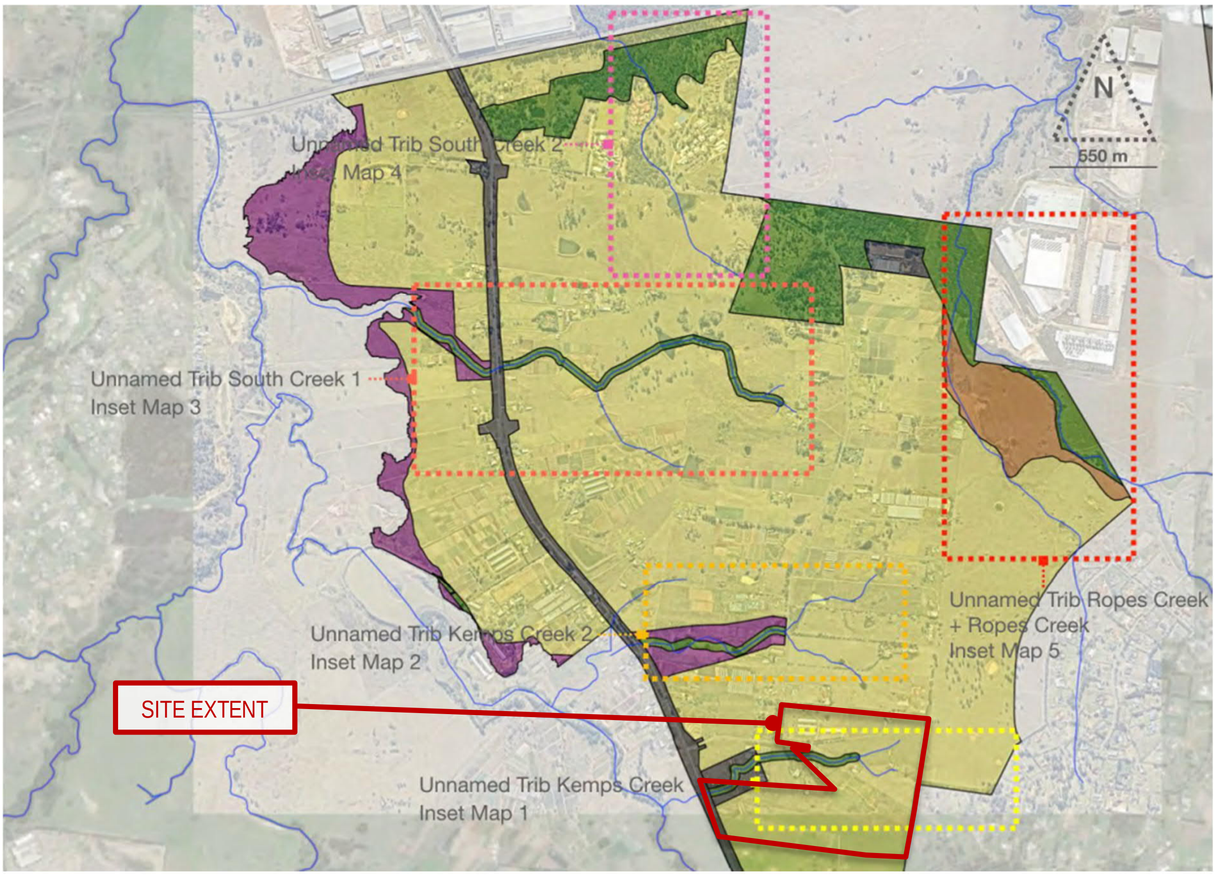


Figure 4: Extract of waterway mapping (CTEnvironmental, April 2020)

Results of the inspection of the unnamed tributary of Kemps Creek are described in the *Mamre Road Precinct Waterway Assessment* (CTEnvironmental, April 2020), and are summarised below:

- Two first order watercourses were evident in the headwaters which run to the north and south of the recently demolished house on 59-62 Abbotts Road.
- A clear flow path was evident below the confluence of the two first order watercourses, which validated the presence of a second order watercourse.
- The flow path did not have defined bed and banks, likely due to the presence of three upstream farm dams.
- From a point approximately 200 metres downstream (west) of the confluence of the first order watercourses, the flow path was observed to be heavily modified and formed into a drainage channel that runs parallel to and on the southern side of Abbotts Road. The flow path continues to Mamre Road.
- The section of mapped watercourse downstream of the Westlink Industrial Estate was not present, refer to Figure 5.
- Due to the lack of vegetation along the upper section of the headwater and significant modification to the drainage channel in the lower section, the watercourse had minimal ecological value.

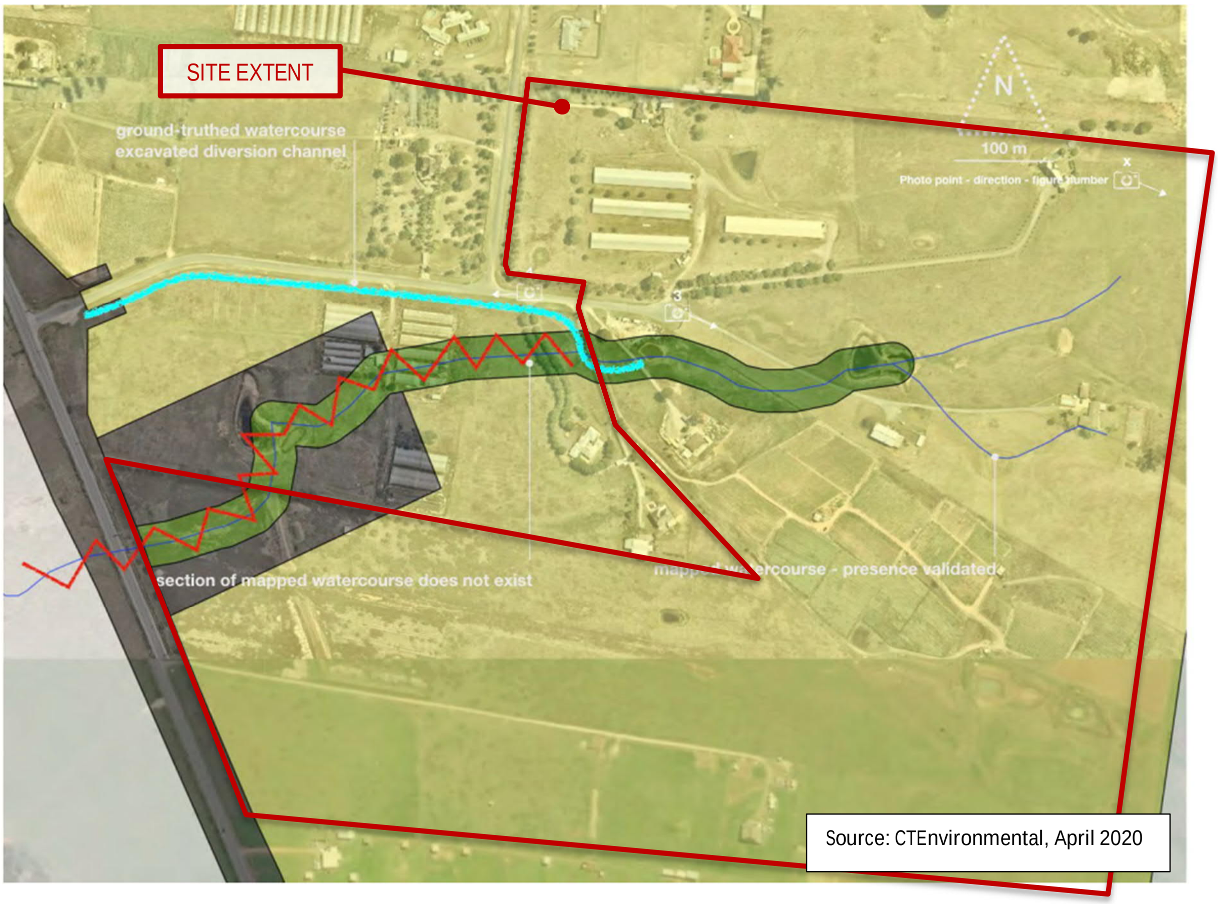


Figure 5: Field validated flow paths and watercourses within and downstream of the site

3.3. Existing Geology

Based on the Preliminary Geotechnical Investigation undertaken by Douglas Partners (reference: 92352.00, dated August 2019) for 59-63 Abbotts Road and the Geotechnical Investigation Report prepared by Alliance Geotechnical (reference: 9687-GR-1-1, dated October 2019) for 290-308 Aldington Road, the following inferred sub surface soils were encountered across the site:

- TOPSOIL / topsoil filling to depths of 0.1 - 0.6m
- FILL to depths of 2.3m over parts of the site
- Residual Soil – variably stiff to hard silty clay, to depths in the range 2.5-3.5m
- BEDROCK - initially extremely low to very low strength shale or sandstone at first contact at depths of 0.7

3.4. Post-Development Catchment Extents

A post-development catchment plan based on the proposed site grading is presented as Figure 6.

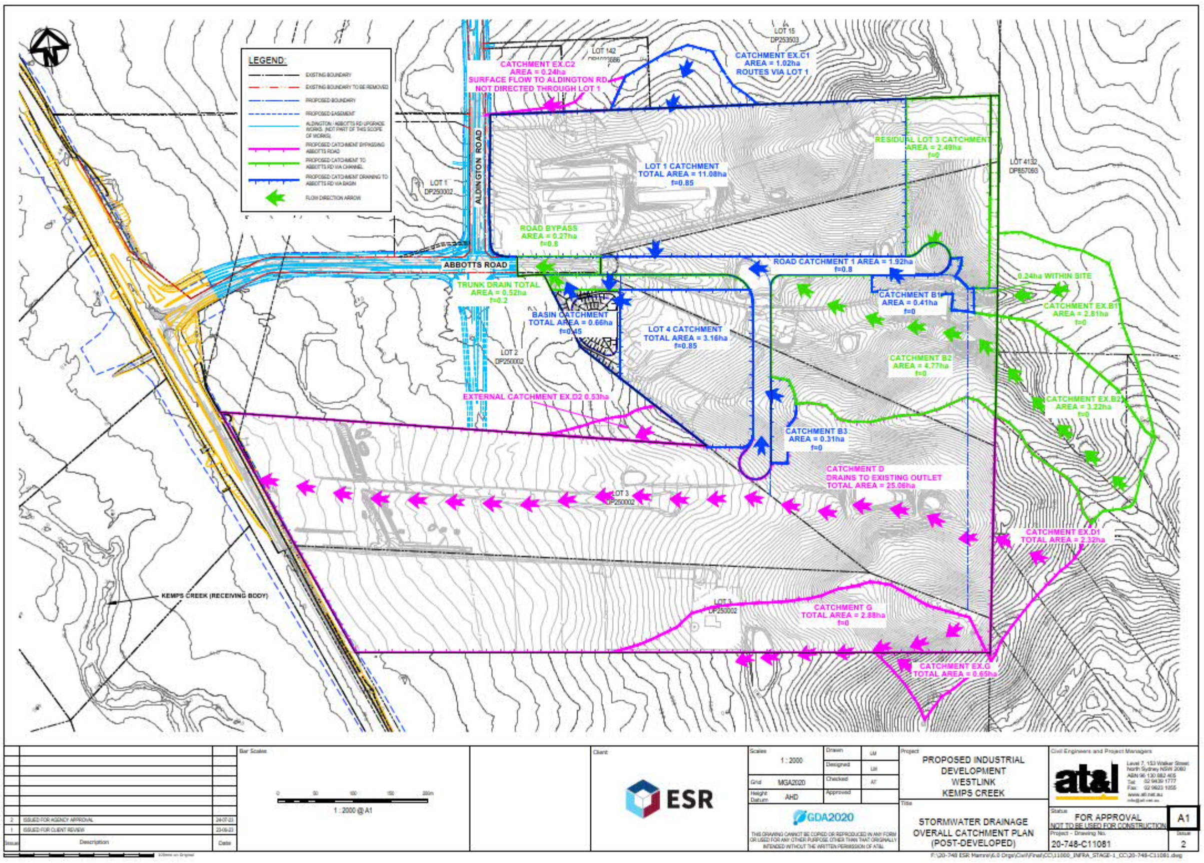


Figure 6: Catchment extents under proposed conditions

The post developed catchment extents are proposed to drain into 3 different catchments as highlighted in Figure 6 and below dot points:

- OSD Basin Catchment – includes all of developed Lot 1 and 4, B1, B3, external catchment EX.C1 north of Lot 1 (temporary only until the northern site is developed) and road reserves as part of the Stage 1.
- 20m wide naturalised trunk drainage channel – includes catchment Residual Lot 3, B2, EX.B1, and the trunk drainage reserve.
- Bypass Catchments include:
    - EX.C2 bypassing into Aldington Road
    - Catchments D, EX.D1, EX.D2 which drain to the west of future stage 2
    - Catchment G and EX.G which currently drain to the south. G will be captured by future stage 2 while EX.G will be diverted into its naturally draining catchment.

All flows into the naturalised trunk drainage channel are assumed undeveloped catchments for this Stage 1 development. Once these catchment are developed, detention measures within future allotments will be required to be implemented to ensure peak post flows into the open channel do not exceed the pre-developed flows. This will need to be determined as part of the Development Applications on each of these lots.

The outlet from the OSD basin will discharge into the naturalised trunk drainage channel via a controlled outlet at the north western end of the channel to discharge into the stormwater network within Abbots Road. These flows will be directed into the downstream naturalised trunk drainage channel when it is constructed in the future. The OSD basin spillway is set at a level higher than the open trunk drainage channel's 1% AEP peak water level to ensure water will not overtop the open channel into the OSD basin for all storm events up to the 1% AEP. Flows from catchment D and G to the south will have a separate discharge point to the stage 2 naturalised trunk drainage channel.

4. Stormwater Drainage

4.1. Stormwater Drainage Design Criteria

Design criteria and requirements for the proposed site stormwater management and stormwater drainage are outlined in the following documents:

- AS 3500.3 – Plumbing and drainage – Stormwater drainage
- Commonwealth of Australia (Geoscience Australia), *Australian Rainfall and Runoff: A guide to flood estimation*, 2019.
- NSW Department of Planning, Industry and Environment (DPIE), *Mamre Road Precinct Development Control Plan 2021*.
- NSW Department of Planning, Industry and Environment (DPIE), *MUSIC Modelling Toolkit – Wianamatta*, 2 August 2021.
- Penrith City Council, *Design Guidelines for Engineering Works for Subdivisions and Developments*, as amended 20 November 2013.
- Penrith City Council, *Water Sensitive Urban Design (WSUD) Policy*, December 2013.
- Penrith City Council, *WSUD Technical Guidelines*, Version 4 – October 2020.

4.2. Proposed Site Stormwater Drainage

The proposed drainage network within the estate has been designed to safely convey major and minor flows prior to discharging to neighbouring properties to the south and west. The following criteria have been adopted for the proposed drainage system:

- Major system (pit and pipe network, overland flow paths and channels): 1% AEP
- Minor system (pit and pipe network): minimum 5% AEP and increased where required to address major system design requirements.
- Flood Impacts from external catchments are to be minimised to an acceptable level for all floods up to the PMF.

The internal site stormwater drainage has been designed to drain towards the proposed detention basin located on the southern side of Abbotts Road. The basin will discharge into a new stormwater drainage line that will be constructed on the southern side of Abbotts Road, which will connect to future stormwater drainage that will ultimately drain towards Mamre Road.

4.3. Trunk Drainage Infrastructure

The *Mamre Road Precinct DCP* includes indicative locations of trunk drainage infrastructure across the precinct, refer to Figure 7. A 20m width naturalised trunk drainage line is situated within the ESR Westlink site, which would drain in a westerly direction on the southern side of Abbotts Road and ultimately towards Mamre Road. J. Wyndham Prince has investigated the hydraulics and spatial design of the trunk drainage in stage 1.

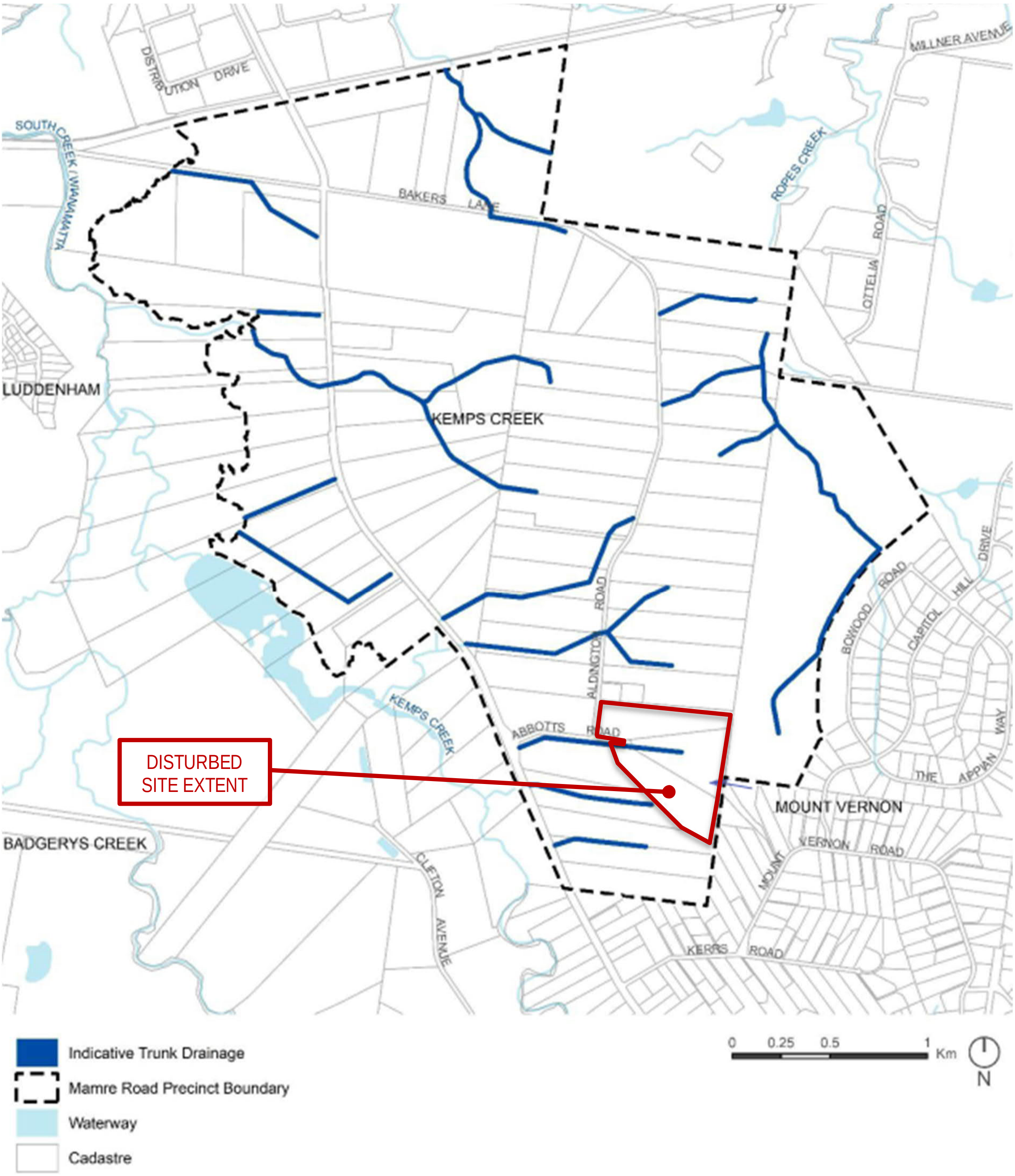


Figure 7: Trunk drainage infrastructure identified in the Mamre Road Precinct DCP

Due to the site topography and the proposed built landform, pits, pipes and a future 20m naturalized trunk drainage channel will be implemented within the Westlink Industrial Estate for trunk drainage infrastructure. Confirmation has been received in discussions with Sydney Water in June 2023 that the naturalized trunk drainage channel within the development can be reduced in width from 25m (as per the Precinct DCP) to 20m. As such all documentation refers to the naturalized trunk drainage channel being 20m wide. There will be two major drainage lines within Road 01:

- Minor system drainage (minimum 5% AEP capacity) to capture and convey stormwater runoff from the proposed Lots 1 and 4 and Road 01. This line will discharge to the detention basin on proposed Lot 2, with outflow from the basin draining to the naturalised trunk drain on the southern side of Abbotts Road. (which in the interim will flow back into an existing pipe in the downstream Abbotts Road)

- Major system drainage (minimum 1% AEP capacity) to capture and convey stormwater runoff from Lot 1, 4 and the road reserves. Stormwater in the piped system is conveyed to the Abbot's Rd basin where flows from the 50% to the 1% AEP storms are attenuated to the existing catchment flows. Future allotments are to provide their own OSD and drain directly into the naturalised trunk drain.
- During stage 1 works, the external catchments to the east of the site and residual catchments in future lot 3 and lot 5 are directed into the open trunk drainage channel.

  This open channel is to form the naturalised trunk drainage network as per the DCP and ultimately connect into the future Sydney Water open channel to the west of the site, south of Abbots Road. The open trunk drainage channel within the Westlink Estate has been designed by JWP in collaboration with Sydney Water.

  At this stage there is no detailed design of this downstream naturalised trunk drainage channel so the channel within the Estate has been drawn indicative only on the civil plans. Refer to Drawing 20-748 C11071 for location of proposed channel. Detailed design of the channel is being undertaken by JWP based on consultation with SWC. In the future, all external catchments to the east of the site will be conveyed through this naturalised trunk drainage channel ultimately draining under Mamre Road. Reference is made to Penrith City Council's submission on the SSDA documentation in their letter to DPIE dated 21 July 2021, which states: '*No objections are raised to the proposed methodology to separate internal treated stormwater flows from external catchment flows*'.

5. Water Management Strategy

This section summarises the proposed water management strategy for the site, including details of the proposed stormwater management measures and characterisation of water quality, quantity and flow volume at the points of discharge at the site boundary against the controls outlined in the Mamre Road Precinct DCP.

5.1. Water Management Strategy Objectives and Controls

The main objectives pertaining to the management of stormwater within the proposed development site are outlined in Section 2.4 of the Mamre Road Precinct DCP. Controls relating to stormwater quantity management and the requirement to attenuate peak flow rates are outlined in Section 2.5 of the DCP.

Specific controls relating to water management, as well as a response to these controls, is summarised below in Table 3.

Table 3: Response to DCP controls relating to water management

DCP Controls	Response
Waterway health and Water Sensitive Urban Design	
1) Development applications must demonstrate compliance with the stormwater quality targets in Table 4 (DCP) and the stormwater flow targets during construction and operation phases in Table 5 (DCP) and Table 6 (DCP) at the lot or estate scale to ensure the NSW Government's waterway objectives (flow and water quality) for the Wianamatta-South Creek catchment are achieved (see Appendix D). Where the strategy for waterway management is assessed at an estate level, the approval should include for individual buildings within the estate, which may be the subject of future applications.	Performance of the proposed water management strategy against the stormwater quality targets is presented in Table 11. Performance against the construction phase stormwater flow targets is presented within Certified Professional in Erosion and Sediment Control (CPESC) report prepared by LENECO Environmental Management. Performance of the proposed water management strategy against the operational stormwater flow targets is presented in Table 13.

DCP Controls	Response
2) The stormwater flow targets during operation phase (Table 5) include criteria for a mean annual runoff volume (MARV) flow-related option and a flow duration-related option. Applicants must demonstrate compliance with either option.	Performance of the proposed water management strategy against the operational stormwater flow targets is presented in Table 13.
3) Development applications must include a Water Management Strategy (WMS) detailing the proposed Water Sensitive Urban Design (WSUD) approach, how the WMS complies with stormwater targets (i.e., MUSIC modelling), and how these measures will be implemented, including ongoing management and maintenance responsibilities. Conceptual designs of the stormwater drainage and WSUD system must be provided to illustrate the functional layout and levels of the WSUD systems to ensure the operation has been considered in site levels and layout.	The Water Management Strategy for the site is outlined in Section 5, and includes the approach to WSUD for the site, performance of the proposed stormwater management measures against the DCP targets, and description of delivery, ongoing management and maintenance of each proposed measure. Design drawings showing the layout and levels of the proposed stormwater management elements are included in the AT&L civil package.
4) The design and mix of WSUD infrastructure shall consider ongoing operation and maintenance. Development applications must include a detailed lifecycle cost assessment (including capital, operation/maintenance, and renewal costs over 30 years) and Maintenance Plan for WSUD measures.	Ongoing management and maintenance considerations are addressed in Section 7 All costs associated with the delivery, operation and maintenance of the estate-based water management measures will be borne by the proponent.
5) WSUD infrastructure may be adopted at a range of scales (i.e., allotment, street, estate, or sub-precinct scale) to treat stormwater, integrate with the landscape and maximise evaporative losses to reduce development flow runoff. Vegetated WSUD measures, naturalised trunk drainage and rainwater/stormwater reuse are preferred. Acceptable WSUD measures to retain stormwater within the development footprint and subdivision are shown in Table 7 (DCP).	A summary of the proposed WSUD infrastructure adopted in the water management strategy is presented in Table 4.
6) Development must not adversely impact soil salinity or sodic soils and shall balance the needs of groundwater dependent ecosystems.	Refer to Geotechnical Investigation Reports prepared by Douglas Partners (for 59-63 Abbotts Road) and Alliance Geotechnical (for 290-308 Aldington Road) for details of soil salinity, sodicity and groundwater.
7) Infiltration of collected stormwater is generally not supported due to anticipated soil conditions in the catchment. All WSUD systems must incorporate an impervious liner unless a detailed Salinity and Sodicity Assessment demonstrates infiltration of stormwater will not adversely impact the water table and soil salinity (or other soil conditions).	The proposed water management strategy does not incorporate infiltration of collected stormwater.
8) Where development is not serviced by a recycled water scheme, at least 80% of its non-potable demand is to be supplied through allotment rainwater tanks.	Refer to Section 5.5.4 for details of proposed rainwater tanks and demand statistics.

DCP Controls	Response
9) Where a recycled water scheme (supplied by stormwater harvesting and/or recycled wastewater) is in place, development shall: ▪ *Be designed in a manner that does not compromise waterway objectives, with stormwater harvesting prioritised over reticulated recycled water;* ▪ *Bring a purple pipe for recycled water to the boundary of the site, as required under Clause 33G of the WSEA SEPP. Not top up rainwater tanks with recycled water unless approved by Sydney Water; and* ▪ *Design recycled water reticulation to standards required by the operator of the recycled water scheme.*	Stormwater harvesting in the form of rainwater tanks on the proposed lots will form one of the components of the Interim Arrangement. Rainwater tanks would not be required under the Ultimate Arrangement. Any tanks constructed on Lots 1 and 4 would be required to be decommissioned upon completion of recycled water mains within the Precinct which this Estate will utlitise.
Trunk Drainage Infrastructure	
10) Indicative naturalised trunk drainage paths are shown in Figure 4 (DCP)	Reproduced in this report for context as Figure 7.
11) Naturalised trunk drainage paths are to be provided when the: ▪ *Contributing catchment exceeds 15ha; or* ▪ *1% AEP overland flows cannot be safely conveyed overland as described in Australian Rainfall and Runoff – 2019;* *unless otherwise agreed by the consent authority.*	Details of the proposed trunk drainage infrastructure are included in Section 4.3. Refer to Drawing 20-748 C11071 and C11221 for proposed location of naturalised trunk drainage path proposed within the Estate Trunk drains are not provided in the undeveloped portion of the site to the south with fully natural catchments.
12) The design and rehabilitation of naturalised trunk drainage paths is to be generally in accordance with NRAR requirements (refer to Section 2.3) that replicates natural Western Sydney streams. An example of a naturalised trunk drainage path is shown in Figure 3.	Based on discussions with Sydney Water there is no detailed design on the naturalised trunk channel downstream of the Estate. It is proposed at detailed design to coordinate with Sydney Water on the design and rehabilitation of the naturalised trunk drainage channel to match into any downstream open channels
13) Naturalised trunk drainage paths shall be designed to: ▪ *Contain the 50% AEP flows from the critical duration event in a low flow natural invert;* ▪ *Convey 1% AEP flows from the critical duration event with a minimum 0.5m freeboard to applicable finished floor levels and road/driveway crossings; and* ▪ *Provide safe conveyance of flows up to the 1% AEP flood event.*	As described above, trunk drainage infrastructure in the form of a pit and pipe system and open channel is proposed to be provided within the site. This system will have sufficient capacity to capture and convey flows up to the 1% AEP design event and with freeboard.

DCP Controls	Response
14) Where naturalised trunk drainage paths traverse development sites, they may be realigned to suit the development footprint, provided that they: ▪ *Comply with the performance requirements for flow conveyance and freeboard;* ▪ *Are designed to integrate with the formed landscape and permit safe and effective access for maintenance;* ▪ *Do not have adverse flood impacts on neighbouring properties; and* ▪ *Enter and leave the development site at the existing points of flow entry and exit.*	The proposed trunk drainage lines within the site will: ▪ Comply with requirements for flow conveyance and freeboard. ▪ Incorporate sufficient access points for maintenance – maximum spacing of pits will not exceed 75 metres, which is consistent with Penrith City Council's *Design Guidelines for Engineering Works for Subdivisions and Developments* (considered an appropriate reference in the absence of any specific Sydney Water guideline or standard). ▪ Have sufficient capacity to capture and convey flow from the external catchments to the east of the Westlink Industrial Estate, and will therefore not result in adverse flood impacts on neighbouring properties. This is currently being confirmed by a flood impact assessment underway. ▪ Discharge from the Westlink Industrial Estate to a point of discharge within the Abbotts Road reserve, to proposed drainage that will be constructed as part of the upgrade of Abbotts Road.
15) Trunk drainage paths shall remain in private ownership with maintenance covenants placed over them to the satisfaction of Council (standard wording for positive covenants is available from Council). Easements will also be required to benefit upstream land.	The proposed naturalised trunk drainage channel and upstream pipework is within private land south of Abbotts Road. The need or otherwise for maintenance covenants to be placed over the proposed stormwater drainage will be confirmed subject to further discussion and coordination with the road authority (Penrith City Council) and the Waterway Manager (Sydney Water).
16) Where pipes/ culverts are implemented in lieu of naturalised trunk drainage paths, they must remain on private land and not burden public roads, unless otherwise accepted by Council.	The only pipe which may be considered trunk is to connect to the downstream drainage outside of private land and hence cannot be kept within private land.
17) High vertical walls and steep batters shall be avoided. Batters shall be vegetated with a maximum batter slope 1V:4H. Where unavoidable, retaining walls shall not exceed 2.0m in cumulative height.	All slopes are graded at maximum 1:4 grades. The only exception is the under-water portion of the interim reuse pond, with 1:2 batters.
18) Raingardens and other temporary water storage facilities may be installed online in naturalised trunk drainage paths to promote runoff volume reductions.	Not applicable to the Westlink Industrial Estate.
19) Subdivision and development are to consider the coordinated staging and delivery of naturalised trunk drainage infrastructure. Development consent will only be granted to land serviced by trunk drainage infrastructure where suitable arrangements are in place for the delivery of trunk infrastructure (to the	The proposed naturalised trunk drainage infrastructure will be staged and delivered commensurate with the staging of earthworks and infrastructure across the estate. The naturalised trunk drainage infrastructure will form a critical component of the site water

DCP Controls	Response
satisfaction of the relevant Water Management Authority).	management strategy throughout construction and will be incorporated into the Erosion and Sediment Control Plan and Construction Environmental Management Plan. The final form of the trunk drainage lines, including connections to infrastructure downstream of the Westlink Industrial Estate, will be undertaken at a suitable stage of development and will be subject to further consultation with the Sydney Water (the nominated Waterway Manager).
20) Stormwater drainage infrastructure, upstream of the trunk drainage, is to be constructed by the developer of the land considered for approval.	All stormwater drainage upstream of the proposed trunk drainage lines will be designed and delivered by the proponent.
21) All land identified by the Water Management Authority as performing a significant drainage function and where not specifically identified in the Contributions Plan, is to be covered by an appropriate "restriction to user" and created free of cost to the Water Management Authority.	Noted – subject to further consultation with Sydney Water (the nominated Waterway Manager).
22) All proposed development submissions must clearly demonstrate via 2-dimensional flood modelling that: *1) Overland flow paths are preserved and accommodated through the site;* *2) Runoff from upstream properties (post development flows) are accommodated in the trunk drainage system design;* *3) Any proposed change in site levels or drainage works are not to adversely impact and upstream or downstream, or cause a restriction to flows from upstream properties;* *4) There is no concentration of flows onto an adjoining property; and* *5) No flows have been diverted from their natural catchment to another.*	Refer to Section 7 for details of overland flow flooding through the site. Refer to the Stantec "Flood Impact Assessment Westlink Industrial Estate – Stage 1 290-308 Aldington Road, Kemps Creek" report for further detail on how Stage 1 satisfies these criteria.
Overland Flow Flooding	
10) Development should not obstruct overland flow paths. Development is required to demonstrate that any overland flow is maintained for the 1% AEP overland flow with consideration for failsafe of flows up to the PMF.	The proposed major and minor system drainage has been designed such that development within the estate will not obstruct any overland flow paths. Suitable allowance for overland flow has been made within the design of the major and minor system. The bypass pipe built for future external flows is to be designed to intercept

DCP Controls	Response
	overland flows at existing flows. Any future development in the external catchments must be attenuated to this flow regime. The flood impact assessment will address storms above the 1% AEP.
11) Where existing natural streams do not exist, naturalised drainage channels are encouraged to ensure overland flows are safely conveyed via vegetated trunk drainage channels with 1% AEP capacity plus 0.5m freeboard. Any increase in peak flow must be offset using on-site stormwater detention (OSD) basins.	Refer to Section 4.3 for details of the proposed trunk drainage infrastructure. Refer to Section 5.5.2 for details of the proposed detention basin that will attenuate peak flows within the estate prior to discharge across the estate boundary and into the proposed drainage system in Abbotts Road.
12) OSD is to be accommodated on-lot, within the development site, or at the subdivision or estate level, unless otherwise provided at the catchment level to the satisfaction of the relevant consent authority.	The location of the proposed detention basin within the estate is presented on drawing 20-748-C11071. On site detention is provided on an estate level, not an allotment level.
13) Stormwater basins are to be located above the 1% AEP.	The site is not subject to mainstream flooding, and therefore the proposed detention basins will be located outside the extent of 1% AEP mainstream flooding.
14) Post-development flow rates from development sites are to be the same or less than pre-development flow rates for the 50% to 1% AEP events.	The performance of the proposed detention basin against the stormwater quantity targets in the Mamre Road Precinct DCP is summarised in Table 12.
15) OSD must be sized to ensure no increase in 50% and 1% AEP peak storm flows at the Precinct boundary or at Mamre Road culverts. OSD design shall compensate for any local roads and/or areas within the development site that does not drain to OSD.	As demonstrated in Table 12, the proposed detention basin has been sized to ensure no increase in peak flows at the discharge point from the estate. All bypass flows are considered in the attenuation requirements.

5.2. Water Management Strategy Overview

Since the release and adoption of the Mamre Road Precinct DCP in November 2021, AT&L has been working with several landowners in the Mamre Road Precinct, Government, other Industry Bodies, and experts in water management to resolve practical solutions that will address the stormwater flow targets that have been adopted in the final DCP.

The *Mamre Road Flood, Riparian Corridor and Integrated Water Cycle Management Report* (FRCIWCM) (Sydney Water, 2023) addresses links between waterway health, hydrology and water quality targets. The stormwater management objectives outlined in the FRCIWCM Report, which have ultimately been adopted in the Mamre Road Precinct DCP, were developed by applying the *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (NSW OEH, 2017). The effects-based assessment outlined in the FRCIWCM Report addressed three metrics relating to waterway health and stormwater management:

1. Flow volume – mean annual runoff volume (MARV), measured in ML/ha/year. The target adopted in the Mamre Road Precinct DCP is 2 ML/ha/year (revised from 1.9 ML/ha/year in the Draft DCP). The outcomes for the Westlink Industrial Estate are summarised in Section 5.9.

2. Seasonal pulses – as shown by flow duration curves. The targets and outcomes demonstrated by a flow duration curve under post-development conditions is presented in Section 5.9.

3. Water quality – as indicated by stormwater pollution reduction. The targets and outcomes demonstrated as reduction in average annual pollutant load are summarised in Section 5.7. Note that as this design contains significant natural catchment, we have adopted the concentration targets as provided in the 20/04/2022 "MUSIC MODELLING TOOLKIT – WIANAMATTA" produced by DPE.

In the FRCIWCM, Sydney Water also discussed the potential for regional facilities to be implemented to satisfy the stormwater flow objectives for the Mamre Road Precinct. The FRCIWCM report states:

> *"It is noted that the most cost-effective way to achieve stormwater volume load reductions is via open water bodies and these have a maintenance implication for developers and a wildlife risk.*
>
> *Through master planning of the Wianamatta South Creek precinct, it will be possible to integrate regional wetlands and water bodies and offset the need for wetlands and open water to be distributed through the Precinct on private lands.*
>
> *This centralised management of water is preferable as it provides a more appropriate scale of WSUD assets for more cost-effective maintenance and management outcomes."*

The Water Management Strategy for Stage 1 has been developed to satisfy the flow targets fully without the regional solution being in place. It is important to note that for the full site to satisfy the flow duration and MARV arrangements, the stage 1 measures may need to be altered, particularly by retrofitting the detention basin. By the time that the future stages are under assessment, it may also be the case that the regional scheme is further progressed, and these measures may be reduced. This report focuses on the "Estate" level flow duration and MARV strategies.

A summary of the proposed stormwater management measures that would be required to satisfy stormwater quality, quantity and flow controls under both the "Estate" and "Regional" Arrangements is presented in Table 4.

Table 4: Proposed water management measures under the Estate and Regional Arrangements

	Estate Arrangement (Stage 1) (prior to implementation of regional stormwater management scheme)		Regional Arrangement (with regional stormwater scheme to be operated by Sydney Water)	
Rainwater tanks for non-potable reuse (refer to Section 5.5.4 for further details)	✓	Assumed to be required for proposed Lots 1 and 4 to comply with the following DCP control: *Where development is not serviced by a recycled water scheme, at least 80% of its non-potable demand is to be supplied through allotment rainwater tanks.*	×	Rainwater tanks would not be required under the Ultimate Arrangement. Any tanks constructed on Lots 1 and 4 would be required to be decommissioned upon completion of recycled water mains within the Precinct which this Estate will utlitise.
Gross pollutant traps (GPTs) (refer to Section 5.5.1 for further details)	✓	GPTs to be installed upstream of the proposed detention basin as a pre-treatment measure for the regional stormwater management scheme. May only be modelled with pollutant treatments if SQIDEP approved model is available.	✓	GPTs with capacity for hydrocarbon and sediment removal (SPEL Stormceptor® or equivalent) to be installed upstream of the proposed detention basin as a pre-treatment measure for the regional stormwater management scheme. The proposed SPEL Filter chamber which is required in the Interim case of no regional basin to connect into, is only a temporary measure to ensure water way health targets are met. Once the regional basins are in place and connected into this SPEL filter chamber will be decommissioned.
Detention basin (refer to Section 5.5.2 for further details)	✓	Required to satisfy stormwater quantity controls.	✓	Required to satisfy stormwater quantity controls.
Residual Irrigation Pond (refer to Section 4.5.3 for further details)	✓	Required to satisfy stormwater flow controls and stormwater quality treatment.	×	Will not be required on the basis that stormwater flow controls and stormwater quality treatment will be incorporated into the regional stormwater management scheme. Stage 1 tanks to be decommissioned.

5.2.1. Technical Guidance for achieving Wianamatta-South Creek stormwater management targets

In September 2022 The Department of Planning and Environment released a *Technical guidance for achieving Wianamatta-South Creek stormwater management targets.* This guideline was prepared to give advice on modelling to undertake, assumptions to make and which data is to be used to demonstrate that the water targets are being achieved. It also provided a range of example WSUD strategies that could be utilised to meet the water quantity targets.

Refer to Figure 8 below for extract from the Technical Guidelines (page 14) which indicates typical WSUD measures which could be implemented to meet the required water quantity targets.

Technical guidance for achieving stormwater management targets

On lot or allotment measures

Typical on lot or allotment WSUD measures include, but are not limited to:

- rainwater tanks
- on-site stormwater detention
- gross pollutant traps (GPTs)
- bioretention basins
- swales
- wetlands, subject to relevant wildlife risk mitigation measures to manage bird strikes (note that wetlands are likely to be interim or temporary under a regional-scale WSUD strategy, see Chapter 4 of this guide)
- stormwater harvesting systems (likely to be interim or temporary under a regional-scale WSUD strategy, see Chapter 4 of this guide).

The design of on lot or allotment measures should consider the existing documents relevant to the Wianamatta–South Creek catchment (see section 'Relationship to other documents'). Important considerations include:

- accessibility for inspections and maintenance
- protection from damage during construction and building phase and then finalised once the site is finished and landscaped
- careful integration with the landscape but avoiding large level drops and walls, and vegetated with trees.

Figure 8 - Extract from Technical Guidance

For this SSD all the dot points as noted within Figure 8 with the exception of a wetland are being incorporated into the civil design to ensure the water quantity targets are met. Refer to Section 4.5 for additional details.

5.3. Hydrological and Hydraulic Modelling

DRAINS modelling software has been used to calculate the Hydraulic Grade Line (HGL) of the proposed estate-wide stormwater network, including pits, pipes, overland flow paths and detention basins. DRAINS is a software package used for designing and analysing urban stormwater drainage systems and catchments. It is widely accepted by Council's across NSW as the basis for stormwater design and has been confirmed by Penrith City Council as the preferred stormwater software analysis package.

A summary of the key hydrological and hydraulic design parameters adopted in DRAINS can be found within Appendix 2 of this report and summaries as follows:

- Minor system (pit and pipe) drainage has been designed to accommodate the 5% AEP storm event.
- The combined pit and pipe drainage and overland flow paths have been designed to accommodate the 1% AEP storm event.
- Where trapped low points are unavoidable and potential for flooding private property is a concern, an overland flow path capable of carrying the total 1% AEP storm event has been provided. Alternatively, the pipe and inlet system has been upgraded to accommodate the 1% AEP storm event.
- Rainfall intensities have been adopted using the Bureau of Meteorology Design Rainfall Data System (2016).
- Times of concentration for each sub catchment have been determined using the kinematic wave equation.
- The width of flow in the gutter does not exceed 2.5 metres and pits are spaced no further than 75 metres apart.
- Velocity x depth product shall not exceed 0.4 m^2/s for all storms up to and including the 1% AEP event.
- Bypass from any pit on grade shall not exceed 15% of the total flow at the pit.

- Blockage factors of 20% and 50% shall be adopted for on-grade and sag pits respectively.
- A hydraulic grade line HGL design method shall be adopted for all road pipe drainage design.
- Pipelines in roadways shall have a minimum diameter of 375mm.
- A desirable minimum grade of 1% for all pipelines is preferred for self-cleansing under low flow velocities. An absolute minimum grade of 0.5% has been adopted.
- The minimum cover over pipes shall be 450mm in grassed areas and 600mm within carriageways.
- Where minimum cover cannot be achieved due to physical constraints the pipe class shall be suitably increased.
- All pipes in trafficable areas will be Reinforced Concrete Pipes (RCP) or Fibre Reinforced Cement (FRC) equivalent.
- Pipes discharging to an overland flow path shall adopt a minimum tailwater level equivalent to respective overland flow level.
- Pit Loss coefficients have been calculated in accordance with the Hare Charts as documented in the Queensland Urban Drainage Manual.
- A minimum 150mm freeboard has been maintained between pit HGL and pit surface levels for the minor design storm event (5% AEP).
- Overland flow paths maintain a minimum of 300mm freeboard to all habitable floor levels.

5.4. Stormwater Quality Modelling

The proposed stormwater treatment train has been modelled using the MUSICX software package (Version 1.1.0). Modelling has been undertaken in accordance with the *MUSIC Modelling Toolkit – Wianamatta* (NSW DPIE, 2021).

<u>Rainfall and evaporation data</u>

Penrith City Council's MUSIC-link climate data (rainfall and evapotranspiration) was adopted in the MUSIC model, which aligns with the *MUSIC Modelling Toolkit - Wianamatta*. The default meteorological data includes:

- Pluviometer data (six-minute rainfall intensity and evapotranspiration) for Penrith Lakes AWS (Station 67113) for the period between 1999 and 2008 inclusive (average annual rainfall over this period = 691mm).
- Monthly potential evapotranspiration (PET) as per the *MUSIC Modelling Toolkit – Wianamatta* Table 7

<u>Rainfall-runoff parameters</u>

The rainfall-runoff parameters adopted in the MUSIC model are consistent with the parameters adopted in *MUSIC Modelling Toolkit – Wianamatta*, refer to Table 5.

Table 5: Rainfall-runoff parameters adopted in MUSIC

Parameter	Unit	Value
Impervious area parameters		
Rainfall Threshold	mm/day	1.0
Pervious area parameter		
Soil Storage Capacity	mm	150
Initial Storage	% of Capacity	30
Field Capacity	mm	130
Infiltration Capacity Coefficient α	-	175

Parameter	Unit	Value
Infiltration Capacity Coefficient β	-	2.5
Groundwater properties		
Initial Depth (groundwater)	mm	10
Daily Recharge Rate	%	25
Daily Baseflow Rate	%	1.4
Daily Seepage Rate	%	0.0

Source nodes and pollutant generation

Pollutant events mean concentrations (EMCs) for base flow and storm flow scenarios have been adopted from Table 6 of Blacktown City Council's WSUD developer handbook (consistent with the *MUSIC Modelling Toolkit - Wianamatta*). The EMC values are applied to source nodes in the MUSIC model to estimate annual pollutant loads exported from the site under the proposed ultimate development scenario. The adopted pollutant EMCs for various catchment types are summarised in Table 6.

Table 6: Stormwater quality parameters for MUSIC source nodes

Landuse category		log10 TSS (mg/l)		log10 TP (mg/l)		log10 TN (mg/l)	
		Base flow	Storm flow	Base flow	Storm flow	Base flow	Storm flow
Roof areas	Mean	1.20	1.30	-0.85	-0.89	0.11	0.30
	Std dev	0.17	0.32	0.19	0.25	0.12	0.19
Road areas	Mean	1.20	2.43	-0.85	-0.30	0.11	0.34
	Std dev	0.17	0.32	0.19	0.25	0.12	0.19
Pervious areas	Mean	1.20	2.15	-0.85	-0.60	0.11	0.30
	Std dev	0.17	0.32	0.19	0.25	0.12	0.19

5.5. Proposed Stormwater Management Measures

A series of stormwater quantity and quality control measures are proposed to be adopted within the site to satisfy the stormwater management strategy objectives listed in Section 5.2. A general description of the proposed stormwater treatment train components is presented in the following sections.

5.5.1. Gross Pollutant Traps

The proposed stormwater treatment train under the Interim Arrangement would consist of a gross pollutant trap (GPT) upstream of the proposed detention basin as a means of primary stormwater treatment. GPTs are designed to capture litter, debris, coarse sediment, as well as some oils and greases.

The high-flow bypass for the GPT has been modelled as 1.8m^3/s which is between the incoming 4EY flow and the 1EY flow. Design flows for the GPTs and their final configuration would be confirmed at the detailed design phase.

Note that currently GPTs are not considered to treat anything other than gross pollutants within the MUSIC model as there are no SQIDEP approved models. A SPEL SVO.1600 off-line model has been specified for the purposes of life cycle costing and spatial considerations.

5.5.2. Detention Basins

As discussed in Section 3.1, the site in its existing condition is broadly divided into six internal catchments, with external catchments draining through the site via the northern and eastern boundaries of the site.

Surface water runoff from the proposed lots and within the internal roads is proposed to be collected via pits and pipes and discharge into the proposed detention basin. Refer to drawings 20-748-C11070 to C11072 inclusive for the layout of the proposed internal stormwater drainage and C11081 for Post-developed catchment plan.

Surface water runoff from the external catchments is proposed to be managed as follows for Stage 1:

- External catchment EX.B1 – to be collected via a catch drain on the eastern boundary into the ultimate bypass pipes within the private road and naturalised trunk drainage channel (all EX.B-catchments will drain here in the ultimate design).
- Existing catchments B2, B4 & EX.B2– to be collected via a catch drain into trunk pipework within the private road to be conveyed into the naturalised trunk drainage channel.
- External catchment EX. C1 – to be collected adjacent to within the northern boundary of Lot 1 and connected into the Lot drainage to ultimately drain into the OSD basin. Note this catchment is temporary only but allowed for in the sizing of the OSD basin and Music modelling. Once the northern neighbour develops their land this catchment will be captured within the developed northern lots and not drain through the Westlink Estate.
- Existing catchment ex. C2 – assumed to drain to the west and north of the site and drain into Aldington Road to the west
- Existing Catchments E1, E2 & E3 – Bypass the site to the north east as per existing conditions (until further future development occurs) These are not considered in the pre-developed flow requirements for stage 1.
- Catchments D, EX.D1, EX.D2, G – Catchments remain in existing conditions and bypass the Stage 1 development. These are not considered in the pre-developed flow requirements for stage 1.

For the post-development scenario, it is proposed to maintain the existing points of discharge as close as possible and to design a solution where post-development peak flow rates are no greater than pre-development peak flow rates for all storm events up to and including the 1% AEP events. Controlled outlets from the detention basin will include surcharge pits connected to subsurface drainage pipes (for low flows) and an emergency spillway across the basin crests (for high flows). Refer to drawing 20-748-C11071 for the detention basin details.

A summary of the key detention basin parameters and DRAINS model results for the major and minor system flow is presented in Table 7.

Table 7: Key detention basin parameters and DRAINS model results

Parameter	Unit	Basin A
Base level	mAHD	50.05
Pond Still Water Level	mAHD	53.05
Low Flow outlet pipe Invert	mAHD	53.05
Low Flow outlet diameter (piped headwall)	mm	225
Mid Flow outlet Invert level	mAHD	53.05
Mid Flow outlet diameter (orifice plate on side of pit)	mm	525
High Flow Grated Pit Inlet Level	mAHD	54.98
High Flow Grated Pit size	m	4 x 1.2m x 1.2m
Spillway level	mAHD	55.30

Parameter	Unit	Basin A
Spillway width	m	10
Embankment Level (minimum)	mAHD	55.60
5% AEP		
Inflow	m^3/s	5.48
Outflow through pit and pipe	m^3/s	1.91
Outflow over spillway	m^3/s	0.00
Peak basin water level	mAHD	55.14
Peak basin storage	m^3	5649
1% AEP		
Inflow	m^3/s	7.63
Outflow through pit and pipe	m^3/s	4.13
Outflow over spillway	m^3/s	0.15
Peak basin water level	mAHD	55.33
Peak basin storage	m^3	6381

5.5.3. Stormwater Harvesting for Irrigation

As per the Technical guidance for achieving Wianamatta-South Creek stormwater management targets stormwater harvesting and reuse is another effective way to reduce stormwater flow volumes from frequent flows events to achieve the water quantity targets.

Water runoff from the developed lots is proposed to be stored in a pond beneath the detention volume of the basin. Refer to Drawings 20-748 C13070, C13071, C13072 and C13075 for details and layout. Water from this reuse basin will be stored and used as irrigation in the residual lands within the Estate (4ha set out from Future Lot 6). Refer to Drawing 20-748 C13075 for extent of residual lands to be irrigated via this basin. It is noted this basin arrangement is interim only to be used before the regional basins are constructed. A total of 4.0 hectares of residual land is to be irrigated at a rate of 600mm/year.

Refer to Hydraulic Drawings C-SK_PUMP PLAN & SECTION MARK UP (PF 1/5 to 5/5) by Sparks and Partners for pump details and refer Westlink Stage 1 Soil Assessment Report J004954_2_ April 2024 prepared by SESL AUST for soil assessment report of the irrigated areas. Upon completion and connection into the regional basin to be constructed by Sydney Water, this basin pond may be filled in.

A summary of the pond volume sizing for all reuse purposes adopted in MUSIC is presented in Table 8.

5.5.4. Rainwater Tanks

Rainwater tanks retain a significant proportion of stormwater that falls on roof areas. Given the large-scale industrial development proposed on the site, rainwater tanks can provide a significant contribution to the objective of minimising the total volume of runoff discharging from the site.

A rainwater tank reuse system on individual lots can be installed in many different configurations, including placing the tank above or below ground and using gravity or pressure systems (pumps) to supply rainwater for non-potable domestic uses. These uses typically include toilet flushing, laundry, hot water installations, car washing and irrigation.

The MUSIC model was developed to estimate the rainwater tank volume required to satisfy the Mamre Road Precinct DCP requirement. To determine the tank volume required to meet at least 80% of non-potable demand on individual lots, the following assumptions have been made:

- Non-potable demand of 15L/person/day at 25 persons/ha has been adopted as per the Wianamatta Creek MUSIC modelling guidelines. This has been calculated on a gross hectares basis
- 50% of the total warehouse roof area would drain to the rainwater tanks.

A summary of the rainwater tanks total sizing for all reuse purposes adopted in MUSIC is presented below in Table 8. Note that this will vary with roof catchment available in more detailed design. As per Table 4 these rainwater tanks are incorporated in the Stage 1 design to meet the waterway health guidelines. Once the regional Sydney Water basins are constructed and recycled water is available for the Estate it is proposed the on lot tanks will be decommissioned. Rainwater tanks would not be required under the Ultimate Arrangement. Any tanks constructed on Lots 1 and 4 would be required to be decommissioned upon completion of recycled water mains within the Precinct which this Estate will utlitise.

Table 8: Summary of Stormwater Harvesting parameters under the Stage 1 Arrangement

Lot	Total Lot Area (ha)	Roof area to rainwater tank (ha)	Estimated annual irrigation demand (kL/yr)	Estimated Toilet reuse demand (kL/day)	Rainwater storage required (kL)
1	11.08	3.25	3708	4.155	250 (TANK)
4	3.16	0.92	888	1.158	60 (TANK)
BASIN POND	N/A	N/A	22440	N/A	2810 (POND)

5.5.5. SPEL Filter

To satisfy the concentration based stormwater treatment requirements, 60 SPEL Filter cartridges in concrete tanks are required to be placed downstream of the detention basin & pond before the outlet to the naturalised channel. The SPEL Filter cartridges are SQIDEP approved and all values for MUSIC are in line with the SQIDEP review document.

The proposed SPEL Filter chamber which is required in the Interim case of no regional basin to connect into, is only a temporary measure to ensure water way health targets are met. Once the regional basins are in place and connected into this SPEL filter chamber will be decommissioned.

Design of the SPEL Filter chamber has been coordinated with tailwater levels within the channel through consultation with JWP and Atlan (the supplier). RL 52.35 is the maximum tailwater for the 4EY storm based on advice received from JWP as designers of the open trunk drainage channel under ultimate conditions (no headwall). SPELFilter system (as shown in Figure 9 below) is proposed with base RL52.35, above the 4EY storm to ensure full treatment of the flows. Advice from Atlan's engineers in July 2023 was that while treatment outcomes reduce when tailwater extends above the invert levels, damage to the cartridges could only occur if the hydraulic head of the downstream channel is significantly higher than the basin head. In this case, the rarer AEP water levels within the basin is significantly higher than in the channel, avoiding this situation. Refer to plan C11072 for cross sections showing levels design.

Each SPEL Filter Cartridge has a treatable flow of 3L/s. 60 cartridges have been specified for a total of 180L/s treatable flow. Excess flow will spill over an 850mm tall weir within the tanks, with detailed design to be confirmed with the supplier. If a model of GPT becomes SQIDEP approved, it would be possible that the treatment rates of the GPT will reduce the number of filters required to meet the concentration based flow targets, however for now the GPT is assumed to treat no TSS, TP or TN. Note that high basin outflows will bypass this system altogether.

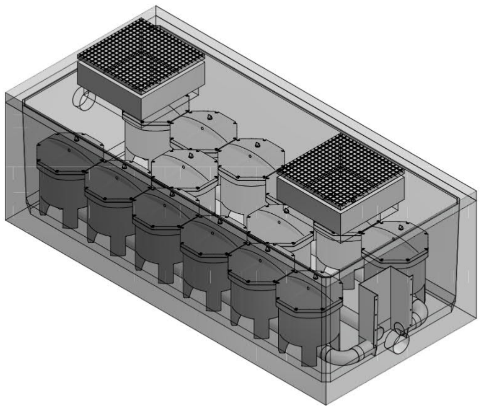


Figure 9: SPEL Filter Typical Arrangement

5.5.6. Passively Irrigated Street Trees

Advice received from Sydney Water are that passively irrigated street trees are an important component of their Regional stormwater drainage scheme. These street trees need to be designed to the Sydney Water Stormwater Scheme Infrastructure and Council's approval.

As the time of writing this report (May 2024) it is our understanding SWC and Penrith City Council have prepared a draft design for the passively irrigated street tree (PIST) which is on exhibition for comments. Whilst no design of the PIST are including within street infrastructure of Westlink Estate as yet these trees will be incorporated into the street infrastructure design once finalised. These trees will be included within all public road reserves as per Sydney Water's requirements.

5.6. Scenario Modelling

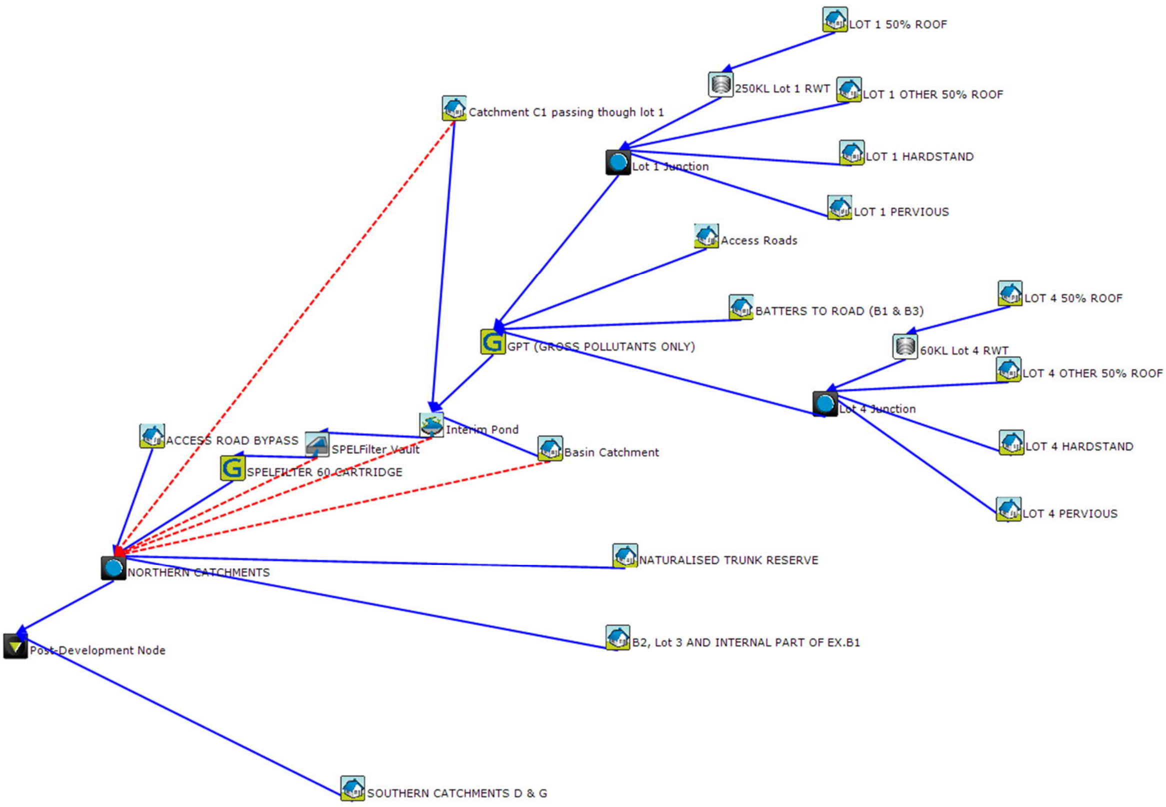


Figure 10: Post-development MUSIC model layout (Stage 1 Arrangement)

A MUSIC model was created to simulate post-development mean annual loads under the Stage 1 scenario. The post-development model has been created based upon the proposed post-development catchment extents presented in Figure 6. Source nodes for each of the proposed lots have been adopted based on typical large-scale industrial land uses, including those depicted in the Estate Plan prepared by Nettleton Tribe. The layout of the post-development scenario is presented in Figure 10.

Note that natural catchments draining externally are not included in the MUSIC modelling or in per hectare targets.

Source node properties are below in Table 9: MUSIC

The proposed land use breakdown for the proposed lots under the post-development scenario is presented in Table 10. This table is to be read in conjunction with drawing 20-748 C11081.

Table 9: MUSIC Modelling Catchments

Catchment	Total Area (ha)	Impervious Area (ha)	Pervious Area (ha)
LOT 1 50% ROOF	3.25	3.25	-
LOT 1 OTHER 50% ROOF	3.25	3.25	-
LOT 1 HARDSTAND	3.34	3.34	-
LOT 1 PERVIOUS	1.24	-	1.24
LOT 4 50% ROOF	0.92	0.92	-
LOT 4 OTHER 50% ROOF	0.92	0.92	-
LOT 4 HARDSTAND	0.93	0.93	-
LOT 4 PERVIOUS	0.39	-	0.39
ACCESS ROADS	1.917	1.534	0.383
BATTERS TO ROAD (B1 & B3)	0.72	-	0.72
BASIN CATCHMENT	0.662	0.331	0.331
NATURALISED TRUNK RESERVE	0.519	0.104	0.415
B2, Lot 3 AND INTERNAL PART OF EX.B1	7.62	-	7.62
SOUTHERN CATCHMENTS D & G	27.94	-	27.94
ACCESS ROAD BYPASS	0.269	0.215	0.054
TOTAL INTERNAL	53.89	14.79	39.09
CATCHMENT C1 PASSING THROUGH LOT 1 [2]	1.02	-	1.02

Table 10: Post-development scenario land use breakdown under the Interim Arrangement

Catchment	Total Area (ha)	Roof area to rainwater tanks (ha)	Other impervious area (ha)	Pervious area (ha)	% Pervious area
Lot 1	11.08	3.25	6.59	1.24	11.2
Lot 4	3.16	0.92	1.85	0.39	12.3
Basin	0.66	-	0.33[1]	0.33	50
Access Roads	2.19	-	1.75	0.44	20
Drainage Reserve	0.52	-	0.10	0.42	80
Stage 1 Developed Areas	18.01	4.17	10.94	2.90	15.9
Residual lands and external catchment draining into trunk drainage channel and bypassing OSD basin [2]	13.29			13.29	100
Residual catchments draining through southern land	27.94	-	-	27.94	100

[1] Pond area is considered impervious area

[2] "CATCHMENT C1 PASSING THROUGH LOT 1" Has been included in the MUSIC model for generating pollutants and water balance only. It has not been included in areas for the flow duration curve or per hectare pollutant generation.

Note: Catchment G, EX,G, E1, E2 and E3 are not considered as contributing to the pre-developed catchments for attenuation purposes as they naturally drain away from the Westlink discharge points.

Residual and External catchments are assumed to represent existing greenfield flows and not included within the Music modelling for flow duration or stormwater quality management, as agreed with EH&G in the consultation period.

The post-development scenario model under the Interim Arrangement incorporates the following stormwater management measures:

- Pervious landscape target of 15% as per Clause 4.2.3 (4) of the Mamre Road DCP s achieved as the total % pervious area for Stage 1 equates to 15.9% (refer Table 10)
- Rainwater tanks, as per the parameters presented in Section 5.5.4.
- GPTs, as per the parameters described in Section 5.5.1.
- Detention basins, as per the parameters described in Section 5.5.2.
- Stormwater harvest basin for irrigation, as per the parameters presented in Section 5.5.3
- Landscape irrigation, at 3.0ML/ha of pervious space (600mm/year with 50% of area irrigated).
- Residual land irrigation at 6.0ML/ha (600mm/year with 100% of area irrigated)
- Baseflow from pervious residual land surfaces is assumed to drain directly to the receiving node over time (red dashed arrows in Figure 10)
- SPEL Filter before discharge into the trunk drainage channel as presented in Section 5.5.5.

The attributes for each of the proposed stormwater management measures have been determined such that they will satisfy the stormwater quality, quantity and flow targets outlined in Section 5.1.

5.7. Performance against stormwater quality targets

The "MUSIC MODELLING TOOKIT – WIANAMATTA" Published on 20/04/2022 by DPE, supplied to "support assessments and development of proposals for State Significant Development", provides two options for operational phase stormwater quality targets. The first option is the traditional "reduction in mean annual load from unmitigated development", while the new Option 2 provides an allowable mean annual load. For this development, due to the high amount of residual land, the allowable mean annual load target has been selected.

MUSIC model results presented as mean annual loads per hectare per year at the receiving node indicate that the adopted stormwater quality target reductions are achieved, as shown in Table 11.

Table 11: Summary of MUSIC modelling results against stormwater quality targets (kg/ha/year)

Parameter	Proposed Layout Source Load (kg/ha/yr)	Proposed Layout Residual Load for Stage 1 (kg/ha/yr)	Target allowable Mean Annual Load (kg/ha/yr)
TSS (kg/ha/yr)	310.7	75.88	80.00
TP (kg/ha/yr)	0.63	0.19	0.30
TN (kg/ha/yr)	4.33	1.76	3.50
Gross Pollutants (kg/ha/yr)	49.3	1.43	16

The MUSIC model results presenting treatment train effectiveness shows that while the adequately satisfies the allowable mean annual loads (Option 2). Due to the large proportion of un-developed land contributing to the treatment train, the reduction targets are less feasible than in a fully developed estate assessment.

Under the Sydney Water Regional strategy, stormwater quality management measures would be incorporated into the regional stormwater management scheme to be designed, delivered and operated by Sydney Water. In this case, the SPEL Filter, residual irrigation, rainwater tanks, and storage ponds are expected to become redundant, with treatment targets met by Sydney Water centralised assets.

5.8. Performance against stormwater quantity targets

Table 12 presents the pre-development and post development flow rates, generated by hydrologic and hydraulic modelling in DRAINS, for a range of events between and including the 50% AEP and 1% AEP design storm events at the discharge points from the site. The predevelopment catchments have been modelled with the Initial Loss – Continuing Loss method. (Note this has been updated from early revisions to reflect the latest best practice from AR&R2019). Refer to Appendix 2 for summary letter prepared to Sydney Water Corporation for the summary of the stormwater design parameters.

Table 12: Pre-development and post-development peak flow rates (Interim and Ultimate Arrangements)

Design Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s) – Site Discharge
50% AEP	1.41	1.08
20% AEP	2.14	2.14
10% AEP	2.99	2.59
5% AEP	3.97	3.83
2% AEP	5.85	5.15
1% AEP	7.43	7.22

Post developed flow rates are provided at the discharge point of the site at the western end of the naturalised trunk channel. This includes outlet flows from the OSD basin plus the flows within the naturalised trunk drainage channel.

The DRAINS model results demonstrate that the post-development peak flow rates would be less than or equal to pre-development peak flow rates for a range of storm events between (and including) the 50% AEP and 1% AEP design events. Therefore, the stormwater drainage system and detention basins as proposed would satisfy the development controls relating to stormwater quantity management.

The OSD basin is sized such that the estimated fully developed future catchment will satisfy the pre-development peak flow rate requirements with OSD required on each future allotment. Similarly, the naturalised trunk drain must be designed for the ultimate catchment flows.

5.9. Performance against stormwater flow targets

MUSIC model results demonstrating performance of the proposed stormwater management measures in the Interim Arrangement against the stormwater flow targets are presented below in Table 13. The resultant flow duration curve is presented as Figure 11.

Table 13: Summary of MUSIC model results against stormwater flow targets (Interim Arrangement)

Parameter	Result	DCP Target	Complies with DCP target	
			DCP Option 1 (MARV approach)	DCP Option 2 (Flow Duration Curve approach)
Mean annual runoff volume (ML/ha/yr)	1.43	2.0	Yes	n/a
95%ile flow (L/ha/day)	18,197	3000 to 15000	n/a	No
90%ile flow (L/ha/day)	2,922	1000 to 5000	Yes	Yes
75%ile flow (L/ha/day)	333	100 to 1000	n/a	Yes
50%ile flow (L/ha/day)	59	5 to 100	Yes	Yes
10%ile flow (L/ha/day)	0.1	0	Yes*	n/a
Cease to flow*	15%*	10% to 30%	n/a	Yes*

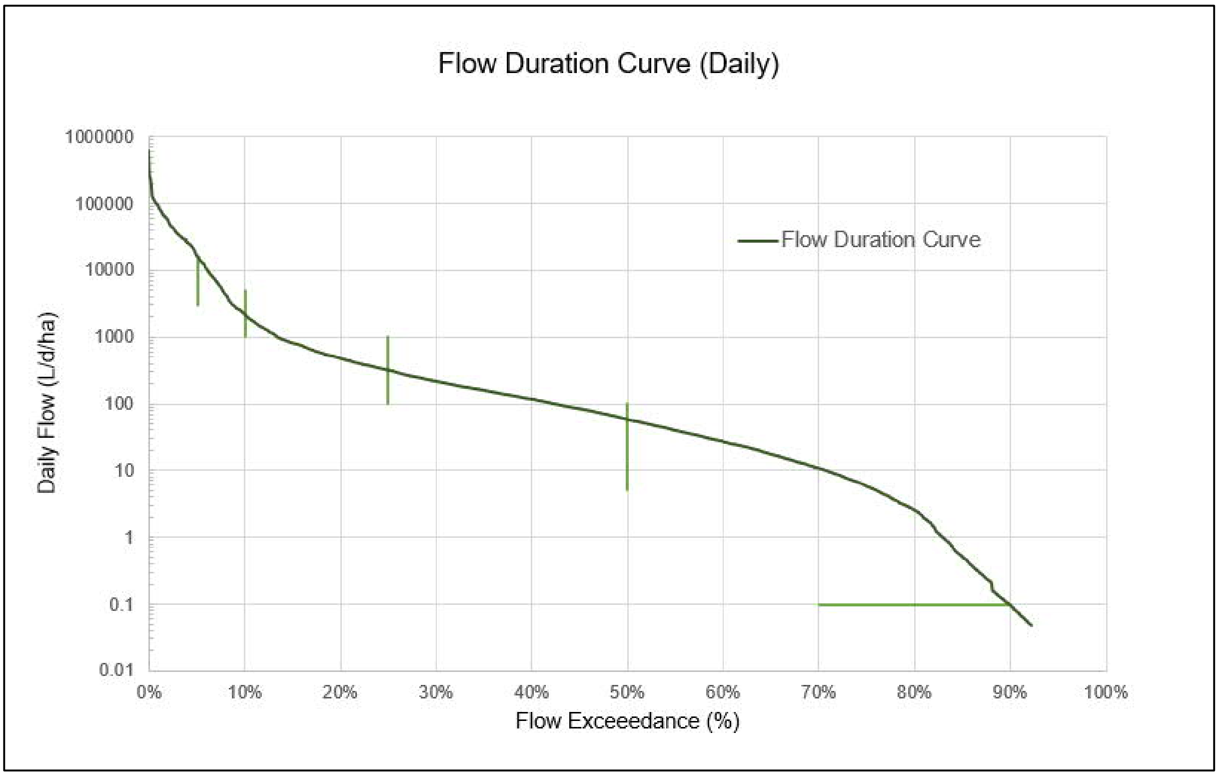


Figure 11: Flow duration curve for the proposed stormwater management measures

The results presented in Table 13 demonstrate the proposed stormwater management measures that will be implemented under the Interim Arrangement satisfy the Option 1 DCP stormwater flow targets for the site. The 10 percentile flow of 0.1L/ha/day & cease to flow of under 10% are not cause for concern. Note that the MUSIC model for Stage 1 rounds off at below 0.05L/ha/day, whereas the benchmark examples from Wianamatta MUSIC guidelines show cease to flow occurring at 1L/ha/day. Using this benchmark, Westlink achieves 15% cease to flow. The large amount of residual land and therefore baseflows are what has caused this fine resolution & lower bounded cease to flow.

6. Site Water Balance

6.1. Water Balance Overview

Potable water supplies in the Sydney area are in recognised short supply with projected population increases, potential climate change and periods of extended drought. It is acknowledged that any development in the Sydney region places greater demand on an already limited water supply. As a result, government bodies, together with Sydney Water have encouraged sustainable development by the implementation of an integrated approach to water cycle management (potable water, sewerage, stormwater and rainwater) to minimise potable water demand and maximise the potential for non-potable water sources to replace potable water demand where possible.

With the appointment of Sydney Water as the regional Waterway Manager and the announcement of a regional stormwater management scheme, opportunities for water reuse within the Mamre Road Precinct will include regional stormwater harvesting and reticulated recycled water.

6.2. Water Requirements

Water requirements within the Westlink Industrial Estate will be typical of large format warehouses and distribution centres. Sources of demand for water within the proposed allotments and public domain will include:

- Office amenities (kitchen, bathrooms)
- Landscape irrigation
- Dust suppression (depending on end user requirements)

6.3. Water Sources

The primary source of water to the Westlink Industrial Estate will be Sydney Water's potable water reticulation network.

A "third-pipe" reticulated recycled water network will supply non-potable water throughout the Mamre Road Precinct. Non-potable water will be supplied from two sources:

- Stormwater harvested within precinct-wide wetlands / ponds, to be delivered and operated by Sydney Water as part of a regional stormwater management scheme.
- Recycled water from the planned Upper South Creek Advanced Recycled Water Centre.

6.4. Water Use Minimisation

Sydney Water provides a wide range of advice and guidance relating to water use minimisation and water efficiency. Whilst warehouses and distribution centres are relatively low water users in comparison to other industrial users, the following water use minimisation principles will apply to development within the Westlink Industrial Estate:

- Avoid using water where possible, such as sweeping hard surfaces instead of washing them.
- Reduce water use by installing water-efficient appliances and equipment (e.g., toilets, urinals, shower heads).
- Reuse water from manufacturing or cooling processes to toilet flushing, landscape irrigation and dust suppression.

7. Overland Flow Flooding

The site is located outside the extent of the Flood Planning Area identified in the *Penrith Local Environment Plan 2010*, refer to Figure 12.

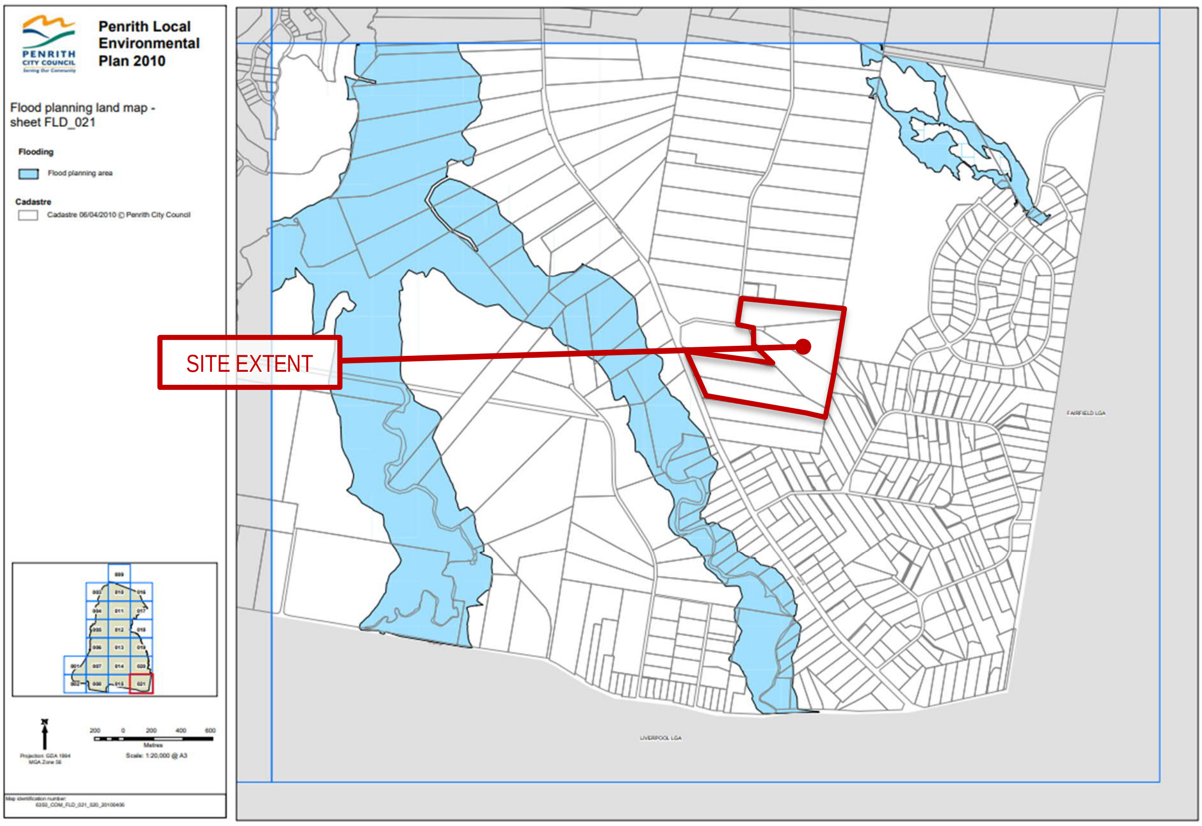


Figure 12: Extract of flood planning land map (Penrith LEP 2010)

Mapping of the 1% AEP flood extent from local catchments within the Mamre Road Precinct is presented in the *Mamre Road Flood, Riparian Corridor and Integrated Water Cycle Management Strategy* (Sydney Water, October 2020), and is reproduced as Figure 13. This mapping shows the extent and depth of overland flow from local catchments within the site.

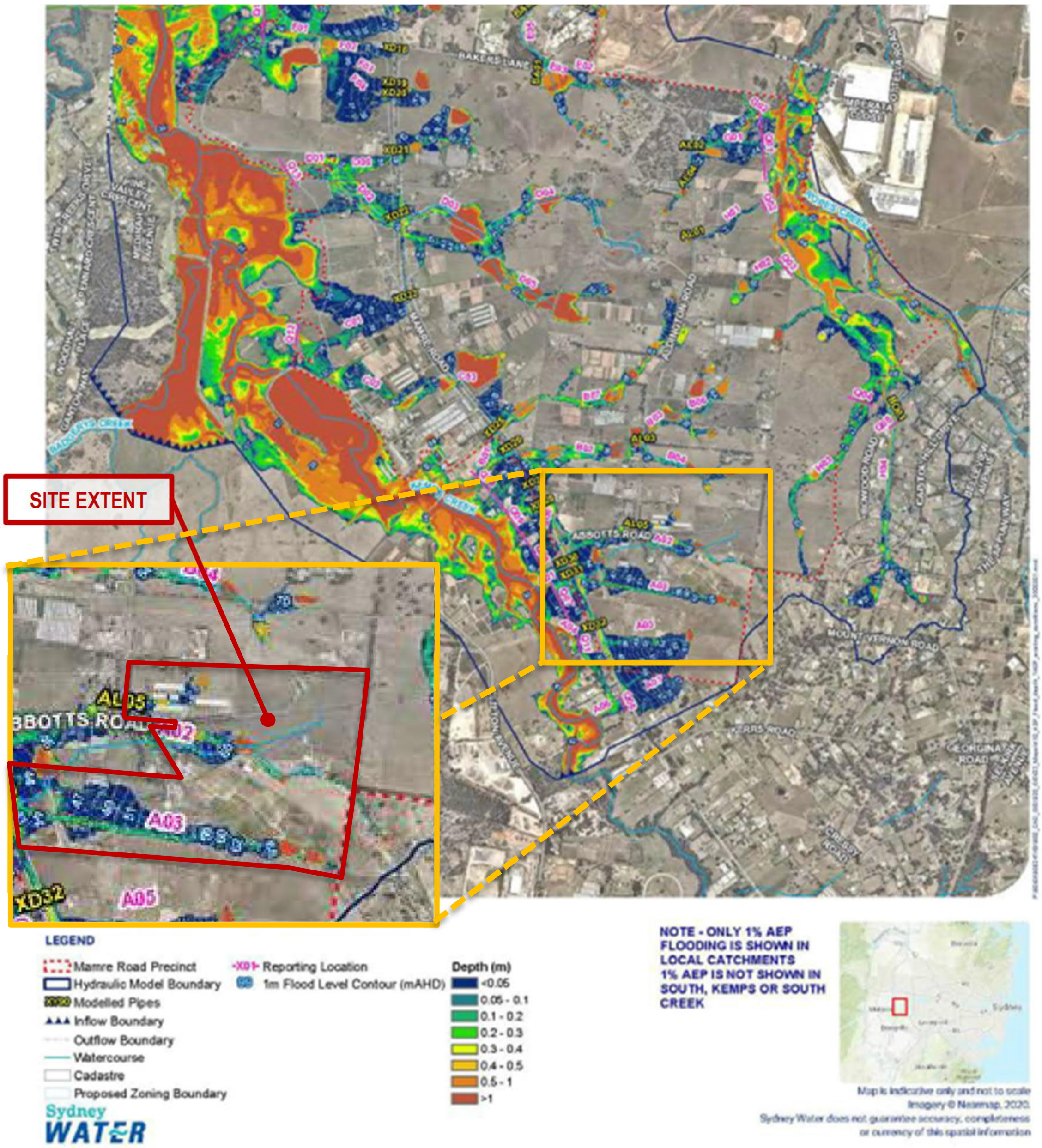


Figure 13: 1% AEP flood depth from local catchments under existing conditions (Sydney Water, 2020)

The proposed development of the site, including bulk earthworks, construction of a major and minor drainage system and construction of the proposed detention basin, will satisfy the development controls related to flood prone land outlined in Section 2.5 of the Mamre Road Precinct DCP.

The design of major system drainage elements is consistent with the principles of the NSW Government *Floodplain Development Manual* and Penrith City Council's *Stormwater Drainage Specification for Building Developments*. Under the post-development scenario, overland flow will be safely contained within the proposed road reserve and within trunk drainage infrastructure that has been incorporated into the design of the subdivision works.

As presented in Table 12, the post-development peak flow rates will be less than the pre-development peak flow rates at each of the discharge points for all design storm events between (and including) the 50% AEP and the 1% AEP event.

Refer to "Flood Impact Assessment Westlink Industrial Estate – Stage 1 290-308 Aldington Road, Kemps Creek" by Stantec for further details including 2D flood modelling of downstream impacts.

8. Inspection and Maintenance Plan

8.1. Maintenance and Operations

Inspection and maintenance of the stormwater management measures that will be implemented under Stage 1 Phase 1 conditions shall be undertaken at the minimum frequency as outlined in Table 14. The majority of these requirements have been derived from the Penrith City Council guideline titled *Water sensitive urban design (WSUD) inspection and maintenance guidelines* (Version 1.0, 2022).

Refer to Appendix 3 for Inspection and Maintenance Sheets for each of the stormwater management elements that will be owned, operated and maintained by the Property Owner (or representatives), including:

- Rainwater tanks
- On-lot stormwater drainage
- Gross pollutant traps
- OSD Basin

Table 14 - Inspection and monitoring requirements

Inspection / Monitoring Requirement	Responsibility	Timing / Frequency	References / Notes
1. On-lot stormwater drainage (including rainwater tanks)			
Eaves / box guttering system and downpipes	ESR as current property manager	At least once every six months	Refer to Inspection and Maintenance Sheets for rainwater tanks in Appendix 3.
On-lot stormwater drainage – grates and pits	ESR as current property manager	At least once every year	Refer to Inspection and Maintenance Sheets for on-lot stormwater drainage in Appendix 3.
On-lot stormwater pits and pipes (by CCTV)	ESR as current property manager	At least once every three years	
Rainwater tank (first flush device, external inspection of tank and fittings)	ESR as current property manager	At least once every six months	Refer to Inspection and Maintenance Sheets for rainwater tanks and Maintenance Manual provided by Atlan Stormwater (Appendix 3).
Rainwater tank – internal inspection and cleaning of tank, pumps, pipework and fittings	ESR as current property manager	At least once every year	
2. Gross pollutant traps			
GPT components (lids and surrounds, inlet, outlet, sump, screens, oil baffles)	ESR as current property manager	At least once every six months	Refer to Vortceptor Operation and Maintenance Manual provided by Atlan Stormwater (Appendix 3).

Inspection / Monitoring Requirement	Responsibility	Timing / Frequency	References / Notes
3. Estate-wide stormwater drainage (within road reserve)			
Stormwater drainage elements visible at ground level (grates, lintels, headwalls)	Penrith City Council	To be determined by Penrith City Council	Assets to be incorporated into Council's asset management system
Stormwater pits and pipes (by CCTV)	Penrith City Council	To be determined by Penrith City Council	
4. OSD Basin			
Basin inlet and outlet (blockage, scour, erosion)	ESR as current property manager	At least once every six months	Refer to Inspection and Maintenance Sheets for OSD Basin in Appendix 3.
Basin discharge control pit (grates, orifices, screens)	ESR as current property manager	At least once every six months	
Basin embankments (erosion, vegetation cover, litter, rock protection at spillway)	ESR as current property manager	At least once every six months	
5. Stormwater Pump Station and Irrigation Rising Main			
Pre-packaged pump station	ESR as current property manager	At least once every six months	To be confirmed with Pump Manufacturers
Rising Main	ESR as current property manager	At least once every six months	
Irrigation sprinkler system	ESR as current property manager	At least once every six months	
6. Open Trunk Drainage Channel			
Irrigation of landscaped elements	Sydney Water and ESR as current property manager	Monthly during establishment. TBC with Sydney Water	Assumed SWC will maintain open trunk drainage channel. To be confirmed with ESR as current property manager how hand over process works
Visual inspections after more than 5mm of rainfall	Sydney Water and ESR as current property manager	Monthly and/or after 5mm of rainfall during establishment	
Debris/Blockage removal	Sydney Water and ESR as current property manager	Monthly during establishment. TBC with Sydney Water	
Weed Management and Plant replacement	Sydney Water and ESR as current property manager	Monthly during establishment. TBC with Sydney Water	
Soil / Rock Protection inspections	Sydney Water and ESR as current property manager	Monthly during establishment. TBC with Sydney Water	

8.2. Monitoring

Elements of the stormwater management measures that will be monitored will be limited to general condition of each of the measures, which will be recorded on the Inspection and Maintenance Sheets for each measure (refer to Appendix 3).

8.3. Reporting and Auditing

Reporting and auditing of the stormwater management measures that will be incorporated under Stage 1 Phase 1 conditions will require completion of Inspection Sheets and Maintenance Sheets at the minimum interval recommended in Table 14. Inspection and Maintenance Sheets for each of the measures are included in Appendix 3 and have been either:

- Reproduced from the Penrith City Council WSUD inspection and maintenance guideline; or
- Produced using a similar format to the sheets incorporated in Council's guideline.

Completed Inspection Sheets and Maintenance Sheets for all stormwater management measures that will be owned, monitored and implemented by the Property Owner will be incorporated in an asset register and retained for the purpose of monitoring and environmental audit reporting that is required under Division 9.4 of Part 9 of the *Environmental Planning and Assessment Act 1979*.

9. Contingency Management

In the event that this SMP is not effective in managing potential environmental impacts, specific contingency actions will be implemented. Table 15 lists actions to be implemented if inspections, monitoring or auditing indicate that the stormwater management measures listed in Section 5 and any specialist management plans are not effective in managing environmental impacts.

The Contingency Plan categorises conditions as follows:

- Condition Green – considered to be normal operating condition.
- Condition Amber – minor non-compliance that should be rectified as soon as practical.
- Condition Red – non-compliance that should be rectified as a matter of urgency.

Table 15 - Contingency measures relating to operational stormwater management

Element	Trigger / Response	Condition Green	Condition Amber	Condition Red
Water quality monitoring	Trigger	No visible indicators within the AIE Site (oil / grease, turbidity). No complaints from property owners downstream of the AIE Site (805 Mamre Road).	Visible indicators within the AIE Site. Complaints from property owners downstream of the AIE Site (805 Mamre Road).	Prolonged poor water quality within ponds and downstream of the AIE Site.
	Response by ESR as current property manager	Continue SMP / OEMP implementation	Water quality sampling and testing to be undertaken to ensure results are just an anomaly and not a trend.	Appropriate rectification measures are implemented (e.g., aeration, additional filtration).

Element	Trigger / Response	Condition Green	Condition Amber	Condition Red
				Follow up water quality monitoring is undertaken to ensure parameters meet the ambient water quality objectives for the Wianamatta-South Creek catchment.
Flooding (inundation of lots, surcharge of stormwater drainage)	Trigger	Stormwater drainage system and riparian corridor functioning as per design intent (no exceedance of capacity, no surcharge in road network or inundation of lots)	N/A	Inundation of lots. Surcharge of stormwater drainage within road reserve.
	Response by ESR as current property manager	Continue SMP / OEMP implementation	N/A	Check for blockages within stormwater drainage network (sediment, debris, OSD Basin inlet and outlet structures). Rectify when required.
OSD Basin – Dam Safety	Trigger	OSD Basin functioning as intended – no visible damage to basin embankments, spillway or discharge control pit, no flow over spillway during events as frequent as the 5% AEP event.	Minor defects within OSD Basin (e.g., scour of embankment, blockage at discharge control pit).	Major defects within OSD Basin (e.g., failure of the discharge control pit, scour of the spillway or embankments)
	Response by ESR as current property manager	Continue SMP / OEMP implementation	Undertake short-term rectification works to address defects.	Undertake urgent works to address defects.
Pumped Irrigation System	Trigger	Pumped Irrigation system functions as intended- no visible damage to pumps or pressure mains.	Minor defects to Pump and pressure main but pump still operating	Major defects with pump and pressure main. Pump broken and not operating
	Response by ESR as current property manager	Continue SMP/OEMP implementation	Undertake minor repairs	Undertake urgent works to address defects

10. Lifecycle Costs

10.1. OSD Basin

Lifecycle costs associated with the OSD basin will be in accordance with Landcom Water Sensitive Urban Design Book 4 – Maintenance as indicated in Figure 14.

The costs within Figure 14 are based off 2003-2004 rates so would need to be indexed off 2023 prices (According to Rawlinsons 2022, 2003 to 2021 indexation is + 93% is a conservative estimate) and based off current rates provided by Civil and Landscape contractors for all associated WSUD works. These prices would be confirmed during Detailed Design and civil/landscaping tendering periods.

LIFE CYCLE COST ELEMENT	BIORETENTION	WETLANDS	PONDS & SEDIMENTATION BASINS
Life cycle	25 to 50 years	15 to 80 years (with 50 years used as the default in MUSIC) Wetlands are designed to have an infinite life span. However, to determine a life cycle cost, a finite number needs to be set	5 year (sedimentation basins) 50 years (ponds)
Total acquisition cost (TAC) (per m²)	$387.4 \times (A)^{0.7673}$ $1000/m² for first 20 m² ($200/m² for remaining area)	$1911 \times (A)^{0.6435}$ The treatment area used in defining the total acquisition cost is the combined inlet and macrophyte zone area	$685.1 \times (A)^{0.7893}$
Total annual maintenance (TAM) (%TAC)	$48.87 \times (TAC)^{0.4410}$	$6.831 \times (A)^{0.8634}$	$185.4 \times (A)^{0.4780}$ The annual maintenance cost considers the volume of material likely to be removed from the basin per year (referred in MUSIC as the size attribute, V). The size attribute is the sum of gross pollutants, coarse sediment and total suspended solids (TSS) that are trapped in the basin / pond per year
Renewal period (years)	25	20 Renewal considerations include replanting and recontouring of the macrophyte zone	1 year (default in MUSIC due to lack of evidence). 10 years based on available data
Renewal costs (%TAC p.a.)	2.0%	0.52%	1.4% Costs associated with access ramps and contouring Limited data available
Decommisioning costs (% TAC)			38% - only applicable to sedimentation basins

Figure 14 - Lifecycle Costs from Landcom

10.2. 60 Cartridge SPELFilter system

SPEL has provided a life cycle costing to AT&L for the 60 cartridge SPELFilter system, which has a design life of 8 years:

	Cost	Unit and notes
Construction Costs	210,000	$ for supply and install
Periodic Cleaning	5,000	$ Per Annum
Annualised average life cycle cost	31,250	$ Per Annum

10.3. SPEL SVO.1600 Vortceptor GPT

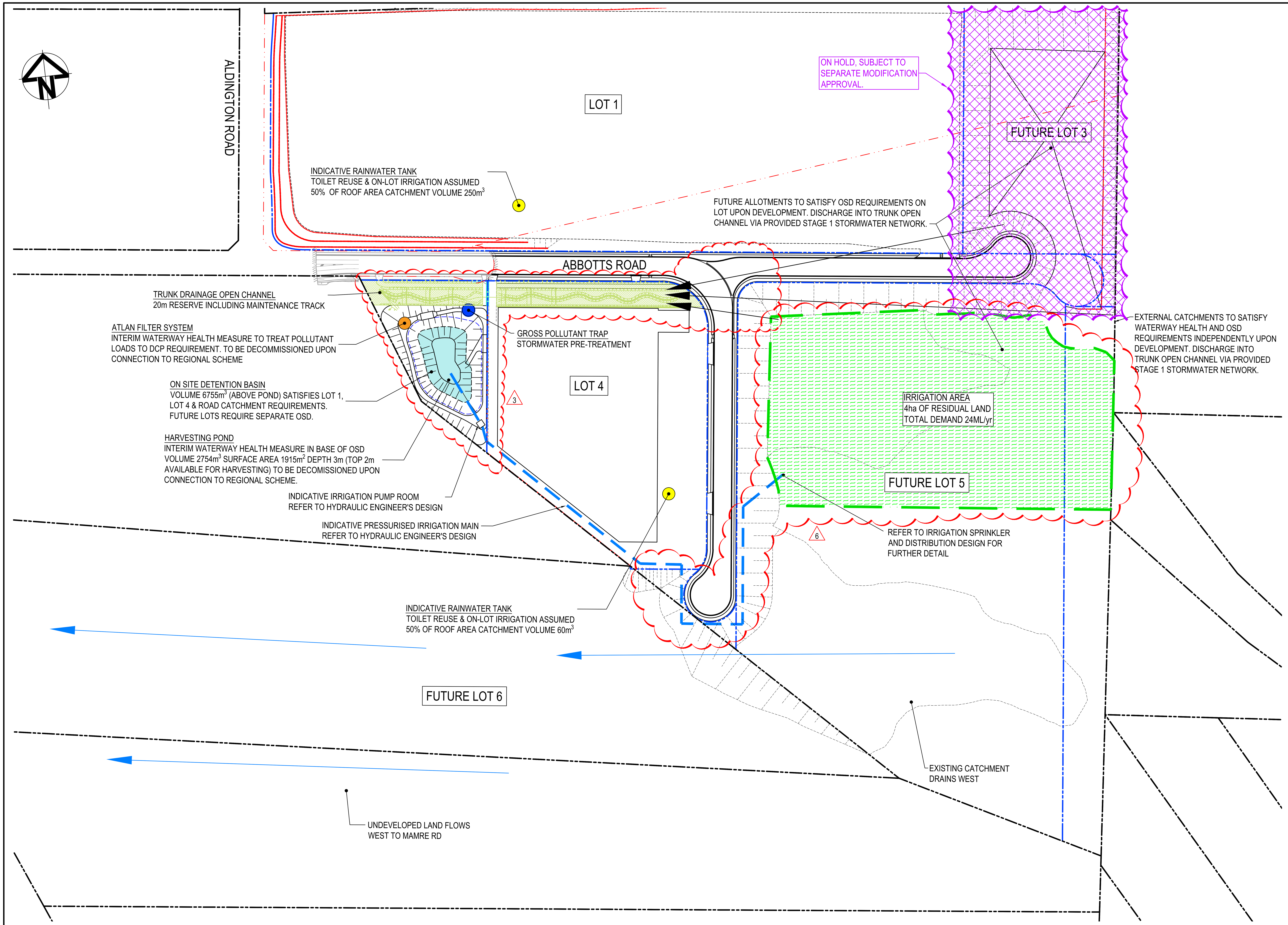
SPEL has provided a life cycle costing table to AT&L for SVO.1600 Vortceptor GPT and Weir Pit, which has a design life of 100 years:

	Cost	Unit and notes
Construction Costs	240,000	$ for supply and install
Periodic Cleaning	8,000	$ Per Annum
Annualised average life cycle cost	10,400	$ Per Annum

10.4. Pumping and Landscape Irrigation System

Pumping spec and life cycle cost will be confirmed by the Hydraulic Engineer. Refer to Sparks and Partners Drawings C-SK-Pump Plan and Section Mark up (PG 1/4) for further detail.

APPENDIX 1 – STORMWATER MANAGEMENT LAYOUT PLAN



STORMWATER MANAGEMENT LEGEND

- EXISTING BOUNDARY
- EXISTING BOUNDARY TO BE REMOVED
- PROPOSED BOUNDARY
- PROPOSED RETAINING WALL
- GROSS POLLUTANT TRAP
- ATLAN FILTER CARTRIDGES FOR WATER QUALITY TREATMENT
- ON-LOT RAINWATER TANKS
- EVAPORATION POND/RE-USE BASIN
- RESIDUAL LAND TO BE IRRIGATED AT 600mm/year RATE
- PROPOSED STORMWATER DRAINAGE TO SERVICE WESTLINK INDUSTRIAL ESTATE
- PROPOSED STORMWATER DIVERSION LINE TO DIVERT EXTERNAL CATCHMENTS TO ABBOTS ROAD UPON FULLY DEVELOPED SITE.

NOTES:

1. THIS PLAN PRESENTS STORMWATER MANAGEMENT MEASURES THAT WOULD BE REQUIRED TO SATISFY STORMWATER QUALITY, QUANTITY AND FLOW TARGETS STIPULATED IN THE MAMRE ROAD DCP 2021 IN THE ABSENCE OF REGIONAL STORMWATER MANAGEMENT INTERVENTIONS.
2. ONCE THE REGIONAL STORMWATER MANAGEMENT SOLUTION IS IN PLACE, MEASURES ON THIS PLAN I.E. EVAPORATION AND REUSE PONDS, ATLAN FILTERS, AND IRRIGATION ARE NO LONGER REQUIRED.
3. REFER TO SPARKS & PARTNERS CONSULTANT ENGINEERS, DRAWING 23272_C_SK_PUMP PLAN & SECTION MARK UP_REV2 FOR DETAILS OF THE IRRIGATION PUMP AND DISTRIBUTION SYSTEM.
4. REFER TO WESTLINK STAGE 1 SOIL ASSESSMENT REPORT J004952_2.0 BY SESL FOR ADDITIONAL DETAIL OF SOIL AMELIORATION OR IMPROVEMENT REQUIRED WITHIN THE IRRIGATION AREA.

Issue	Description	Date
6	ISSUED FOR APPROVAL	22-04-24
5	ISSUED FOR APPROVAL	19-03-24
4	RE-ISSUED FOR SWC APPROVAL	06-02-24
3	RE-ISSUED FOR SWC APPROVAL	30-01-24
2	ISSUED FOR SWC APPROVAL	22-01-24
1	ISSUED FOR CLIENT REVIEW	23-11-23

Bar Scales
0 30 60 90 120 150m
1 : 1500 @ A1 1 : 3000 @ A3

Client: ESR

Scales: 1 : 1500
Grid: MGA2020
Height Datum: AHD
GDA2020

Drawn: LM & QD
Designed: LM
Checked: AT
Approved:

Project: PROPOSED INDUSTRIAL DEVELOPMENT WESTLINK KEMPS CREEK - STAGE 1

Title: STORMWATER MANAGEMENT PLAN INTERIM ARRANGEMENT

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney NSW 2060
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9923 1055
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION
A1

Project - Drawing No.: 20-748-C13075
Issue: 6

100mm on Original

F:\20-748 ESR Mamre\6.0 Drgs\Civil\Final\CC\13000_INFRA_STAGE-1_CERTIFIED\20-748-C13075.dwg

APPENDIX 2 – STORMWATER HYDROLOGY SUMMARY

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04 July 2023

Sydney Water
PO Box 399
Parramatta NSW 2124

Your Ref: TBC
Our Ref: LTR007-02 -20-748 Westlink Industrial Estate Hydrology

Attention: John Molteno

Email: TBC

Dear John,

Westlink Industrial Estate Hydrology

1. General

This letter summarises the hydrological assumptions being utilised by AT&L across the Mamre Road Precinct to establish predevelopment and post development flow rates.

2. Existing Available Information

The following list of documents provide historical hydrological estimation methods within the Wianamatta South Creek Catchment:

- Flood Study Report, South Creek' (Department of Water Resources, 1990).
- South Creek Floodplain Management Study' (Willing and Partners Pty Ltd, 1991).
- ADI St Mary's Watercycle & Soil Management Study - Final Study Report' (Sinclair Knight Merz, 1998).
- Austral Floodplain Risk Management Study and Plan' (Perrens Consultants, 2003).
- South Creek Floodplain Risk Management Study and Plan' (Bewsher Consulting, 2004).
- Upper South Creek Flood Study' (WMA Water, 2012).
- Upper South Creek Floodplain Risk Management Study and Plan' (Cardno, 2014).
- Updated South Creek Flood Study' (WorleyParsons, 2015).
- South Creek Floodplain Risk Management Study and Plan' (Advisian, 2020).
- Wianamatta-South Creek Catchment Flood Study Existing Conditions (Advisian, 2022).
- Stormwater Scheme Infrastructure Design Guidelines Draft (Sydney Water, 2022).

We note that the hydrological methods for establishing existing conditions across the Wianamatta South Catchment in the reports above vary greatly and range from RAFTS, RORB, WBNM and ILSAX.

3. Predevelopment Hydrology Assumptions

AT&L have been consistent with the Stormwater Scheme Infrastructure Design Guidelines Draft (Sydney Water,

2022) and utilised the ARR2019 IL-CL methodology to establish existing conditions across the development. We note that the *Wianamatta-South Creek Catchment Flood Study Existing Conditions* by Advisian utilised ARR1987 rainfall values in combination with RAFTS to calibrate flows to an existing Flood Frequency Analysis (FFA) for the area.

3.1. Rainfall Data

Rainfall Data was derived from ARR Datahub for the area.

- Coordinates: Longitude: 150.792 Latitude: -33.845
- Rainfall IFD (2019) data
- NSW median pre-burst rainfalls were derived from ARR Datahub.

3.2. IL - CL values

The IL-CL values were derived from the Stormwater Scheme Infrastructure Design Guidelines Draft (2022)

- Pervious Areas – IL: 37.1mm CL: 0.94mm
- Impervious Areas – IL: 1.00mm CL: 0.00mm

No Bx value was nominated as the RAFTS (Laurenson) method for calculating flows was not used.

3.3. Catchment Perviousness

The following Assumptions have been made for catchment perviousness.

- Effective Impervious Area: 5% of total catchment area to account for waterbodies and directly connected roads.
- Remaining Impervious Area: Not utilised
- Pervious Area: 95% remainder of site. We note a sensitivity test was run on perviousness of 100% and 90% and found changes in the order of +- 5%.

3.4. Time of Concentration

Time of concentration estimation was determined through a combination of the following methods:

- Friend's equation: at the most upstream ends of the catchment to estimate sheet flow (*dependent on Horton's roughness and slope*). A comparative assessment of kinematic wave vs friends equation was undertaken with JWP and AT&L, results indicated time of concentration is similar in both instances for catchment lengths less than 30m . For catchment lengths greater than 30m the a typical manning's open channel equation was utilised with an assumed velocity ranging between 1.5m/s-3m/s dependant on flow rate.
- Manning's Open Channel Flow: where sheet flow ends and becomes concentrated.
- Manning's Pipe Flow: Where open channel flow ends and enters a culvert.

Time of concentration typically ranged between 15 minutes – 28 minutes.

4. Post Development Hydrology

AT&L have been consistent with the industry standards for estimating flows in urban catchments and utilised the ILSAX methodology to establish post development conditions across the local site.

4.1. Rainfall Data

Rainfall Data was derived from ARR Datahub for the area.

- Coordinates: Longitude: 150.792 Latitude: -33.845
- Rainfall IFD (2019) data
- NSW median pre-burst rainfalls were derived from ARR Datahub.

4.2. Soil Depression Storage

The ILSAX values were derived from the Stormwater Scheme Infrastructure Design Guidelines Draft (2022)

- Paved (impervious) area depression storage: 1 mm
- Grassed (pervious) area depression storage: 5 mm
- Soil type: 3

4.3. Catchment Perviousness

Catchment perviousness was established based on land use as follows:

- IN2 Land – 85% imperviousness and 15% perviousness (to be measured at detailed design).
- Roads – 85% imperviousness and 15% perviousness (to be measured at detailed design)
- Water Courses 5% imperviousness and 95% perviousness.

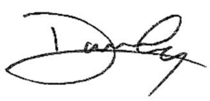
4.4. Time of Concentration

Time of concentration estimation was determined through a combination of the following methods:

- Friend's equation: at the most upstream ends of the catchment to estimate sheet flow (*dependent on Horton's roughness and slope*).
- Manning's Pipe Flow: Where open channel flow ends and enters a culvert.

Time of concentration typically ranged between 6 minutes – 15 minutes. Generally, lots scales along with pit and pipe data results in a fast-reacting catchment.

Yours sincerely,



Darren Galia
Senior Civil Engineer
0433 759 556

APPENDIX 3 – INSPECTION, MAINTANCE AND OPERATIONS GUIDELINES

Operation &
Maintenance Manual

Spel Filter®

Cartridge Filter For Tertiary Stormwater Treatment

spel.com.au

Contents

spelstormwater

Introduction

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

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

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

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

Figure 1 - SPELFilters in a concrete chamber / vault

Features

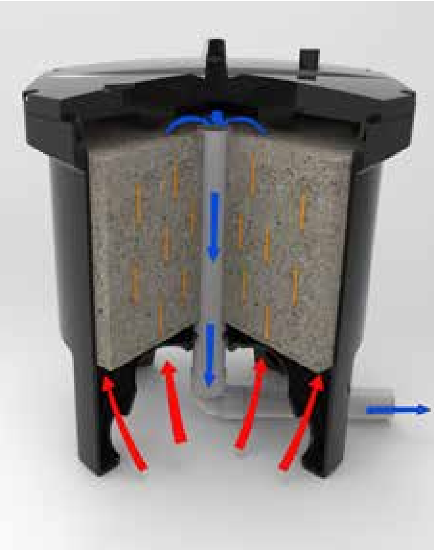


Figure 2 - Diagram of water flow through SPELFilter

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

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

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

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

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

SPELFilter Media Self-Backwash feature

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

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

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

Figure 3 - Typical Outlet Weir Wall

Features

Self Supporting Feet

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

Figure 4 - Bolting the feet

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

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

Sizes

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

	Full Height SF.30-EMC -M	Half height SF.15–EMC-M
SPELFilter total height	874mm	560mm
SPELFilter Diameter	726mm	726mm
Minimum Head required	850mm	450mm
Treatment flow rate	2.83 L/s	1.47 L/s
Height of inlet ports above vault floor	240mm	240mm
Filtered water collection pipe diameter	50mm	50mm

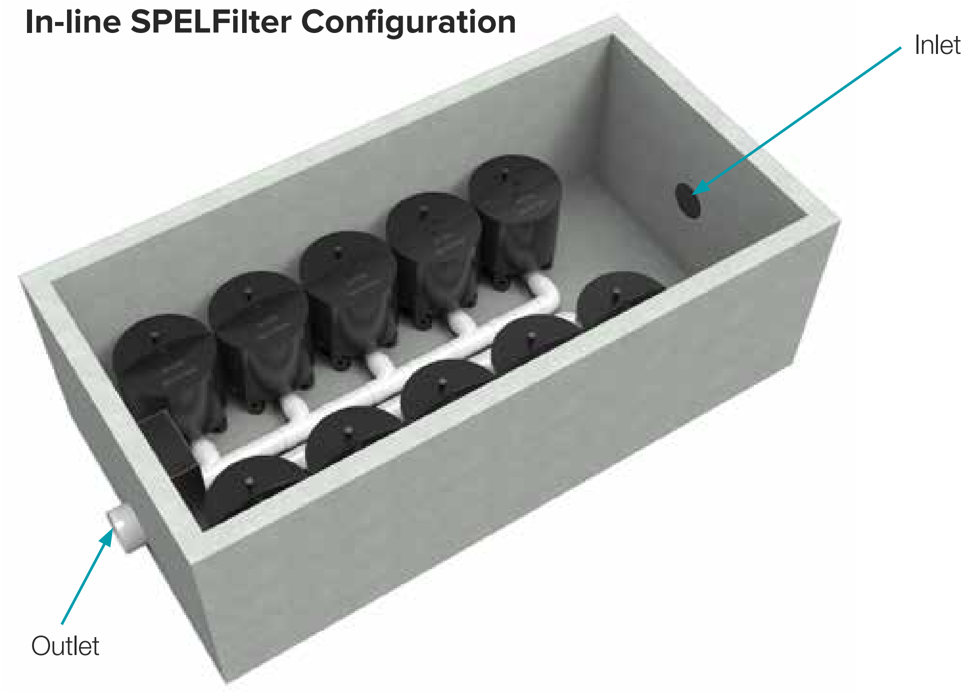
SPELFilter Full Height- SF.30-EMC-M

SPELFilter Half Height - SF.15-EMC-M

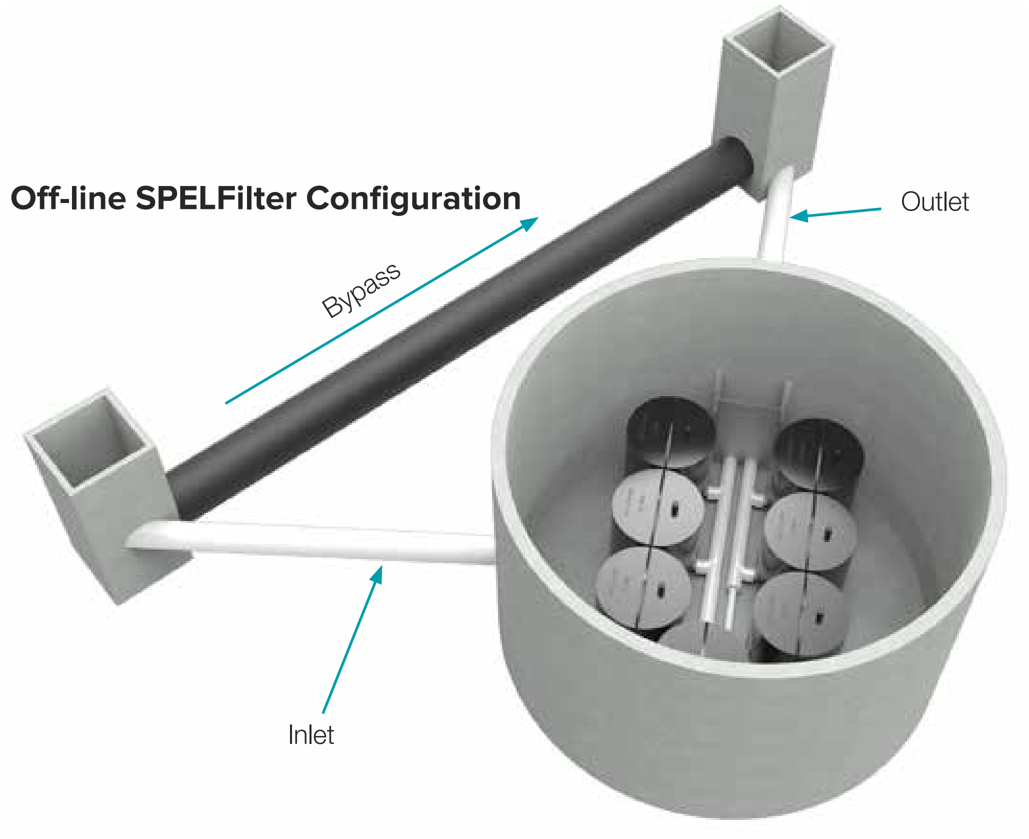
System Configuration

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

In-line SPELFilter Configuration



Off-line SPELFilter Configuration



Health and Safety

A. Personal Health & Safety

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

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

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

B. Personal Protective Equipment / Safety equipment

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

Personal protective equipment / safety equipment in this application includes:

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

C. Confined space

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

- Harness
- Gas detector
- Tripod
- Spotter

D. Traffic Control

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

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

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

Maintenance Frequency

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

Standard inspection

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

General Cleaning

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

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

Cartridge Replacement

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

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

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

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

Maintenance Procedures

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

Standard inspection

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

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

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

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

Site Inspection Procedures

1. Implement Pre-start safety measures.

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

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

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

3. Open manhole lid.

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

4. Conduct Gas tests.

(If tank is classed confined space)

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

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

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

6. SPELFilter system assessment.

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

7. Reinstate SPELFilter system and disposal.

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

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

General Cleaning

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

1. Implement Pre-start safety measures.

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

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6. SPELFilter system assessment.

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

7. Pollutant removal from tank.

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

8. Reinstate SPELFilter system and disposal.

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

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

Cartridge Recycling and Replacement

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

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

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

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

1. Implement Pre-start safety measures.

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

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

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

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

6. Remove exhausted cartridges.

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

7. Pollutant removal.

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

8. Install pipework and SPEL Filters.

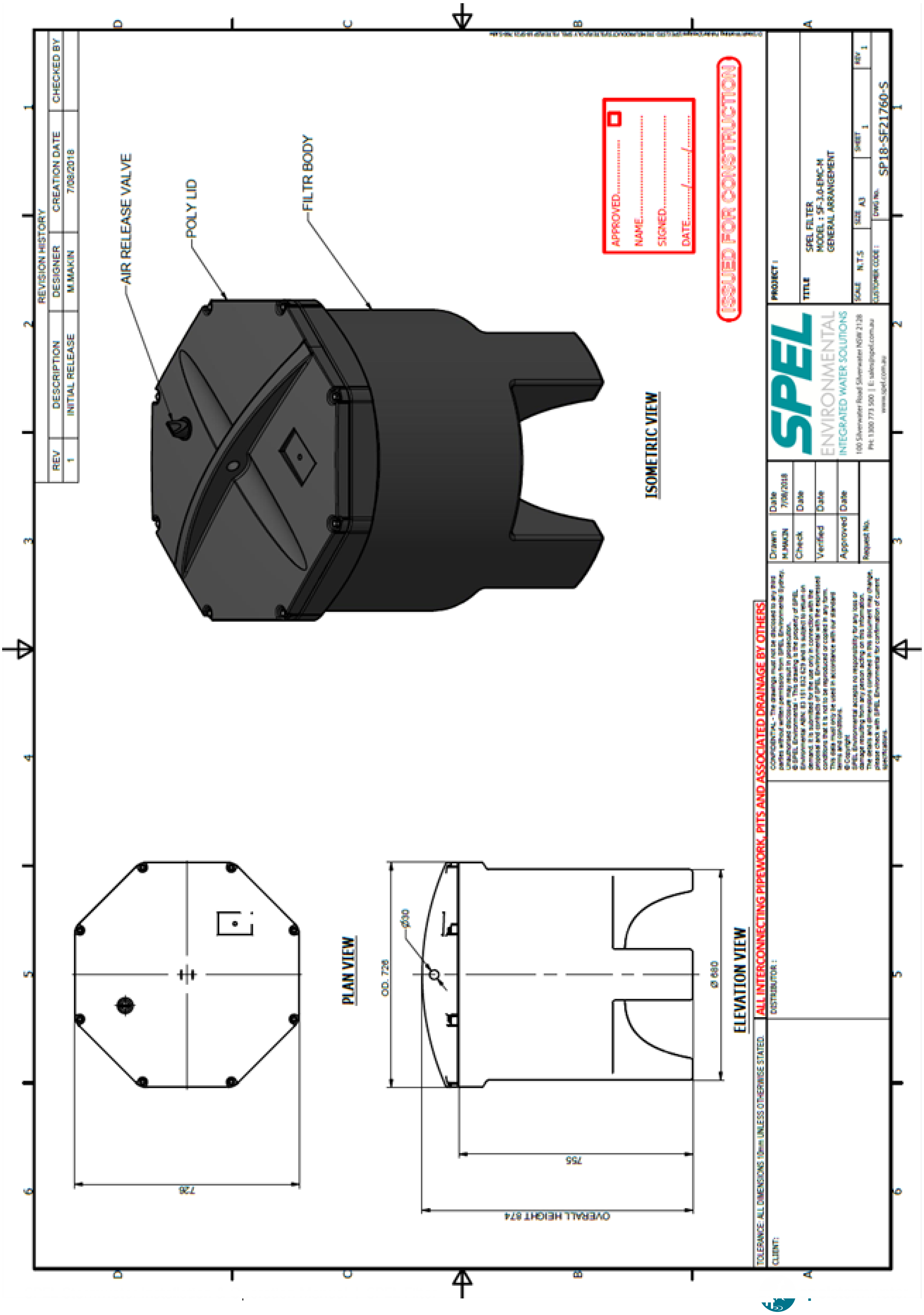
Please refer to the below standard install diagrams for the SPEL Filters. Then refer to your site specific drawings, as site requirements may require something different to the standard layout. Lower filters into tank, position into place, connect filter outlet pipework with the supplied fittings.

9. Install anti–floatation system.

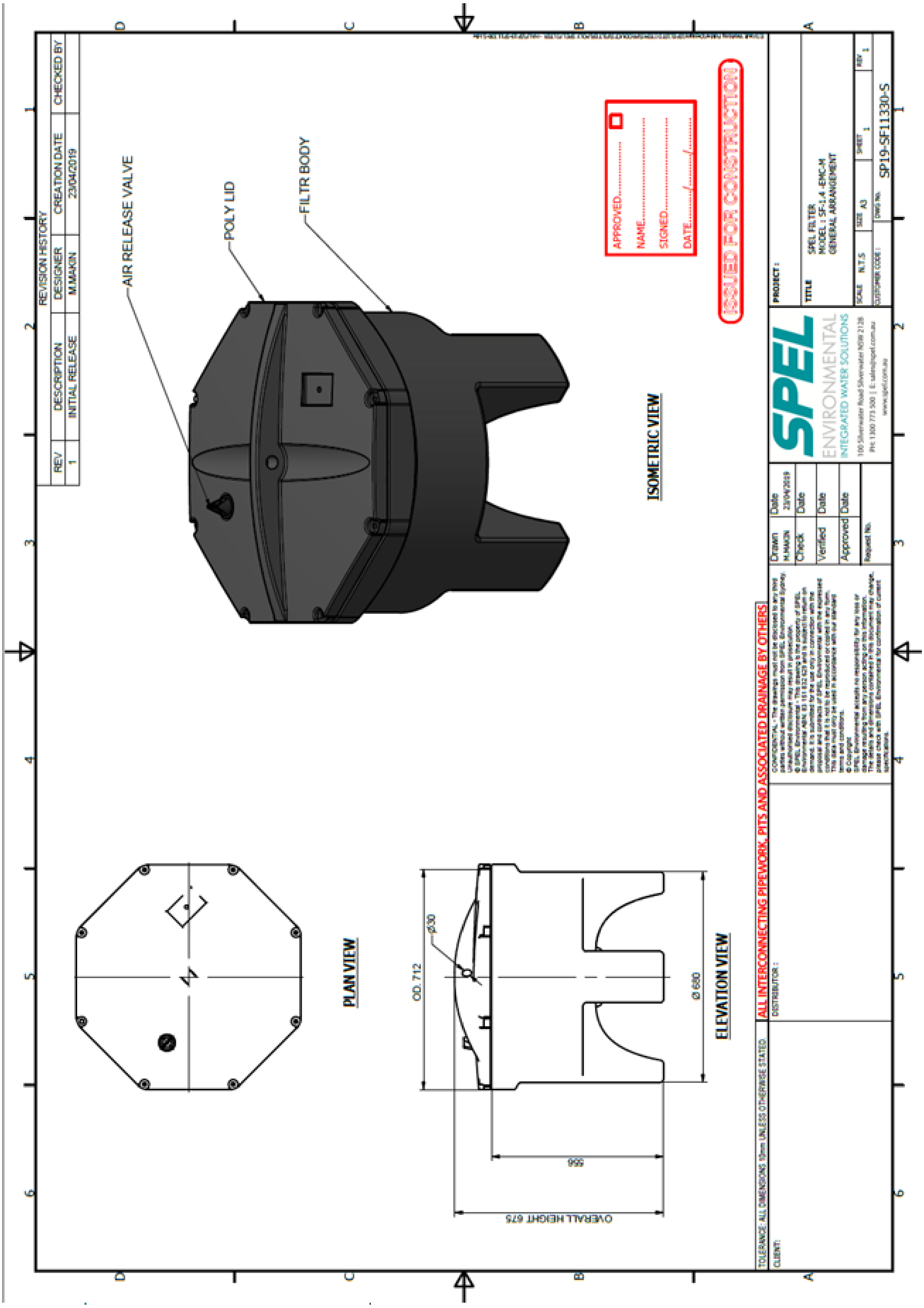
Please refer to the detailed drawings showing how the Anti – Floatation (Anchor) bars are to be installed.

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

Standard Drawings - Full Height



Standard Drawings - Half Height



Site Exit & Clean Up

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

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

spelstormwater
joy in water

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FAX +61 (0) 2 8014 8699

Design/Safety Factor used for 100 Year Design Life on SPEL FRP Tanks

As per BS4994:1987;

1. $K = 3 \cdot K_1 \cdot K_2 \cdot K_3 \cdot K_4 \cdot K_5$

Where:

The factor 3 represents a constant which allows for the reduction of material strength for long term loading, and K_1 to K_5 represent factors determined by the method of manufacture and operating conditions. No vessel or tank shall have a design factor K of less than 8.

For SPEL:

2. K_1 = 1.5 - Relates to the method of manufacture.

From Table 6 of BS4994:1987.

Method of manufacture	Factor k_1
Handwork	1.5
Machine-controlled filament winding	1.5
Machine-controlled spray application	1.5
Hand-held spray application	3.0

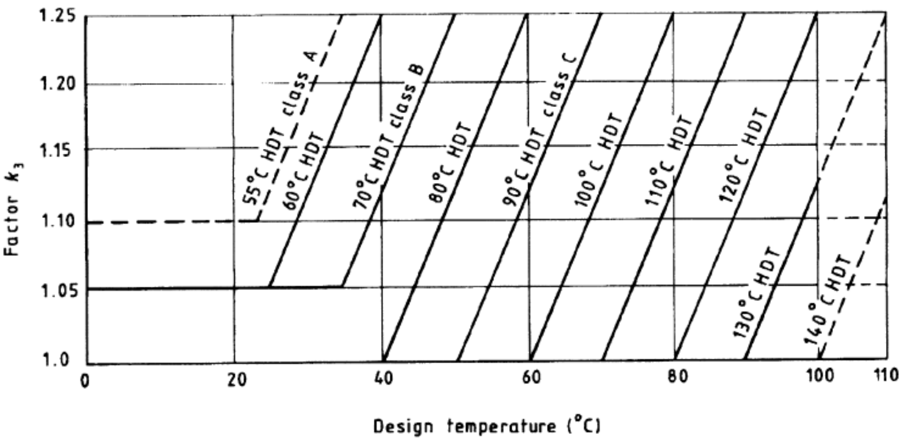
- *Based upon SPEL tanks manufactured using machine-controlled Filament winding machinery.*

3. K_2 = 1.493 - Relates to the chemical environment and allowable temperature. Appendix E of BS4994:1987.

- *Based upon SPEL tanks long term case history and resin manufacturers media compatibility.*

4. K_3 = 1.0 - Relates to the HDT = 95ºC and design temperature = 30ºC.

From Figure 1 of BS4994:1987.



- *Based upon SPEL tank resin system selected and design temperature of 30°C*

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FAX: +61 (0)2 8014 8699

5. K_4 = 1.1 - Relates to cyclic loading and expected operation of equipment.

From figure 2 of BS4994:1987.

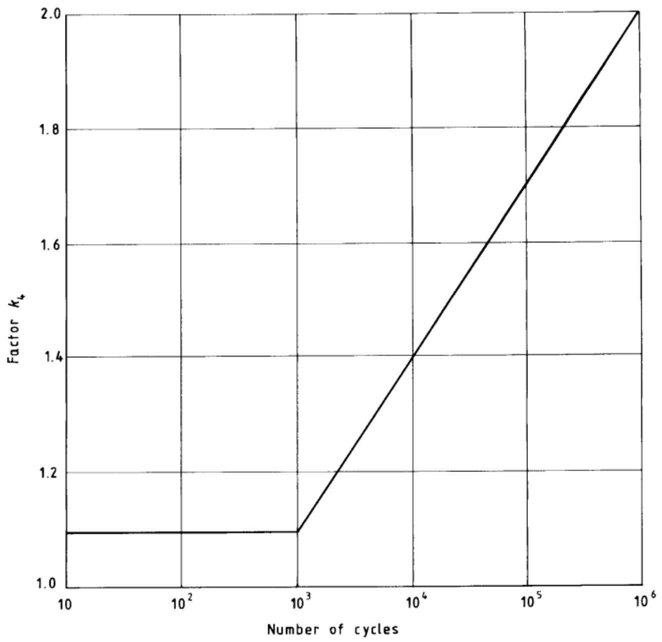

Figure 2 — Factor relating to cyclic loading, k_4

- *SPEL conservatively assumes 3 No. cycles every year for 100 years, resulting in 300 cycles.*

6. K_5 = 1.3 - No post cure.

- *On standard SPEL tanks where the media is not aggressive, no post cure is required from a design perspective or media/resin compatibility perspective.*

Resulting in a design factor of:

7. K = $3 . K_1 . K_2 . K_3 . K_4 . K_5$ = 9.605

- *SPEL uses a design factor of 9.605 for their equipment.*

SPEL Filter & Stormsack Product Warranty

The SPEL Filter & Stormsack Product Warranty

Manufacturer's Warranty

Solely a warranty on the structural integrity of the supplied SPEL Filters & Stormsacks. This warranty is automatic with supply and last 5 years on Spel Filters and 2 years on Spel Stormsacks

Operational Warranty

For as long as the SPEL products were commissioned at the time of construction completion and there is an active maintenance contract currently in place with SPEL, SPEL warrants that the operating components of the SPEL Stormwater treatment system are in full operatable condition.

SPELFilter Operational Warranty Caveats;

1. Warranty will not apply if SPELFilters are subjected to construction silt load
2. Warranty only applied to projects that have StormSacks fitted in all upstream pits or a SPEL approved GPT
3. SPEL have an active maintenance contract in place for the site

StormSack Operational Warranty Caveats;

1. Warranty does not apply to StormSack bags damaged by cigarette butt burns
2. Warranty doesn't apply to damage caused by vandalism
3. Warranty doesn't apply if SPEL does not have an active maintenance contract in place

Commissioning is a standard requirement of the Operational Warranty and is intended to ensure that all SPEL products are installed correctly and they are in a clean operatable condition at the time of site hand over/ construction completion. As part of the Commissioning process, a SPEL representative will attend the site, inspect and provide a report of approval. This report can be provided to any involved parties for their general records. This report of approval is also generally used by the installer as a record to say that they have installed as per manufacturer's specifications and requirements. If the client chooses to forfeit the SPEL onsite Commissioning, SPEL has no operational warranty obligation in this instance.

The SPEL Maintenance Contract is a maintenance program offered by SPEL for all sites and all SPEL products and is also a standard requirement of the Operational Warranty. Included in the maintenance program, SPEL technicians conduct scheduled periodic maintenance inspections to ensure the SPEL products are operating in accordance with their requirements and provide a report on their findings. Based on the report will further action added to the contract be required if there are repairs, rectifications, or extensive cleans, etc needed to restore the SPEL products to full operating conditions. For as long as there is an active maintenance contract in place with SPEL, SPEL will guarantee that the SPEL products are operating in their designed manner. If the client chooses to tender out/award the Maintenance and Operational Warranty to another service provider, this is fine with SPEL and it is now the new service provider's responsibility to warrant that the operating components of the SPEL Stormwater treatment system are in full operatable condition. SPEL has no operational warranty obligation in this instance.

SPEL STORMWATER
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SPEL STORMWATER

SPEL Vortceptor

Operation & Maintenance Manual

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Introduction

This operation and maintenance manual has been written to assist asset owners and maintenance staff understand how the Vortceptor GPT works, and how to maintain their asset to ensure it performs optimally throughout its life cycle.

The Vortceptor is a vortex type Gross Pollutant Trap that provides robust, high performing, and reliable primary stormwater treatment. It is able to remove litter, sediment, oil, and particulate bound nutrient pollutants out of stormwater. The Vortceptor has no moving parts, which reduces the risk of moving part malfunctions. It is constructed out of a FRP (fibreglass) body, and 316 stainless steel screens that has been specifically engineered to withstand the tough demands of stormwater and wastewater applications. FRP is resistant to the most demanding of conditions and can exceed the durability of conventional precast concrete and cast in situ concrete construction.

Design Life

The Vortceptor has been engineered to provide 100 year design life.

Manufacture

The Vortceptor is manufactured in Penrith NSW Australia.

Why FRP?

Glass fibre reinforced polymer (FRP) or fibreglass is a composite material of high strength glass fibre reinforcement in a polymer resin matrix. The glass fibres provide the main load bearing function of the material, and can be woven and aligned specifically for strength. Glass fibre reinforcing provides ideal engineering properties of linear elastic behaviour until failure, and extremely high strength that can exceed that of steel in tension. The matrix has 4 important functions: 1. It holds the glass fibre reinforcing in place 2. It transfers forces to and between the fibres, 3. Prevents buckling of the fibres 4. it provides the beneficial protection from the environment. The resin is specifically formulated to ensure resistance to harsh stormwater environments, that can exceed the durability that of concrete.

This material stands up to the harshest environments, commonly found in stormwater, wastewater, acid sulfate soils, and saltwater.

Fibreglass is becoming a material that is enjoying increased adoption in civil structural engineering applications worldwide due to its light weight, high strength, and its ability to resist degradation.

The ability of fibreglass to achieve high strength with low weight means that the Vortceptor can be fabricated and delivered to site in a substantially assembled state. The treatment chamber is mostly one-piece, with the other sections being any risers, covers, and a precast concrete diversion chamber. One-piece construction means there are no joints to be made on site for the treatment chamber, which eliminates the potential for leaking joints, and risk of backfill and subgrade degradation from water egress through leaking joints. This means that the Vortceptor will provide a more reliable and watertight body, than one made from precast concrete components that are joined and sealed onsite. This is especially important as joints must be able to withstand tremendous hydrostatic pressures. The Vortceptor takes away this risk by eliminating joints, using a single piece FRP body.

Structural strength of FRP

The Vortceptor has been engineered to withstand the forces associated with structures that are buried and carry vehicular loads. The Vortceptor has been engineered to withstand vehicular loadings to Class D rating per AS3996. A cast in situ concrete cover slab that is 600mm larger than the diameter of the FRP Vortceptor separation chamber, and 200mm thick is required to support a dynamic T44 traffic load. The precast concrete diversion chamber is rated to carry Class D traffic loads without the need for the additional concrete cover slab. Refer to SPEL Environmental Vertical Tank installation guide for further details.

Safety Precautions

The Vortceptor is an underground structure that retains water. Ensure that adequate safety equipment and procedures are in place to avoid personnel falling into the Vortceptor, as there is a severe risk of drowning

The Vortceptor is deemed a confined space. It is not necessary to enter the Vortceptor during maintenance, however in the rare event that entry is required, it should only be done so by suitably qualified and equipped personnel, working in accordance with strict OH&S laws, regulations and procedures.

Pollution captured by the Vortceptor can be hazardous to health. Do not make contact with the pollutant material. Ensure personnel are fully equipped with PPE to avoid contact and have procedures in place for first aid.

Operation

The Vortceptor is comprised of two chambers:

The Separation treatment chamber

Stormwater enters this chamber by being directed by a weir into a chute and is then circulated into the screening area. A vortex flow pattern forms as a result of flow velocity and head. Pollutants are removed via screening, and via centrifugal and gravitational forces acting to separate sediment and other particles. Pollutants are captured and are stored in a sump area separate to the screening area. The shear cone separates the screening area and the sump, and acts to create quiescent conditions in the sump. This is what allows the Vortceptor to avoid resuspension of captured pollutants. The sump resides directly below the screening area and is conveniently accessible from the manhole for vacuum cleaning.

Storage of pollutants away from the screening area ensures that the Vortceptor can provide a consistent treatment flow rate, that does not diminish according to the level of pollutants stored. This is a key advantage over other GPTs that store pollutants in the screening area.

Floating pollutants are kept at the top of the screening area, but do not impede flow rate. An oil baffle acts to contain oil and hydrocarbons within the treatment chamber. The captured floatable pollution remains inside the Vortceptor until the time it is cleaned.

The vortex action of flow acts to create a shear force across the face of the 316 stainless steel vortex separation screen. The flow is tangential to the screen, which acts to create a self-cleaning effect and prevents the screen from blinding.

Treated flows are then discharged into the diversion chamber via the outlet chute and then discharged from the diversion chamber outlet into the drainage network.

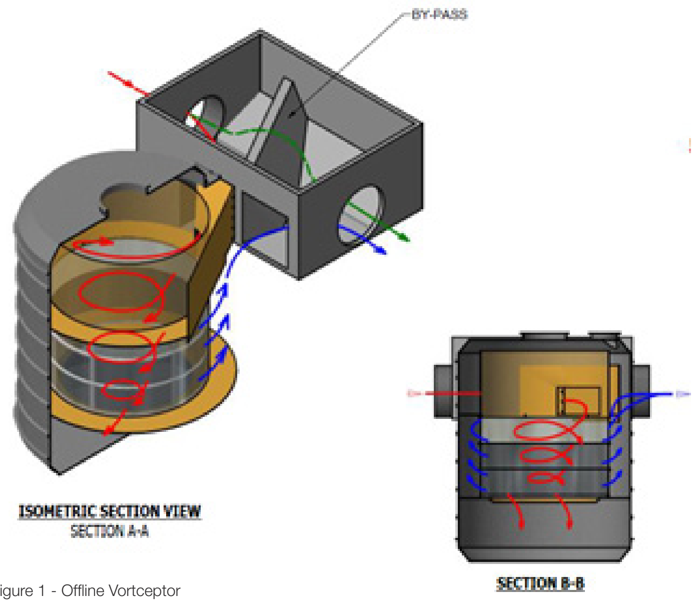


Figure 1 - Offline Vortceptor

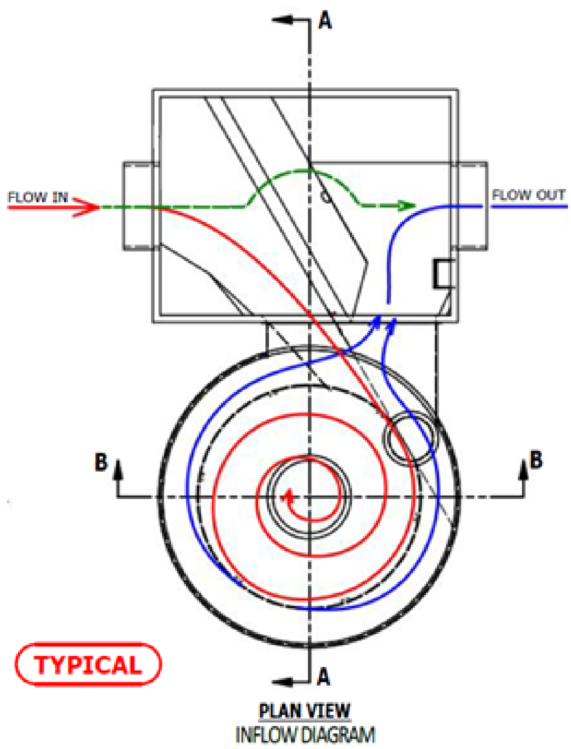


Figure 2 - Offline Vortceptor Plan view showing Separation treatment chamber (Circle) and diversion chamber (rectangle)

The Diversion chamber pit

This chamber allows interface of the Vortceptor with the pipe or culvert drainage network. A weir goes across the width of the diversion chamber and is angled so that it is aligned with the entry chute to the separation treatment chamber. The Diversion chamber is sized to allow bypass of flows exceeding the treatment flow rate over the weir.

Inline Vortceptor models have a small diversion chamber integrated over the separation treatment chamber, to provide a unit that is packaged into a compact footprint.

Offline and Online

The Vortceptor GPT comes in an offline and online configuration. Offline – the treatment separation chamber is adjacent to the diversion chamber.

Online – The diversion chamber and the separation treatment chamber are integrated together.

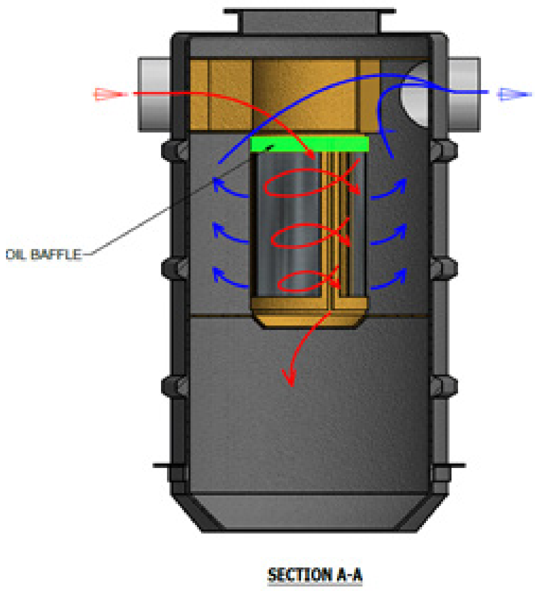


Figure 3 - Online Vortceptor in Elevation view

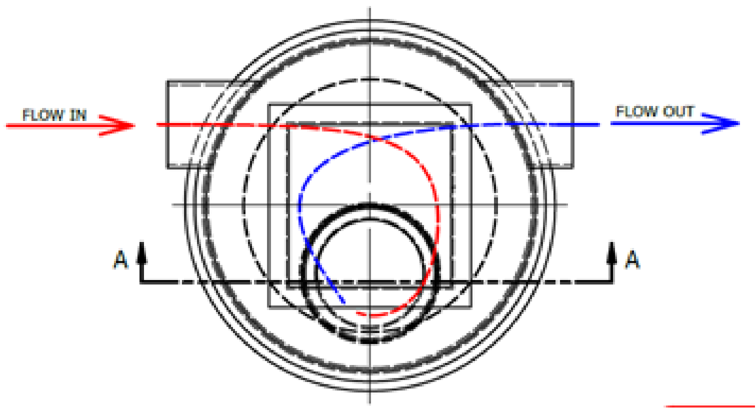


Figure 4 - Online Vortceptor in Plan view showing the diversion chamber and separation chamber in line

Cleaning options

The following cleaning options allow asset owners to choose the best option available for ongoing maintenance and the required cleaning frequency with the right cleaning services and resources available.

Depending on the size, access, and depth of the system, the three following methods can be used to clean the SPEL Vortceptor.

Vacuum Suction Cleaning

Equipment needed – eductor truck

Personnel needed – 2

Suction cleaning is used for most proprietary GPT's. This is by far the most convenient and safest method but does require specialist machinery to achieve. There are several specialist companies that offer vacuum suction cleaning of GPTs. Costs are usually based on the total volume of pollutants disposed, as well as water removed. Asset owners should enquire with cleaning contractors if the option to decant captured water back into the Vortceptor is possible, to reduce disposal fees.

Grab Cleaner

Equipment needed – truck with mounted crane and grab attachment

Personnel needed – 1 to 2

The Grab Cleaner can be carried out without dewatering the system. However, this operation is limited to the larger Vortceptor models with larger screen internal diameters. This option is practically only available for the SVO.530 and above as they have screen internal diameters of 2m. Care must be taken by the operator to ensure that the grab does not make contact with the stainless steel screen, and the shear cone underneath the screen area.

The grab truck cleaning option offers the removal of 80 – 90% of the pollution stored in a sump. It can be a cheaper option than vacuum suction cleaning. However, the asset owner must still allow for an annual vacuum clean, to remove accumulated sediment in the sump and behind the screens.

Removable Basket

Truck with mounted crane

Personnel – 1 to 2

If a removal waste basket is fitted, it can be lifted at any time, without the need for dewatering. This is the fastest and the most cost-effective option but comes at the sacrifice of sump capacity. The basket will not impede flow rate.

The smaller sump capacity that results from using a basket may lead to the need for more frequent maintenance activities. But this is offset by the ease and ability to carry out the cleaning activity in house.

An annual vacuum clean to thoroughly dewater and remove accumulated sediment will be recommended for this approach.

Tidal and Backwater affected Vortceptors

Gross pollutant traps, including the Vortceptor, may from time to time, be required in tidal and backwater affected locations. The designer should consider specifying a penstock or stop valve on the outlet side of the Vortceptor, so that the Vortceptor can be isolated from tidal and backwater, and effectively dewatered and cleaned. It will be critical for the maintenance crew to re-open the penstock or stop valve after they have finished maintaining the Vortceptor. Failure to re-open the penstock or valve can lead to catastrophic flooding.

Increasing the Vortceptor Sump capacity to spread out the cleaning intervals

Vortceptor sump capacities can be increased over and above the standard capacities listed in Table 1 below. It is recommended that the designer carefully estimate the expected pollution load volumes from their catchment and target a sump capacity to match a desired cleaning frequency. Extending the sump is only possible during the desktop design stage, before the Vortceptor is manufactured, so good early planning and design is essential.

SPEL Vortceptor Maintenance Capacities & Dimensions

Table 1 - Vortceptor Maintenance Capacities and Dimensions

Models	Treatable Flow rate (L/s)	Depth below invert (mm)	Screen Internal diameter (mm)	Screen Height (mm)	Sump depth (mm)	Internal Diameter of Vortceptor (mm)	Manhole Size	Sump Capacity (m^3)	Light Liquid Volume (L)	Floatables Volume (m^3)
IN-LINE SERIES										
SVI.025	25	1400	500	600	770	1370	600x600	0.6	110	0.05
SVI.055	55	1650	700	800	770	1850	900x900	1.4	246	0.22
SVI.055.M	55	1585	700	800	770	2200	900x900	1.9	394	0.15
OFFLINE SERIES										
SVO.096	96	2160	1000	900	1150	1500	900x900	2.0	239	0.39
SVO.140	140	2580	1000	1200	1320	1500	900x900	2.3	239	0.39
SVO.180	180	2940	1000	1500	1380	1500	900x900	2.5	239	0.39
SVO.220	220	2940	1500	1500	1430	2200	900x900	4.3	515	1.1
SVO.360	360	3430	1500	1800	1570	2200	900x900	6.0	515	1.1
SVO.530	530	3130	2000	1800	1270	3000	900x900	8.5	1263	2.8
SVO.800	800	4130	2000	2800	1270	3000	900x900	8.5	1263	2.8
SVO.810	810	3400	3000	1800	1540	4000	900x900	19.3	2155	5.65
SVO.1200	1200	4030	3000	2400	1540	4000	900x900	19.3	2155	5.65
SVO.1600	1600	4710	3000	3000	1560	4000	900x900	19.3	2155	5.65

Maintenance

The SPEL Vortceptor requires regular inspections and cleaning. There are no consumable parts on the SPEL Vortceptor throughout its operating life.

The regularity of inspections and cleaning of the Vortceptor is contingent on the features and properties of the catchment area. Good monitoring and record keeping systems by the asset owner will allow them to optimally schedule cleaning activities for each individual Vortceptor. The section below provides asset owners some guidance to the frequencies for maintaining the Vortceptor.

Inspection

Routine inspection is the key to effective maintenance. Pollutant transportation and deposition may vary from catchment to catchment. Regular routine inspections will help the asset owner assess the rate of pollutant capture for that specific location.

At a minimum, routine inspections should be performed twice per year. The suggested inspection frequency in the first year of operation is 3 months. This interval can be extended to 6 months at the discretion of the asset owner.

The routine visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet, outlet, and separation screen. The routine inspection should also quantify the accumulation of floating trash, and sediment in the sump. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. All inspections should be recorded. A sample inspection report is attached to this manual. Furthermore, it is recommended that the Vortceptor be inspected after every major rain event, with a focus on ensuring there are no blockages to the inlet and outlets of the Vortceptor and the diversion chamber.

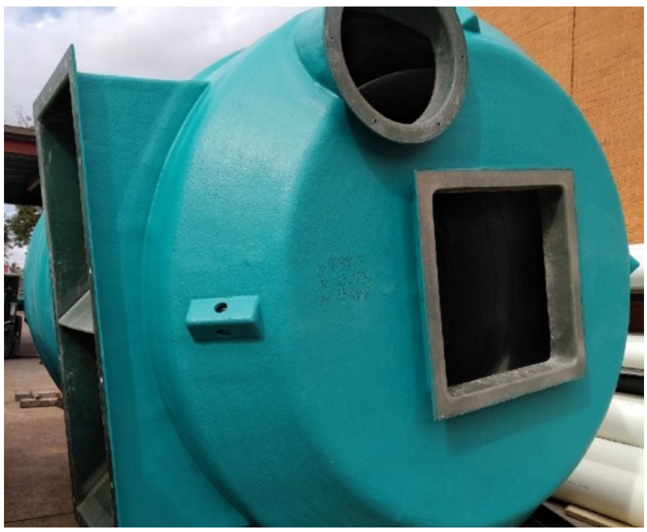
Access for Maintenance

Separation Treatment chamber

The separation treatment chamber has adequate access for maintenance. Vortceptor models up to SVO.360 have single manhole access, whereas the larger Vortceptor models SVO.530 and above have 2 manholes, consisting of Class D cast iron lids. The lid in the centre of the separation chamber provides access into the screen and sump area.

The single round lid as pictured below provides access behind the screen, so that sediment can be extracted using a vacuum.

The lids are locked with bolts. The lids can be lifted using standard manhole cover lifters.



Separation Treatment chamber

As described above, an additional Class D manhole cover allows access to the clean water side of the screen, or otherwise called the area 'behind the screen'. This area can have some level of sediment deposition over time. This manhole allows convenient access, by allowing the vacuum hose to be dropped down vertically to the area behind the screen. It is recommended that the area behind the vortex separation screen be cleaned annually, to avoid buildup of sediment. Alternatively, access behind the screen can be gained by inserting the vacuum hose from the outlet side of the diversion chamber, and into the outlet of the separation treatment chamber.

Diversion chamber

There are access manholes above the diversion chamber, with a lid situated either above the inlet side and/or the outlet side of the chamber. These manholes allow for visual inspection to the treatment chamber inlet and outlet chutes, and if required, access for cleaning.

Access for Maintenance

Pollution removal performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to reaching maximum sump capacity for easier removal of sediment. The level of sediment is easily determined by measuring from the finished surface level down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile.

Method to calculate the % sump capacity filled with pollutants

1. Determine the water depth that is above the sediment layer. This is done by taking two measurements with a measuring staff: one measurement from the finished surface level (ie manhole opening level) to the top of the sediment pile and the other from the manhole opening to the water surface.
2. If the difference between these measurements is less than the Depth from water level to top of sump in table 2, the system should be cleaned out. If the water depth to the sediment is less than the water depth to the top of sump, this means the sediment level is above the sump.
3. If the water depth to sediment is greater than the depth from water level to top of sump, calculate the % of sump that contains sediment by the following method:

Height of sediment = Depth of Water level to top of sump + Sump depth - water depth to sediment

Sump % full = height of sediment / height of sump x 100

A work sheet is attached to the end of this manual to assist with calculating and recording the sump levels.

Models	Sump depth (mm)	Depth from Water level to top of sump	Sump Capacity (m^3)	Light Liquid Volume (L)	Floatables Volume (m^3)
IN-LINE SERIES					
SVI.025	25	1400	500	600	770
SVI.055	55	1650	700	800	770
SVI.055.M	55	1585	700	800	770
OFFLINE SERIES					
SVO.096	1150	1010	2.0	239	0.39
SVO.140	1320	1260	2.3	239	0.39
SVO.180	1380	1560	2.5	239	0.39
SVO.220	1430	1510	4.3	515	1.1
SVO.360	1570	1860	6.0	515	1.1
SVO.530	1270	1860	8.5	1263	2.8
SVO.800	1270	2860	8.5	1263	2.8
SVO.810	1540	1860	19.3	2155	5.65
SVO.1200	1540	2490	19.3	2155	5.65
SVO.1600	1560	3150	19.3	2155	5.65

Table 2 - Sump depth dimensions

Cleaning

Cleaning of the Vortceptor system should be done during dry weather conditions when little or no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump.

The system should be completely drained down and the sump fully evacuated of sediment, and a final hose down of the screen and sump.

Disposal of material

The material captured by the Vortceptor could include hazardous material, such as syringes, chemicals, and sharp objects. Care must be taken by cleaning crews and they must work in accordance with a specific job safety plan. PPE such as gloves, protective wear, boots should be mandatory. Disposal of material must be done in accordance with all environmental regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins.

Inspection and cleaning frequencies

The frequency of cleaning will depend on the pollutant loads of the catchment, so inspections are recommended to confirm the maintenance intervals, which could be either three, six or twelve months.

Visual inspection and cleaning frequencies

	After every major storm	3 months	6 months	12 months
Visual inspection of treatment chamber		visually inspect every 3 months. Measure the amount of pollut-ants in the sump		
Visual inspection of diversion chamber	Check inlet and outlet pipe or culvert for blockages		visually inspect the diversion chamber for any signs of blockage and sedi-ment build up	visually inspect the diversion chamber for any signs of blockage and sedi-ment build up
Regular Clean – Removal of captured pollutant material from the Vortceptor separation chamber				
			Primarily to remove floatables and sump contents contents. Note Cleaning interval is every 6 months on average but may need to be adjusted according to site specific conditions. Interval frequency can be reduced if extended sump has been installed	
Full dewater and clean				Full sump pump out, jet screen and sump
Clean behind screen				In conjunction with full dewater and clean
Visual inspection of Vortex separation screen				Note the condition of the screen – note down signs of damage if any
Clean diversion chamber			Visual inspection	Remove sediment buildup if required.

Repairs and replacement

The Vortceptor does not have any consumable parts that require replacement throughout its design life of the unit. However, in the unlikely event that the Vortceptor requires repair due to damage, the following provides guidance on repairing the Vortceptor.

All repairs should be conducted by suitably qualified personnel, following OH&S requirements for working in confined spaces.

All repairs should be conducted in dry weather and should be conducted after the Vortceptor has been dewatered and emptied.

Vortex Separation Screen

The vortex separation screen is comprised of 316 stainless steel. The Screen is not a consumable item. In the unlikely event that the screen is damaged, specific sections of the screen can be removed by cutting them out. Replacement screens can be riveted into the fibreglass body, and tack welded to the neighbouring screens. The installer must ensure that the screen is installed such that the screen aperture is facing the correct direction. The way to check this is to run a hand over the surface of the screen. Ensure you are wearing gloves. The screen is smooth when stroking in one direction, and rough when stroking in the opposite direction. The smooth direction indicates the direction

that the vortex will flow. Ensure that the replaced screen is in the same direction as of the screens next to them. Replacement screens are available from SPEL Stormwater, as well as specialist on site support from SPEL Stormwater's maintenance team.

Shear cone

The shear cone is not a consumable item. The only practical way it will be damaged is if a grab makes contact. Vortceptors up to SVO.360 have FRP shear cones, and the units from SVO.530 and above have 316 stainless steel shear cones. Replacement of the shear cone has been designed for easy replacement. First completely dewater the unit, then gain access, noting that it is a confined space. Undo bolts and replace the damaged shear cone section. The shear cone is divided into 4 separate sections, so that only the damaged section needs to be replaced. Replacement shear cone sections are available from SPEL Stormwater as well as specialist on site support from SPEL Stormwater's maintenance team.

Cast iron Manhole covers

Cast iron manhole covers are not consumable items. However in the event they are damaged, they are readily available on the market as standard covers are used for the Vortceptor.

Precast concrete Diversion chamber

The diversion chamber is made of min 40Mpa concrete. Damage or cracks can be repaired with a concrete mortar such as Rapidset, Xypex, Parchem. 2-part epoxy and flexible fillers such as Sikaflex are also widely available. Refer to the manufacturers for specialist details on repairing precast concrete for water retaining structures.

Fibreglass components

One of the many benefits of using FRP/fibreglass over conventional materials such as concrete is its ease and durability of repairs. The material to repair fibreglass is readily and widely available.

Safety

Ensure the work area is well ventilated as the resin fumes can be harmful, especially in a confined space area.

Resins, acetone, and FRP dust are flammable. Peroxides (catalyst) are strong oxidizing agents and can ignite fuels. Follow MSDS instructions, including PPE prior to commencement of repair work.

Repairs to Fibreglass

A key principle of repairs to fibreglass is that the repair will differ from the original fibreglass primary structure. The original resin and glass reinforcing fabric in the primary structure has cured and bonded chemically and physically with each other, forming the primary bond. Repairs to a damaged fibreglass part is referred to as secondary bonds, that are attached to the primary structure. The repair relies on the physical bond to the primary structure, and the resin must have strong adhesive properties. Increasing the surface area of the bond to the primary structure will increase the strength and durability of the repair.

Parts for Repair

1. Resin – Polyester resin or Vinyl ester resin
2. Catalyst / Hardener – MEKP (Butanox M50 or equivalent)
3. Fibreglass matt – 450g/m2 chopped strand mat
4. Acetone – for cleaning the bond surface
5. Hot Coat – finishing layer (resin mixed with 1% solution of 8% wax in styrene can be used for this purpose)
6. Paint brush and or roller – for applying resin to fibreglass mat

Commercial fibreglass repair kits are widely available and can be used to repair the Vortceptor.

Identify the Damaged Area

Identify the damage and draw the boundary of the damage. An easy inspection method is to tap a solid material, like a coin, and listen for any differences in the sound of the tap. Mark out suspect areas. Damage could be cracks, holes, puncture, and delamination.

Trimming and cutting

Cut out the damaged area if you cannot patch over the area. Otherwise grind the surface as described below. Most concrete or masonry cutting tools are compatible to cut FRP. Note that high speed cutting tools for metals are not suitable for FRP.

Surface cleaning and grinding

Grind approximately 20mm or more of surface area from the damaged area to promote adhesion of the repair. Grind surface using abrasive methods. Recommended equipment are 4 inch grinder with 34 grit sanding disc, or an orbital sander with a low grit number such as 60 grit. Do not use chemical primers. Grind the surface until the glossy finish of the resin is no longer visible, surface is even and uniform with no high or low spots. A slight taper in the surface will assist with locking in the repair.

Clean the surface of dust, water, oil. Brush or vacuum to remove dust, then wipe the surface with clean acetone. The surface should not be wet and must be dried.

The surface must be prepared again if the repair has not been performed within 24 hours of the surface preparation, or if the surface is contaminated with oil or water.

Resin preparation

Mix resin and catalyst in small batches. Catalyst should be between 1.25% to 2.5% of the resin weight. The reaction of the resin and catalyst will cause high amount of heat when curing. Refer to the resin and catalyst manufacturer's instructions.

Applying Fibreglass layers

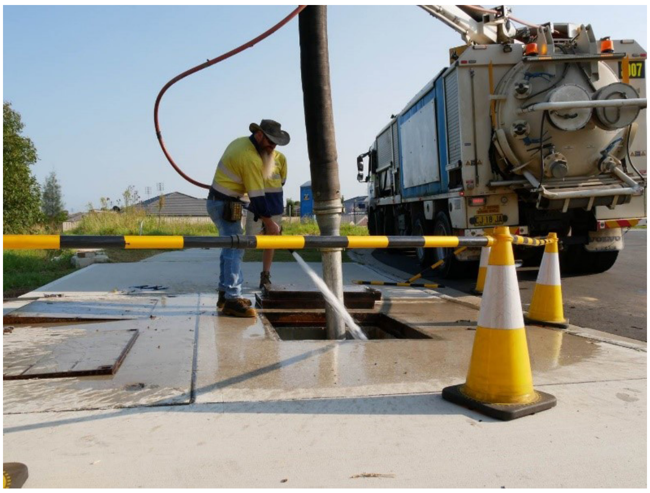
Wet the bonding surface with catalysed resin. Apply fibreglass mat in layers, and completely cover with resin. Minimise the layer thickness to no more than 7mm, to avoid generating excess heat. Build up the layers until it matches or exceeds the thickness of the primary structure. Press the layers together to avoid the formation of air pockets between the layers, by using a roller.

Finishing the Fibreglass repair

After all layers are applied, a final coat of 'Hot Coat' is to be applied. The Hot coat can be applied while the top layer is still wet.

Further Assistance

Thank you for choosing the SPEL Vortceptor GPT. We are confident that it will faithfully carry out the essential task of keeping our waterways clean of pollution and do so in a robust and hassle-free manner for years to come. Our confidence in the product is backed by our 25 year warranty. Engineering and maintenance support are at hand for all asset owners. Contact SPEL Stormwater on 1300 773 500 or email maintenance@spel.com.au



Inspection & Maintenance Log

SPEL Model: ______________________ **Location:**____

Date	Depth from manhole to top of sediment (1)	Depth from manhole to top of water level (2)	Water depth to sediment (1) – (2) (3)	Water Depth top of sump (from table 2) (4)	Is the water Depth (3) less than water depth to sump (4) Yes/No If yes, organize clean	% sump capacity full	Describe Maintenance Performed	Comments

a. The water depth to sediment is determined by taking two measurements with a measuring staff: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface.

b. Obtain the Water depth to top of sump for the specific Vortceptor model from table 2 of this manual

c. Compare the Water Depth to Sediment (3) to the Water Depth to top of sump (4). If the water depth to the sediment is less than the water depth to the top of sump, this means the sediment level is above the sump.

d. If the water depth to sediment is greater than the depth from water level to top of sump, calculate the % of sump that contains sediment by the following method:

Height of sediment = Depth of Water level to top of sump + Sump depth - water depth to sediment

Sump % full = height of sediment / height of sump x 100

e. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

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