Aspect Industrial Estate

SSD-10448 Modification 3

Lots 1-5 DP1285305

788-882 Mamre Road, Kemps Creek

Water and Stormwater Management Plan

CLIENT/ Mirvac

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Commercial in Confidence

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1. Introduction

This Water and Stormwater Management Plan (WSMP) has been prepared by AT&L on behalf of Mirvac Projects Pty Ltd (Mirvac) to inform a modification application, Modification No.3 (MOD3) of State Significant Development Application (SSDA) for the staged development of the Aspect Industrial Estate (AIE) at 788-882 Mamre Road, Kemps Creek (reference SSD-10448). The MOD3 application generally relates to changes to SSD-10448 to support a separate SSDA submission for the on-lot development located within Lot 9 (reference SSD-46516461).

This report supports the MOD3 application to SSD-10448 for the Site and should be read in conjunction with the EIS, development plans and supporting documentation submitted with the SSDA, with the original SSDA having been approved on 24 May 2022.

The location of the AIE Site is presented as **Figure 1**.

Figure 1: Site Location (imagery from nearmap dated 10 January 2023)

2. Site Description and Pre-Development Site Conditions

2.1. Location

The AIE Site is legally described as Lots 1 – 5 in DP 1285305, and is located east of Mamre Road, Kemps Creek within the Penrith Local Government Area (LGA). The site has approximately 950m of direct frontage to Mamre Road with a proposed signalised intersection providing vehicular access via Mamre Road to the M4 Motorway and Great Western Highway to the north and Elizabeth Drive to the south.

The site is located approximately 4km north-west of the future Western Sydney Nancy-Bird Walton Airport, 13km south-east of the Penrith CBD and 40km west of the Sydney CBD.

The Site has an area is approximately 55.83 Ha. Construction works, namely bulk earthworks, commenced across the Site in October 2022. Prior to the commencement of works, the Site was primarily used for rural activities and comprised of dwellings, sheds, dams and grassed fields.

2.2. Waterways and Vegetation

A Riparian Assessment report was undertaken by Eco Logical Australia to support SSD-10448 for the Aspect Industrial Estate (Eco Logical Australia, 2020). Within this report it was determined there were two mapped hydrolines located within the site. These hydrolines are indicated on **Figure 2**.

Figure 2: Watercourses mapped within the AIE Site

Realignment of the mapped hydrolines was approved under SSD-10448, and will generally include the following work (refer to **Figure 3**):

- Removal of the existing watercourse and establishment of a 40 metre wide riparian corridor, consisting of an 800 metre long channel.
- A low flow channel with a typical width of 3.75m – 5.7m.
- A high flow channel with a typical width of 20m.

- Establishment of Inner and Outer Vegetated Riparian Zones (VRZs).

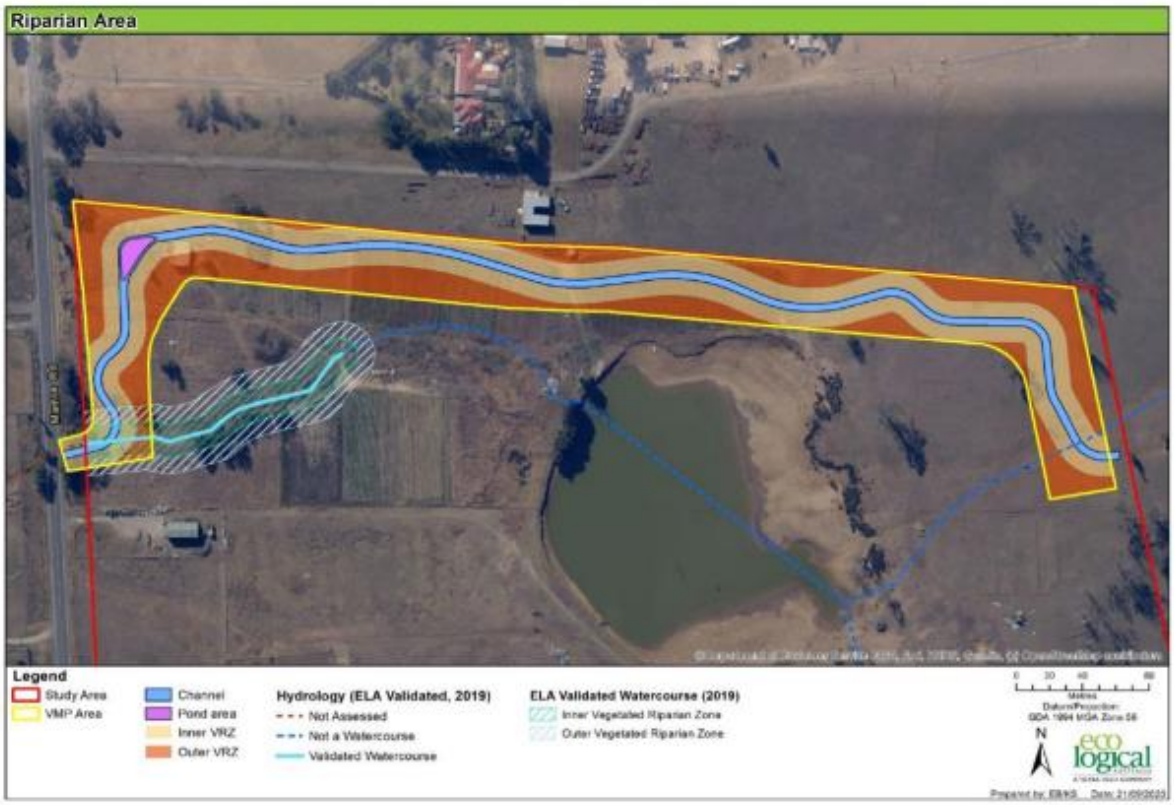

Figure 3: Proposed riparian corridor alignment approved under SSD-10448

The diversion of the pre-development watercourse and proposed riparian corridor is generally unchanged as part of the MOD3 application.

2.3. Geology and Soils

Based on a Geotechnical Report undertaken by Pells Sullivan Meynink (PSM) (reference: PSM3739-004L Rev6, dated 13 October 2020) the following inferred sub surface soils were encountered across the site:

- Topsoil – Silty CLAY Depth 0.0 - 0.3m
- Natural Soil/ Fill – CLAY and Silty CLAY: Depth 0.1 to 4.5m
- Bedrock –SHALE: Depth 1.0 to 6.5m

2.3.1. Salinity

Based on site investigations undertaken by PSM, consisting of testing of 20 samples undertaken across the Site, the majority of soils were found to be "non-saline to moderately saline". One sample out of the 20 tested was found to be "very saline". The location of this sample is in an area on future lot 4 that will be filled by approximately 2 metres above pre-development ground level.

2.3.2. Sodicity

The Exchangeable Sodium Percentages (ESPs) calculated from tests undertaken by PSM ranged from 5.6% to 53.4%, which indicates that the soils on site range from sodic to highly sodic when compared to criteria listed in *Site Investigations for Urban Salinity* (DLWC, 2002).

2.3.3. Construction Salinity Management Plan

PSM prepared a *Construction Salinity Management Plan* (CSMP, July 2022) for the AIE Site to effectively manage site salinity, to minimise the effect of the proposed development on salinity processes and to protect

the development of the AIE Site from salinity damage. A range of strategies are outlined in the CSMP to manage potential impacts relating to salinity, including:

- Implementation of erosion and sediment control practices (e.g., diversion of surface water runoff around disturbed areas, sediment traps, silt fencing, sealing temporary batters and stockpiles).
- Avoid over-watering for dust suppression.
- Grade surfaces to prevent ponding of surface water
- Undertake salinity testing of soils to be imported to ensure high saline soils are not bought into the site.

2.3.4. Assessment of Potential Impacts on Soil Resources

PSM have also prepared an *Assessment of Potential Impact on Soil Resources and Infrastructure* (August 2022) in support of the MOD3 application. PSM noted that from a geotechnical point of view, the proposed development has close to no impact on soil resources at the site. The earthworks will comprise a cut to fill balance on site with minor import.

2.4. Pre-Development Catchment Delineation

Catchment delineation of the AIE Site under pre-development conditions is presented in **Figure 4**.

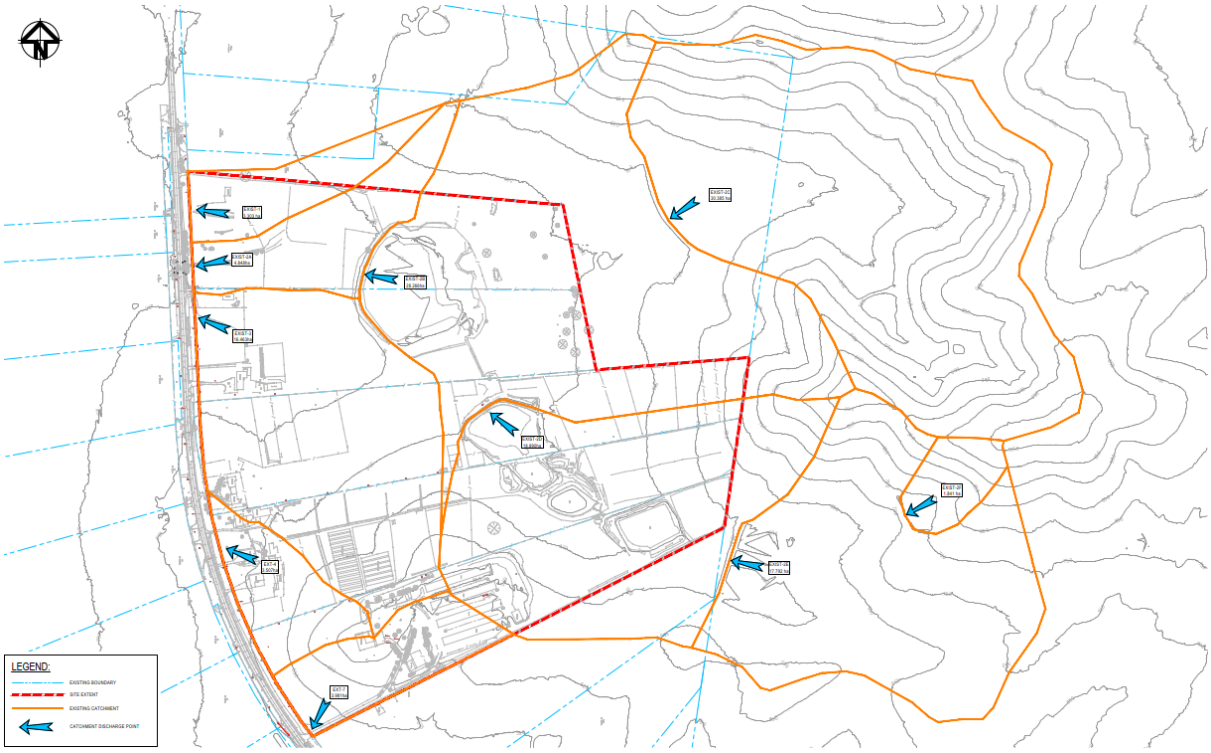

Figure 4: Catchment delineation under pre-development conditions

A summary of the internal and external catchments under pre-development conditions is presented in **Table 1**.

Table 1: Internal and external catchments under pre-development conditions

Catchment ID	Area (ha)	Internal / External	Description
1	3.303	Internal & External	North-western portion of AIE Site and a small portion of adjacent site to the north. Discharges towards Mamre Road.
2A	4.848	Internal & External	North-western portion of AIE Site and a small portion of adjacent site to the north. Discharges towards a box culvert drainage crossing under Mamre Road.
2B	28.266	Internal & External	North-eastern portion of the AIE Site, including external catchment that drains towards a farm dam within the Site.
2C	30.385	External	External catchment that drains towards the eastern boundary of the Site.
2D	18.890	Internal & External	South-eastern portion of the AIE Site, including external catchment that drains towards three farm dams within the Site.
2E	17.792	External	External catchment that drains towards the southern boundary of the Site.
2F	1.841	External	External catchment that drains towards the southern boundary of the Site.
3	16.463	Internal	Western portion of the Site that drains towards Mamre Road.
4	3.507	Internal	Western portion of the Site that drains towards Mamre Road.
7	3.981	Internal	South-western portion of the Site that drains in a southerly direction towards Mamre Road.

3. Proposed Development

3.1. Scope of MOD3 Application

A number of amendments are proposed to the Concept Approval and Stage 1 of SSD-10448 for MOD3. Modification to the Concept Masterplan is proposed as per the Estate Plan reproduced as **Figure 5** and will include the following:

- Reconfiguration of the Estate layout south of Access Road 1 and west of Access Road 3 including:
  - Reduction in overall lot numbers across AIE from 11 to 9.
  - Relocation and shortening of Access Road 4.
  - Reconfiguration of warehouse lots 6-11 into lots 6-9.
  - New warehouse footprints including GFA of warehousing and office areas, car parking, estate landscaping.

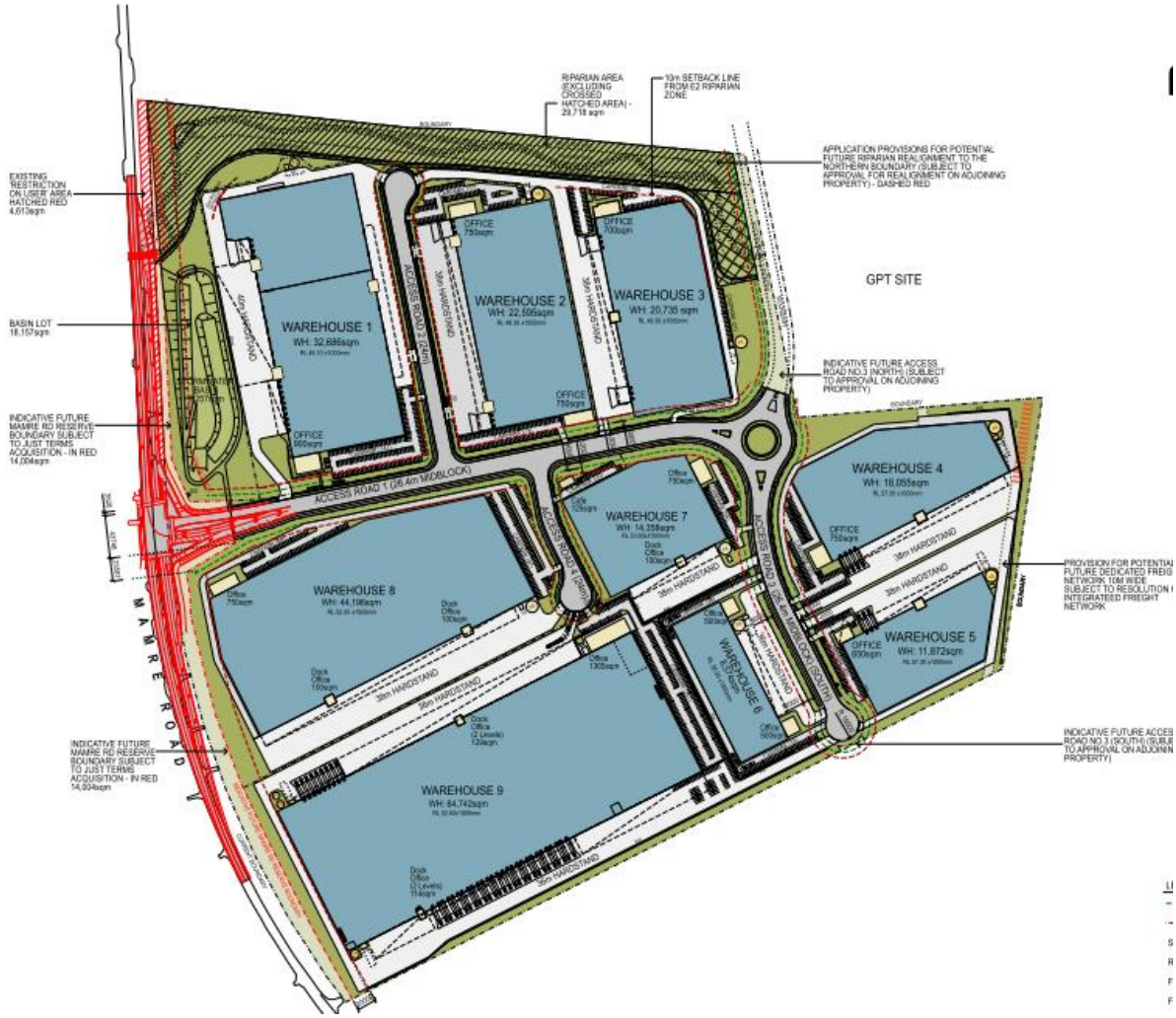

Figure 5: SSDA-MOD3 Estate Masterplan (SBA Architects, February 2023)

Stage 1 works are presented in **Figure 6**. Modifications to the Stage 1 works proposed under the MOD3 application are as follows:

- Modification of the Stage 1 consent to provide for the following in respect of Access Road 4:
  - Updated road subdivision plan to provide for subdivision of Access Road 4.
  - Updated civil works package to facilitate construction of Access Road 4.

- Provision of landscaping works within road reserve of Access Road 4.

- Specific civil infrastructure elements that are proposed to be changed under the scope of MOD3 include the following:
  - Adjustment to bulk earthworks levels, generally to the lots bound by Road 1 and Road 3 (Lots 6-9). The overall cut/fill balance across the AIE Site has been maintained.
  - Changes to the proposed stormwater network design. Generally, this will involve changing standard reinforced concrete pipes to a combination of fibre reinforced concrete pipe (up to DN600) and reinforced concrete box culverts.
  - Adjustments to retaining wall 22, to suit the revised bulk earthworks level for Lot 9. The bottom of wall level has been adjusted to suit the specific MOD3 Masterplan arrangement. The top of wall level remains unchanged from the approved SSD-10448.
  - Inclusion of an additional retaining wall (retaining wall 23) between Lot 9, and Lots 6 and 7. The retaining wall is proposed as part of the Stage 1 works due to its locality to on-lot works within Lot 9 contemplated as part of SSD-46516461.

Figure 6: SSDA-MOD3 Estate Staging Plan (SBA Architects, February 2023)

3.2. Trunk Drainage Paths

In December 2022, Sydney Water released the Mamre Road Precinct Stormwater Scheme Plan (SSP), reproduced below as **Figure 7**. The SSP presents indicative regional trunk drainage infrastructure proposed by Sydney Water in the Mamre Road Precinct. The SSP was developed in line with NSW Government planning requirements and includes measures that would ensure development in the precinct complies with the waterway health targets outlined in the Mamre Road Precinct DCP.

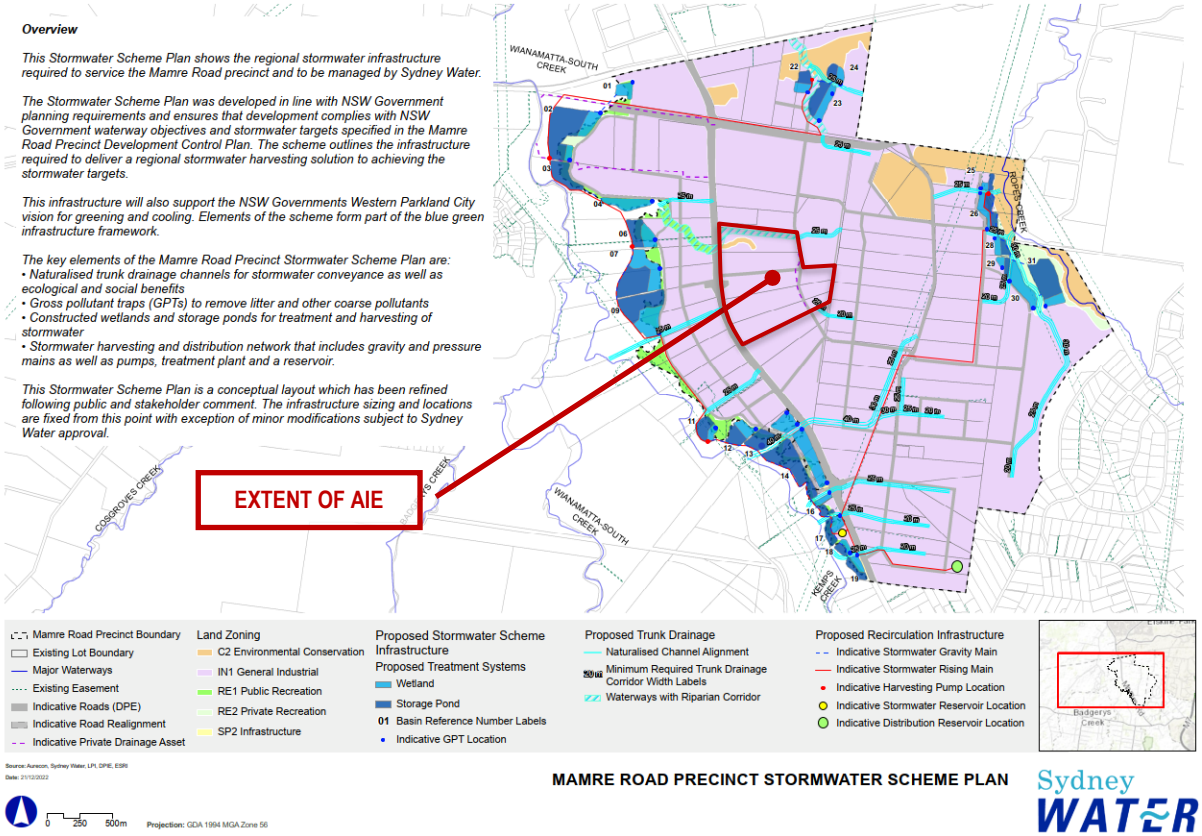

Figure 7: Mamre Road Precinct Stormwater Scheme Plan (Sydney Water, December 2022)

The approved SSDA for the AIE Site incorporates realignment of the trunk drainage channel such that it will follow the northern boundary of the Site. This is consistent with the proposed waterway shown in the SSP.

The SSP also shows a private drainage asset, which will drain the external catchment to the south and east of the AIE Site via a pit and pipe network that will be installed parallel to proposed Road 3. This drainage line will ultimately discharge into the proposed trunk drainage corridor. This proposed private drainage asset was approved under SSD-10448 and will remain unchanged as a result of the MOD3 application.

3.3. Post-Development Catchment Delineation

Catchment delineation of the AIE Site under post-development conditions is presented in **Figure 8**.

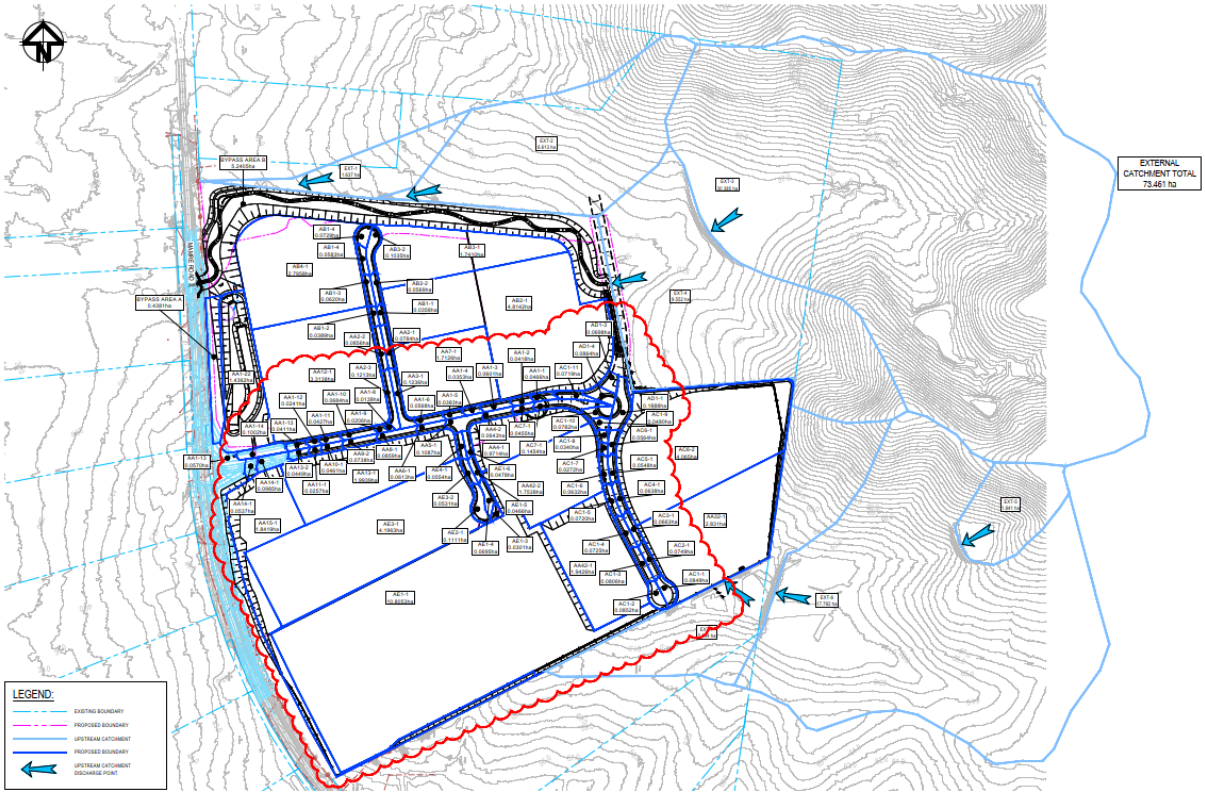

Figure 8: Catchment delineation under post-development conditions

Internal catchments within the AIE Site will be directed via a network of proposed stormwater drainage infrastructure towards estate-based stormwater management measures, consisting of:

- A proprietary bio-retention system, which will treat low flows prior to discharge from the Site. Further details of the proposed basin are outlined in **Section 5.2.4**.
- A detention basin, which has been designed to attenuate peak flows such that the stormwater quantity management controls in the Mamre Road Precinct DCP are satisfied. Further details of the proposed basin are outlined in **Section 5.2.5**.

External catchments will be managed through the Site as follows:

- Catchments 1 and 2A will drain towards the northern boundary and will discharge into the proposed drainage channel.
- Catchments 2B and 2C will drain towards the natural low point at the eastern boundary and into the upstream end of the proposed drainage channel.
- Catchments 2D, 2E and 2F will discharge into an upstream diversion line (pit and pipe), which will follow the alignment of Road 3 and discharge into the upstream end of the proposed drainage channel.

3.4. Water Sources and Demands

3.4.1. Water Requirements

Water requirements within the AIE Site 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)

3.4.2. Water Sources

The primary source of water to the AIE Site will be Sydney Water's potable water reticulation network. Details of existing and proposed infrastructure that will be required to service the estate are presented in the Civil 10 Infrastructure Report prepared by AT&L.

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.

3.4.3. 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 AIE Site:

- **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.

4. Stormwater Targets

The Mamre Road Precinct DCP establishes the construction and operational phase stormwater quality and quantity (flow) targets for the Site. This Water and Stormwater Management Plan addresses operational phase targets only. Construction phase targets are addressed in an Erosion and Sediment Control Plan for the Site.

For the operational phase targets there are two options available for stormwater quality and two options available for stormwater flow.

Stormwater quality targets for Option 1 (annual load reduction) and Option 2 (allowable loads) are summarised in **Table 2**.

Table 2: Operational phase stormwater quality targets – Options 1 and 2

Parameter	Option 1 Target (reduction in mean annual load from unmitigated development)	Option 2 Target (allowable mean annual load from development)
Gross pollutants (anthropogenic litter >5mm and coarse sediment >1mm)	90%	< 16 kg/ha/yr
Total suspended solids (TSS)	90%	< 80 kg/ha/yr
Total phosphorus (TP)	80%	< 0.3 kg/ha/yr
Total nitrogen (TN)	65%	< 3.5 kg/ha/yr

Stormwater quantity (flow) targets for Option 1 (mean annual runoff volume) and Option 2 (flow percentiles) are summarised in **Table 3**.

Table 3: Operational phase stormwater quantity (flow) targets – Options 1 and 2

Parameter	Option 1 Target (MARV)	Option 2 Target (flow percentiles)
Mean annual runoff volume (MARV)	≤ 2 ML/ha/yr at the point of discharge to the local waterway	n/a
95%ile flow (L/ha/day at the point of discharge to the local waterway)	n/a	3000 – 15000
90%ile flow (L/ha/day at the point of discharge to the local waterway)	1000 – 5000	1000 – 5000
75%ile flow (L/ha/day at the point of discharge to the local waterway)	n/a	100 – 1000
50%ile flow (L/ha/day at the point of discharge to the local waterway)	5 – 100	5 – 100
10%ile flow (L/ha/day at the point of discharge to the local waterway)	0	n/a
Cease to flow	n/a	Between 10% to 30% of the time

5. Water Sensitive Urban Design Strategy

The Water Sensitive Urban Design (WSUD) Strategy for the MOD3 application incorporates a series of management measures to address stormwater quality, quantity (peak flow attenuation) and flow volume. This Strategy should be read in conjunction with the following documents:

- *SSD-10448 Aspect Industrial Estate, Amended Development Report* (Urbis, 5 May 2022)
- *Aspect Industrial Estate, SSD-10448 Modification 2, Civil Infrastructure Report* (AT&L, 25 August 2022)

5.1. Strategy Overview

This WSUD Strategy has been developed for the Stage 1 development scenario, for which approval is being sought under the MOD3 application to SSD-10448. The key elements of this Strategy are presented on drawing 18-596-C1047B and form a solution that will satisfy the stormwater quality, quantity (peak flow) and flow volume controls presented in **Section 4**.

As an outcome of liaison between Mirvac and NSW DPE, a preferred strategy for water management under Stage 1 development conditions has been developed and primarily relies on large-scale evaporation ponds on future lots 2 and 8, with irrigation occurring across Lots 4, 6 and 7.

Any further amendments to the WSUD Strategy that would be required to support further development of the AIE Site will form part of subsequent applications (e.g., modification to the Stage 1 development or supplementary SSDAs/DAs).

5.1.1. Stormwater Quality and Flow Management Measures – Stage 1

The proposed measures to address the operational stormwater quality and flow targets for Stage 1 are summarised in **Table 4**. Cells shaded grey indicate elements of the WSUD Strategy that were approved under SSD-10448 or the subsequent MOD2 application and will remain unchanged as a result of the MOD3 application.

Table 4: Summary of options to address stormwater quality and flow management targets for Stage 1

Measure	**Stage 1** (refer to drawing 18-596-C1047B in **Appendix A**)
Rainwater tanks (for non-potable reuse)	▪ Rainwater tanks on proposed lots 1, 3 and 9 to meet at least 80% demand for non-potable water (toilet flushing and landscape irrigation)
Evaporation ponds for stormwater harvesting and irrigation of undeveloped lots	▪ Evaporation ponds on future lots 2 and 8 ▪ Retention pond to be incorporated into the detention basin between Mamre Road and proposed lot 1 for storage and transfer of stormwater to evaporation ponds on lots 2 and 8. ▪ Water stored in the two ponds to be used for irrigation of undeveloped lots 4, 6 and 7, and part of lots 2 and 8.
Primary treatment (Gross Pollutant Traps)	▪ On Lots 1, 3 and 9
Biofiltration	▪ Proprietary Filterra® bio-retention system within the proposed detention basin between Mamre Road and Lot 1

5.1.2. Stormwater Quantity Management Measures

The proposed detention basin between Mamre Road and Lot 1 is proposed to satisfy the stormwater quantity targets for the AIE Site. The detention basin has been designed to satisfy the following controls adopted in Section 2.5 of the Mamre Road Precinct DCP:

- *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.*
- *13) Stormwater basins are to be located above the 1% AEP.*

- *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.*
- *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.*

The detention basin dimensions and location remain unchanged to that approved under SSD-10448.

5.2. Proposed Water Management Measures

A general description of the proposed stormwater treatment train components is presented in the following sections.

5.2.1. Rainwater Tanks

Rainwater tanks have been adopted to satisfy the following control in the MRP DCP:

- *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.*

The MUSIC model for the AIE site was developed to estimate the rainwater tank volume required to satisfy this control. 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 for toilet flushing has been based on 15 litres per person per day, at a rate of 25 persons per hectare of warehouse roof.
- Non-potable demand for landscape irrigation has been based on 50% of the on-lot landscape area being irrigated at a rate of 600 millimetres per year (equivalent to 6 ML/ha/yr).
- At least 50% of the warehouse roof area would drain to the rainwater tank (or multiple tanks if required based on configuration of roof guttering and downpipes). If a proportion of the roof cannot drain to a rainwater tank, the tank volume would be increased to satisfy the 80% non-potable supply requirement. This would be confirmed during detailed design.

A summary of the rainwater tank volumes adopted in MUSIC is presented in **Table 5**. The rainwater tank parameters for lots 1 and 3 remain unchanged from the SSD-10448-MOD2 application.

Table 5: Rainwater tank volumes adopted in MUSIC

Lot	Total Area (ha)	Roof area to rainwater tank (ha)	Non-potable demand in toilets (kL/day)	Non-potable irrigation demand (ML/year)	Adopted rainwater tank volume (kL)	% of reuse demand met
1	6.19	4.09	1.25	2.01	120	80.1
3	4.29	0.72	0.79	2.44	220	81.4
9	11.31	3.15	2.88	2.66	190	80.8

5.2.2. Ponds for Stormwater Harvesting and Reuse

As an interim measure to satisfy the stormwater flow volume targets for the AIE Site under Stage 1 conditions, large-scale ponds are proposed to provide an effective means of reducing runoff volume from the Site as water would be lost via evaporation over a large area. Ponds can capture and store large quantities of stormwater runoff, while also being relatively easy to maintain.

Under the Stage 1 strategy, three ponds would be required: a retention pond to be incorporated into the detention basin between Mamre Road and proposed lot 1 for storage and transfer of stormwater to evaporation ponds on lots 2 and 8.

Key parameters adopted for the ponds are summarised below in **Table 6**. These ponds will only be required as an interim measure, until the ultimate water management strategy is implemented for the AIE Site.

Table 6: Pond parameters for Stage 1

Parameter	Interim Retention Pond (within detention basin)	Lot 2 Evaporation Pond	Lot 8 Evaporation Pond
Inflow from:	Lot / Warehouse 1, 3 and 9 Estate Roads 1, 2, 3 and 4	Lot 2	Lot 8
Overflow to:	Drainage corridor, approx. 100m upstream of culvert crossing of Mamre Road	Road 1	Road 1
Surface area (m^2)	3,500	30,000	50,000
Permanent pool volume (m^3)	3,500	36,000	60,000
Exfiltration rate (mm/hr)	0.01	0.01	0.01
Evaporation loss (% of PET)	100	100	100
Extended detention depth (m)	0.5	0.4	0.4
Outlet (equivalent pipe diameter)	50	300	300
Adopted reuse (kL/yr) (applied as Monthly Pattern as per *MUSIC Modelling Toolkit*)	15,000 [1]	0 [2]	0 [2]

[1] Reuse from Interim Retention Pond would require pumping to the evaporation ponds on lots 2 and 8 at a rate equivalent to the peak monthly demand as defined in MUSIC.

[2] No additional reuse demand is assumed, on the basis that all demand as been applied to the Interim Retention Pond node in MUSIC.

Stored water from the Lot 2 and Lot 8 Evaporation Ponds would be used to irrigate lots 4, 6 and 7, and part of lots 2 and 8, across a total area of approximately 9 hectares (assuming an average annual irrigation rate of 600mm/year).

A stormwater pumping system would be required within the Interim Retention Pond contained within the bio-retention basin, to discharge stormwater runoff into the proposed evaporation ponds on future lots 2 and 8. The sizing of the pumps and discharge mains would be subject to detailed design.

The ponds and their associated irrigation systems would need to incorporate a series of measures to demonstrate ongoing compliance with the stormwater flow controls and to mitigate potential risks associated with stormwater harvesting and reuse. The design and operation of these systems will comply with the principles and guidance outlined in the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2); Stormwater harvesting and reuse* (Australian Government, 2009). As a minimum it is expected that the system will incorporate the following:

- A pump system to transfer water from the pond to the irrigation area, and potentially a small holding tank to store water upstream of irrigation infrastructure
- Stormwater treatment measures, which may include further filtration or other means. Any required treatment would be subject to detailed design, as well as consideration of the water reuse type, i.e. irrigation.

Multi-channel irrigation controllers including inputs for flow meters, moisture sensors and weather stations may form part of the irrigation system to control, monitor and record irrigation system operation. It is expected that the controller would be a readily available "off-the-shelf" product and would be implemented and operated by the Proponent.

5.2.3. Gross Pollutant Traps

The proposed stormwater treatment train will consist of on-lot Gross Pollutant Traps (GPTs) as a means of primary stormwater treatment. GPTs are designed to capture litter, debris, coarse sediment, as well as some oils and greases. GPTs will be installed on each lot prior to stormwater discharge to the estate-wide stormwater drainage network.

A high-flow bypass for the GPTs would nominally be equivalent to the 4 EY (3-month ARI) peak flow rate discharging to the GPT. Design flows for the GPTs and their final configuration would be confirmed at the detailed design phase.

5.2.4. Filterra® Biofiltration System

The objective of biofiltration systems is to provide a filtering effect when stormwater runoff flows through a vegetation layer and sand and/or gravel filer media to remove pollutants from the runoff. Biofiltration systems generally consist of an open space containing landscaping of native grasses, shrubs and trees with an underlying filter media.

A Filterra® proprietary biofiltration system is proposed to be incorporated into the estate-wide basin located north of Access Road 1, between Mamre Road and proposed Lot 1. The proposed arrangement and surface area of the Filterra® system is consistent with the approved SSDA design.

MUSIC model parameters adopted for the Filterra® system are summarised in **Table 7**.

Table 7: Filterra® biofiltration system parameters

Parameter	Unit	Value
Basin filter area	m^2	1200
Basin surface area	m^2	1200
Extended detention depth	m	0.15
Unlined filter media perimeter	m	0.01
Saturated hydraulic conductivity	mm/hr	3550
Filter depth	m	0.53
TN content of filter media	mg/kg	500
Orthophosphate content of filter media	mg/kg	1.0
Exfiltration rate	mm/hr	0
Base Lined?	-	Yes
Vegetation properties	-	Vegetated with effective nutrient removal plants
Overflow weir width	m	158 (overflow into detention basin)
Underdrain present	-	Yes
Submerged zone	-	No

The Filterra® system will be lined with an impermeable liner, such that subsurface flow from the system will not permeate the underlying soils.

5.2.5. On-site Stormwater Detention (OSD) Design Parameters

OSD is required within the development to mitigate post developed flows to pre-developed flow rates for design storm events between the 50% AEP event (approximately equivalent to the 1.5 year ARI) and the 1% AEP event (equivalent to the 100 year ARI).

The majority of the site currently falls towards the north-west corner and runoff drains into existing culverts underneath Mamre Road. For the post-development case, it is proposed to maintain this outlet and ensure peak flow rates are not increased via the OSD basin and controlled outlets within through the use of low flow orifices and high flow weirs. Refer to Drawing 18-596-C1060 and 18-596-C1061 for the OSD basin details.

The base of the OSD basin will be ameliorated with gypsum and compacted to minimise the potential for infiltration to the underlying sodic soils.

6. Performance Assessment

6.1. 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 basin. 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 to develop a major and minor system drainage design for the proposed development are 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 flowpath 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 flowpaths maintain a minimum of 300mm freeboard to all habitable floor levels.

6.2. Stormwater Quality Modelling

6.2.1. MUSIC Model Parameters

A MUSIC model of the proposed stormwater management strategy has been created to simulate post-development mean annual loads and treatment train effectiveness. MUSIC model parameters including rainfall and evaporation, rainfall-runoff and source node pollutant generation are consistent with the parameters adopted in the *MUSIC Modelling Toolkit – Wianamatta* (NSW DPIE, 2021).

6.2.2. Scenario Modelling

A MUSIC model has been created and simulated for the Stage 1 development scenario for which approval is being sought under the MOD3 application to SSD-10448.

Source nodes for each of the proposed lots and internal estate roads have been adopted based on the Stage 1 and Masterplans. The layouts of the Stage 1 MUSIC models is presented in **Figure 9**.

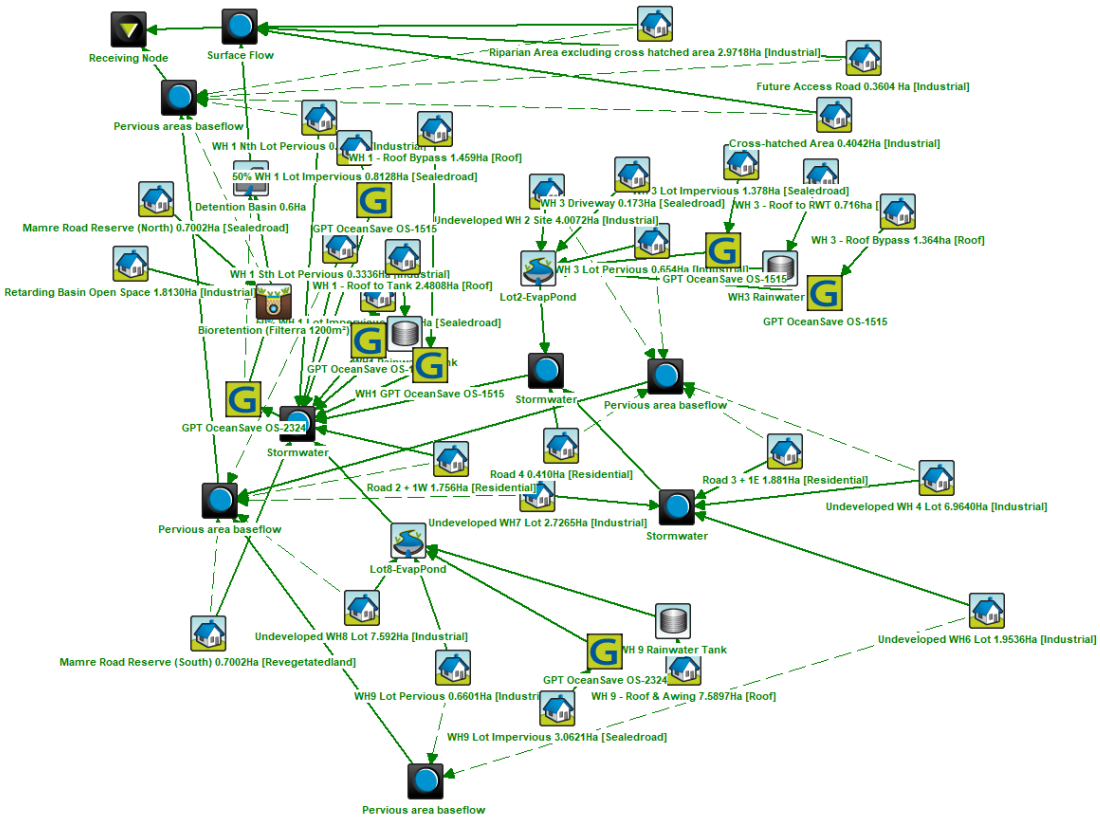

Figure 9: Post-development MUSIC model – Stage 1

6.3. Performance Against Stormwater Targets

6.3.1. Stormwater Quality

MUSIC model results presented as mean annual loads at the receiving node for the Stage 1 development scenario is presented in **Table 8**.

Table 8: Summary of MUSIC modelling results against stormwater quality targets – Stage 1, Option 2

Parameter	Sources Post-Development	Residual Load Post-Development	Reduction (%)	Complies with DCP Option 1 Target?	Mean annual load (kg/ha/yr)	Complies with DCP Option 2 Target?
TSS (kg/yr)	22,600	2,470	**89.1**	No	45.0	Yes
TP (kg/yr)	46.4	13.1	**71.8**	No	0.24	Yes
TN (kg/yr)	355	124	**65.2**	Yes	2.26	Yes
Gross Pollutants (kg/yr)	4,330	0	**100**	Yes	0	Yes

The MUSIC model results presenting allowable mean annual loads demonstrate the proposed stormwater management measures under the Stage 1 development scenario will satisfy the Mamre Road Precinct DCP stormwater quality controls.

6.3.2. Stormwater Quantity

The assessment of the performance of stormwater quantity management for the AIE Site has been undertaken for the Ultimate development scenario only, on the basis that the detention basin will be constructed as part of the Stage 1 works and will provide attenuation of stormwater runoff as the site is progressively developed.

Table 9 indicates the pre-development and post-development peak flow rates for a range of design storm events between and including the 1-year ARI and 100-year ARI at the Mamre Road culverts. Note the modelling of the basin tailwater levels within the Mamre Road culverts have been incorporated based on flood modelling undertaken by Cardno.

Table 9: Pre-development and post-development flows at discharge point to Mamre Road culvert

Design Storm Event	Pre-Development Peak Flow (m^3/s)	Post Development Peak Flow (m^3/s)
1-Year ARI (63.2% AEP)	1.40	1.23
2-Year ARI (39.4% AEP)	4.34	2.10
5-Year ARI (18.1% AEP)	8.54	3.34
10-Year ARI (≈ 10% AEP)	10.1	7.40
20-Year ARI (≈ 5% AEP)	12.1	7.79
100-Year ARI (1% AEP)	15.7	10.8

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.

6.3.3. Stormwater Flow Volume

MUSIC model results demonstrating performance of the proposed stormwater management measures against the stormwater flow targets for Stage 1 are presented in **Table 10**. The results shown confirm compliance with DCP Option 1 (Mean Annual Runoff Volume approach) for the Stage 1 development scenario.

Table 10: Summary of MUSIC model results against stormwater flow targets – Stage 1

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)	1.86	2.0	Yes	n/a
95%ile flow (L/ha/day)	15,053	3000 – 15000	n/a	No
90%ile flow (L/ha/day)	4,980	1000 – 5000	Yes	Yes
75%ile flow (L/ha/day)	1422.2	100 – 1000	n/a	No
50%ile flow (L/ha/day)	63.1	5 – 100	Yes	Yes
10%ile flow (L/ha/day)	0	0	Yes	n/a
Cease to flow	18.5%	10% to 30%	n/a	Yes

The resultant flow duration curve for the Stage 1 development scenario is presented in **Figure 10**.

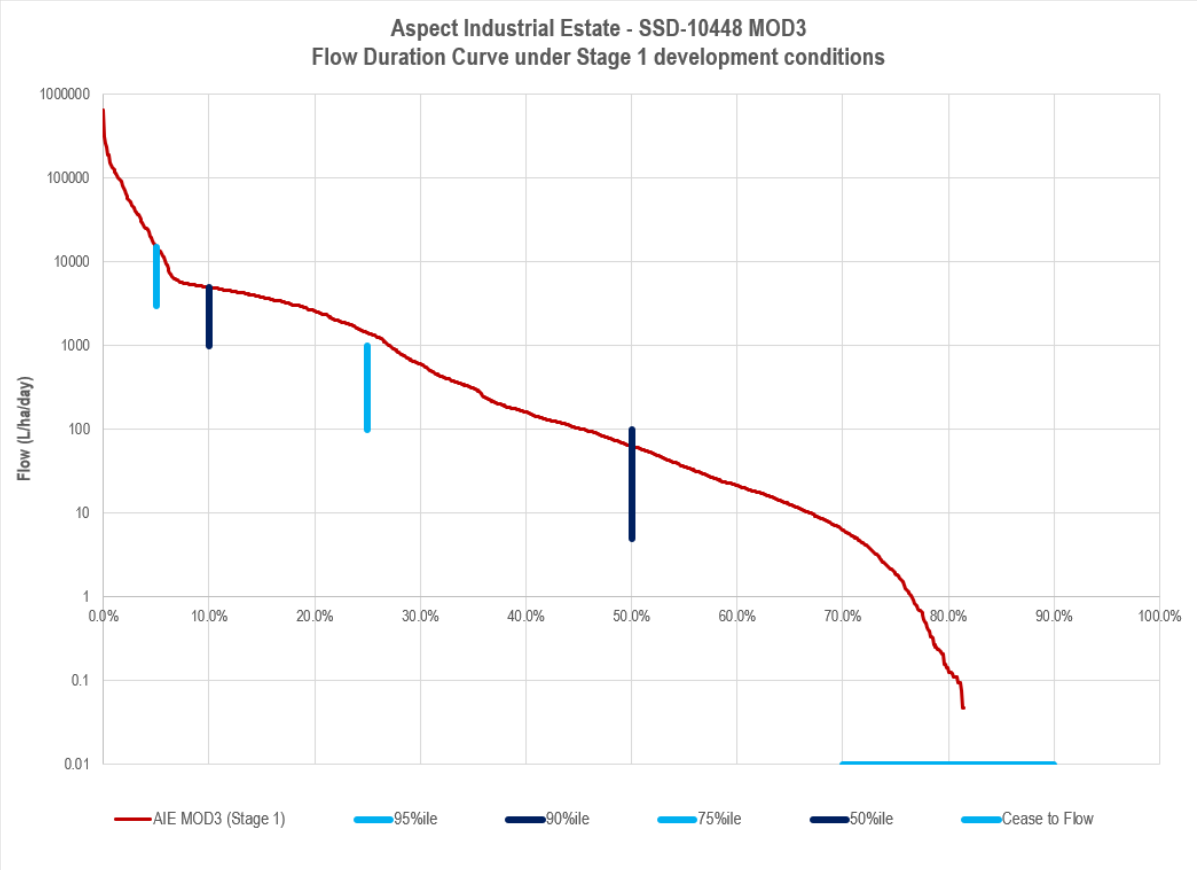

Figure 10: Flow duration curve for the proposed Stage 1 water management measures

The results presented above demonstrate the proposed stormwater management measures that will be implemented for the Stage 1 development scenario will satisfy the DCP stormwater flow targets for the AIE Site per DCP Option 1.

7. Maintenance and Operations

All proposed water management measures that will be located within the AIE Site would be managed and maintained by the proponent. An Inspection and Maintenance Plan will be prepared and lodged with the construction certificate application for the subdivision works once final design details and the extent and layout of all proposed water management measures is confirmed.

It is anticipated that the Inspection and Maintenance Plan would be prepared using current best practice guidance such as *Water sensitive urban design inspection and maintenance guidelines* (Blacktown City Council, 2019) and would describe:

- Each of the functional components of each water management measure
- Expertise required to inspect, maintain and (where necessary) repair or replace components
- Minimum required frequency of inspection, repair or replacement activities
- Inspection and maintenance forms that list all necessary activities and contain a record of activities completed.

8. Conclusion

This WSMP presents a WSUD Strategy that will satisfy the stormwater quality, quantity (peak flow attenuation) and flow volumes targets outlined in the Mamre Road Precinct DCP.

The interim waterway health measures outlined in this WSMP would be provided prior to the issuance of an Occupancy Certificate for the first warehouse within the estate, unless evidence is provided that an agreement is in place to demonstrate that the development will be integrated into the regional stormwater system as required in SSD-10448 MOD2 Condition B6.

9. References

Blacktown City Council, *Water sensitive urban design inspection and maintenance guidelines*, Version 1.0, 2019, https://www.blacktown.nsw.gov.au/Plan-build/Stage-2-plans-and-guidelines/Developers-toolkit-for-water-sensitive-urban-design-WSUD/WSUD-inspection-and-maintenance-guidelines

Eco Logical Australia, *Aspect Industrial Estate State Significant Development Application - Riparian Assessment*, prepared for Mirvac Projects, 2020 https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-10448%2120201110T053852.271%20GMT

PSM, *788-904 Mamre Road, Kemps Creek, Result of Geotechnical Investigations*, reference PSM3739-004L Rev 6, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-10448%2120201110T053418.906%20GMT

at&l

NORTH SYDNEY
LEVEL 7
153 WALKER STREET
NORTH SYDNEY NSW 2060
02 9439 1777
INFO@ATL.NET.AU

PARRAMATTA
SUITE 4 LEVEL 4
17-21 MACQUARIE STREET
PARRAMATTA NSW 2150
02 9068 8517
INFO@ATL.NET.AU

BRISBANE
SUITE A1 LEVEL 20
127 CREEK STREET
BRISBANE QLD 4000
07 3211 9581
INFO-QLD@ATL.NET.AU

MELBOURNE
LEVEL 24
570 BOURKE STREET
MELBOURNE VIC 3000
INFO-VIC@ATL.NET.AU

atl.net.au