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CIVIL ENGINEERING DESIGN REPORT

WALLGROVE BUSINESS HUB

97-151 WALLGROVE ROAD, CECIL PARK, NSW

Revision 4.1

September 2025

henry&hymas

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Table of Contents

Project verification 2

Preface 4

1. Site overview 5

2. Proposed Development 7

3. Site Works 8

   3.1 Bulk Earthworks 8

   3.2 Embankment Stability/ Retaining Walls 9

4. Stormwater Management 11

   4.1 Existing System 11

   4.2 Proposed Stormwater System 12

   4.3 Stormwater Quality 16

   4.4 Stormwater Quality Improvement Devices (SQIDs) 18

   4.5 Water Conservation 20

5. Sediment and Erosion Controls 20

6. Flooding 21

7. Conclusion 31

8. Appendices 32

Appendix A: Civil Engineering Drawings by Henry & Hymas Engineers 33

Appendix B: Site Survey 34

Appendix C: Architectural concept drawings – Site plan 35

Appendix D: Flood Mapping and results by CSS 36

Appendix E: E-mail correspondence with Water NSW 37

Preface

Henry & Hymas has been engaged by Greater Sydney Parklands to prepare this Civil Engineering Report (The Report) to satisfy civil engineering matters in support of the State Significant Development Application (SSDA) for the proposed Wallgrove Business Hub at 97-151 Wallgrove Road, Cecil Park.

The Report aims to provide a summary of key civil engineering design elements of the proposed Development Application:

- General site locality, topography and existing characteristics;
- The proposed site works – earthworks and site access;
- Stormwater management;
- Flooding;
- Sediment and Erosion

The Report has been prepared in conjunction with a set of Civil Engineering Drawings which show the general proposed civil and stormwater design for the development. The drawings are available for review in Appendix A of this Report.

The following principles have been adopted as part of the design process:

- Consideration of design intent in relation to functionality, expectations and requirements of the end user.
- Compliance with relevant Council and relevant authority standards and policies.
- Design coordination with the project team.
- A design philosophy sympathetic to the site constraints, environment, terrain, and landform.
- Retention of existing infrastructure where suitable.

The civil engineering component of the aforementioned project has been designed in accordance with the following Council codes and policies:

- Fairfield City Council's Stormwater Management Policy 2017.
- Fairfield City Council's Policy 4-515 – Specification for Roadwork and Drainage associated with subdivision or other development.
- Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design.

Furthermore, Catchment Simulation Solutions Pty Ltd (CSS) have been engaged by Greater Sydney Parklands to undertake flood modelling and investigate the impact of the proposed development on the local flood behavior under a Development Agreement with Council. The flood modelling and associated flood mapping and results are presented in Chapter 6 of The Report. Interpretation and discussion on the flood modelling and associated flood mapping and results is presented in Chapter 6 of this report.

1. Site overview

The subject site is located within Cecil Park in the municipality of Fairfield City Council and within the Western Sydney Parklands at 97-151 Wallgrove Road, Cecil Park. The site is legally described as Part Lot 25 Sec.4 DP2954 and Part Lot 24 DP1152887 and is approximately 9.889ha in area.

The subject site located within the Parklands is shown in red in the aerial photo at Figure 1 below and is approximately 7.3ha in area. The site is located approximately 500m north of Elizabeth Drive and the proposed M12 Motorway, and to the west of the M7 Motorway and Wallgrove Road. The M7 Motorway from Wallgrove Road is located within 100m south of the site.

A tributary of Ropes Creek is located west of the site. Land to the north and further west of the site is not within the Parklands, and is therefore subject to Fairfield Local Environmental Plan 2013 (Fairfield LEP 2013). This adjacent land is primarily zoned RU4 Primary Production Small Lots under the Fairfield LEP 2013, with a minimum subdivision size of 1ha. There are rural dwellings located within 100m to the west, accessed off Cecil Road, and to the north, accessed off Kosovich Place. This area adjacent to the site is part of the Horsley Park and Cecil Park Urban Investigation Area, with the preferred structure plan (2019) for the land identifying small lot single dwelling housing as the preferred future use. No. 17-19 Kosovich Place, located adjoining the north-west boundary of the site, has development consent for the staged construction of a new Saints Peter and Paul Assyrian Primary School, intended to cater for up to 630 students (SSD-9210).

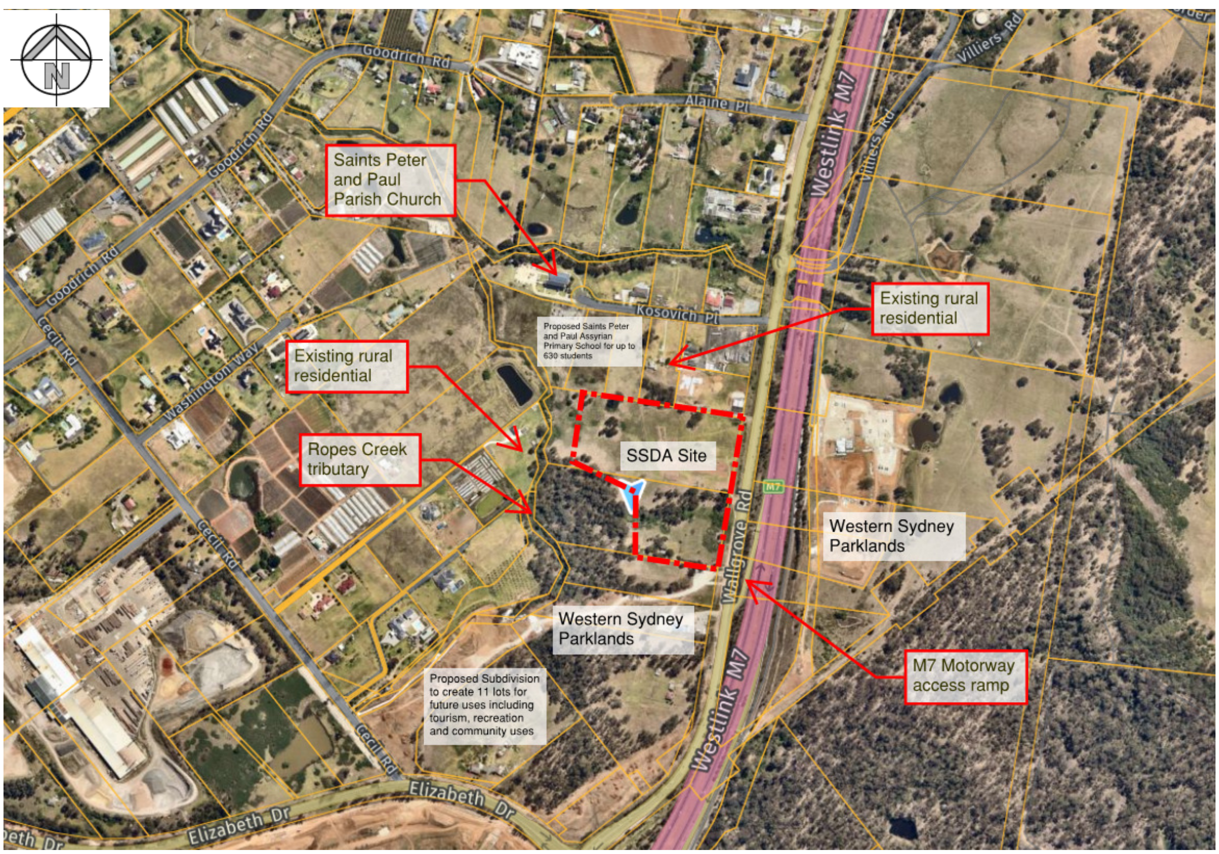


Figure 1: Exiting Site Locality Sketch, Nearmap Images, Annotations by H&H

The existing site is undeveloped and covered in grass and vegetation with the exemption of small sheds and an unsealed access road near the southern boundary of the site. The site generally falls from east to west at an average grade of approximately 5% with 22.8m of fall across the site from the southeastern corner to the northwestern corner. The existing site topography can be seen in the feature survey by Boxall Surveyors (Figure 2 below). The survey plan is included in Appendix B.

Figure 2: Feature Survey by Boxall Surveyors

An existing high voltage 11kV feeder is located in the Wallgrove Road reserve along the frontage of the site. The site does not currently have access to potable water or sewer. A 500mm trunk water main is located on the Wallgrove Road frontage, and two high pressure trunk gas main is located adjacent to the frontage of the site. The site is not currently serviced by any formal stormwater drainage network.

2. Proposed Development

The proposed development is proposed to be subdivided into two lots comprising two tenancies (WH1, WH2) with associated access roads, car parks and loading areas. The main access road (Estate Road) for vehicles near the northern boundary of the site will tie into Wallgrove Road and form a road intersection, and is intended to be dedicated to Fairfield City Council in the future. The proposed car parks and loading areas servicing the warehouse buildings are proposed to be accessed via the proposed internal driveways off the Estate Road.

The total site area is 9.8895ha, among which an approximate area of 7.0298ha is developable. The proposed two warehouses feature a Building Area of 3.6475ha in area with associated carparking, driveway, road and landscaping areas.

The proposed development is intended to be delivered in two stages. Stage One (Subdivision Stage) which is the subdivision works stage aims to provide fully accessible, prepared and benched pads with the associated roads, driveways and infrastructure including the On-site Stormwater Detention (OSD) basins and the stormwater drainage system for the main access road (Estate Road). Stage Two (Lot Development Stage) which is the final construction stage aims to deliver the two warehouse buildings with the associated hardstand areas and car parks. The civil engineering design detailed in this report focuses on Stage One as it is expected Stage Two is to be designed as part of future Development Applications for each individual lot.

Architectural concept plans can be found in Appendix C of this report, and excerpt of the site plan with an indicative staging map is shown below in Figure 3.

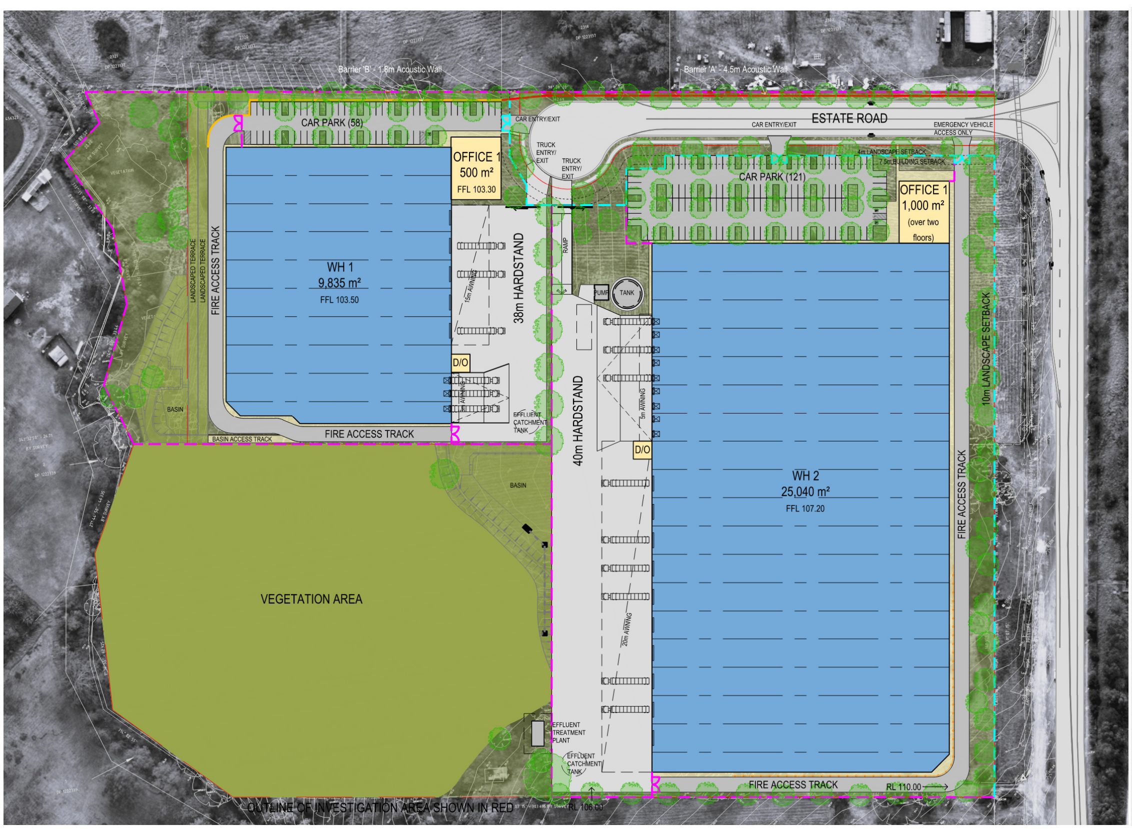


Figure 3: Architectural Site Plan of the Proposed Development. Nettletontribe 2025

3. Site Works

3.1 Bulk Earthworks

Cut and fill earthworks are required to achieve the grades and levels required to form the general proposed site levels and access the development with a focus on minimising earthwork spoil or shortfall. The cut and fill earthworks calculations have been undertaken for Subdivision Stage and Lot Development Stage.

The cut and fill quantities for the subdivision as a whole effectively balance with a minimal site spoil of material in the order of 210m^3. The site spoil is proposed to be stockpiled onsite for future use to form the individual pads which will effectively balance in the masterplan scenario. Benched pad levels have been designed such that each individual lot will balance when future development occurs.

The distribution of cut and fill throughout the site in the Subdivision Stage is shown on civil engineering drawings 230804_DA_BE01, Appendix A. A smaller-scale figure is shown below, Figure 4. Green represents filling and red represents cutting.

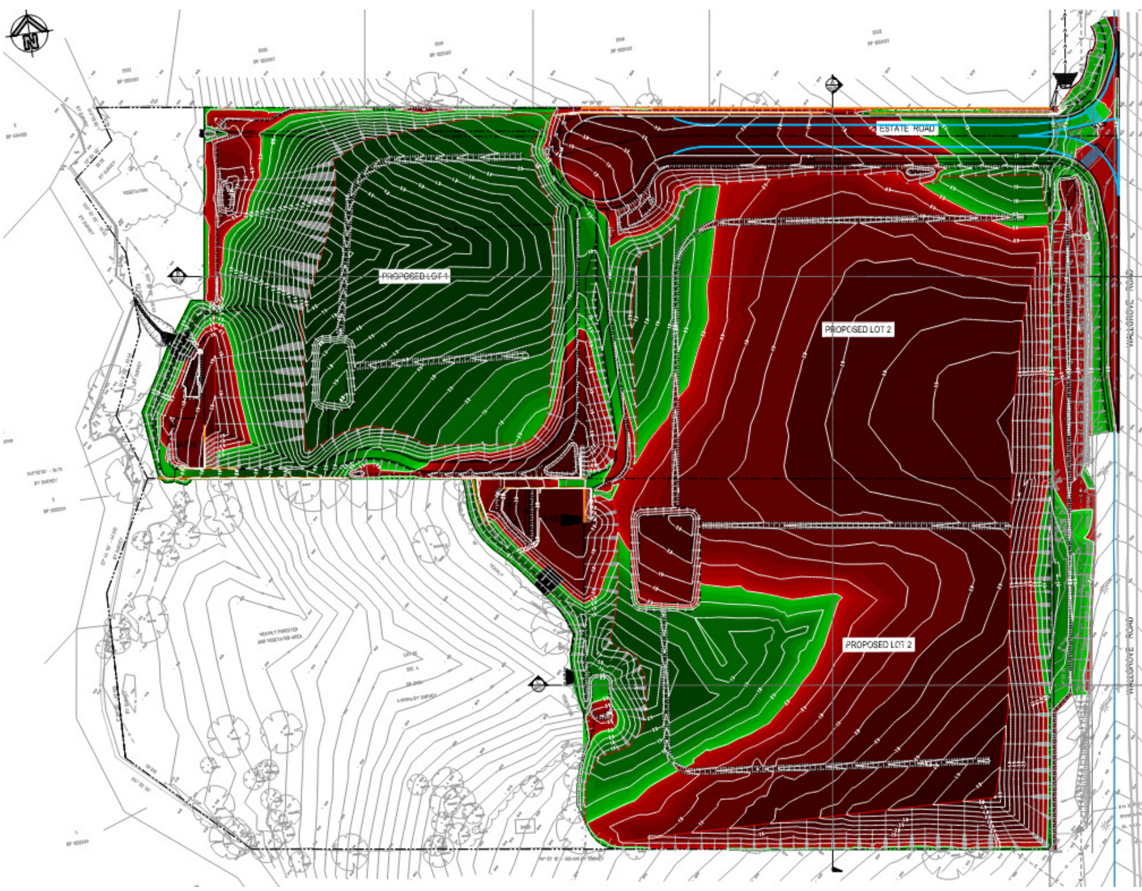


Figure 4: Bulk Earthworks Cutting and Filling Plan – Stage One. Henry & Hymas 2025

3.2 Embankment Stability/ Retaining Walls

Earthworks batters are provided wherever possible as part of the proposed Stage one works. Earthworks batters will be provided at maximum slopes of 1 in 3 as per geotechnical advice by Section 6.3.3 of the Geotechnical Report prepared by Construction Science dated 6th September 202. And where short-term construction batters at maximum slopes of 1 in 1 are implemented, these will be protected from erosion by appropriately installed sediment and erosion control measures.

Given that the focus of this design is the subdivision works phase, retaining walls within the site driven by the internal layout and/or boundary walls easily constructed as part of the individual development of each lot are not detailed in the engineering drawings (however are shown indicatively based on the masterplan design). Additional retaining walls may be required at a later stage but these will be designed as part of any future Development Applications for each individual lot. A preliminary grading and retaining plan has been prepared for a typical lot layout for the individual lots and is shown on engineering drawing C150. The plan shows a typical retaining and grading strategy for a future lot.

Whilst earthworks batters will be provided wherever possible, retaining walls will be required in some instances where there are significant level changes including where stormwater structures such as basins are proposed. Additional retaining walls will be required to provide interim suitable access locations to the proposed lots or stormwater infrastructure delivered in Stage One. These walls are predominately located adjacent to the access roads, and the OSD basins which are discussed in Chapter 4 below. The locations and heights of these retaining walls are shown on the engineering drawings located in Appendix A. Retaining walls are required to form compliant grading for the proposed access road, reinforced core-filled blockwork walls are proposed to provide a ‘maintenance free’ retaining solution for all retaining elements within the public road reserve.

3.3 Road Works

The main access road (Estate Road) that is intended to be dedicated to Fairfield City Council in the future was designed in accordance with Council’s Policy No. 4-515: Specification for Roadworks and Drainage associated with subdivision or other development (The Policy), and Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design. The key design elements are summarised as follows.

Typical Road Section

A 21.4m wide road reserve has been applied with a 14.4m wide road carriageway. The road geometry and grading has been designed in accordance with Council’s Standard Drawing S-1 ‘Typical cross section for subdivision roads’ as well as relevant provisions of Austroads. The road cross section was widened from the Council’s typical section in response to agency comments to increase the through-lane to 4.2m in width and provide a min 3.0m wide packing back to support larger vehicles. Refer to the civil engineering drawings C111 in Appendix A for more details.

Indicative Pavement Thickness Design

Based on Table 1.0 of The Policy, a design Equivalent Standard Axles (ESAs) of 5×10^6 for 20-year design life was used in pavement thickness design. It should be noted that the design ESA for the development can be amended for specific traffic data specific to the subject site.

According to the Geotechnical Report prepared by Construction Science dated 6th September 2023, it is anticipated that a design CBR of 3% would need to be adopted. Subgrade remediation such as subgrade replacement using crushed rock and lime stabilisation would likely be necessary in weak areas identified in the Geotechnical Report. It should be noted that given the anticipated significant excavation work, treatment of encountered weak material is subject to further geotechnical assessment following availability of construction plans to review significance in relation to depth and proximity of weak layers to the proposed development. It is also recommended that additional CBR testing is undertaken following the bulk excavation works to determine the design CBR more accurately and the suitable subgrade treatment method.

The pavement thickness design was undertaken based on Section 2.1.4 of The Policy, the design ESAs mentioned above, as well as relevant provisions of Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design.

The proposed preliminary pavement profiles are as follows:

- Wearing course - 60mm thick asphaltic concrete (AC) comprising a 40mm AC14 layer followed by a 20mm AC10 layer.
- Base course - 200mm thick DGB20 (from approved sources only)
- Sub-base course - 200mm thick DGS40 (from approved sources only).
- Subgrade – lime stabilised subgrade to a depth of 300mm (assuming minimum 5% design CBR is achieved by stabilisation) in cut locations or import of select fill to effective 5% CBR in fill locations.

To reduce the overall pavement thickness, lime stabilisation should be considered where the bulk level cuts into the existing surface. Additionally, due to the extent of filling onsite, select fill can be imported to site to create an effective CBR of 5% or greater.

4. Stormwater Management

4.1 Existing System

The existing site topography shown in the survey plan indicates that majority of the site falls towards the existing tributary of Ropes Creek along the western site boundary, with the exemption of the grassed area in the proximity of the northeastern corner of the site falling towards the neighbouring site (2322 DP 1223137) and Wallgrove Road (Figure 5 below). Figure 5 also indicates that the local depressions within the site area form three natural valley, conveying majority of the site stormwater runoff to the tributary of Ropes Creek under the pre-development scenario. In-ground stormwater systems are not present onsite as indicated by the survey plan in Appendix B.

In addition, it can be seen from Figure 5 that stormwater runoff from a portion of the road reserve of Wallgrove Road fronting the subject development site drains towards the site as indicated by the topography. The majority of Wallgrove Road drains north due to the existing cross fall which prevents stormwater from entering the subject site.

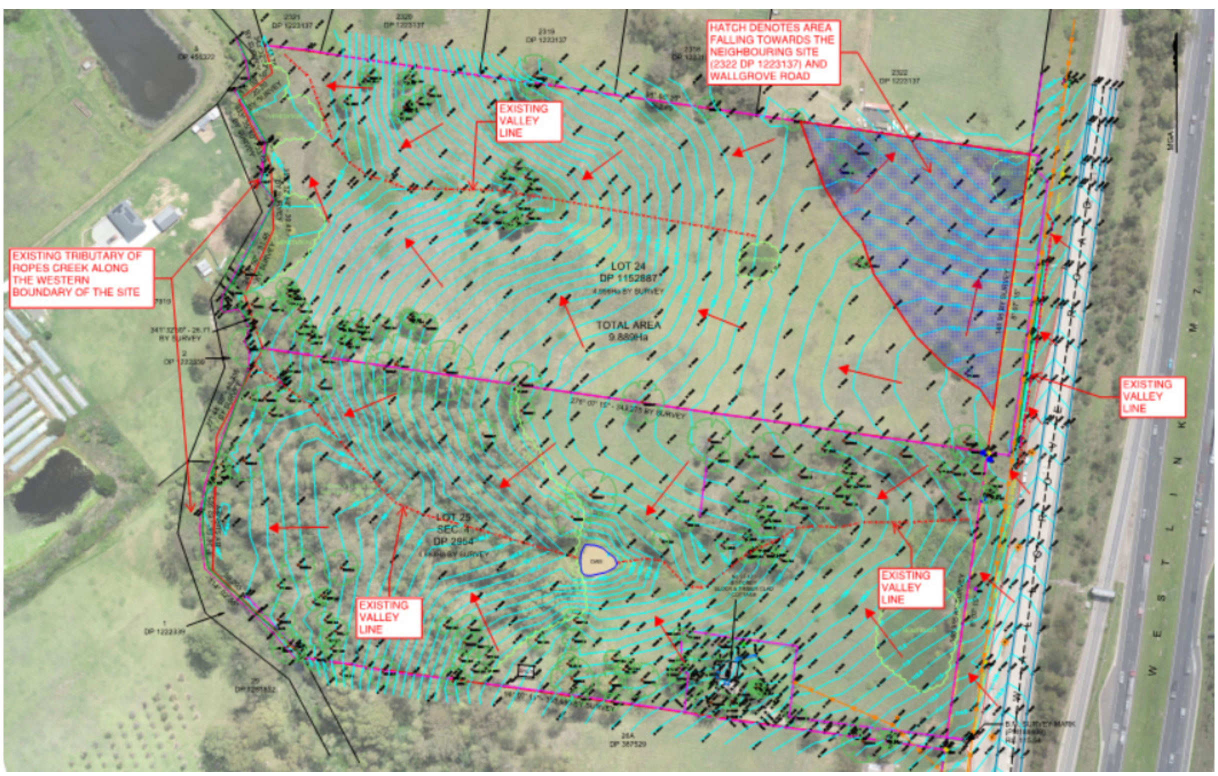


Figure 5: Feature Survey by Boxall Surveyors, Annotations by H&H

4.2 Proposed Stormwater System

The proposed stormwater management system responds to the architectural layout and incorporates the natural topography and site constraints to produce a cost-effective layout that meets best industry practices. The proposed stormwater management system has been designed to reduce the overall impact of the development on the existing onsite and surrounding stormwater systems and flow regime.

Onsite Stormwater Detention (OSD) will be provided to control the peak stormwater flows from the site by temporarily detaining stormwater from major storms in two above ground basins which are then discharged to the downstream drainage system (existing tributary of Ropes Creek) at a controlled rate. In accordance with Fairfield City Council's Stormwater Management Policy 2017, OSD will be provided to control stormwater runoff from the subject development site such that, maximum (Permissible Site Discharge) PSD of 78L/s/ha for the 5, 15, 30, 60, 180, 360 and 540-minute duration storms for the 5 to 100 year ARIs for the developed site is not exceeded. The proposed OSD system for the subject development comprises two above ground basins which are detailed in the civil engineering drawings in Appendix A.

In Stage One (Subdivision Stage), stormwater runoff from the prepared pad sites of Lot 1 and Lot 2 is proposed to be diverted to temporary sediment basins within the sites via catch drains, and later drain to the OSD basins which ultimately discharge to the existing tributary of Ropes Creek to the west of the site. The OSD basins are proposed to be constructed as permanent basins which cater for the future Stage Two development (Lot Development Stage). Also, the portion of the site that drains towards the neighbouring site under the pre-development scenario is proposed to be developed into sealed access road, and has been designed to drain towards the tributary of Ropes Creek at the back of the site so as not to adversely impact on the neighbouring property. Refer to the civil engineering drawings in Appendix A for details and locations of the proposed temporary basins and catch drains.

In Stage Two (Lot Development Stage), the stormwater management system for the future development is intended to collect all concentrated flows from future impervious areas such as roofs, car parks, loading areas and driveways as well as stormwater runoff generated by pervious areas such as landscaping. The design of the stormwater system for Stage Two is subject to separate Development Applications for each individual lot, however, the downstream infrastructure delivered as part of Stage One has been appropriately design (layout and sizing etc.) for the masterplan layout based on indicative lot layouts reflective of the current development standard.

The site stormwater drainage system and the proposed OSD system have been designed based on two main sub-catchment areas which are designed to be generally consistent with the existing catchments and maintain existing downstream drainage depressions which are vegetated. The western catchment area including future warehouse WH1 and the associated pavement and landscaped areas is in the order of approximately 2.0079ha. The eastern catchment area in the order of approximately 4.5556ha includes future warehouse WH2 and the associated pavement and landscaped areas. OSD basins have been designed such that the overall site discharge from the site as a whole is in accordance with the PSD requirements from Fairfield City Council. Refer to Figure 6 below for details of the prepared stormwater catchment plan.

Furthermore, flood modelling described in Chapter 6 in this report has been undertaken by Catchment Simulations Solutions (CSS) to assess the impact of minor variations to the existing predeveloped catchments i.e. existing portion of land previously draining north which is proposed to be directed to the west (same overall catchment being the Ropes Creek Tributary).

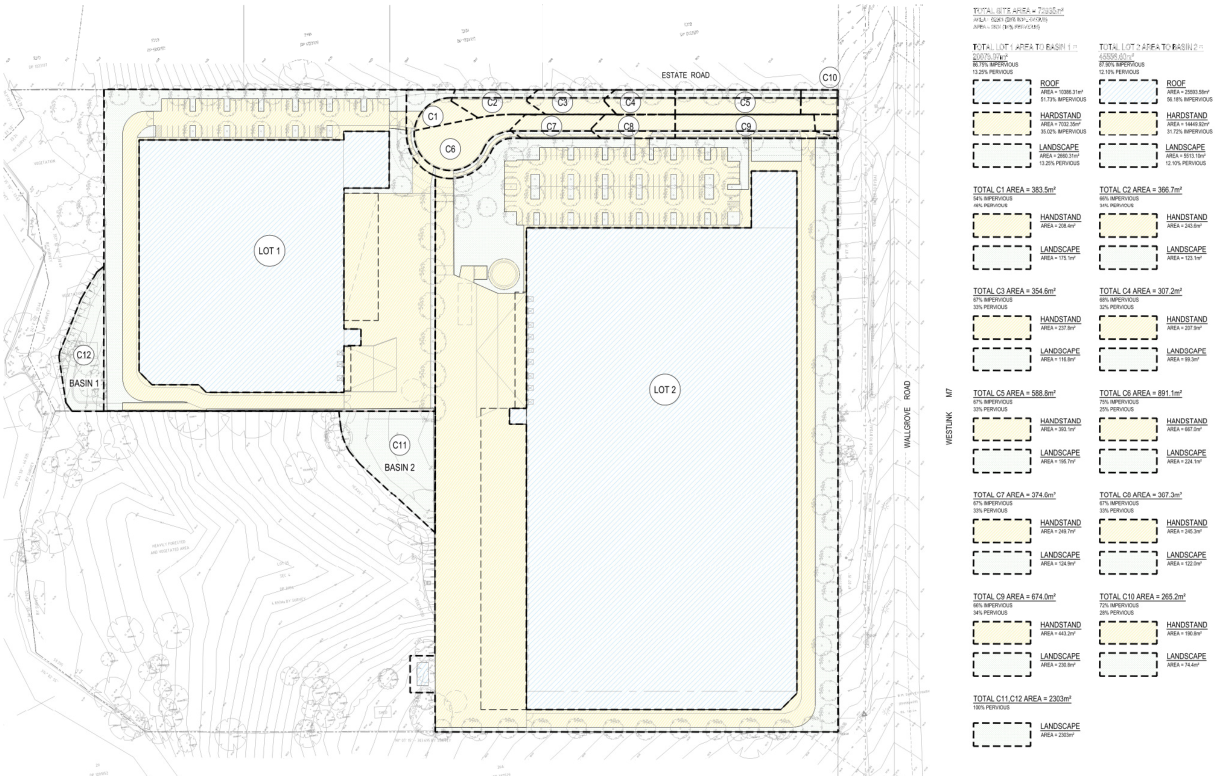


Figure 6: Stormwater Catchment Plan, H&H 2025 (drawing no. 230804_DA_C250)

Figure 7 below shows the proposed locations of the two OSD basins. Basin 1 (760m^3) which has been designed to cater for the western catchment area and the site area of warehouse WH1 is located to the west of the future warehouse building of WH1. Basin 2 (1988m^3) which has been designed for the eastern catchment area and the site area of future warehouse WH2 is located to the west of the WH2 Hardstand. Both basins are to be constructed from earthen batters, and where required, retaining structures. Details and specifications of the proposed OSD system can be found in the civil engineering drawings, Appendix A. It should be noted that due to the constraints in levels, flooding and adjacent creek Basin 1 has limited volume capacity. Basin 2 was increased in volume to compensate for the Basin 1 with the overall PSD for the development within Council's requirements.

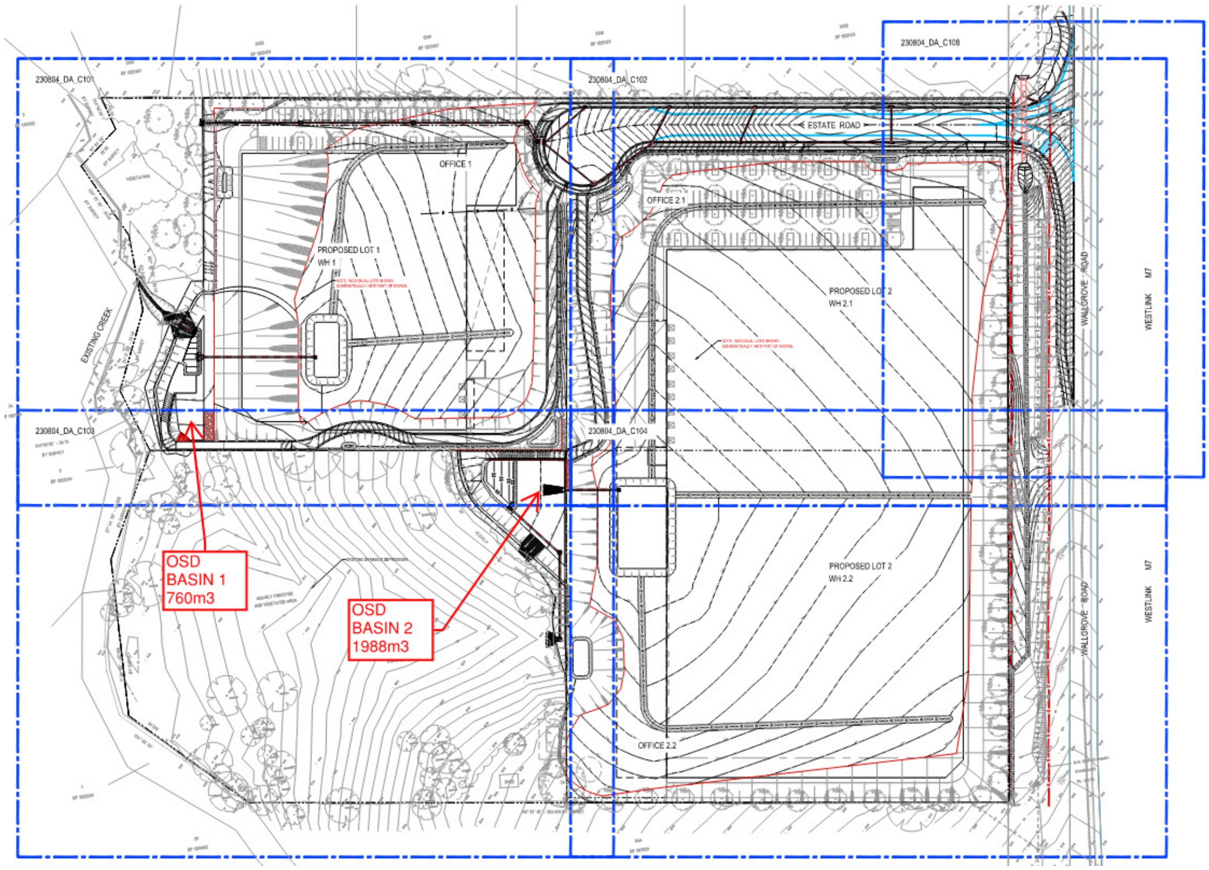


Figure 7: Civil Engineering Site Plan, H&H 2025

DRAINS modelling software and analysis methods recommended by 2019 edition of Australian Rainfall and Runoff were used to ensure that Council's PSD requirements are met by the attenuation of run-off flows provided by the proposed OSD basins. Table 1 below summarises the site discharge flow rates in the 20-year and 100-year ARI storm events.

ARI	Western catchment discharge flow rate (OSD Basin 1) (L/s)	PSD – Western catchment (L/s)	Eastern catchment discharge flow rate (OSD Basin 2) (L/s)	PSD – Eastern catchment (L/s)	**Total discharge flow rate (L/s)**	**Total PSD (both catchments) (L/s)**
20	196	156.6	284	355.3	**480**	**511.9**
100	195	156.6	316	355.3	**511**	**511.9**

Table 1: Site discharge flow rates for OSD sizing

By providing the OSD system, and from review of Table 1 above summarising the discharge flow rates, it is evident that the PSD requirements have been met to the satisfaction of Fairfield City Council's Stormwater Management Policy 2017.

The DRAINS file submitted for assessment is detailed below:

- 230804_Site drainage [03]

The OSD basin outlets have been designed to be coordinated with the existing site topography. Basin outlets are proposed to be installed with rip rap scour protection. The outlet of OSD basin 1 is proposed to discharge to the existing watercourse along the western site boundary which is a tributary of Ropes Creek via a proposed rip rap lined drainage channel. The eastern catchment (i.e. outlet of OSD basin 2) has been oriented to maintain environmental flow in existing drainage depression (natural valley line) within the undeveloped area which ultimately discharges to the same watercourse. The flood model has been developed to incorporate the sizes and locations of the stormwater basin outlets to ensure the discharge locations do not adversely impact the existing flow regime. Refer to Chapter 6 for further details. The 20-year ARI and 100-year ARI flood levels at the locations in the proximity of the discharge locations of the OSD basins have been adopted as the tailwater levels in the DRAINS model.

4.3 Stormwater Quality

It should be noted that the subject development site is located within the Rural Zone as denoted by Figure 8 – Stormwater Management Zones of Fairfield City Council's Stormwater Management Policy 2017. As stated by the policy, stormwater quality improvement is not required within the Rural Zone. However, given the nature of the proposed development which is classified as industrial and involves the development of an existing green field site into impervious areas such as pavement and roofs, stormwater quality treatment is proposed for the development.

Pollution and contamination dislodged or inherent to and in stormwater and stormwater run-off from urban developments have the potential to damage the ecology and health of local creeks and waterways. As such stormwater quality improvement devices (SQIDs) that aim to minimise pollution during construction and operation of the development have been incorporated into the overall stormwater management design. These devices have been sized, specified and designed in accordance with Fairfield City Council's Stormwater Management Policy 2017.

The performance of the stormwater quality improvement devices (SQIDs) in mitigating pollution from urban development can be assessed by simulating a post developed pollutant reduction rate for the stormwater system. In accordance with Fairfield City Council's Stormwater Management Policy 2017 the development must achieve a minimum percentage reduction of the post developed average annual loads of pollutants in accordance with the Table 2 below:

Pollutant	% Post development pollutant reduction targets
Gross Pollutants (GP)	90
Total Suspended Solids (TSS)	80
Total Phosphorous (TP)	55
Total Nitrogen (TN)	40

Table 2: Post development pollutant reduction targets – Fairfield City Council

To better determine the conceptual design of the water quality treatment trains and to ensure the treatment trains satisfy the reduction parameters outlined in Table 1, a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) was developed.

The MUSIC model was set up with the rainfall station, time period data, evapotranspiration data, source node data, treatment node data and run-off parameters provided in Council's Policies.

SQIDs proposed for the development site are provided in a treatment train which consists of bio-retention basins and primary screening (Gross Pollutant Traps (GPTs) or pit baskets). The proposed bio-retention basins are in the form of combined OSD/Bio-retention basin which is incorporated in the two proposed OSD basins discussed in Section 4.2 of this report. The two bio-retention basins and the retaining walls required around the perimeter of the basins are proposed to be delivered as part of the OSD basin constructions in Stage One (Subdivision Stage), so that the combined OSD/Bio-retention basins are online servicing lot 1 and lot 2 from Stage One onwards. The Primary treatment are to be installed within the new stormwater pits as part of the Stage Two (Lot Development Stage) works. Pit baskets have been utilised in the MUSIC modelling however, the pit baskets can be substituted by Gross Pollutant Traps (GPTs) subject to future design of the individual lots.

Areas not draining to the proposed water management basin, such as the access road reserve, will be treated for gross pollutants, suspended solids and hydrocarbons by a Gross Pollutant Trap (GPTs). The GPT which do not drain to the bioretention filter media will be fitted with an oil battle to remove hydrocarbons within the stormwater run-off generated by developed site areas. Due to the intention to dedicate the Estate Road to Council, it is understood a GPT is preferable to other treatment methods due its compliance with Councils pre-existing maintenance methodology. Under the Subdivision Stage scenario, sediments are prevented from entering the bio-retention basins by the provision of several sedimentation basins provided for the prepared pads.

A schematic of the MUSIC model can be viewed below in Figure 9. The schematic illustrates the interrelationship between source nodes (catchments) and treatment nodes (water quality treatment measures) for the catchment. The resultant reduction in post developed pollutants calculated by the simulation is presented in Table 3 below. With the implementation of the following stormwater quality improvement (SQIDs) devices, the resultant post developed pollutant loads have been reduced below the reduction target for all targeted pollutants. Detailed drawings and specifications of the proposed SQIDs can be found on the civil engineering drawings included in Appendix A.

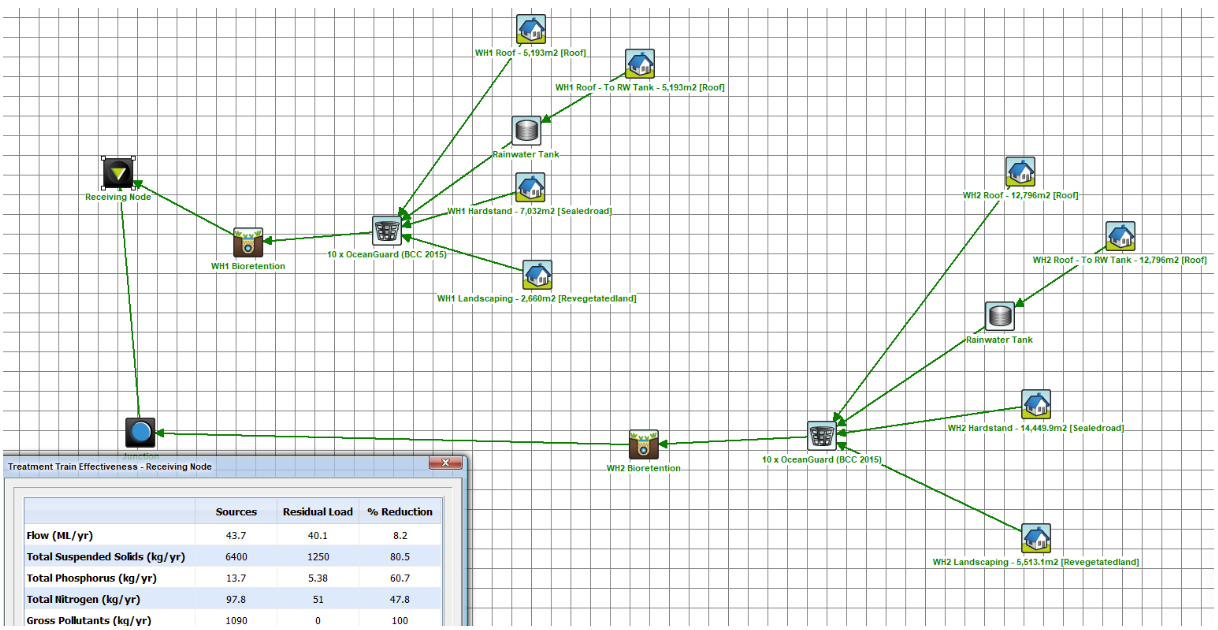


Figure 9: MUSIC modelling results

Pollutant	% Post development pollutant reduction targets	Achieved % Post development pollutant reduction targets
Gross Pollutants (GP)	90	100
Total Suspended Solids (TSS)	80	80.5
Total Phosphorous (TP)	55	60.7
Total Nitrogen (TN)	40	47.8

Table 3: Summary of Pollutant Reduction Targets Achieved

The following MUSIC model prepared for the proposed development site is detailed below:

- 230804_MUSIC MODEL[03].sqz

4.4 Stormwater Quality Improvement Devices (SQIDs)

Primary Treatment - Pit Baskets and Gross Pollutant Traps

As part of an effective treatment train for the site system, selected areas of the development or targeted removal zones (TRZs), will be pre-treated via passive screening pit baskets. To form a site-wide primary treatment system the TRZ for the development encompasses all external areas not beneath roofs and exposed to surface run-off. Target zones, mostly comprising of highly trafficked and hardstand areas that have suitable hydraulics to drain through the basket, are subject to higher instances of pollution and litter and stand most to benefit from effective pre-treatment and have been modelled in MUSIC.

The pit basket proposed to be used is the “200-micron mesh Oceanguard” pit basket filter by Ocean Protect. Due to the preliminary nature of the analysis a nominal 10-15 pit baskets are proposed for each lot to provide effective pre-treatment for the modelling. It is understood this nominal quantity is subject to the layout and design of each development stage. The pit baskets can be substituted by GPTs subject to future design of the individual lots. A typical pit basket filter is shown in Figure 10 below.

Primary treatment in the form a GPT is proposed to be provided for the Estate Road. The recommended GPT is the Rocla CDS Unit 0708. The GPT is to assist in the water quality treatment for the main access road by capturing gross pollutant, litter, grit, sediment and associated soils.

The Rocla CDS is a Gross Pollutant Trap designed to capture and retain gross pollutants, litter, grit, sediments and associated oils, utilizing indirect screening technology. A typical Rocla CDS GPT is shown in Figure 11 below.

Secondary treatment – Bioretention Filter Basin

To meet the water quality requirements, and to successfully implement a treatment train approach, a bioretention basin is located at the end of the major stormwater drainage lines for each lot. Bioretention systems are commonly used in Sydney to meet stormwater quality targets and are often preferred due to cost and integration with surrounding landscape. Bioretention systems are vegetated soil media filters, which treat stormwater by allowing it to pond on the vegetated surface, then slowly infiltrate through the soil media. Treated water is captured at the base of the system and discharged via outlet pipes. A typical cross-section of a bioretention system is shown in Figure 12. The natural media filtration targets the removal of gross pollutants, suspended solids, targeted nutrients and hydrocarbons within the stormwater run-off generated by the developed site areas and is proposed to be used in this development.

The bioretention basins are proposed to include a partially permanently saturated transition zone to increase the longevity and establishment of biofilm, in addition to ensuring adequate water sources for planted macrophilic plant species.

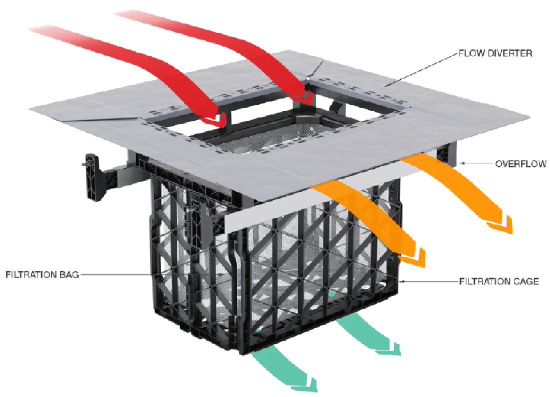
Proposed bioretention basins are specified and modelled with appropriate depth of filter media, transition and drainage layers as outlined in typical bioretention filter detail in Fairfield City Council’s WSUD Stormwater Management Policy 2017.

The bioretention filter area required for each basin (lot) is listed below in Table 3.

	Bioretention filter surface (m²)
Basin 1 (Lot 1)	70
Basin 2 (Lot 2)	180

Table 3: Summary of Bioretention filter surface area per basin

The maintenance of the SQIDS is important to ensure the effective removal of pollutants throughout the life of the asset. As such, a maintenance schedule will be required to be detailed at the Construction Certificate stage.



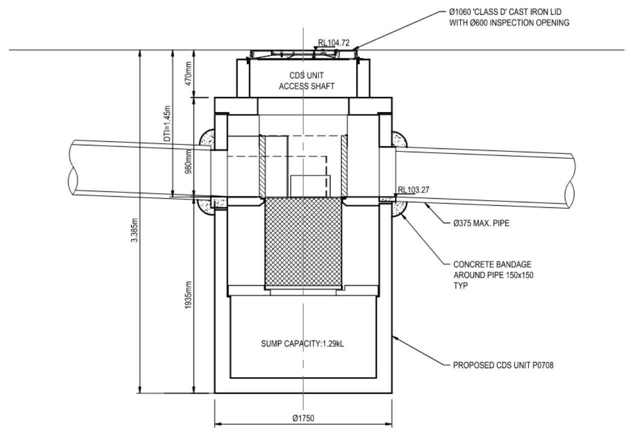


Figure 10 and 11: OceanGaurd pit basket filter (Ocean Protect) (left), Rocla CDS Unit 0708 GPT filter (Rocla) (right)

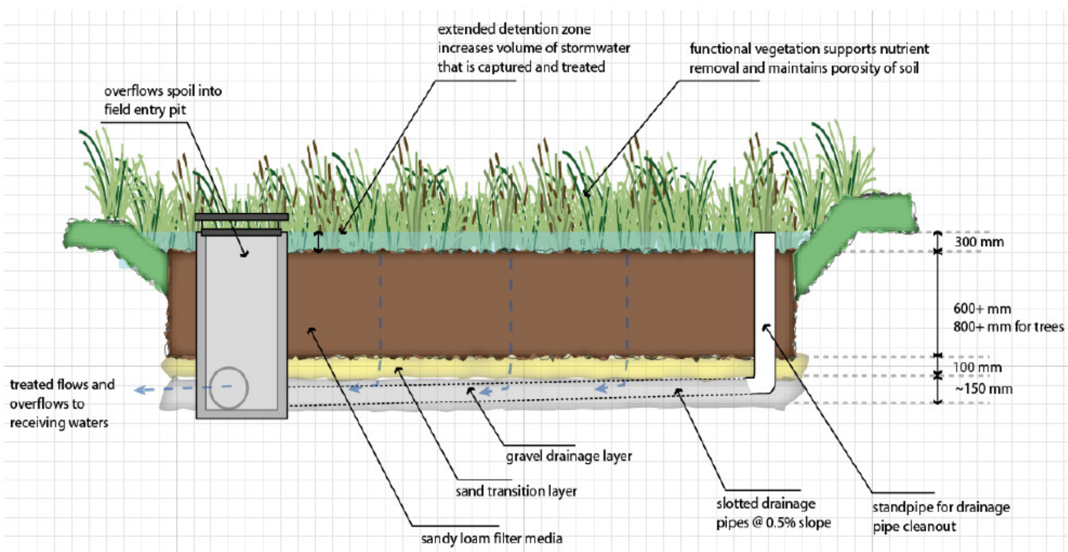


Figure 12: Bioretention filter cross section (Water by Design, 2009)

4.5 Water Conservation

Given the scale of the development lots, the nature of their use and the unknown arrangement of each lot (subject to individual Development Application), an industry standard water conservation strategy for industrial/commercial developments is proposed to meet a minimum of 80% of the non-potable water demand on site through rainwater. Water demand must allow for internal rainwater reuse at the rate of 0.1 KL/day per toilet/urinal and external landscape watering (excluding turf areas) at rate of 0.4 kL/year/m^2 as PET-Rain.

As water reuse will likely form part of any effective water quality treatment train for the proposed development, rainwater tanks that harvest and store rainwater for have been included in the water quality modelling for the site. Using MUSIC water quality modelling software, a rainwater tank size that satisfies 80% of the non-potable water demand of the development was estimated. Several assumptions are to be made when sizing the rainwater tanks. These assumptions are fundamental for determining the water demand of each rainwater tank, and thus the storage volume. These assumptions include;

- 50 - 75% of the roof area of a specific roof catchment will drain to the rainwater tank;
- 75 - 100% of landscaped area within the development area (i.e. Lot 1 and Lot 2 site areas) will be drip irrigated using harvested water. Remaining landscaped areas that are undisturbed by the development throughout the site are assumed to not require irrigation;
- All toilets/urinals within the future development lots are proposed to operate with harvested water;
- Rainwater reuse is to be in accordance with the intent of Council’s policies.

Water quality MUSIC modelling was performed in accordance with the MUSIC modelling guidelines and the above assumptions listed above. The MUSIC modelling established that a rainwater storage volume of 150kL is required for Lot 1 and 60kL for Lot 2. The rainwater tanks satisfy approximately 80% of non-potable demand for the subject site.

It should be noted that the individual rainwater tank volumes can be increased/ decreased based on the catchment draining to the tank and the final configuration of the development lot.

5. Sediment and Erosion Controls

During construction, appropriate sediment and erosion control measures need to be implemented to ensure that downstream receiving waters are not adversely impacted as a result of construction activities. The engineering drawings 230804_SSDA_SE01-SE02 (Appendix A) by Henry & Hymas outline appropriately designed and detailed measures to mitigate against this risk. These measures have been designed in accordance with the requirements of the publication “Landcom – Managing Urban Stormwater - Soils and Construction, Volume 1, 4th Edition March 2004” and Fairfield City Council requirements. These measures include temporary sediment basins, catch drains, sediment fences, stabilised site access, haybale filters, and mesh and gravel inlet filters.

6. Flooding

As previously noted, the site is located adjacent to a tributary to Rope Creek which lies to the north of the development. The subject site is identified at risk of flooding as identified in the 'Rural Area Flood Study Ropes, Reedy & Eastern Creeks' flood study prepared by BMT dated November 2013. Flood mapping indicating the subject site and the 1% Annual Exceedance Probability (AEP) flood event flood extent, depth and level is shown below in Figure 13. Figure 13 indicates portions of the site are subject to flooding although it is evident that floodwaters are generally confined to the existing tributary and corresponding contributing drainage depressions. It is recognised that a Flood Impact Assessment is required for the development to ensure the proposed development has adequate immunity to flooding and to assess the developments impact on local flood behavior, if any.

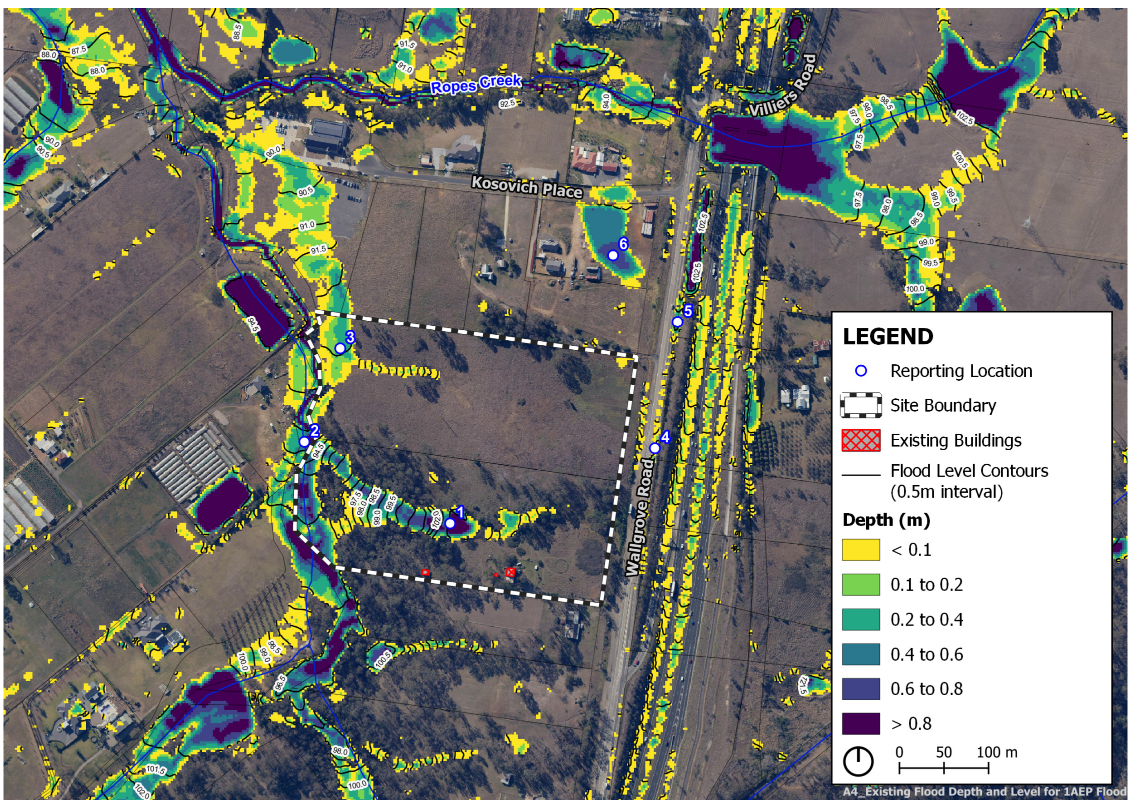


Figure 13: Existing Flood Depth and Level - 1% AEP

Specialist flood engineers, Catchment Simulations Solutions (CSS), were engaged to undertake a detailed Flood Impact Assessment for the development. CSS were specifically engaged to undertake the assessment due to their understanding of the Ropes Creek Catchment and their ongoing involvement with Council as a preferred flood expert. It is understood that CSS has entered into a development agreement with Council and as such will provide a copy of the flood extent/depth and hazard mapping as well as 'difference' mapping which shows the development's impact of existing flood behavior (if relevant) directly to Council. It is also understood a copy of the Hydraulic Model will be provided to Council's engineers to assess the configuration and parameters of the model. A detailed summary of the flood mapping produced by CSS is presented below including information about the model, its configuration, and key results.

A discussion of the flood mapping produced by CSS is also provided below.

The modelling program TUFLOW was utilised to develop a hydraulic model that simulates existing flood conditions and the impact the development will have on existing flood behavior. The assessment has included detailed modelling of the local reaches of the local floodplain to establish existing design flood conditions. The establishment of design flood conditions largely serves two objectives:

- Ensuring appropriate development design to achieve desired flood immunity standard; and
- Establishing baseline conditions for the quantification of potential impacts due to changes to the existing flooding regimes and to assess the potential impact of the proposed development.

Flood Hazard (literature review)

The Flood Hazard Guideline 7-3 of the Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR, 2017) represents the current industry best practice with regards to defining flood hazard. The guideline considers a holistic approach to consider flood hazards to people, vehicles and structures. The flood hazard level is determined on the basis of the predicted flood depth and velocity. This is conveniently done through the analysis of flood model results. A high flood depth will cause a hazardous situation while a low depth may only cause an inconvenience. High flood velocities are dangerous and may cause structural damage while low velocities generally have no major threat. The Flood hazard is expressed as the product of flood velocity and depth or Flood Velocity x Depth product.

TUFLOW Model Configuration

The hydraulic model for the development utilised Fairfield City Council's Rope Creeks TUFLOW model and builds upon the updated "existing conditions" flood information that was provided by Council's Drainage Engineers.

The post-development modelling included the following updates to the existing condition modelling:

- Inclusion of the design terrain model (refer engineering drawings for proposed levels). The design terrain model relates to the masterplan scenario i.e. completed individual lots.
- Inclusion of the proposed stormwater pit and pipe system. This included the on-site stormwater system that drains the impervious sections of the site into Ropes Creek, as well as the box culvert that drains a roadside swale beneath the proposed driveway crossover.
- Inclusion of proposed buildings as flow obstructions.
- Updates to hydraulic roughness and imperviousness to reflect the new hardstand areas.

The updated model was then used to re-simulate the design 5% AEP and 1% AEP floods along with the Probable Maximum Flood (PMF) for post-development conditions.

TUFLOW Modelling Results

Flood mapping indicating flood level/depth/extent, flood velocity and 'Velocity x Depth product' mapping for the proposed 1% AEP flood event is shown in Figure 14 to 16 below. 'Difference mapping', indicating the difference between flood level/depth/extent, flood velocity and 'Velocity x Depth' between the existing and proposed scenarios in the 1% AEP flood event is shown in Figure 17, 18 and 19 below. Additional flood extent/depth mapping and 'Velocity x Depth product' mapping for the 5% AEP flood event and Probable Maximum Flood (PMF) event is included in Appendix E of this report. Full scale mapping for the 1% AEP scenario (Figures 14 -16) is also included in Appendix E of this report. Tables 4 - 7 which show flood data and key reporting locations are shown below. The key reporting locations are also shown below in Figures 14 – 19.

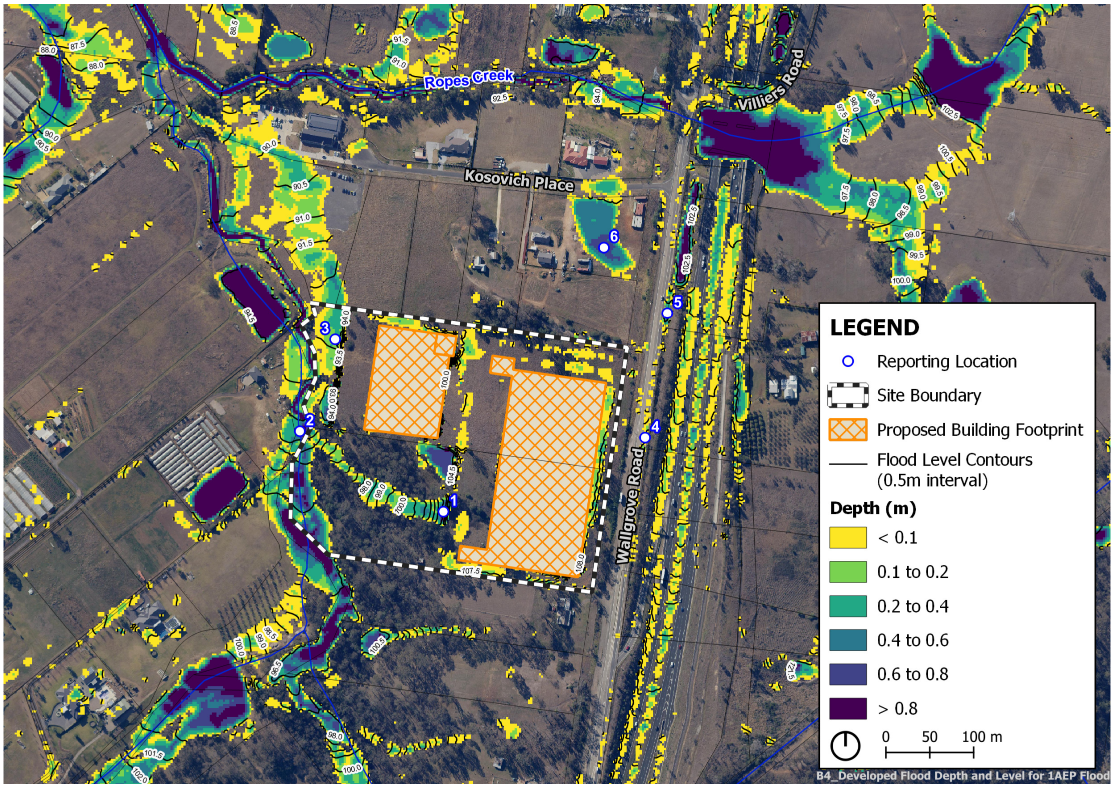


Figure 14: Developed Flood Depth and Level - 1% AEP

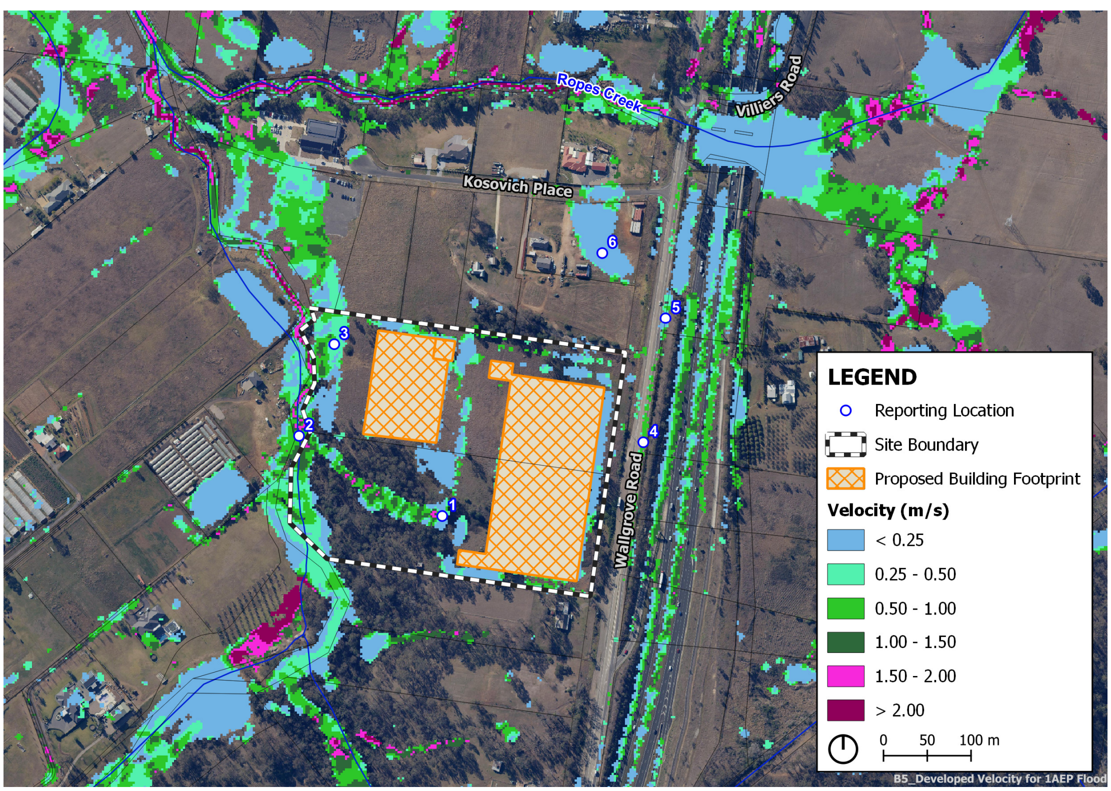


Figure 15: Developed Velocity - 1% AEP

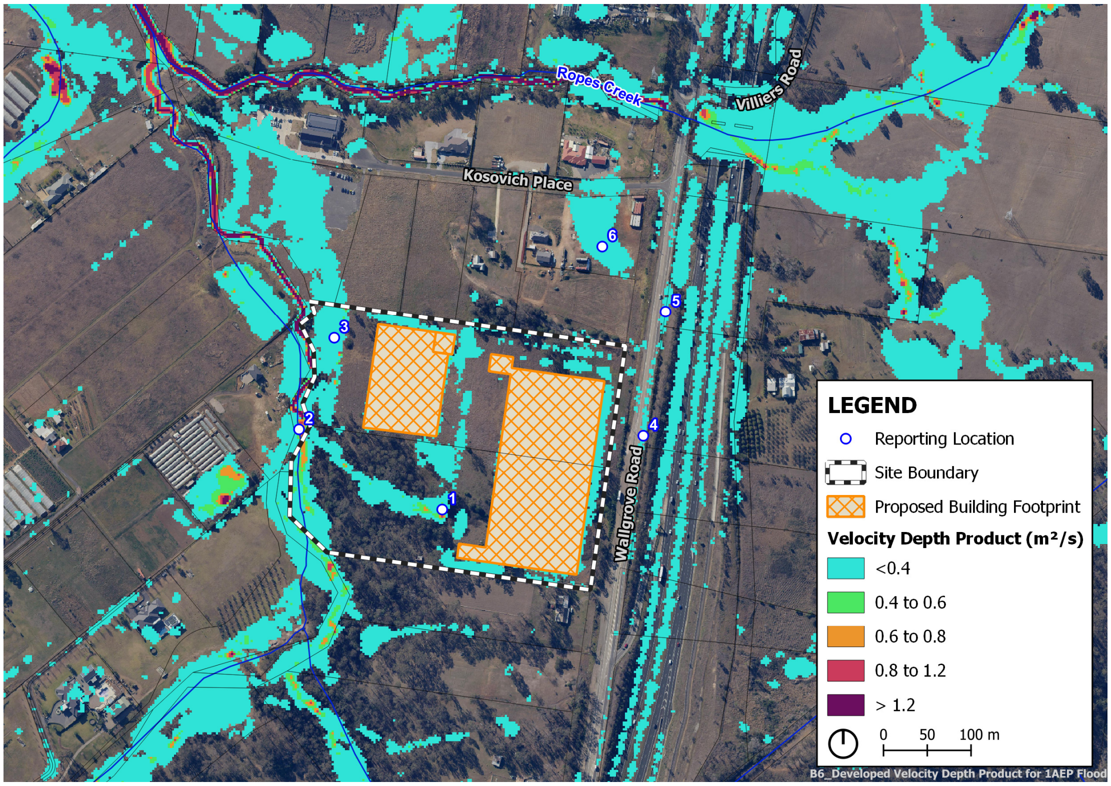


Figure 16: Developed Velocity x Depth Product - 1% AEP

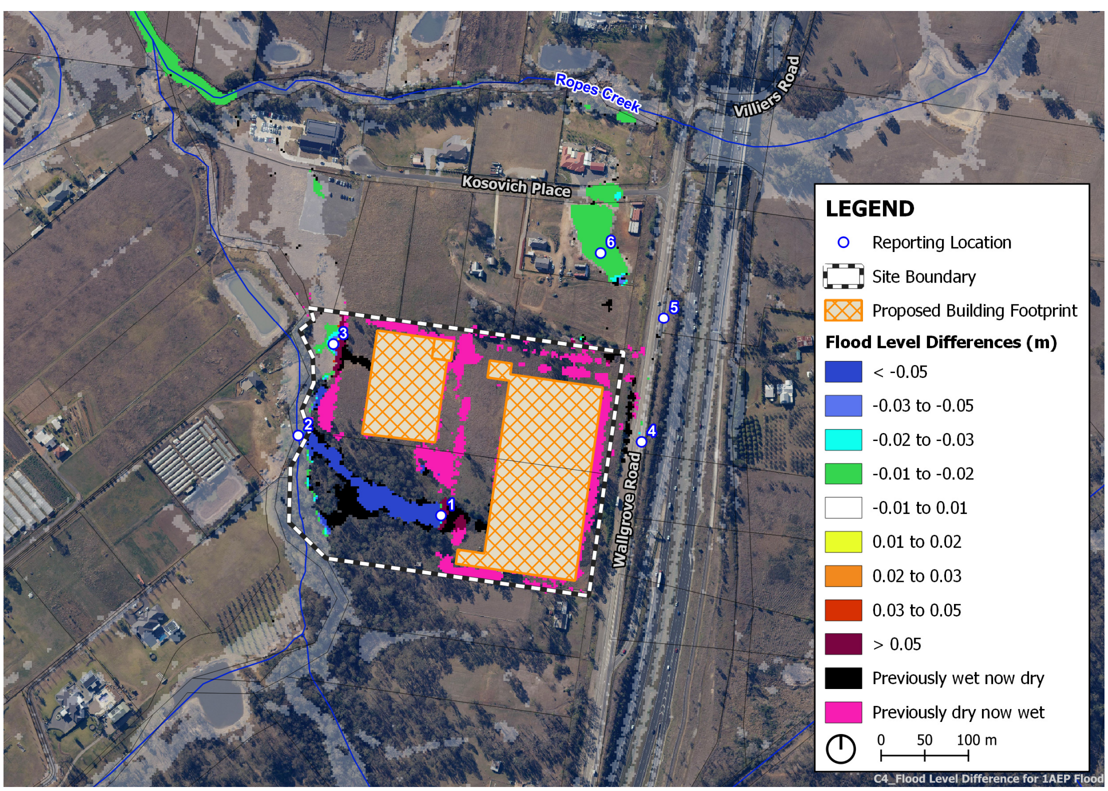


Figure 17: Flood Level Difference - 1% AEP

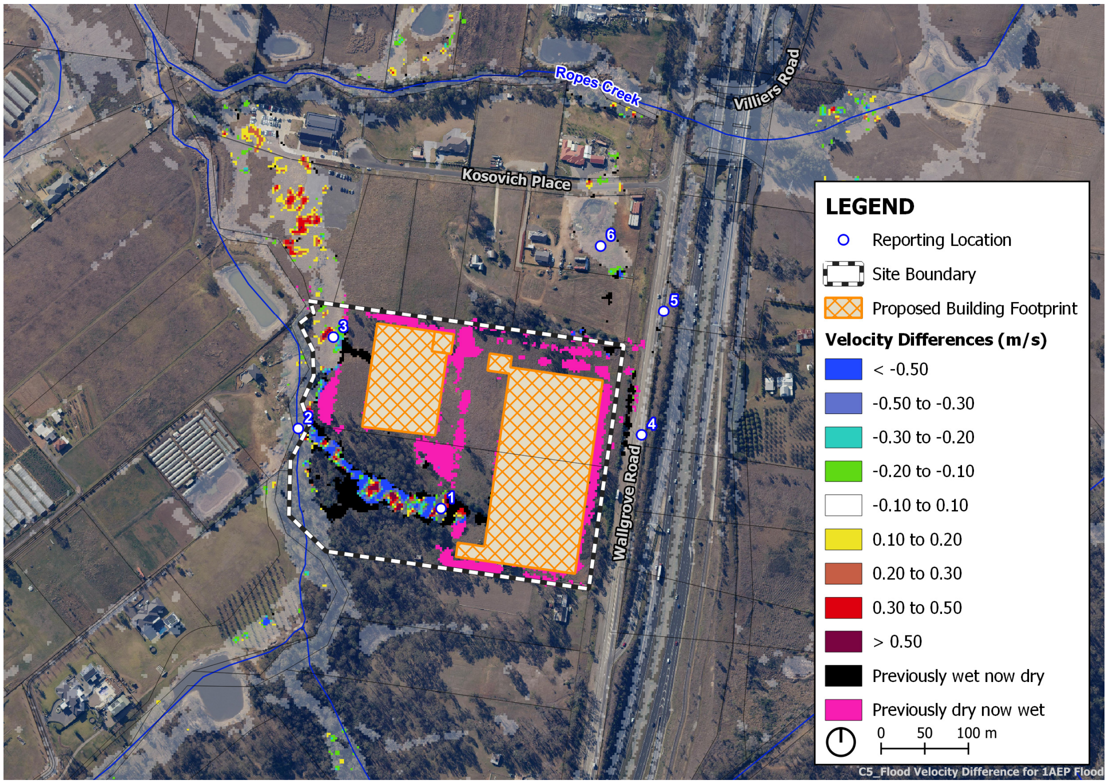


Figure 18: Flood Velocity Difference - 1% AEP

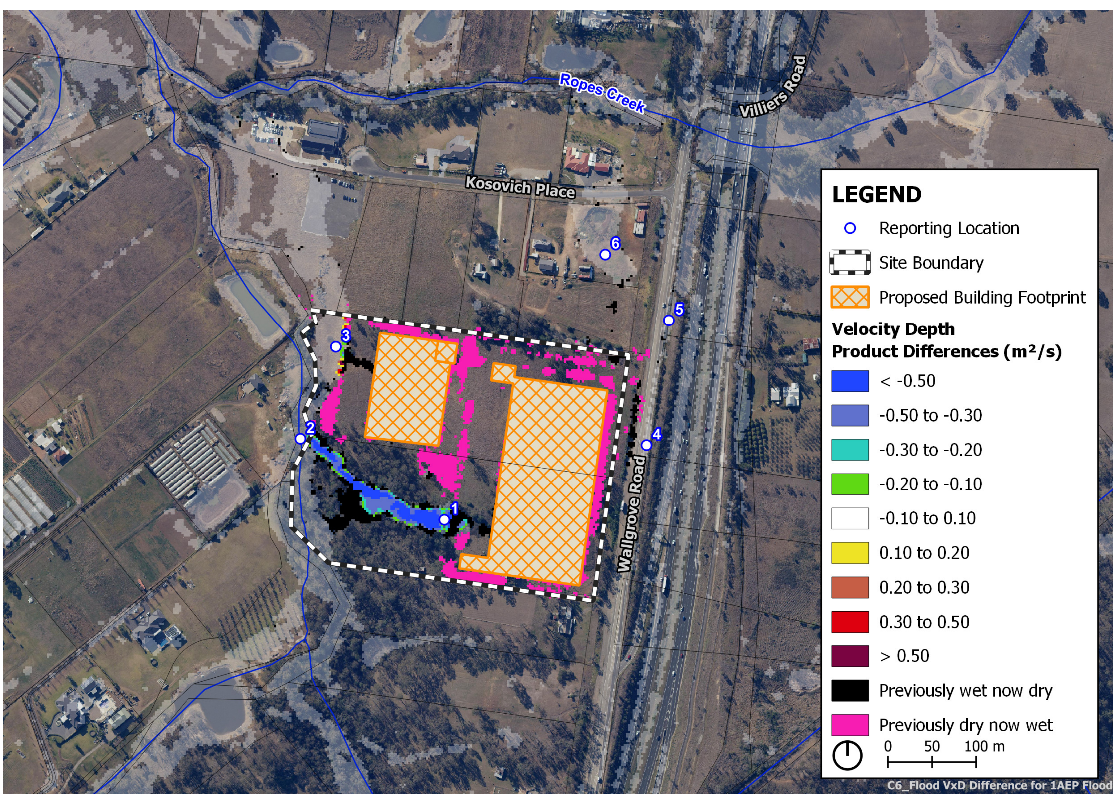


Figure 19: Flood Velocity x Depth Product Difference - 1% AEP

Reporting Location	Depth (m) 1% AEP		5% AEP		PMF	
	Existing	Developed	Existing	Developed	Existing	Developed
1	1.45	1.69	1.45	1.69	1.33	1.45
2	0.90	0.90	0.82	0.82	1.61	1.60
3	0.22	0.17	0.19	0.06	1.02	0.99
4	0.11	0.11	0.10	0.10	0.16	0.16
5	0.67	0.67	0.66	0.66	0.72	0.72
6	0.64	0.63	0.63	0.61	0.85	0.87

Table 4: Flood Depths Comparison Table

Reporting Location	Level (m) 1% AEP			5% AEP			PMF		
	Existing	Developed	Differences	Existing	Developed	Differences	Existing	Developed	Differences
1	103.09	103.08	-0.01	103.09	103.08	-0.01	102.96	102.83	-0.13
2	93.82	93.81	0.00	93.74	93.74	0.00	94.53	94.51	-0.02
3	92.46	92.41	-0.05	92.43	92.30	-0.13	93.26	93.23	-0.03
4	110.08	110.08	0.00	110.08	110.07	0.00	110.13	110.13	0.00
5	104.23	104.23	0.00	104.22	104.22	0.00	104.28	104.28	0.00
6	100.03	100.02	-0.01	100.02	100.00	-0.02	100.24	100.26	0.01

Table 5: Flood Levels Comparison Table

Reporting Location	Velocity (m/s) 1% AEP			5% AEP			PMF		
	Existing	Developed	Differences	Existing	Developed	Differences	Existing	Developed	Differences
1	0.00	0.00	0.00	0.00	0.00	0.00	1.49	1.35	-0.14
2	0.58	0.58	0.00	0.51	0.51	0.00	1.27	1.28	0.01
3	0.40	0.36	-0.03	0.36	0.09	-0.28	1.01	1.07	0.07
4	0.94	0.93	0.00	0.86	0.86	0.00	1.45	1.45	0.00
5	0.08	0.08	0.00	0.06	0.06	0.00	0.20	0.20	0.00
6	0.02	0.02	-0.01	0.02	0.01	-0.01	0.15	0.12	-0.03

Table 6: Flood Velocities Comparison Table

Reporting Location	VxD (m^2/s) 1% AEP			5% AEP			PMF		
	Existing	Developed	Differences	Existing	Developed	Differences	Existing	Developed	Differences
1	1.91	2.29	0.00	1.91	2.29	0.00	1.74	1.91	-0.14
2	0.56	0.51	0.00	0.56	0.43	0.00	2.02	2.02	0.01
3	0.09	0.06	-0.03	0.07	0.01	-0.28	1.03	1.06	0.07
4	0.11	0.11	0.00	0.09	0.09	0.00	0.24	0.24	0.00
5	0.08	0.08	0.00	0.06	0.06	0.00	0.07	0.07	0.00
6	0.03	0.02	-0.01	0.03	0.01	-0.01	0.06	0.08	-0.03

Table 7: Flood Velocity x Depth Products Comparison Table

Summary of the Modelling Results

Based on the figures and tables above, the impact of the proposed development on the existing flood behaviour and flow regime in the storm events (5% AEP, 1% AEP and PMF) can be summarised as follows.

- Flood depths and levels

Figure 17 and Table 4 and 5 indicates the proposed development will slightly decrease the flood levels within the downstream neighbouring properties and the majority of the subject site area in the order of 0.01m to 0.05m. Although a small portion of the site area in the proximity of 'Location 1' shows slight increase in flood depth, it is located away from the proposed warehouse buildings and sufficient freeboard is achieved. This increase is due to the OSD basin which requires local excavation (depression) in this area. It should be noted at this location the overall flood level is lower than existing i.e. increased depth but lower level due to the location of the proposed basin. In the PMF event a minor increase (10mm) in flood level is noted to the northeast of the development (reporting location 6). However, from review of hazard mapping it is evident the minor increase in flood level does not result in increase in velocity x depth product and does not constitute additional 'hazard'. The peak flood level impacts are generally a reduction in level and limited to within the site boundary with no significant impacts on neighbouring property upstream or downstream of the Site.

- Flood velocities

Figure 18 and Table 6 indicates the velocity of the floodwaters within and outside the subject site will either remain unchanged or decrease as a result of the proposed development, with the exception of the area to the northwest of the site in the 1% AEP storm event. The minor and localised increase in flood velocity is understood to be contributed by the instability of the flood model which does not reflect the true flood behaviour. All other velocity changes correspond to local changes in the flow distribution and have no broader impacts to property upstream or downstream of the Site.

- Flood velocity x depth products (Hazard)

Figure 19 and Table 7 indicates there is no change of the flood velocity x depth products (i.e. hydraulic hazards) beyond the subject site, which is indicative of that the proposed development will not introduce additional hazard to downstream/neighbouring properties and waterways. All other velocity x depth products changes correspond to local changes in the flow distribution and have no broader impacts to property upstream or downstream of the site nor the proposed development itself.

All Lot's finished levels are above the peak 1% AEP flood level for flooding originating off-site or from Rope Creek Tributary (with a 0.5 m freeboard allowance). The proposed finish levels of the development provide all Lots with flood immunity up to the Extreme Event (PMF). It should be noted, Flood modelling does not include the proposed stormwater system for the future development site. Although flood mapping indicated 'wet' locations within the development pads, these locations will be effective drained via the individual stormwater system and directed to the proposed OSD basins. The three outlet locations have been modelled in the flood model. Resultant flood mapping indicates no offsite increases in flood level, velocity or hazard as a result of the proposed locations for the outlets or corresponding redistribution in pre-developed flows.

Notwithstanding advice from the ecological consultant It is expected that the minor changes to peak flood levels are unlikely to cause a widespread shift from the existing ecological community which is adapted to periodic flooding to another distinct ecological community.

Flood Emergency Management

Major development in the floodplain typically requires consideration of flood emergency management procedures and response. The post-development flood mapping indicates that all of the developments lots remains flood free up to and including the PMF level. Accordingly, risk to life is effectively managed in providing areas of flood free refuge. Flood-free access to or from the development Site is available up to and including the PMF event, The development access road (Estate Road) and intersection with Wallgrove Road provides safe emergency access to minimum 1% AEP flood immunity (up to PMF immunity). Local surrounding road networks (Wallgrove Road) provide safe emergency access to the greater high network (M7).

Notwithstanding the low flood risk for the development area, Site based emergency management plans can be developed to incorporate flood warning and emergency response opportunities. This may be simply to include flooding considerations in the development of individual business/occupant emergency management plans that address other site risks such as fire etc. The management action may be as simple as acknowledgement of the access route to the greater highway network. Other flood monitoring/warning actions can be linked to existing services from BoM and SES. Given the low flood risk of the broader estate, there is no requirement for any estate specific flood warning system or response plan.

Flooding Conclusion

The key outcomes of flood assessment with consideration of the suitability of the proposed development with respect to flooding constraints are summarised below:

- Flood Planning Levels – the flood planning level (FPL) is derived from the peak 1% AEP flood level from local catchment flooding, plus a 0.5 m freeboard allowance. This provides the minimum habitable floor levels for the proposed development. The proposed finish levels of the development provide all lots with flood immunity up to the PMF Event (i.e. no inundation).
- Flood Impacts – the flood impact assessment has indicated localised changes to peak flood level and velocity distributions as a result of the encroachment of the proposed development landform into the existing flood inundation extent. Impacts are typically confined to within the Site boundaries with no significant impacts on adjacent and upstream/downstream property.
- Flood Risk Management – all of the proposed development lots are located outside of the PMF extent. The development access road provides a minimum 1% AEP flood immunity (up to PMF immunity).

Additional Flooding Information – April 2025.

- In response to agency comments the concept layout was amended with changes predominately relating to the internal lot layout of Lot 1 as well as minor changes to Lot 2 layouts (refer architectural package for further commentary). The external facing earthen batter of the Stormwater detention basin (Basin 1 and Basin 2) have had no significant changes in the updated civil design and are consistent with the previously documented (and modelled) design.
- Henry & Hymas provided a design surface (digital terrain model) for analysis in the flood modelling detailed earlier in this chapter (Chapter 6).
- Henry & Hymas have undertaken a review of the previous civil design Feb 2024 and confirm the development extent at the proposed flood interface remains unchanged and is consistent with the previously modelled interface. The future retaining wall associated with the future development of Lot 1 as well as earthen batters to Basin 1 do not extend further into the neighbouring floodplain and do not alter the currently understood/established and simulated flood conveyance capacity (floodway), flood storage or flood fringe. A comparison is provided in Table 8 below which shows the extent of works between the previous civil design and the updated civil design included in Appendix A of this report.
- Henry & Hymas confirm that the design surface (digital terrain model) associated with the currently proposed civil design in Appendix A does not result in an increase of fill material or a change of works extent within the flood interface/extent when compared to the design surface which formed the basis of the original Tuflow modelling presented above.

Based on the above, Henry & Hymas conclude that the flood modelling associated with the previous submission remains an accurate representation of the development interaction with the local floodplain and is suitable for assessment.

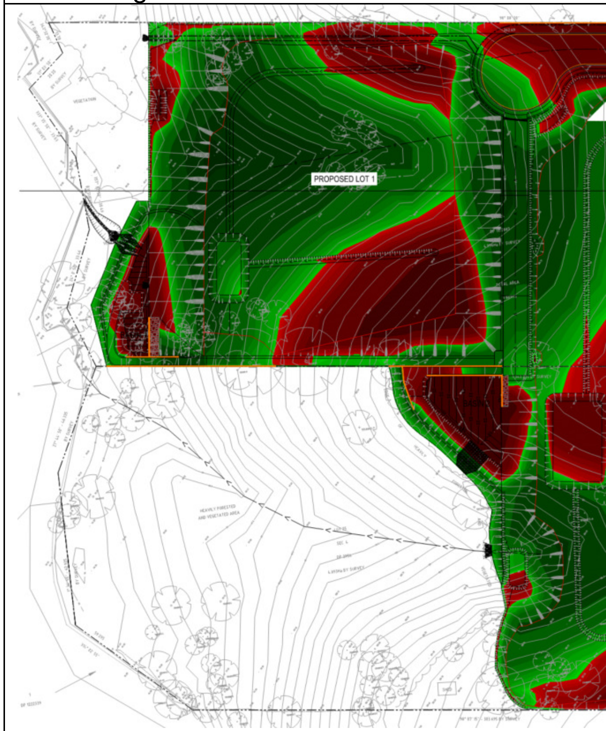
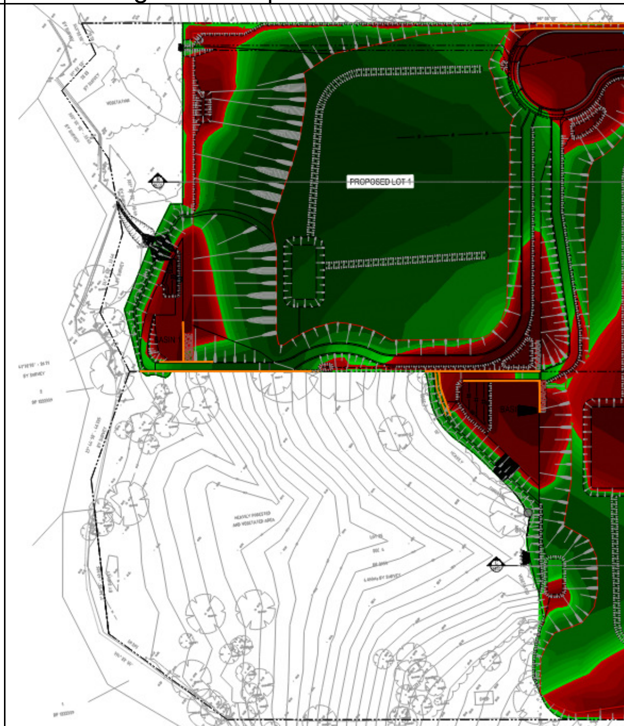
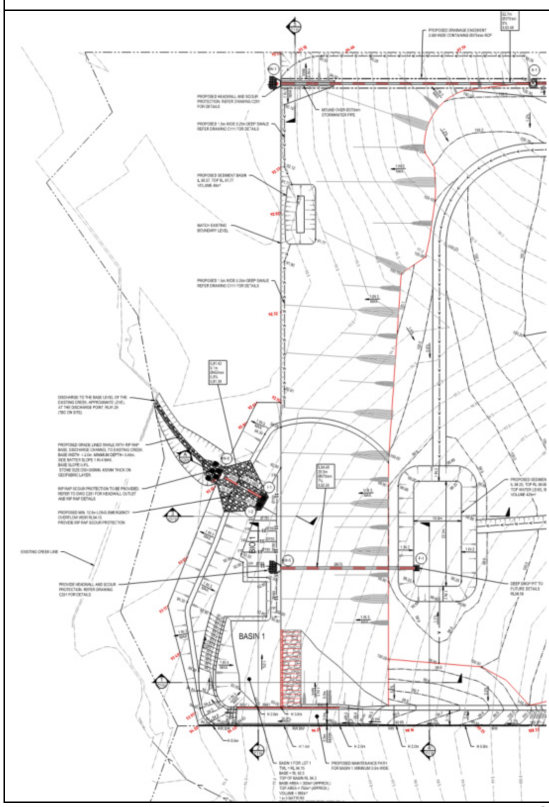
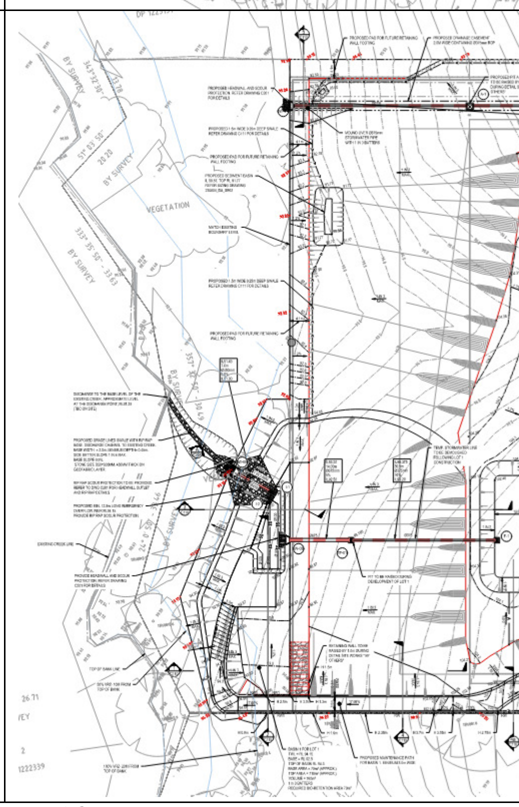
Civil Design dated Feb 2024	Civil Design dated April 2025
	
	

Table 8: Comparison of Civil Design

7. Conclusion

In general, the engineering objectives of civil design and stormwater management elements mentioned above are to create a system that is based on the architectural layout and incorporates the natural topography and site constraints to produce a cost-effective and appropriate drainage system that meets best industry practices and governing water quality and quantity objectives.

Furthermore, agency advice from Water NSW stating that Water NSW has no comments or particular requirements regarding the potential impacts of the proposed development on Water NSW's assets. Water NSW has been further consulted and has advised that adequate consultation has been undertaken. Refer to Appendix E for the e-mail correspondence with Water NSW.

We trust the information provided in this report satisfies matters relating to bulk earthworks, site works and stormwater matters such as site stormwater drainage, On-site Stormwater Detention, water quality, water conservation and flooding.

8. Appendices

Appendix A: Civil Engineering Drawings by Henry & Hymas Engineers

Appendix B: Site Survey

Appendix C: Architectural concept drawings – Site plan

Appendix D: Flood Mapping and results by CSS

Appendix E: E-mail correspondence with Water NSW

Appendix A: Civil Engineering Drawings by Henry & Hymas Engineers

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