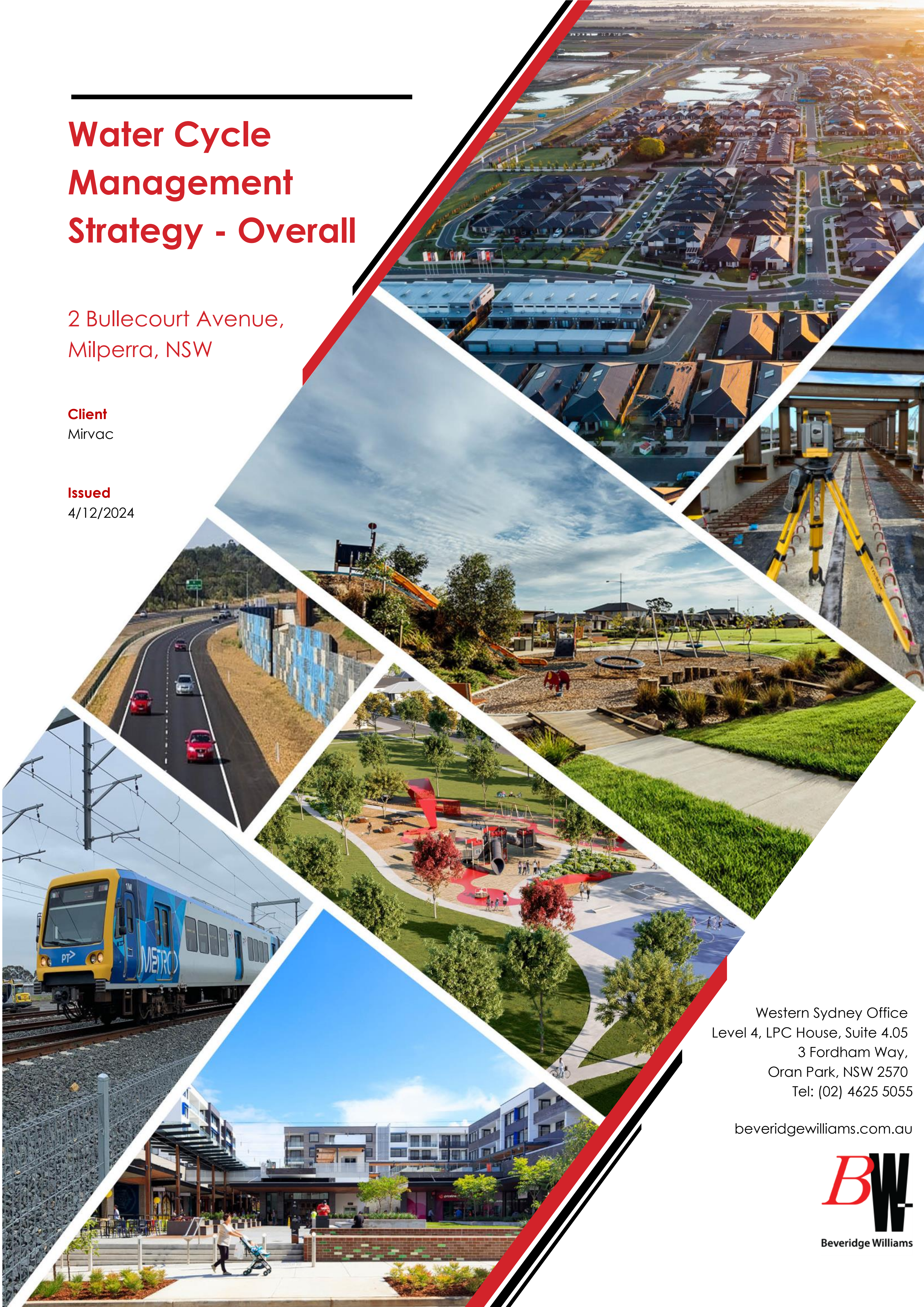
Water Cycle Management Strategy - Overall

2 Bullecourt Avenue,
Milperra, NSW

Client
Mirvac

Issued
4/12/2024



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Surveying
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Project Management

Revision Table

REV	DESCRIPTION	DATE	AUTHORISED
1	Issue for DA	**04/12/2024**	**SG**

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1. INTRODUCTION

Beveridge Williams has been engaged by Mirvac, to prepare a water cycle management study addressing the management of stormwater for the proposed residential subdivision of the site known as the Milperra campus of Western Sydney University, located at 2 and 2A Bullecourt Avenue, Milperra - Lot 2 of DP1291984.

This report is to be read in conjunction with the following documents which are separate:

- **Flood and Risk Impact Assessment**, WSU Campus Milperra, Planning Proposal, J. Wyndham Prince, Rev C May 2023

The purpose of this study is to ensure that the staged construction and overall development is carried out in accordance with best practice floodplain and stormwater management guidelines, as well as flood and stormwater planning controls outlined in Canterbury Bankstown Development Control Plan (DCP, 2023). Specifically, this study aims to:

- Ensure that floodplain and stormwater management is integrated into the development in an efficient and sustainable way,
- Determine on-site detention requirements for the overall development,
- Protect receiving water quality from adverse effects of development through the implementation of Water Sensitive Urban Design (WSUD) for the overall development.

1.1. Project Background

The subject site is located within Canterbury-Bankstown Council (CBC) Local Government Area (LGA). The indicative lot layout proposes approximately 384 residential lots consisting of a mix of small and medium lots, one commercial lot, one active open space area, and three drainage reserves containing proposed on-site detention (OSD) and water sensitive urban design (WSUD) infrastructure. The proposed development layout including the proposed staging is presented on the staging plan which can be found in Appendix A. Further detail on the development context is summarised in the Statement of Environmental Effects which will be lodged with each DA.

The Georges River is located approximately 1.6km west of the site. During major storm events the Georges River backs up to partially flood the southwest corner of the site. The flood modelling of the site and surrounding area has been previously assessed in the Flood and Risk Impact Assessment Report, WSU Campus (J. Wyndham Prince, 2023). The JWP report which was prepared in support of the rezoning of the site. As part of the assessment JWP prepared a preliminary grading plan of the site that considered the proposed zones and basin locations and parks. The report assessed the regrading of the site and illustrated that compensatory storage could be achieved by filling the areas affected by flooding while excavating to produce extra flood volume in the proposed basins.

1.2. Objectives

The objectives of this report comprises of:

- Undertaking stormwater concept design to ensure the adequacy of the pit and pipe system in safely managing runoff to each discharge point in a controlled manner. Ensuring that these pit and pipe networks as well as surface runoff have optimal connectivity to the basins.
- Conducting a comprehensive water quantity assessment for the development. This includes sizing and designing OSD basins through hydrology modelling of pre-developed and post-developed peak flows.
- Employing MUSIC modelling to determine the appropriate sizing and design of the treatment train for the development. This is crucial for achieving the approved water quality treatment targets.
- Designing and evaluating Compensatory Floodplain Storage solutions for areas already impacted by Georges River regional flooding.

1.3. Study Area

The site has until recently been used as the Milperra Campus of Western Sydney University (WSU). The existing campus is spread out, consisting of a range of buildings used for learning, student housing and office administration. In addition, the Campus also possesses ancillary impervious surfaces used for parking, footpaths, as well as pervious areas of open space and vegetation.

The existing site (Lot 2 of DP1291984) consists of approximately 19.6 ha of university land (refer **Figure 1**). The site currently has access via Horsley Road in the east, Ashford Avenue in the west, and Bullecourt Avenue in the north. The South-Western Motorway (M5) runs east-west along the southern boundary of the site. The roadway is separated by a noise attenuation fence and a vegetated batter and swale approximately 15m wide. No access is available via the southern boundary. Under the development proposal, the road network will connect to the existing roads in the east, west and north.

The topography within the site area is characterised by predominantly sloping terrain from the high point in the northeast corner of the site. The westerly grade creates a ridgeline that diverts flows in two directions south/southwest and northwest. Slopes of approximately 3% - 8% fall towards Ashford Avenue in the west and M5 in the south and Bullecourt in the northwest.

The southern part of the site discharges to an existing vegetated swale within the M5 via multiple headwalls or overland. The swale runs parallel to the southern boundary which conveys flows to the existing culverts (4 x 1500mm dia. RCP) under the freeway and ultimately into the downstream watercourse on the southern side of the M5.

Figure 1: Site Plan (NTS)

1.4. Relevant Stormwater DCP Controls

The Stormwater objectives and controls listed in the Canterbury Bankstown Development Control Plan will be addressed for the development's design as follows:

O1: To control Stormwater runoff and minimise discharge impacts on adjoining properties and into natural drainage systems before, during and after construction

During the whole lifecycle of the project and following completion, the runoff conveyed from this area will not affect the natural drainage systems. Retarding basins, sediment basins and Bioretention basins designed for this project will ensure that runoff during construction work and post-development will not increase peak flows or pollute natural drainage systems.

O2: To prevent flood damage to the built and natural environment, inundation of dwellings and stormwater damage to properties

Stormwater assets such as pits and pipes will be appropriately placed, sized, and graded to ensure that it will convey runoff respective to the design storm being catered to. Furthermore, the precinct's road and lot layout has been designed to convey runoff and prevent inundation and damage to dwellings. In addition, the flood compensatory storage will be provided by the construction of the basins.

O3: To ensure the design of buildings and structures does not create any unreasonable risks to life and assets

Stormwater assets have been designed to meet safety requirements such as ensuring that freeboard and runoff velocity requirements have been met. Appropriate grades and berms will be adopted for basin designs to ensure safety for maintenance vehicles and staff.

O4: To ensure that proposed development does not adversely affect the operational capacity of the downstream stormwater system

Analysis using DRAINS has been conducted to determine whether post development flows are greater than the corresponding predevelopment flows. Where post development flows are larger than predevelopment flows, OSD basins have been proposed to reduce peak flows to predevelopment levels. The basins 1 &2 will ensure that the Milperra development will not impact the operational capacity of the downstream stormwater system.

O5: To ensure an integrated water cycle management approach through water-sensitive urban design principles and does not adversely impact public recreation opportunities within the RE1 Public Recreation zoned land

All basins are located in accordance with the rezoning documents, proposed zoning and recently adopted site specific DCP. Outside of major storm events, there is opportunity for the basins to be utilised for public recreation opportunities as the space is not designed to retain runoff.

C1: The following devices must be provided in accordance with Council's specifications and subject to Council approval:

a) **Bio Basin in Southern Open Space (Basin 1), with an area of approximately 650 sqm**
b) **Bio Basin in Drainage Basin (Basin 2), with an area of approximately 210 sqm**
c) **Bio Basins in Northern Open Space (Basin 3), with an area of approximately 350 sqm**

All three Bio Basins stated above have been detailed in the following report. With the addition of GPT's the bioretention portion of the basins were able to be reduced which helps provide more usable park land for Basins 1 and 2 and allows easier maintenance by Council.

C2: All proposed dwellings must comply with Section 3.1 Development Engineering Standards of the Canterbury Bankstown Development Control Plan 2023

All stormwater runoff from future residential dwellings will be designed in accordance with Section 3.1 of the Canterbury Bankstown Development Control Plan. This will be completed under a separate DA.

C3: Drainage systems should be sized to consider increases in rainfall intensity, frequency and duration under future climate change

The design storm was determined from data obtained from the ARR using the 'Interim Climate Change Factor' which reflects the increase in rainfall intensity, frequency, and duration under future climate change. The final drainage design during the Subdivision Works Certification phase will design and detail all pipe sizes. This final design will include the 'Interim Climate Change Factor'.

C4: A local Stormwater Management Plan is to be provided with the first Development Application for proposing subdivision/construction of residential accommodation of the site

The local Stormwater Management plan is provided by the submission of this Water Cycle Management Strategy report.

2. GENERAL WATER CYCLE MANAGEMENT STRATEGY

Best practice stormwater and floodplain management principles have been applied to this development to ensure that floodplain and stormwater management is integrated into the development in an efficient and sustainable way.

The layout of key stormwater features in the post-developed condition is presented in **Figure 3**. This report also investigates the implementation of water cycle management strategy for the pre-development conditions as shown in **Figure 2.**

Stormwater quantity is managed on site using 2kL rainwater reuse tanks on each lot, which reduces potable water requirements of future homes, as well as OSD basins which will prevent post-development discharge conditions exceeding pre-development conditions. Wastewater on site will be managed by future connection to the Sydney Water sewerage system. Wastewater recycling is not proposed for this development. An assessment of OSD volume requirements for stormwater quantity management are discussed further in **Section 3**.

Stormwater drainage will be designed in accordance with Council's stormwater design manual and the major (1% AEP) – minor (10% AEP) approach recommended in Australian Rainfall and Runoff 2019 (ARR 2019). Major overflow routes are designed to convey stormwater exceeding the capacity of the pipe network (minor storm) safely to the OSD basins for the 1% AEP event to ensure the basins can cater for all storms up to the 1% AEP. Additional consideration will be given to extreme events in the design of major overland flow routes through the subdivision. The concept Masterplan of the stormwater layout can be found in Appendix B. The Masterplan concept is indicative only and will be designed in detail at the subdivision works certificate phase when the design levels of the subdivision are finalised.

A water quality treatment train has been incorporated into the proposed subdivision consisting of 2 kL rainwater tanks on each lot, end of line gross pollutant traps (GPTs), and bioretention basins. Due to a lack of stormwater quality pollution removal targets from CBC, pollutant removal targets of 90% GP, 85% TSS, 65% TP, and 45% TN have been adopted from the "Flood and Risk Impact Assessment Report" prepared by J. Wyndham Prince which in turn was based on from the adjacent Liverpool City Council WSUD Technical Guidelines. Water quality modelling to determine the WSUD requirements are provided in **Section 3**.

The concept design is based on the proposed zonings identifies in the Planning Proposal Report as well as the "Flood and Risk Impact Assessment Report" prepared by J. Wyndham Prince. The proposed bioretention filters have been integrated into the OSD basins to make efficient use of the available space. Where routine maintenance of community assets (future basins and GPTs) is required, space and access ramps/tracks will be provided to facilitate any required maintenance.

Where practical, stormwater management has been integrated into the landform in an unobtrusive way. Many of the proposed OSD/WSUD assets will be incorporated into public space, be landscaped in a way to create a positive public space, and utilise plants selected from local ecological communities. This will also enhance the liveability of the proposed development and provide opportunities for passive recreation.

The proposed basins have been designed with a combination of vertical retaining walls and various embankment grades. Final configuration of walls and embankments will be designed in conjunction with Council. Various opportunities are available to manage the steep terrain, avoid excessive impact on both existing vegetation and future revegetation works, and allow for safe and easy access to the invert of each basin.

A detailed flood assessment including 2-dimensional hydraulic modelling has been conducted by J. Wyndham Prince in the Flood and Risk Impact Assessment Report to determine the 1%AEP flood level and ensure that the proposed development does not create unacceptable flood impacts external to the site, and no loss in floodplain storage occurs due to the proposed development. The proposed finished surface level modelling has been designed to provide the required compensatory floodplain storage for the 1% AEP event. The assessment of floodplain management is presented in **Section 4**.

3. WATER QUANTITY MANAGEMENT

3.1. Hydrological modelling methodology and parameters

The hydrologic modelling to determine peak flow rates discharging from the site has been conducted using the RAFTS Storage Routing model in DRAINS software package, an industry standard model for hydrological modelling. The procedures and model inputs for this assessment are consistent with the Australian Rainfall and Runoff Guidelines and the CBC DCP.

In the JWP report, the hydrologic modelling uses ARR 1987 procedures and rainfall intensity-frequency-durations (IFD) inputs, however, modelling undertaken in this study uses the latest ARR 2019 procedures. Due to this, it is expected that the hydrology and hydraulic parameters presented from the analysis and modelling from this study will vary from previous reports. The modelling in this report supersedes previous modelling as it is in line with the current industry standard.

Adopted Parameters for the hydrologic modelling have been summarised in **Table 1**. The DRAINS model and results are provided in **Appendix E**.

Table 1: Hydrological Parameters and Considerations

Software Package	DRAINS Version 2021.02 – 4 Aug 2021	
Rainfall Estimation Procedures	ARR 2019	
Rainfall Runoff Model	RAFTS Storage Routing model (as applied in DRAINS)	
IFD Data	ARR 2016 Design Rainfalls	Bureau of Meteorology
Losses	Impervious Area IL = 0 mm Impervious Area CL = 0 mm/h Pervious Area IL = 29 mm Pervious Area CL = 0.8 mm/h	ARR Book 5, Section 3.5.3.1.2 ARR Datahub ARR Datahub Value x 0.4
Temporal Patterns	10 Rainfall Patterns from the East Coast South region	ARR Datahub
Mannings	Pre-Development = 0.03 Post-Development= 0.02 Post-Development with 10% effective impervious= 0.03	

Both the pre-development and post-development models have adopted the same Pervious Area IL as both pervious areas are of the urbanised condition with similar levels of compaction.

RAFTS is a storage routing runoff model that is commonly used for the determination of hydrographs, peak flow rates and to inform the size and outlet requirements of detention basins. RAFTS is one of the recommended models under ARR2019 and is suitable for modelling a range of catchment sizes and configurations. For this report, RAFTS was selected for the catchment hydrology in preference to the DRAINS IL/CL model as it give more reliable hydrological estimates on medium to large catchment sizes, such as the lumped catchments used for this assessment.

3.2. Hydrological modelling inputs

3.2.1. Pre-Development Scenario

The existing site consists of three discharge points: DSP1 (south), DSP2 (northeast) and DSP3 (northwest) with various catchments discharging into them as shown in **Figure 3** below.

The southern section of the site comprises two catchments, Ex1A and Ex1B which discharges to DSP1 through the swale before reaching the existing culverts under the M5. The northeastern catchment, Ex2A and Ex2B discharges into DSP2 to the existing drainage pipe and road infrastructure at the intersection of Bullecourt Ave and Horsley Road. The northwestern portion of the site consists of three catchments, Ex3A, Ex3B and Ex3C which discharges to DSP3 to the existing drainage pipe and road infrastructure at the intersection of Bullecourt Ave and Ashford Ave.

The imperviousness of the pre-development catchment has been assessed based on current conditions i.e. existing buildings and hardstand areas being in place (as shown in **Figure 2**). Details of the pre-development catchment are tabulated in **table 2**.

3.2.2. Post-Development Scenario

For the post-development scenario, the catchment areas are divided up into smaller catchment areas as shown in **Figure 4** below. DSP1 consists of catchment areas: Pr1A, Pr1B, Pr1C, Pr1D, Pr1E, Pr1F, Pr1G; DSP2 consists of catchment areas: Pr2A, Pr2B; DSP3 consists of catchment areas: Pr3A, Pr3B, Pr3C, Pr3D, Pr3E.

The design surface levels of catchment areas for DSP2 and DSP3 are at levels which make discharge into the drainage network and OSD basins leading towards the southern DSP1 not feasible without significant earthworks. Overall, the catchment areas of DSP2 and DSP3 has a very minimal increase in impervious area for the post developed scenario. To obtain the imperviousness values for each proposed catchment, an imperviousness of 85% was applied to lot areas (consistent with the WCMS for Stage 1), as well as 95% for road reserve areas and 10% for parks as shown in **Figure 2**. The overall imperviousness for each catchment is shown in **table 3**.

In the proposed development, the site has been regraded to allow for most of the flows from the development to flow south and discharge into the two OSD storage areas before heading towards DSP1. This will reduce peak flows at DSP2 and DSP3, ensuring that post development peak flow rates do not exceed existing peak flow rates as shown in **table 4** such that an OSD is not warranted for either DSP2 or DSP3.

Both OSD systems in the south-east (OSD 1) and south-west (OSD 2) is proposed to be located above the proposed bioretention basin(s) and be integrated into the reserve areas. The proposed OSD system aligns with the previous concept design presented by JWP and approved by council as part of the approved Planning Proposal.

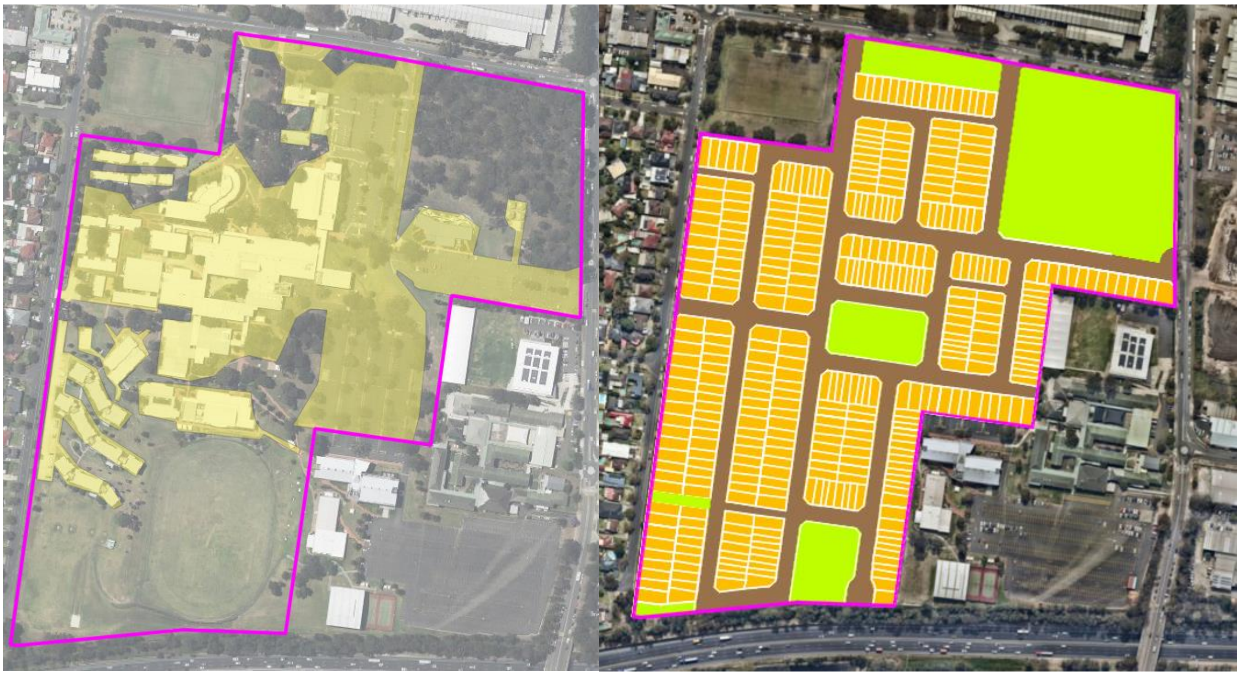

Figure 2: Areas used for the determination of imperviousness (left for pre-development conditions, right for post-development conditions)

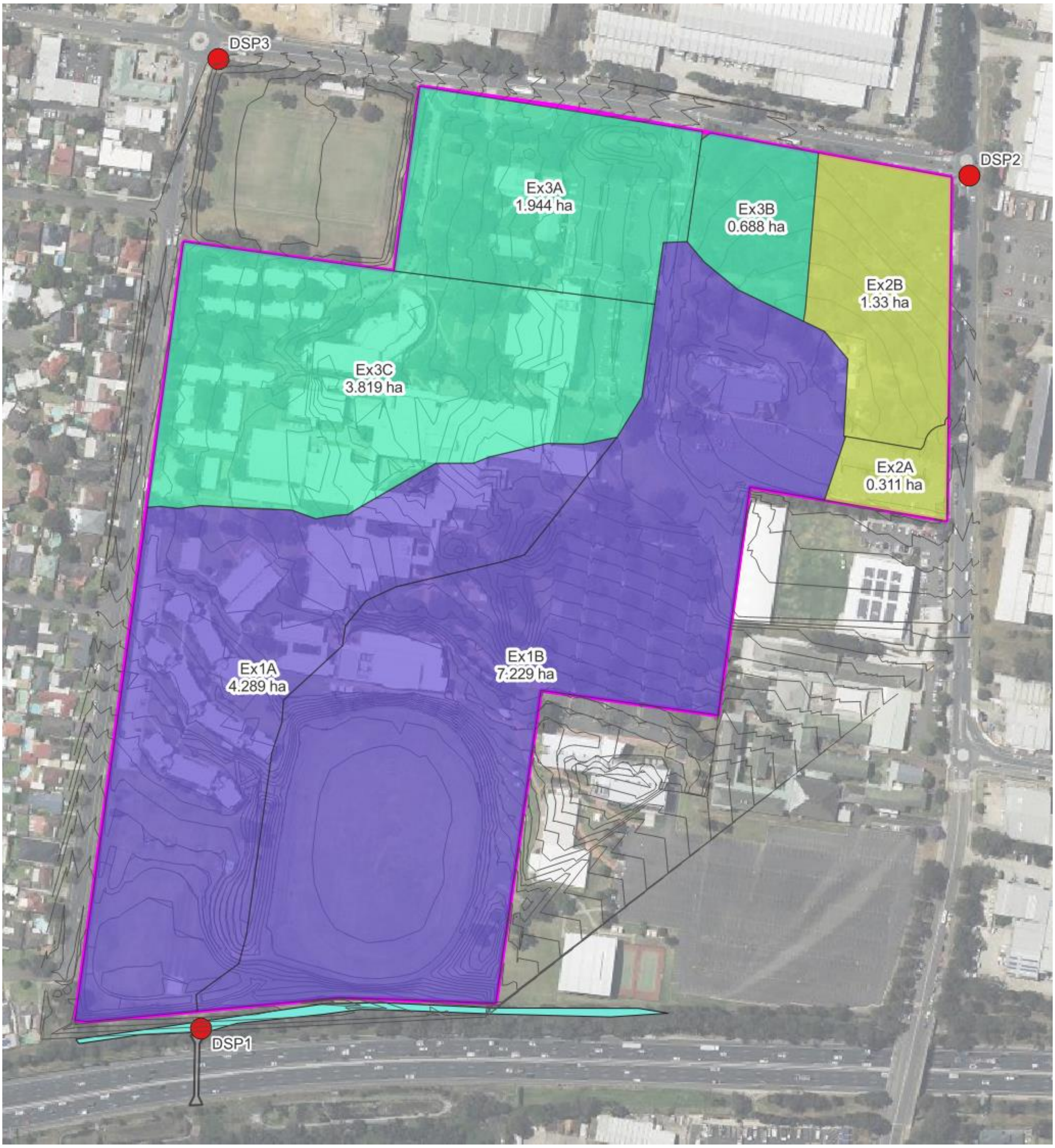

Figure 3: Pre-Development Catchment Plan

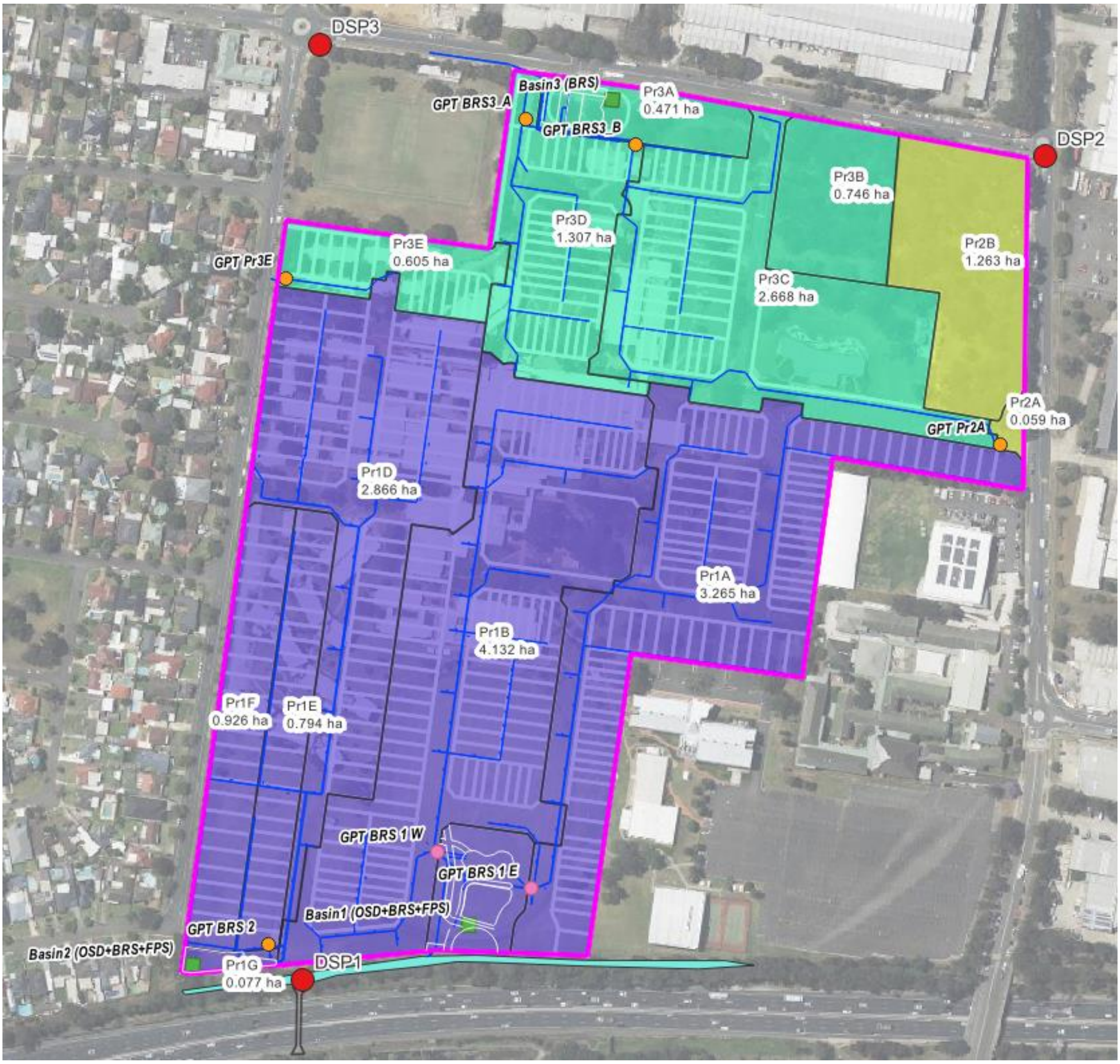

Figure 4: Post-Development Catchment Plan

Table 2: Existing Catchment Properties

DISCHARGE POINT	CATCHMENT	AREA (ha)	IMPERVIOUSNESS % *()
DSP1	Ex1A	4.289	47 (2.02)
	Ex1B	7.229	38 (2.75)
	Total Area of DSP1	11.52	41
DSP2	Ex2A	0.311	16.08 (0.05)
	Ex2B	1.33	21.88 (0.291)
	Total Area of DSP2	1.64	21
DSP3	Ex3A	1.944	58.64 (1.14)
	Ex3B	0.688	3.2 (0.022)
	Ex3C	3.819	83.77 (3.199)
	Total Area of DSP 3	6.45	68
	Total Area	19.6	48

*Impervious areas in hectares ()

Table 3: Proposed Catchment Properties

DISCHARGE POINT	CATCHMENT	AREA (ha)	IMPERVIOUSNESS % *()
DSP1	Pr1A	3.265	88.44 (2.93)
	Pr1B	4.132	77.83 (2.87)
	Pr1C	0.461	10 (0.05)
	Pr1D	2.866	88.15 (2.87)
	Pr1E	0.794	85 (0.67)
	Pr1F	0.926	85 (0.79)
	Pr1G	0.077	19.80 (0.02)
	Total Area of DSP1	12.52	81
DSP2	P2A	0.059	94.64 (0.06)
	Pr2B	1.263	10 (0.13)
	Total Area of DSP2	1.32	14
DSP3	P3A	0.471	10 (0.05)
	Pr3B	0.746	10 (0.07)
	Pr3C	2.668	66.54 (1.78)
	Pr3D	1.307	86.72 (1.13)
	Pr3E	0.605	89 (0.54)
	Total Area of DSP 3	5.80	62
	Total Area	19.6	71

*Impervious areas in hectares ()

Table 4: Peak Flow Rates Comparison

DISCHARGE POINT	10% AEP (m³/s)	1% AEP (m³/s)
Existing DSP1 (Ex1A+Ex1B)	2.521	4.01
Proposed DSP1 – No OSD (Pr1A+Pr1B+Pr1C+Pr1D+Pr1E+Pr1F+Pr1G)	4.03	6.39
Proposed DSP1 – With OSD (Basin1 + Basin2)* (Pr1A+Pr1B+Pr1C+Pr1D+Pr1E+Pr1F+Pr1G)	1.792	2.896(No TW), 4.019(TW)
CHANGE	-0.729	-1.114, +0.009
Existing DSP2 (Ex2A+Ex2B)	0.309	0.496
Proposed DSP2 (Pr2A+Pr2B)	0.219	0.377
CHANGE	-0.09	-0.119
Existing DSP3 (Ex3A+Ex3B)	1.843	2.764
Proposed DSP3 (Pr3A+Pr3B+Pr3C+Pr3D+Pr3E)	1.371	2.067
CHANGE	-0.472	-0.697

*Tailwater level for 1% AEP is 5.55m

3.2.3. OSD Basin Sizing and results

The OSD basins were sized to ensure that proposed scenario critical storm peak flow rates were maintained at or below existing peak flow rates. The approximate OSD storage volumes required are shown in **Table 5** and a comparison of peak flow rates is summarised in **Table 4**.

The proposed OSD basins were designed using the 12d software package and the concept design is presented on Masterplan which is included in **Appendix B**.

The 1% AEP event was modelled under two scenario's. 1. No tail water (i.e. local 1%AEP event only) and 2. Tailwater of RL5.55 (Regional 1%AEP Flood of the Georges River)

A conservative approach was taken when sizing the OSD basins. It was assumed that that the OSD basins were required to operate in a 1% AEP local storm during a 1% AEP regional flood event of the Georges River. This results in the storage volume in the basins being above the 1%AEP Flood level RL 5.55 resulting in higher ground levels around the basins to ensure that the house levels are above the top of water level in the basins.

The stormwater drainage network was modelled for the overall site using DRAINS. Please refer to **Appendix D** for the model setup and data inputs respectively.

Table 5: Approximate OSD Storage Volume

BASIN	LOW FLOW DISCHARGE – ORIFICE PLATES	OVERFLOW WEIR	EFFECTIVE DETENTION VOLUME (m^3) AT 1% AEP WITHOUT TAILWATER	EFFECTIVE DETENTION VOLUME (m^3) AT 1% AEP WITH TAILWATER	DESIGNED TOTAL VOLUME
Basin 1 (DSP1 Southeast)	0.6m wide x 0.4m high @ IL2.64 0.8m wide x 0.45m high @ IL3.85 0.8m wide x 0.45m high @ IL3.85	0.25m wide @ RL4 (located in the retaining wall)	1253 (at 4.3m)	5813 (at 5.81m)	6692(at 6.0m)
Basin 2 (DSP1 Southwest)	0.2m wide x 0.15m high @ IL2.6 0.8m wide x 0.4m high @ IL4.04 0.9m wide x 0.3m high @ IL5	12.5m wide @ RL5.55	958 (at 5.28m)	1221 (at 5.68m)	1478(at 5.75m)

4. WATER QUALITY MANAGEMENT

4.1. Water Quality Management Strategy

A stormwater quality treatment train has been assessed utilising the MUSIC software package. Assets within the treatment train have been selected and sized to meet the targets specified in CBC DCP 2023, specifically:

- 85% reduction in the post-development mean annual load of Total Suspended Solids (TSS)
- 45% reduction in the post-development mean annual load of Total Nitrogen (TN)
- 65% reduction in the post-development mean annual load of Total Phosphorous (TP)
- 90% reduction in the post-development mean annual load of Gross Pollutants (GP)

The proposed treatment train consists of lot scale rainwater tanks (2 kL RWTs), end of line gross pollutant traps (GPTs) for primary treatment, and a bioretention basin as the secondary treatment. Three bioretention basins are proposed, where the first (BRS 1) will be in the base of OSD basin No.1 in the southeast RE1 zoned land, the second (BRS 2) in the base of OSD Basin No.2 in the southwest corner and the third (BRS 3A & BRS 3B) will be located in the northern RE1 zoned land (public recreation). Bioretention basin BRS 3A and BRS 3B will be tiered into a split basin to address the level difference across the site which thereby allows the basin to not be so deep while still effectively treating the stormwater runoff.

The Atlan Ecoceptor series 8000 which has a high flow bypass of 0.22m^3/s will be implemented for the two GPTs connected with BRS1. The Atlan Ecoceptor series 6000 which has a high flow bypass of 0.14m^3/s will be implemented for the GPT connected with BRS2. Lastly, the Atlan Ecoceptor series 4000 with a high flow bypass of 0.06m3/s will be implemented for all the other GPTs. GPT configurations are shown in **Figure 5**. The combination of these tthree GPT products demonstrate that targets can be met as shown in **Table 13.**

The MUSIC catchments draining to each discharge point are presented in **Figure 6** and the proposed basin concept is presented in the Masterplan. It is noted that for the purpose of the Modelling BRS 3 has been named BRS 3A (lower) and BRS 3B (upper) to represent the split level design of the bioretention basin.

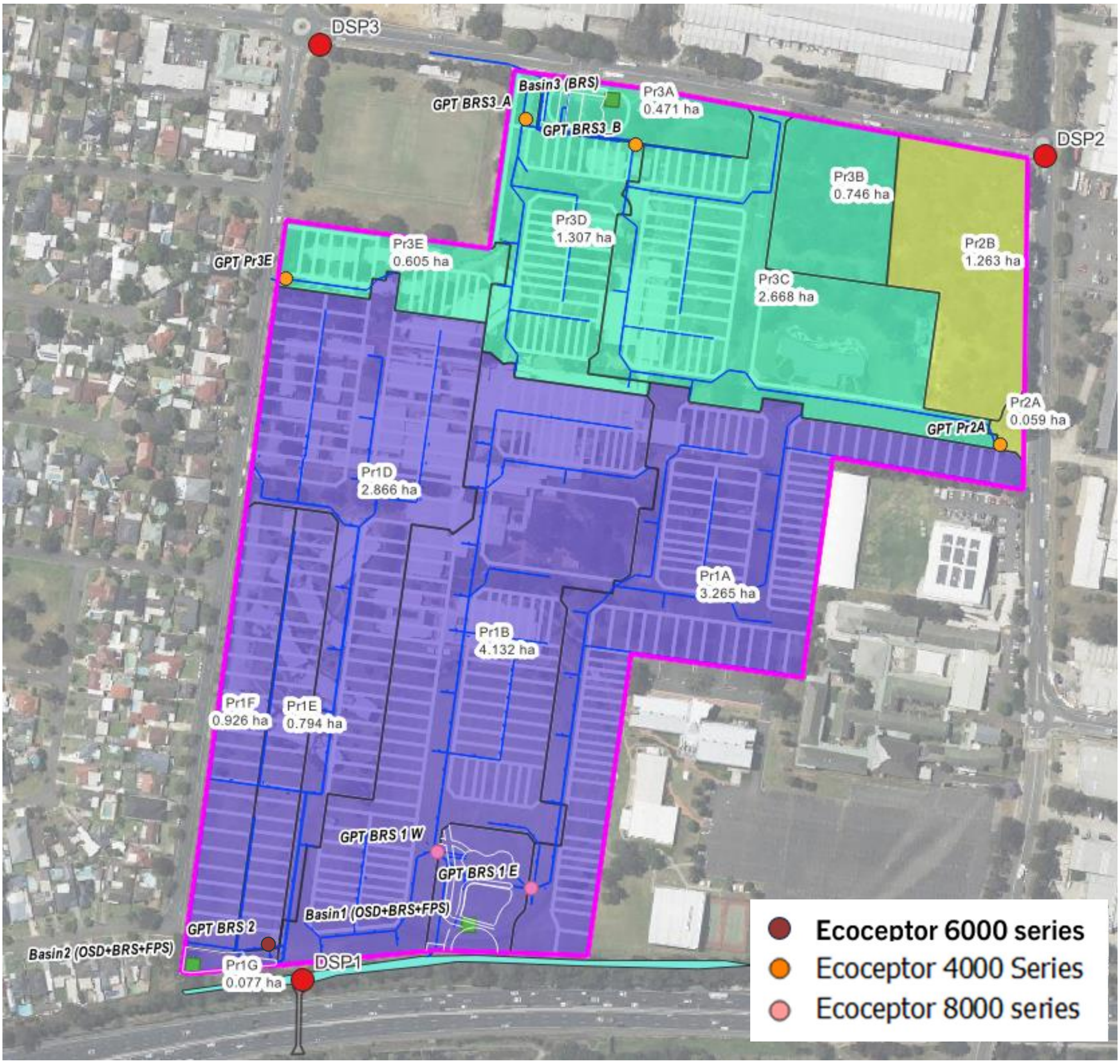

Figure 5: MUSIC Catchments

4.2. Model Configuration

The configuration of the treatment train in MUSIC is presented in **Figure 6**. Rainfall input into the model was using MUSIC-link file for Liverpool City Council (Clay). The Liverpool City Council MUSIC-link file was implemented due to the proximity to Canterbury Bankstown Council. A conservative estimation of Clay soil has been assumed in the modelling in lieu of the Georges River sandy loam option.

Source node, RWT and GPT inputs into the model have been adopted from Water NSW's Using MUSIC in Sydney's Drinking Water Catchment (2019) or left as recommended model defaults. Design parameters for the bioretention basins have been adopted following the recommendations of Bioretention Technical Design Guidelines (Water by Design, 2014) and Advancing the Design of Stormwater Biofiltration (FAWB, 2008).

The proposed per lot assumptions are determined as per the following assumptions:

- Roof Area for lots within Catchment Pr1F = 300m^2
- Roof Area of lots within Catchment Pr1D & Pr1E = 240m^2
- Roof Area of lots remaining = 180 m^2
- Roof Area contributing to Rainwater Tank (RWT) = 75% of the Roof Area
- Roof Area that overflows to drainage system (ex RWT) = 25% of the Roof Area
- Yard Area = Lot Area – Roof area
- Effective Impervious of Lot = 85%
- Effective Impervious of Roof = 100%
- Effective Impervious of Yard = varies (19 - 51)%
- Effective Impervious of Road Reserve = 95%
- Effective Impervious of Open Space = 10%

Inputs into the model are as follows:

- Catchment properties adopted in the model are summarised in **Table 7**.
- Soil parameters in the model are summarised in **Table 8**.
- Pollutant generation parameters are summarised in **Table 9**.
- RWT input parameters are summarised in **Table 10**.
- GPT input parameters are summarised in **Table 11**.
- Bioretention input parameters are summarised in **Table 12**.

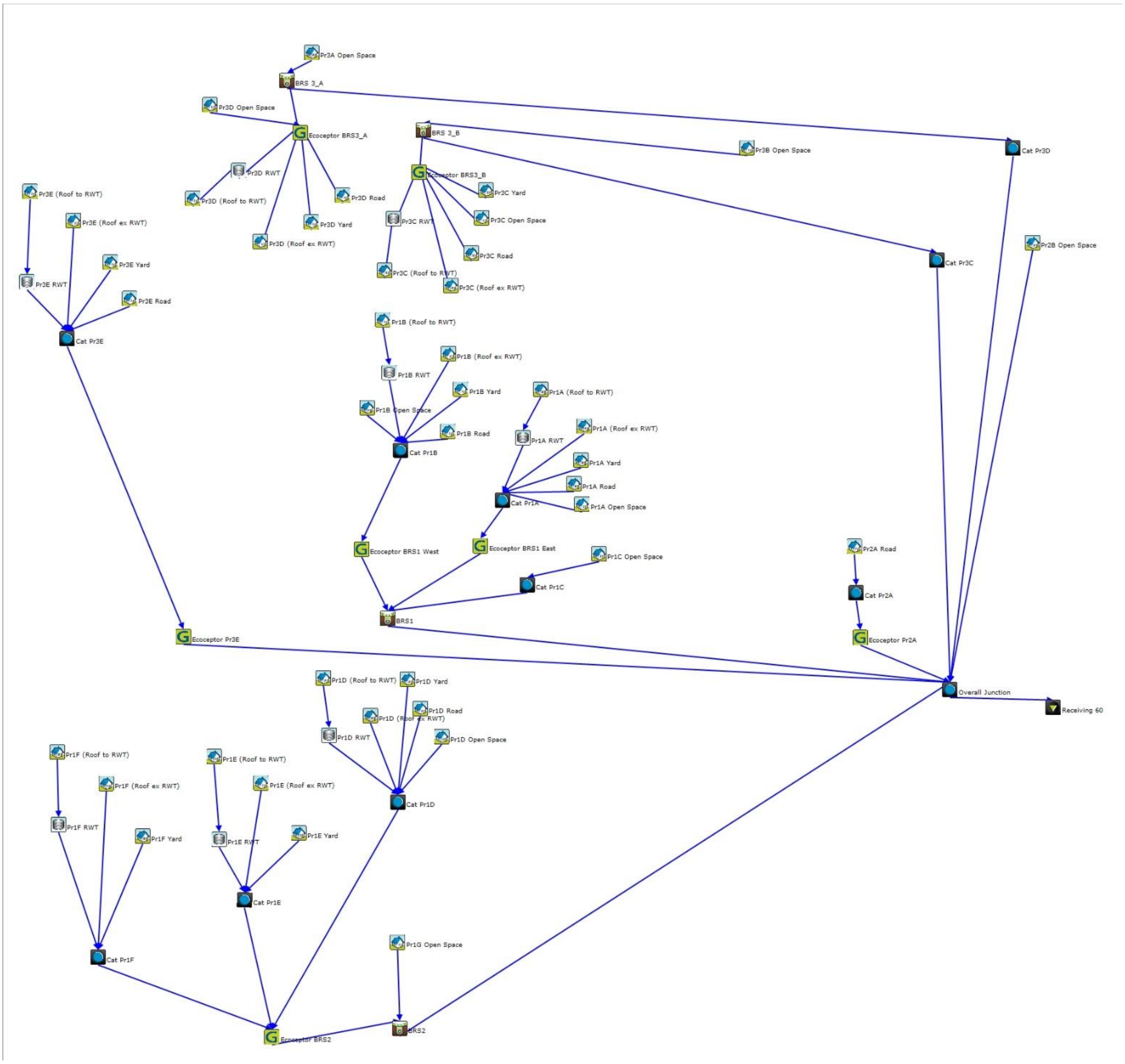

Figure 6: MUSIC Treatment Train

Table 6: MUSIC Catchment Properties

Catchment	Total Catchment Area (ha)	Lot Area (ha)	No. of Lots	Avg Lot Size (m2)	Road Reserve Area (ha)	Commercial (ha)	Open Space (ha)	Roof to RWT (ha)	Roof ex RWT (ha)	Yard (ha)	Effective % Impervious
								Node Inputs			
Pr1A	3.265	2.146	92	233.271	1.116	0	0.003	1.242	0.414	0.490	88.35
Pr1B	4.132	2.246	94	238.936	1.379	0	0.507	1.269	0.423	0.554	79.13
Pr1C	0.461	0	0	0	0	0	0.461	0	0	0	10.00
Pr1D	2.866	1.953	63	310.000	0.910	0	0.003	1.134	0.378	0.441	88.10
Pr1E	0.794	0.794	27	294.059	0	0	0	0.486	0.162	0.146	85.00
Pr1F	0.925	0.925	24	385.349	0	0	0	0.540	0.180	0.205	85.00
Pr1G	0.077	0	0	0	0	0	0.077	0	0	0	9.95
Pr2A	0.059	0	0	0	0.059	0	0	0	0	0	95.00
Pr2B	1.263	0	0	0	0	0	1.263	0	0	0	10.00
Pr3A	0.471	0	0	0	0	0	0.471	0	0	0	10.00
Pr3B	0.746	0	0	0	0	0	0.746	0	0	0	10.00
Pr3C	2.668	0.860	33	260.483	1.016	0.79	0	0.446	0.149	0.266	93.26
Pr3D	1.307	0.751	34	220.908	0.517	0	0.039	0.459	0.153	0.139	86.72
Pr3E	0.605	0.357	14	254.930	0.247	0	0	0.189	0.063	0.105	88.99
Total	19.6	10.0	381.0	2197.9	5.2	0.8	3.6	5.8	1.9	2.3	74.64

Table 7: MUSIC Soil Properties

PARAMETER	VALUE
Rainfall Threshold (mm)	0.3
Soil Storage Capacity (mm)	187
Initial Storage (%)	30
Field Capacity (mm)	127
Infiltration Capacity Coefficient A	135
Infiltration Capacity Coefficient B	4
Initial Depth (mm)	10
Daily Recharge Rate (%)	10
Daily Baseflow Rate (%)	10
Daily Deep Seepage Rate (%)	0

Table 8: MUSIC Pollutant Generation Parameters

PARAMETER	ROOF	RESIDENTIAL	SEALED ROAD
TSS Baseflow Mean (Log mg/L)	1.1	1.2	1.2
TSS Baseflow Std Dev (Log mg/L)	0.17	0.17	0.17
TSS Stormflow Mean (Log mg/L)	1.3	2.15	2.43
TSS Stormflow Std Dev (Log mg/L)	0.32	0.32	0.32
TP Baseflow Mean (Log mg/L)	-0.82	-0.85	-0.85
TP Baseflow Std Dev (Log mg/L)	0.19	0.19	0.19
TP Stormflow Mean (Log mg/L)	-0.89	-0.6	-0.3
TP Stormflow Std Dev (Log mg/L)	0.25	0.25	0.25
TN Baseflow Mean (Log mg/L)	0.32	0.11	0.11
TN Baseflow Std Dev (Log mg/L)	0.12	0.12	0.12
TN Stormflow Mean (Log mg/L)	0.3	0.3	0.34
TN Stormflow Std Dev (Log mg/L)	0.19	0.19	0.19

Table 9: Rainwater Tank Parameters

CATCHMENT	NUMBER OF TANKS	VOLUME (L)	TOTAL DAILY DEMAND* (kL/d)	OUTLET PIPE DIAMETER (m)
Pr1A	92	2000 per tank	43.24	0.1 per tank
Pr1B	94	2000 per tank	44.18	0.1 per tank
Pr1C	0	-	-	-
Pr1D	63	2000 per tank	29.61	0.1 per tank
Pr1E	27	2000 per tank	12.69	0.1 per tank
Pr1F	24	2000 per tank	11.28	0.1 per tank
Pr1G	0	-	-	-
Pr2A	0	-	-	-
Pr2B	0	-	-	-
Pr3A	0	-	-	-
Pr3B	0	-	-	-
Pr3C	33	2000 per tank	15.51	0.1 per tank
Pr3D	34	2000 per tank	15.98	0.1 per tank
Pr3E	14	2000 per tank	6.58	0.1 per tank

*Total Daily Demand is based on 0.47kL/d per household lot

Table 10: GPT Parameters

PARAMETER	VALUE	
Low Flow Bypass (m³/s)	0.00	
High Flow Bypass (m³/s)*	**Location**	**Flow Rate**
	BRS1 (8000 series)	0.22(west) 0.22 (east)
	BRS2 (6000 series)	0.140
	BRS3_A (4000 series)	0.060
	BRS3_B (4000 series)	0.060
Concentration Based Capture Efficiency	**Input**	**Output**
TSS (mg/L)	0	0
	15	0
TP (mg/L)	0	0
	100	31
TN (mg/L)	0	0
	100	53
GP (mg/L)	0	0
	1000	290

*Splitter Pits will be used to separate low and high flows. The intent is to send low flows to the GPT's and bioretention basins while the high flows will bypass the treatment train and discharge directly to outlets.

Table 11: Bioretention Parameters

PARAMETER	BRS1	BRS2	BRS3_A	BRS3_B
Low Flow Bypass (m³/s)	0	0	0	0
High Flow Bypass (m³/s)	0.44	0.22	0.22	0.22
Extended Detention Depth (m)	0.30	0.30	0.30	0.30
Surface Area (m²)	262	210	180	180
Filter Area (m²)	262	210	180	180
Saturated Hydraulic Conductivity (mm/h)	100	100	100	100
Filter Depth (m)	0.40	0.40	0.40	0.40
TN Content of Filter Media (mg/kg)	600	600	600	600
Orthophosphate Content of Filter Media (mg/kg)	30	30	30	30
Base Lined?	Yes	Yes	Yes	Yes
Unlined Filter Media Perimeter (m)	0.01	0.01	0.01	0.01
Exfiltration Rate (mm/hr)	0	0	0	0
Vegetation Properties	Effective Nutrient Removal Plants	Effective Nutrient Removal Plants	Effective Nutrient Removal Plants	Effective Nutrient Removal Plants
Overflow Weir Width (m)	3	3	3	3
Underdrain Present?	Yes	Yes	Yes	Yes

Submerged Zone Present?	No	No	No	No

4.3. Music Model Results

Model results are presented in **Table 14** and demonstrate that all pollutant load reduction targets have been achieved.

Table 12: Overall Treatment Train Effectiveness

PARAMETER	SOURCES (kg/yr)	RESIDUAL (kg/yr)	DIFFERENCE (kg/yr)	REDUCTION (%)	TARGET (%)	COMPLIANT?
TSS	19588.733	2316.447	-17272.286	88.175	85	Yes
TP	39.674	9.575	-30.099	75.866	65	Yes
TN	278.228	105.133	-173.095	62.213	45	Yes
GP	3290.477	131.679	-3158.80	95.998	90	Yes

5. FLOODPLAIN MANAGEMENT

As noted previously within this report, J. Wyndham Prince (JWP) prepared a Flood impact study as part of the Rezoning documentation. As part of this reporting TUFLOW modelling results were provided in the JWP report where the impacts of the proposed development and storage has been discussed.

The JWP report concluded that the flood level difference mapping provided indicates that there are no adverse flood level impacts external to the site in the 1% AEP event. The report also states that some minor areas of new flood affectation occurs where depth is less than 50 mm on lots which are already flood affected and therefore inconsequential. This report was accepted by Council and the Department of Planning as part of the rezoning and

5.1. Compensatory Storage

The JWP report included an assessment of the preliminary developed grading plan which proposed to fill the southeast corner above the flood planning level while excavating a portion of the existing site in the location of OSD Basin No.1 to provide an equivalent flood volume storage. The JWP report states that a minimum flood storage volume of 6,400 m3 is required in the developed scenario to offset the volume from the existing site which is affected by regional flooding in the 1% AEP event.

It is worth noting that the JWP modelling was based on an existing surface that was created from Lidar information and a design surface that was based on a preliminary grading concept.

As part of the development of this site, a proper topographic survey has been completed to fix the "existing surface" and BW has prepared a more comprehensive road and surface grading model of the entire site. Noting that the JWP report identified that there are no adverse flood level impacts external to the site in the 1% AEP event, a further compensatory storage assessment of the site under both existing and developed conditions was prepared to ensure that adequate compensatory flood storage was provided.

The compensatory storage assessment was undertaken in 12D and is documented in Appendix C – Plan of Compensatory Storage assessment.

The 12D modelling assessed all surface levels and volume between RL 3.00 (lowest part of the site under existing conditions) and the 1%AEP flood level. The surface modelling of the developed scenario included proposed retaining walls, battering etc. The modelling found that the required compensatory flood storage has been provided in OSD Basins 1 and 2 where OSD Basin 1 provides 6692 m^3 of storage and OSD Basin 2 provides 1591 m^3 of storage.

Basin 1 has been generally designed in accordance with the DCP which required maximum batter grades of

	This Study	JWP's Study
Pre-development Flood Storage	6400.429 m^3	6400 m^3
Post-development Flood Storage	6423.356 m^3 (inc Basin1+ Basin2)	9600 m^3
Balance	22.93 m^3	3200 m^3

It is worth noting that the JWP model was based on a simple trapezoidal basin and didn't consider discharge control conditions or the more detailed modelling of the raingardens and basin together with it's usage as a recreation area. The BW modelling has taken on to account the more detailed design of the recreational space prepared by Urbis as well as the outlet conditions and more detailed drainage design. This is the reason why the values of compensatory storage are more balanced.

6. CONCLUSIONS AND RECOMMENDATIONS

The water cycle management strategy outlined in this report has been prepared in support of the development of the Milperra Estate. It is to be read in conjunction with the following documents which are separate to this report:

- **Flood and Risk Impact Assessment**, WSU Campus Milperra, Planning Proposal, J. Wyndham Prince, Rev C May 2023

This report provides the following conclusions and recommendations for the proposed future overall development:

- A Digital Terrain Model of the topographic survey and a 3D surface model of the proposed development of the site has been prepared. The modelling of the developed site is generally in accordance with the original grading concept prepared by JWP as part of the rezoning documentation.
- A DRAINS RAFTS Storage Routing model in accordance with AR&R 2019 has been prepared for both existing and developed conditions. The model illustrates that:
  - The regrading of the site ensures no OSD basins are required along the eastern or northern boundaries of the site. Two larger basins are required along the southern boundary of the site. These basins will compensate for the regrading of the site.
  - OSD Basin 1 will be located in the south eastern portion of the site within the public recreation (RE1) land and will be used as an open space during dry conditions. The basin will contain a discharge control pit that contains three orifices of various sizes and ILs as well as an overflow weir in accordance with the details shown in the Basin Plans in Appendix G and table 5 of this report.
  - OSD Basin 2 will be located in the south west corner of the site and will service a portion of the western catchment. The basin will contain a discharge control pit that contains three orifices of various sizes and ILs as well as an overflow weir in accordance with the details shown in the Basin Plans in Appendix G and table 5 of this report.
- MUSIC modelling shows that a treatment train consisting of 2kL reuse rainwater tanks in each lot, GPTs and Bioretention basins will improve stormwater runoff, exceeding Council's specifications
  - OSD Basins 1 and 2 will contain a bioretention basin of varying areas within their base as part of the treatment train to improve water quality leaving the site
  - A bioretention Basin 3 will be installed in the northern public recreation area to address and improve water quality from the northern portion of the site. Due to the level differences across this public recreation area, it is proposed that this bioretention basin is tiered
- Compensatory storage on site for post-development meets the pre-development values by filling the existing low lying areas in the southwest corner and excavating OSD Basin No.1 and No.2 to creating flood storage
- The regrading of the site ensures that all lots are above the 1%AEP Regional Flood Level of RL5.55
- The JWP report identifies that there will be no detrimental offsite impacts as a result from the proposed development

The proposed Water Cycle Management Strategy meets the following objectives:

- There are no detrimental offsite impacts as a result from the proposed development,
- There is no increase in flood levels, and flow rates as a result of this development,
- Compensatory Storage has been provided,
- OSD and treatment design requirements has been met as per CBC council requirements.
- OSD and treatment design requirements for the overall development is achievable as shown by the current modelling and will be detailed in future design.

In summary, the proposed development achieves all stormwater objectives in Council's DCP and all impacts (temporary or permanent) can be mitigated as part of the detailed design process.

Prepared by

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APPENDIX A: OVERALL STAGING PLAN

Stage No.	No. of Residential Lots	No. of Public/Drainage Reserve Lots	Stage Area	Length of Road Centreline	Area of Pavement
Stage 1	16	1	7308	0	0
Stage 2	133	2	65017	1263	13027
Stage 3	65	3	25909	308	3226
Stage 4	85	0	36287	971	9876
Stage 5	82	1	35224	595	5931

WARNING

BEWARE OF UNDERGROUND SERVICES

The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown.
Locate all underground services before commencement of works

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REV	DESCRIPTION	DATE	DRN.	APP.
E	STAGE 4 & 5 BOUNDARY MODIFIED	13.06.24	S.G.	S.G.
D	LAYOUT MODIFIED	23.05.24	S.G.	S.G.
C	STAGE 1 BOUNDARIES	31.01.24	S.G.	S.G.
B	STAGE 1 LIMITS UPDATED	22.01.24	S.G.	S.G.
A	ISSUED FOR INFORMATION	15.12.23	D.H.	S.G.

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Sheet 01 of 01

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Project Number	Reference	Drawing No	Revision
2301879	302	010	E

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APPENDIX B: OVERALL MASTERPLAN CONCEPT

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Sheet 04 of 23

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Project Ref	Stage No	Drawing No	Rev
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SERVICE OFFSET TABLE

Location	ND - Water		Water		Electricity		Telecommunication	
	Side	Offset (m)	Side	Offset (m)	Side	Offset (m)	Side	Offset (m)
ROAD 1	N	2.60	N	2.90	S	0.95*	S	1.75 *
ROAD 2 (17.2m & 18.0m ROAD RESERVE)	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 2 (18.7m ROAD RESERVE)	N	2.60	N	2.90	S	2.45*	S	3.25*
ROAD 3	N/W	2.60	N/W	2.90	S/E	0.95*	S/E	1.75*
ROAD 4	N	2.60	N	2.90	E	0.95*	E	1.75*
ROAD 5	W	2.60	W	2.90	E	0.95*	E	1.75
ROAD 6	E	2.60	E	2.90	W	0.95*	W	1.75
ROAD 7	N	2.60	N	2.90	S	0.95*	S	1.75
ROAD 8	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 9	W	2.60	W	2.90	E	0.95*	E	1.75*
ROAD 10	N	2.60	N	2.90	S	0.95*	S	1.75*
LANE 2	S	2.60	S	2.90	S	0.50*	S	1.75*
LANE 5	S	2.60	S	2.90	S	0.50*	S	1.75*
WALK 1	S	2.60	S	2.90	S	0.50*	S	1.75*

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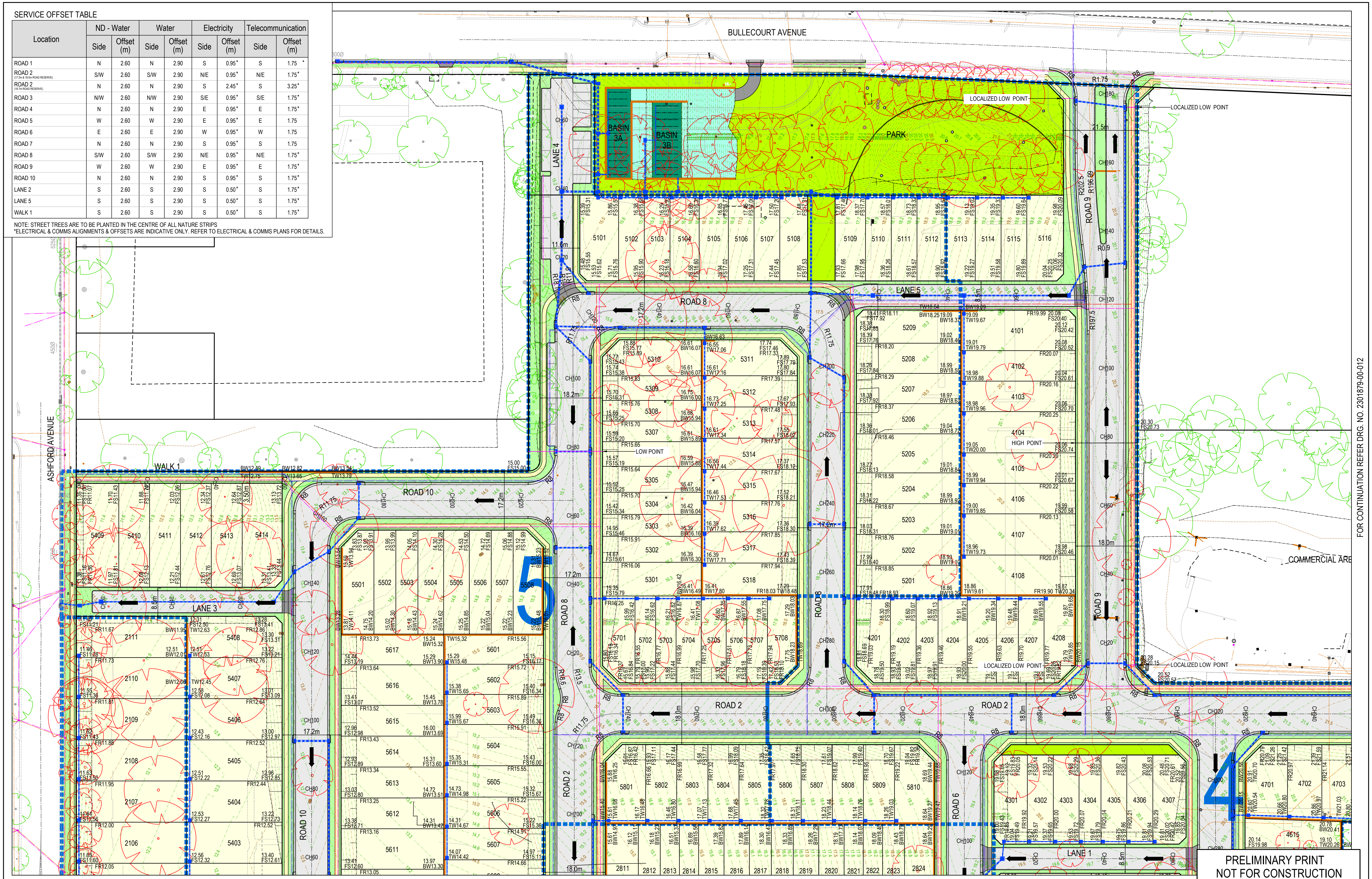

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Drawing Title: FUNCTIONAL LAYOUT PLAN
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Sheet 05 of 23
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Project Ref	Stage No	Drawing No	Rev
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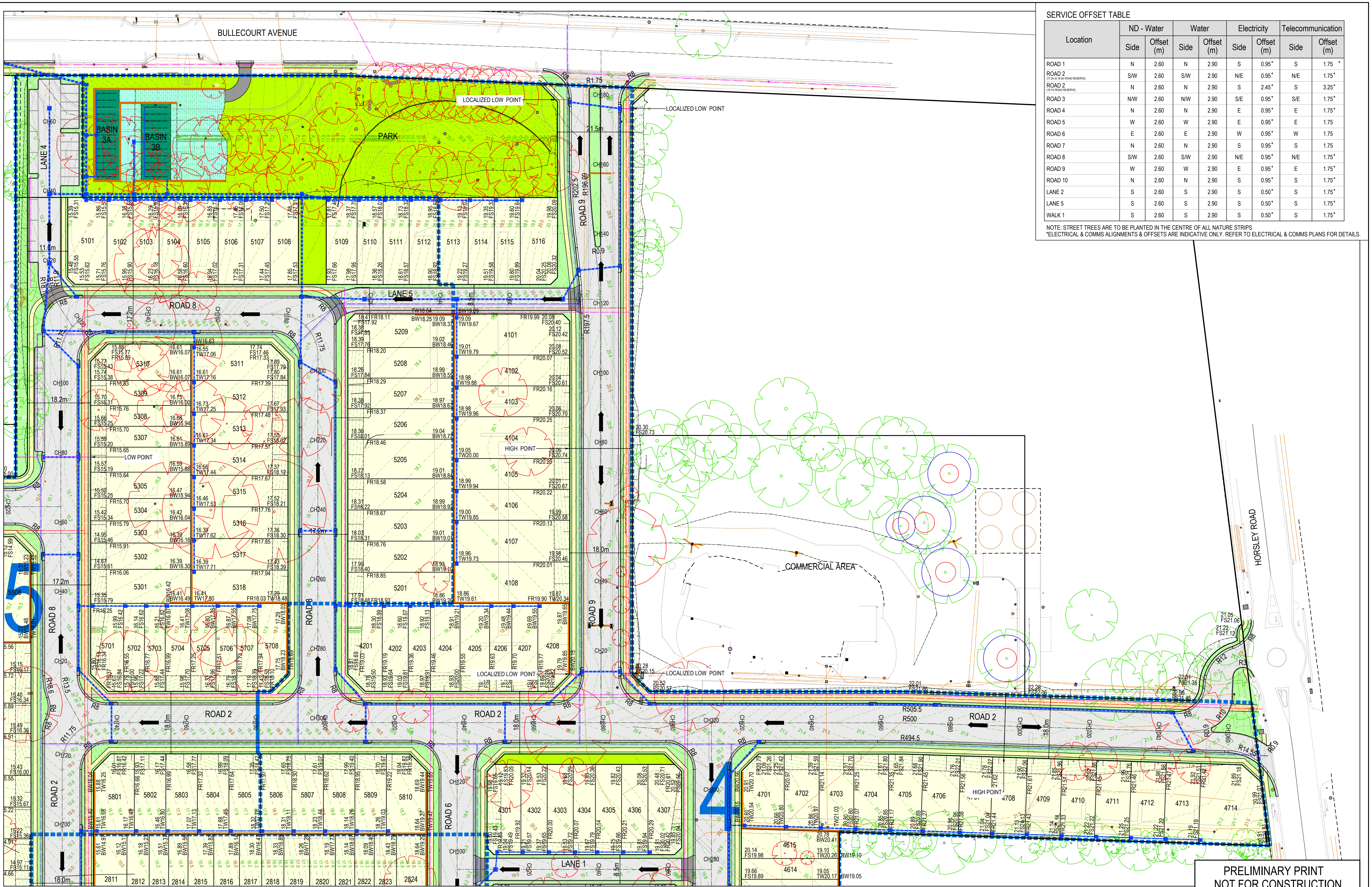

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ROAD 2 (17.2m & 18.0m ROAD RESERVE)	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 2 (18.7m ROAD RESERVE)	N	2.60	N	2.90	S	2.45*	S	3.25*
ROAD 3	N/W	2.60	N/W	2.90	S/E	0.95*	S/E	1.75*
ROAD 4	N	2.60	N	2.90	E	0.95*	E	1.75*
ROAD 5	W	2.60	W	2.90	E	0.95*	E	1.75
ROAD 6	E	2.60	E	2.90	W	0.95*	W	1.75
ROAD 7	N	2.60	N	2.90	S	0.95*	S	1.75
ROAD 8	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 9	W	2.60	W	2.90	E	0.95*	E	1.75*
ROAD 10	N	2.60	N	2.90	S	0.95*	S	1.75*
LANE 2	S	2.60	S	2.90	S	0.50*	S	1.75*
LANE 5	S	2.60	S	2.90	S	0.50*	S	1.75*
WALK 1	S	2.60	S	2.90	S	0.50*	S	1.75*

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Sheet 06 of 23
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ROAD 2 (17.2m & 18.0m ROAD RESERVE)	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 2 (18.7m ROAD RESERVE)	N	2.60	N	2.90	S	2.45*	S	3.25*
ROAD 3	N/W	2.60	N/W	2.90	S/E	0.95*	S/E	1.75*
ROAD 4	N	2.60	N	2.90	E	0.95*	E	1.75*
ROAD 5	W	2.60	W	2.90	E	0.95*	E	1.75
ROAD 6	E	2.60	E	2.90	W	0.95*	W	1.75
ROAD 7	N	2.60	N	2.90	S	0.95*	S	1.75
ROAD 8	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 9	W	2.60	W	2.90	E	0.95*	E	1.75*
ROAD 10	N	2.60	N	2.90	S	0.95*	S	1.75*
LANE 2	S	2.60	S	2.90	S	0.50*	S	1.75*
LANE 5	S	2.60	S	2.90	S	0.50*	S	1.75*
WALK 1	S	2.60	S	2.90	S	0.50*	S	1.75*

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Sheet 07 of 23

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ROAD 2 (18.7m ROAD RESERVE)	N	2.60	N	2.90	S	2.45*	S	3.25*
ROAD 3	N/W	2.60	N/W	2.90	S/E	0.95*	S/E	1.75*
ROAD 4	N	2.60	N	2.90	E	0.95*	E	1.75*
ROAD 5	W	2.60	W	2.90	E	0.95*	E	1.75
ROAD 6	E	2.60	E	2.90	W	0.95*	W	1.75
ROAD 7	N	2.60	N	2.90	S	0.95*	S	1.75
ROAD 8	S/W	2.60	S/W	2.90	N/E	0.95*	N/E	1.75*
ROAD 9	W	2.60	W	2.90	E	0.95*	E	1.75*
ROAD 10	N	2.60	N	2.90	S	0.95*	S	1.75*
LANE 2	S	2.60	S	2.90	S	0.50*	S	1.75*
LANE 5	S	2.60	S	2.90	S	0.50*	S	1.75*
WALK 1	S	2.60	S	2.90	S	0.50*	S	1.75*

NOTE: STREET TREES ARE TO BE PLANTED IN THE CENTRE OF ALL NATURE STRIPS
*ELECTRICAL & COMMS ALIGNMENTS & OFFSETS ARE INDICATIVE ONLY. REFER TO ELECTRICAL & COMMS PLANS FOR DETAILS.

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P3	BASINS AMENDED	07.08.24	S.F.	S.F.
P2	ISSUED FOR INFORMATION	02.05.24	S.F.	S.F.

mirvac

0 5 10 20 30 40
SCALE 1:500 AT A1 SIZE

Designed S.FERGUSON
Date 27.02.2024
Drawn S.FERGUSON
Approved S.GRAY
Date 27.02.2024
PS Number -

Beveridge Williams
32 Iolanthe St
Campbelltown NSW 2560
ph: 02 46255055
www.beveridgewilliams.com.au

Project Details: 2 BULLECOURT AVENUE, MILPERRA
OVERALL ESTATE
MIRVAC

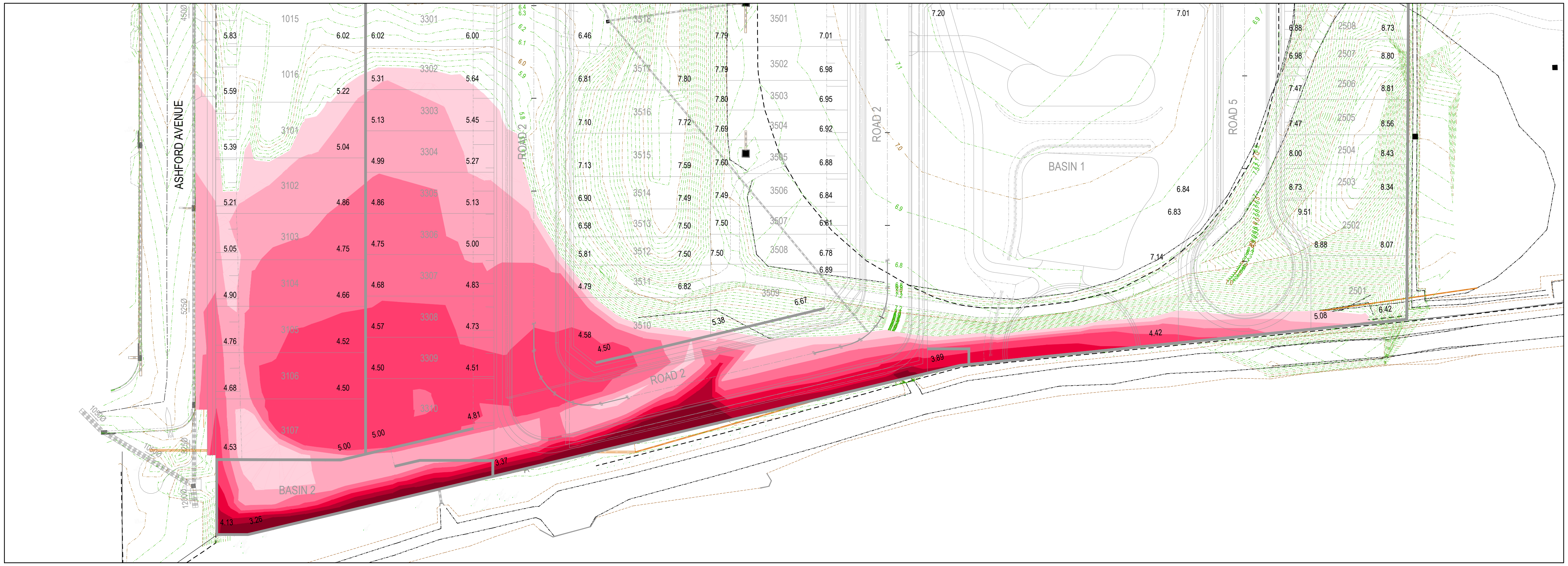
Drawing Title: FUNCTIONAL LAYOUT PLAN
(SHEET 4 OF 4)

Sheet 08 of 23
Scale 1:500 @ A1
N

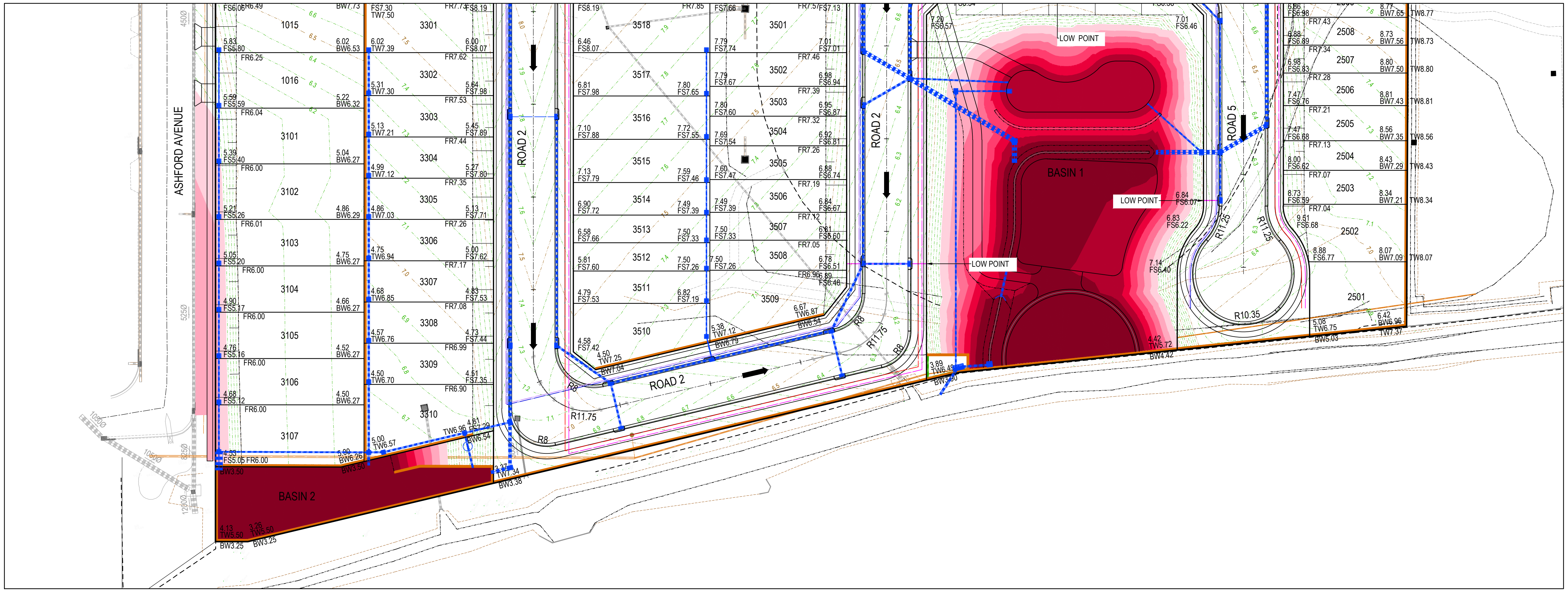
Project Ref	Stage No	Drawing No	Rev
2301879	00	914	P3

Q:\wsy\jobs\23\2301879 - 2 Bullecourt Avenue Milperra_Eng\General\Drawings\2301879-00-910-FLP.dwg

APPENDIX C: COMPENSATORY STORAGE PLANS



FLOOD STORAGE - EXISTING SCENARIO



FLOOD STORAGE - DEVELOPED SCENARIO

STORAGE LEGEND

DEPTH RANGE (m)		COLOUR
>1.8m STORAGE		
1.8	1.5	
1.5	1.2	
1.2	0.9	
0.9	0.6	
0.6	0.3	
0.3	0.0	

STORAGE VOLUMES:

EXISTING SCENARIO : 6400 m^3
DEVELOPED SCENARIO : 6424 m^3

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P2	DRAWING REVISED	07.08.24	C.Y.	S.F.
P1	ISSUED FOR INFORMATION	14.05.2024	C.Y.	S.F.

mirvac

0 5 10 20 30 40
SCALE 1:500 AT A1 SIZE

Designed S.FERGUSON
Date 14.05.2024
Drawn C.YAP
Approved S.FERGUSON
Date 14.05.2024
PS Number -

Beveridge Williams
32 Iolanthe St
Campbelltown NSW 2560
ph: 02 46255055
www.beveridgewilliams.com.au

Project Details: 2 BULLECOURT AVENUE, MILPERRA
OVERALL ESTATE
MIRVAC

Drawing Title: COMPENSATORY STORAGE PLAN

Sheet 01 of 01

Scale: 1:500 @ A1

Project Ref	Stage No	Drawing No	Rev
2301879	00	850	P2

Q:\wsy\jobs\23\2301879 - 2 Bullecourt Avenue Milperra_Eng\General\Drawings\2301879-00-850-CSP.dwg

APPENDIX D: OSD DRAINS IL CL MODEL - SETUP & DATA

PIT / NODE DETAILS Version 15

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Dept (m)	Major Safe Pond Depth (m)
DSP1_EX	Node							0		313423.7	6242436		18		No					
N_Ex1A	Node							0		313430.9	6242518		19		No					
N_Ex1B	Node							0		313694.5	6242654		20		No					
DSP3_EX	Node							0		313178.5	6242908		21		No					
DSP2_EX	Node							0		313686.8	6242887		22		No					
N_Ex3B	Node							0		313382.7	6242859		23		No					
N_Ex3A	Node							0		313289.6	6242721		24		No					
N_Ex2B	Node							0		313570.2	6242817		25		No					
N_Ex2A	Node							0		313644.3	6242752		26		No					
N_Ex3C	Node							0		313196.4	6242696		27		No					
nPr1A	Node							0		314421.9	6242548		1		No					
nPr1B	Node							0		314290.9	6242530		2		No					
nPr1C	Node							0		314281	6242365		3		No					
nPr1D	Node							0		314207	6242615		4		No					
nPr1E	Node							0		314157.7	6242466		5		No					
nPr1F	Node							0		314127.8	6242468		6		No					
nPr1G	Node							0		314118.7	6242319		7		No					
nPr2A	Node							0		314622.5	6242661		8		No					
nPr2B	Node							0		314593.4	6242764		9		No					
nPr3A	Node							0		314387	6242861		10		No					
nPr3B	Node							0		314509.3	6242806		11		No					
nPr3C	Node							0		314460.8	6242740		12		No					
nPr3D	Node							0		314330.6	6242779		13		No					
nPr3E	Node							0		314226.2	6242763		14		No					
DSP3	Node							0		314178.5	6242908		15		No					
DSP2	Node							0		314644.5	6242835		16		No					
DSP1	Node							0		314204.6	6242301		17		No					
nPr1A_bas	Node							0		314071.9	6242248		28		No					
nPr1B_bas	Node							0		313940.9	6242230		29		No					
nPr1C_bas	Node							0		313931	6242065		30		No					
nPr1D_bas	Node							0		313857	6242315		31		No					
nPr1E_bas	Node							0		313807.7	6242166		32		No					
nPr1F_bas	Node							0		313777.8	6242168		33		No					
nPr1G_bas	Node							0		313768.7	6242019		34		No					
Pit3845	OnGrade	Junction Pi	Junction Pit or Manhole		1.5	5.5		0	0	313833.5	6242007	Yes	2163549	1 x Ku	No	New				
DSP1_bas2	Node					2.57		0		313846.5	6242000		932258		No					
Pit2177	OnGrade	Junction Pi	Junction Pit or Manhole		1.5	6		0	0	313874.1	6242009	Yes	1819492	1 x Ku	No	New				
DSP1_bas1	Node					2.56		0		313854.6	6242001		35		No					

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng	id
Basin2_bas	2.6	1		None						313814.8	6242013	No			931880
	3.4	1													
	3.5	1													
	3.6	605.114													
	3.7	608.178													
	3.8	611.149													
	3.9	614.026													
	4	616.811													
	4.1	619.52													
	4.2	622.159													
	4.3	624.727													
	4.4	627.223													
	4.5	629.67													
	4.6	632.158													
	4.7	634.694													
	4.8	637.281													
	4.9	639.917													
	5	642.603													
	5.1	645.338													
	5.2	648.123													
	5.3	650.958													
	5.4	653.842													
	5.5	656.776													
	6	656.776													
Basin1_bas	2.64	1		None						313891.1	6242027	No			931883
	3.2	1													
	3.3	89.872													
	3.4	149.953													
	3.5	218.535													
	3.6	797.596													
	3.7	1075.9													
	3.8	1317.05													
	3.9	1750.7													
	4	1890.04													
	4.1	2009.35													
	4.2	2123.45													
	4.3	2240.17													
	4.4	2360.88													
	4.5	2449.34													
	4.6	2540.03													
	4.7	2641.8													
	4.8	2762.35													
	4.9	2885.75													
	5	2999.68													
	5.1	3094.98													
	5.2	3194.7													
	5.3	3294.25													
	5.4	3391.96													
	5.5	3490.77													
	5.6	3592.25													
	5.7	3695.36													
	5.8	3802.66													
	5.9	3914.36													
	6	4045.06													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area	Impervious Area	Avg Slope(%)	Mannings n	Time lag (mins)	Rainfall Multiplier	Hydrological Model
Ex1A	N_Ex1A	4.289	47	2.8	0.03	0	1	RAFTS
Ex1B	N_Ex1B	7.229	38	3.7	0.03	0	1	RAFTS
Ex3B	N_Ex3B	0.688	3.2	1.8	0.03	0	1	RAFTS
Ex3A	N_Ex3A	1.944	58.6	2.9	0.03	0	1	RAFTS
Ex2B	N_Ex2B	1.33	21.9	3.5	0.03	0	1	RAFTS
Ex2A	N_Ex2A	0.311	16.1	0.5	0.03	0	1	RAFTS
Ex3C	N_Ex3C	3.819	83.8	3	0.03	0	1	RAFTS
cPr1A	nPr1A	3.31	88.4	4	0.02	0	1	RAFTS
cPr1B	nPr1B	3.693	77.8	3	0.02	0	1	RAFTS
cPr1C	nPr1C	0.461	10	0.5	0.03	0	1	RAFTS
cPr1D	nPr1D	3.261	88.2	1.4	0.02	0	1	RAFTS
cPr1E	nPr1E	0.794	85	2.8	0.02	0	1	RAFTS
cPr1F	nPr1F	0.925	85	2.8	0.02	0	1	RAFTS
cPr1G	nPr1G	0.077	19.8	0.5	0.02	0	1	RAFTS
cPr2A	nPr2A	0.059	94.6	2.2	0.02	0	1	RAFTS
cPr2B	nPr2B	1.263	10	3.4	0.03	0	1	RAFTS
cPr3A	nPr3A	0.471	10	0.5	0.03	0	1	RAFTS
cPr3B	nPr3B	0.746	10	1.4	0.03	0	1	RAFTS
cPr3C	nPr3C	2.668	66.5	1	0.02	0	1	RAFTS
cPr3D	nPr3D	1.307	86.7	0.7	0.02	0	1	RAFTS
cPr3E	nPr3E	0.605	89	3.7	0.02	0	1	RAFTS
cPr1A_bas	nPr1A_bas	3.31	88.4	4	0.02	0.290258	1	RAFTS
cPr1B_bas	nPr1B_bas	3.693	77.8	3	0.02	0.253458	1	RAFTS
cPr1C_bas	nPr1C_bas	0.461	10	0.5	0.03	1.23736	1	RAFTS
cPr1D_bas	nPr1D_bas	3.261	88.1	1.4	0.02	0.1105	1	RAFTS
cPr1E_bas	nPr1E_bas	0.794	85	3	0.02	0.103067	1	RAFTS
cPr1F_bas	nPr1F_bas	0.925	85	2.8	0.02	0.268267	1	RAFTS
cPr1G_bas	nPr1G_bas	0.077	19.8	0.5	0.02	0.150542	1	RAFTS

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
Pipe Outlet	Pit3845	DSP1_bas2	4	2.6	2.58	0.5	Concrete, ι	450	450	0.013	New	1	Pit3845	0					
Pipe Outlet	Pit2177	DSP1_bas1	7.5	2.64	2.56	1.07	Concrete, ι	450	450	0.013	New	1	Pit2177	0					

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

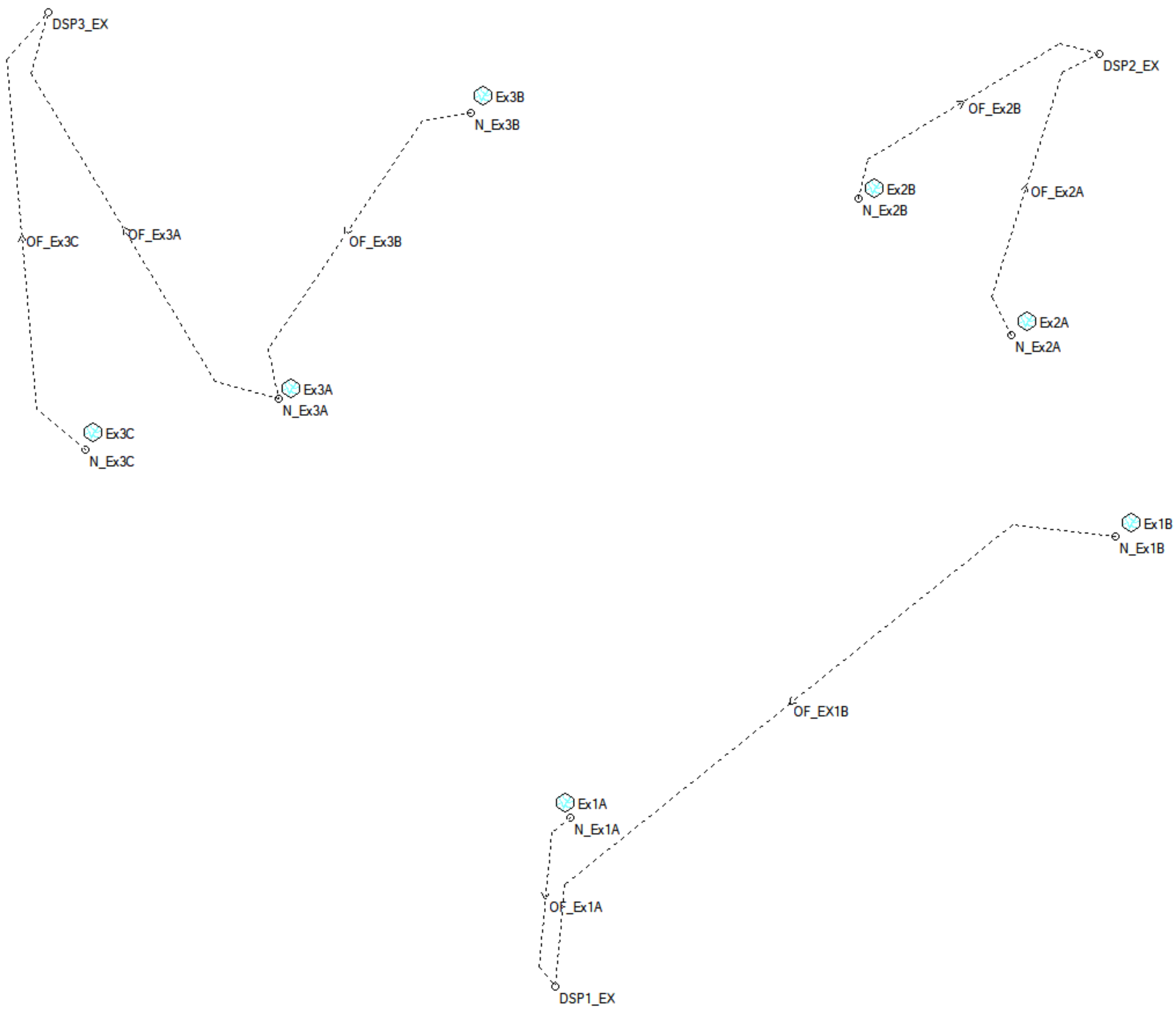
OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	SafeDepth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id	U/S IL	D/S IL	Length (m)
OF_Ex1A	N_Ex1A	DSP1_EX	0.1				Channel se	0.6	0.6	1	10	100		115	5	4	10
OF_EX1B	N_Ex1B	DSP1_EX	0.1				Channel se	0.6	0.6	1	10	100		116	5	4	10
OF_Ex3B	N_Ex3B	N_Ex3A	0.1				Channel se	0.6	0.6	1	10	100		117	6	5	10
OF_Ex3A	N_Ex3A	DSP3_EX	0.1				Channel se	0.6	0.6	1	10	100		118	5	4	10
OF_Ex2B	N_Ex2B	DSP2_EX	0.1				Channel se	0.6	0.6	1	10	100		119	5	4	10
OF_Ex2A	N_Ex2A	DSP2_EX	0.1				Channel se	0.6	0.6	1	10	100		120	5	4	10
OF_Ex3C	N_Ex3C	DSP3_EX	0.1				Channel se	0.6	0.6	1	10	100		121	5	4	10
oPr1A	nPr1A	nPr1C	0.1				7.5 m road	0.6	0.6	0.4	2.64864	100		101	21.17	6	572.747
oPr1B	nPr1B	nPr1C	0.1				7.5 m road	0.6	0.6	0.4	3.111282	100		102	19.041	6	419.152
oPr1C	nPr1C	DSP1	0.1				7.5 m road	0.6	0.6	0.4	1.043793	100		103	6	4.81	114.007
oPr1D	nPr1D	DSP1	0.1				7.5 m road	0.6	0.6	0.4	2.039669	100		104	14.682	4.81	484
oPr1E	nPr1E	nPr1G	0.1				7.5 m road	0.6	0.6	0.4	1.746149	100		105	11.499	6	314.922
oPr1F	nPr1F	nPr1G	0.1				7.5 m road	0.6	0.6	0.4	1.508106	100		106	11.182	6	343.61
oPr1G	nPr1G	DSP1	0.1				7.5 m road	0.6	0.6	0.4	1.074412	100		107	6	4.81	110.758
oPr2A	nPr2A	DSP2	0.1				7.5 m road	0.6	0.6	0.4	1.849884	100		108	21.547	17.7	207.959
oPr2B	nPr2B	DSP2	0.1				7.5 m road	0.6	0.6	0.4	3.373079	100		109	22.12	17.7	131.038
oPr3A	nPr3A	DSP3	0.1				7.5 m road	0.6	0.6	0.4	2.229769	100		110	15.454	10.78	209.618
oPr3B	nPr3B	nPr3A	0.1				7.5 m road	0.6	0.6	0.4	2.031285	100		111	22.12	20.18	95.5061
oPr3C	nPr3C	nPr3A	0.1				7.5 m road	0.6	0.6	0.4	1.086508	100		112	21.651	17.354	395.487
oPr3D	nPr3D	nPr3A	0.1				7.5 m road	0.6	0.6	0.4	0.423548	100		113	16.199	15.454	175.895
oPr3E	nPr3E	DSP3	0.1				7.5 m road	0.6	0.6	0.4	1.384615	100		114	15.1	10.78	312
oPr1A_bas	nPr1A_bas	nPr1C_bas	0.1				7.5 m road	0.6	0.6	0.4	2.64864	100		122	21.17	6	572.747
oPr1B_bas	nPr1B_bas	nPr1C_bas	0.1				7.5 m road	0.6	0.6	0.4	3.111282	100		123	19.041	6	419.152
oPr1C_bas	nPr1C_bas	Basin1_bas	0.1				7.5 m road	0.6	0.6	0.4	3.33	100		124	6	5.9	3
oPr1D_bas	nPr1D_bas	Basin1_bas	0.1				7.5 m road	0.6	0.6	0.4	2.039669	100		125	14.682	4.81	484
oPr1E_bas	nPr1E_bas	nPr1G_bas	0.1				7.5 m road	0.6	0.6	0.4	1.746149	100		126	11.499	6	314.922
oPr1F_bas	nPr1F_bas	nPr1G_bas	0.1				7.5 m road	0.6	0.6	0.4	1.508106	100		127	11.182	6	343.61
oPr1G_bas	nPr1G_bas	Basin2_bas	0.1				7.5 m road	0.6	0.6	0.4	3.33	100		128	6	5.9	3

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)	
Pipe Outlet	Concrete, ι	450	0.6	-0.5	Unsafe
Pipe Outlet	Concrete, ι	450	0.6	-0.49	Unsafe

This model has no pipes with non-return valves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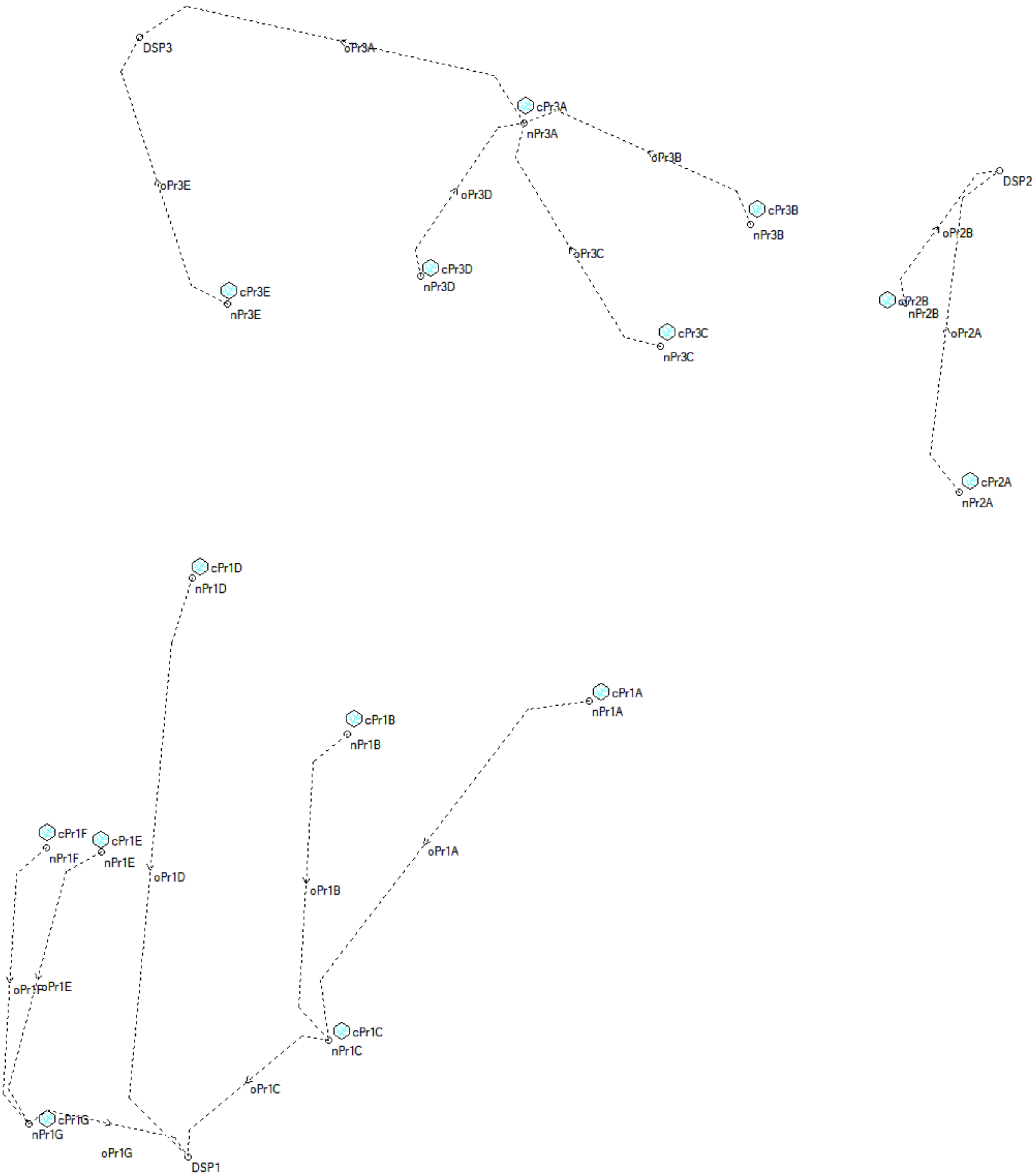
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nPr3D
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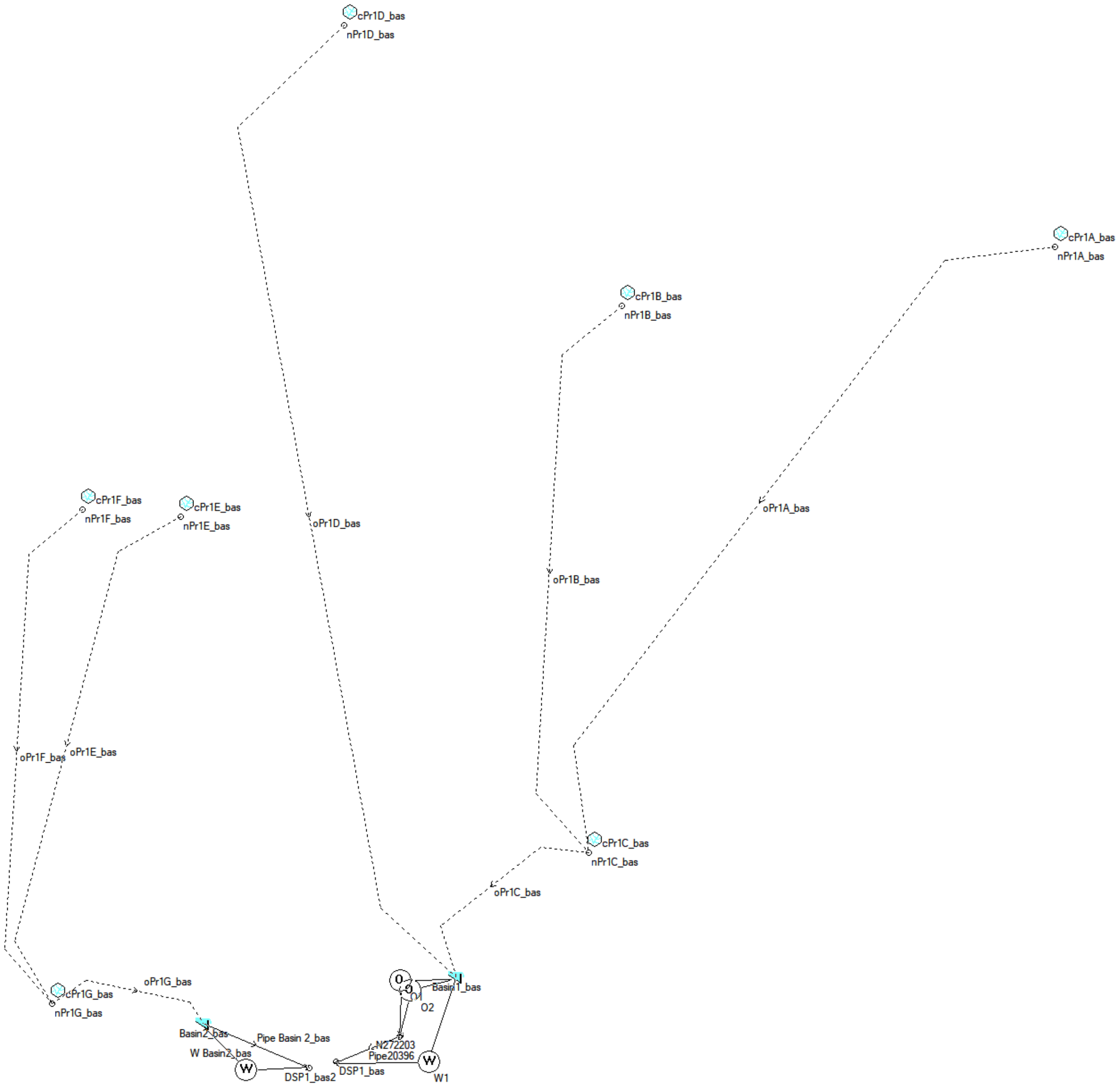
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nPr1G_bas
Basin1_bas
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Pipe20396
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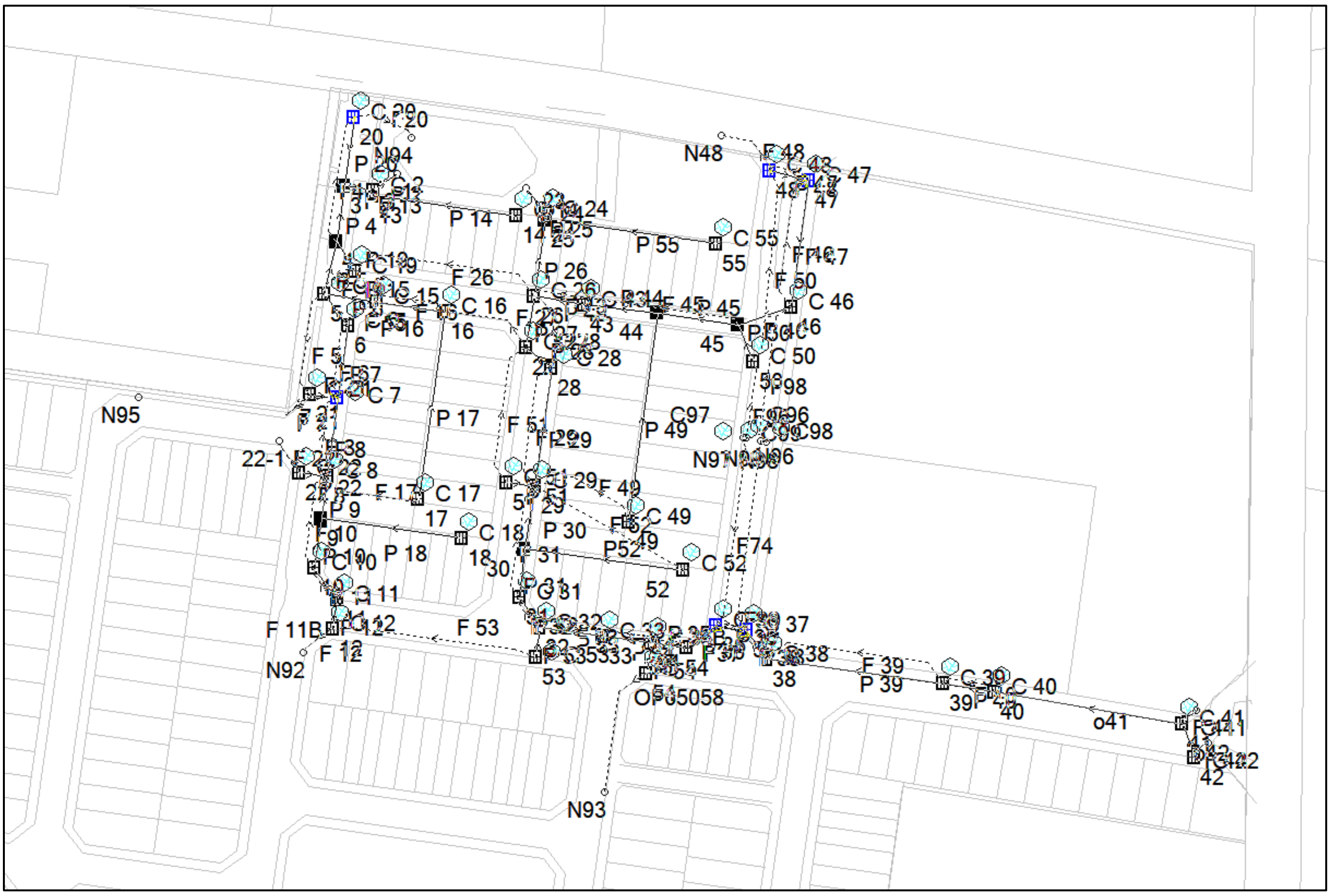
W1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C 55
55
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C 46
C 50
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C 17
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C 18
P 18
P 30
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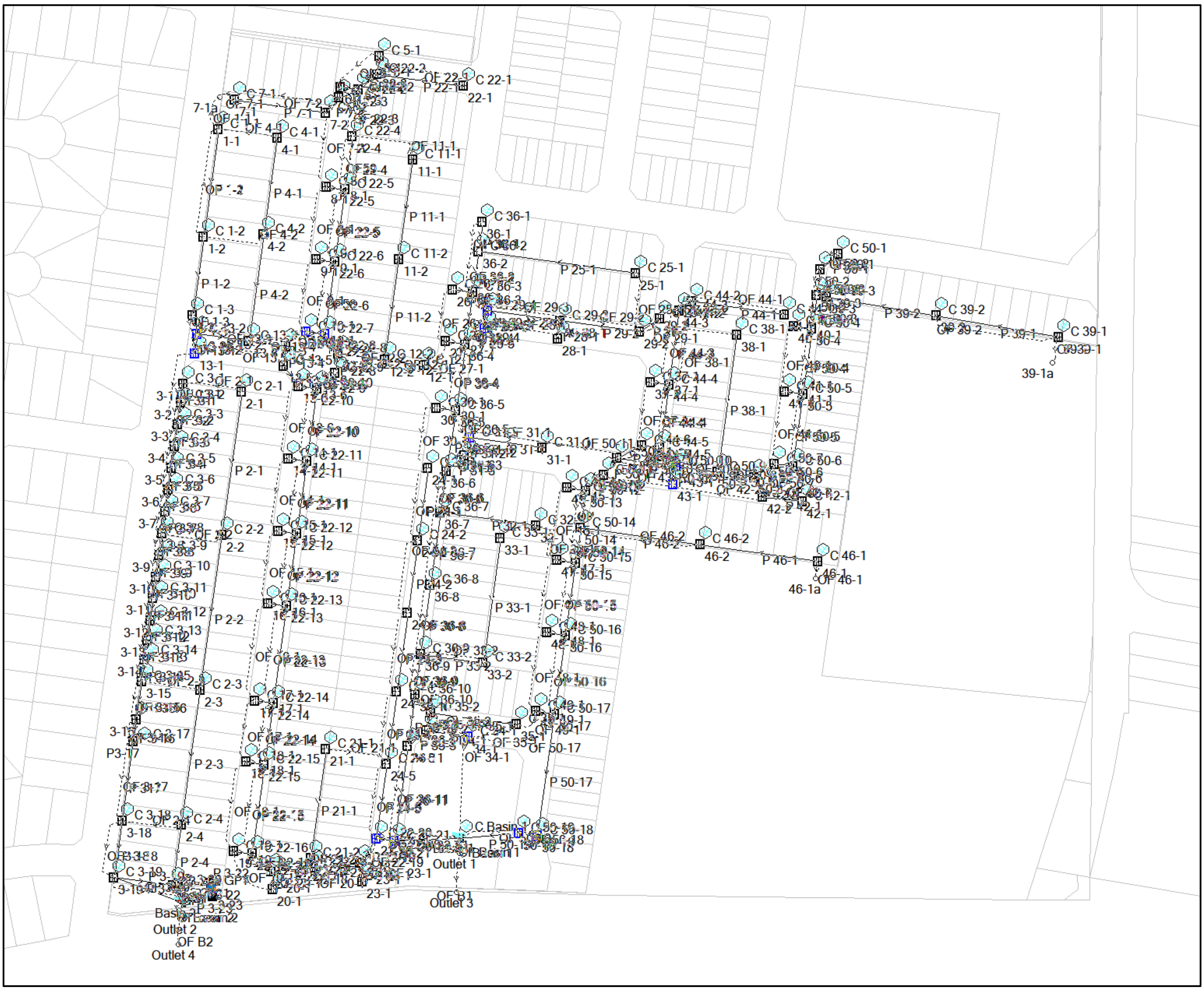
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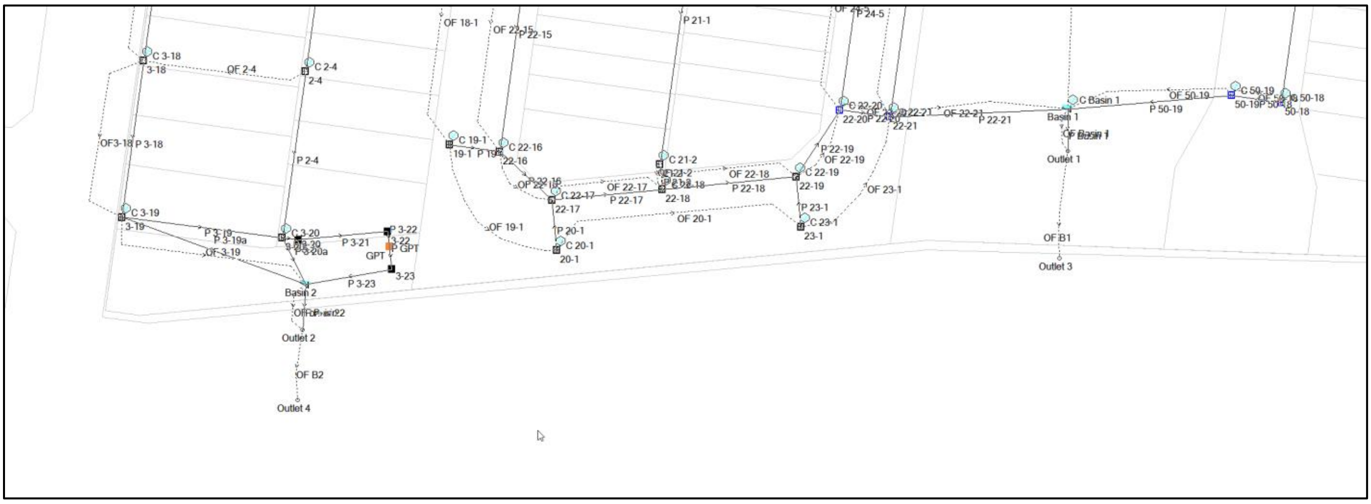
Outlet 2
Outlet 3
Outlet 4
OF B2
39-1a
46-1a


Basin 1
Basin 2
Outlet 1
Outlet 2
Outlet 3
Outlet 4
OF B1
OF B2
GPT

APPENDIX E: OSD DRAINS IL CL MODEL - RESULTS

DRAINS results prepared from Version 2023.11.8726.15750

PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivir (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
DSP1_EX	0		5.544				
N_Ex1A	5.07		2.175				
N_Ex1B	5.09		3.37				
DSP3_EX	0		3.737				
DSP2_EX	0		0.672				
N_Ex3B	6.02		0.156				
N_Ex3A	5.05		0.709				
N_Ex2B	5.03		0.618				
N_Ex2A	5.01		0.07				
N_Ex3C	5.08		2.439				
nPr1A	21.39		2.136				
nPr1B	19.26		2.382				
nPr1C	6.35		4.518				
nPr1D	14.91		2.097				
nPr1E	11.65		0.512				
nPr1F	11.34		0.597				
nPr1G	6.21		1.109				
nPr2A	21.62		0.038				
nPr2B	22.24		0.409				
nPr3A	15.68		2.431				
nPr3B	22.22		0.184				
nPr3C	21.88		1.605				
nPr3D	16.42		0.833				
nPr3E	3.79E+22		0.39				
DSP3	0		2.479				
DSP2	0		0.422				
DSP1	0		7.857				
nPr1A_bas	21.39		2.136				
nPr1B_bas	19.26		2.382				
nPr1C_bas	6.28		4.518				
nPr1D_bas	14.91		2.097				
nPr1E_bas	11.65		0.512				
nPr1F_bas	11.34		0.597				
nPr1G_bas	6.17		1.109				
Pit3845	5.56		0		0		Outlet System
DSP1_bas2	5.55		0				
Pit2177	5.65		0		0.35		None
DSP1_bas1	5.55		0				

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
Ex1A	1.607	1% AEP, 10 min burst, Storm 7
Ex1B	2.398	1% AEP, 20 min burst, Storm 8
Ex3B	0.135	1% AEP, 30 min burst, Storm 5
Ex3A	0.849	1% AEP, 10 min burst, Storm 7
Ex2B	0.434	1% AEP, 25 min burst, Storm 7
Ex2A	0.062	1% AEP, 30 min burst, Storm 5
Ex3C	1.86	1% AEP, 5 min burst, Storm 1
cPr1A	1.777	1% AEP, 5 min burst, Storm 1
cPr1B	1.912	1% AEP, 5 min burst, Storm 1
cPr1C	0.074	1% AEP, 45 min burst, Storm 6
cPr1D	1.677	1% AEP, 5 min burst, Storm 1
cPr1E	0.427	1% AEP, 5 min burst, Storm 1
cPr1F	0.497	1% AEP, 5 min burst, Storm 1
cPr1G	0.025	1% AEP, 25 min burst, Storm 1
cPr2A	0.032	1% AEP, 5 min burst, Storm 1
cPr2B	0.351	1% AEP, 20 min burst, Storm 5
cPr3A	0.076	1% AEP, 45 min burst, Storm 6
cPr3B	0.163	1% AEP, 25 min burst, Storm 1
cPr3C	1.162	1% AEP, 10 min burst, Storm 7
cPr3D	0.639	1% AEP, 5 min burst, Storm 1
cPr3E	0.326	1% AEP, 5 min burst, Storm 1
cPr1A_bas	1.779	1% AEP, 5 min burst, Storm 1
cPr1B_bas	1.923	1% AEP, 5 min burst, Storm 1
cPr1C_bas	0.074	1% AEP, 45 min burst, Storm 6
cPr1D_bas	1.686	1% AEP, 5 min burst, Storm 1
cPr1E_bas	0.427	1% AEP, 5 min burst, Storm 1
cPr1F_bas	0.497	1% AEP, 5 min burst, Storm 1
cPr1G_bas	0.025	1% AEP, 25 min burst, Storm 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe Outlet	0.055	0.34	5.557	5.55	1% AEP, 5 min burst, Storm 1
Pipe Outlet	0.158	0.99	5.573	5.55	1% AEP, 5 min burst, Storm 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF_Ex1A	1.607	1.606	12.321	0.072	0.15	11.44	2.09	1% AEP, 5 min burst, Storm 1
OF_EX1B	2.398	2.399	12.321	0.091	0.22	11.83	2.44	1% AEP, 5 min burst, Storm 1
OF_Ex3B	0.058	0.906	12.321	0.051	0.09	11.03	inf	1% AEP, 10 min burst, Storm 7
OF_Ex3A	0.905	0.904	12.321	0.051	0.09	11.03	1.68	1% AEP, 5 min burst, Storm 1
OF_Ex2B	0.434	0.434	12.321	0.033	0.04	10.66	1.29	1% AEP, 5 min burst, Storm 1
OF_Ex2A	0.062	0.062	12.321	0.01	0.01	10.21	0.6	1% AEP, 5 min burst, Storm 1
OF_Ex3C	1.86	1.866	12.321	0.079	0.17	11.57	inf	1% AEP, 5 min burst, Storm 1
oPr1A	1.703	2.083	0.903	0.235	0.68	6.47	inf	1% AEP, 5 min burst, Storm 1
oPr1B	1.808	1.85	0.857	0.22	0.65	6.11	inf	1% AEP, 5 min burst, Storm 1
oPr1C	3.924	4.474	1.189	0.357	0.94	8.85	inf	1% AEP, 5 min burst, Storm 1
oPr1D	1.534	1.742	0.975	0.232	0.58	6.39	inf	1% AEP, 5 min burst, Storm 1
oPr1E	0.408	0.466	1.033	0.158	0.25	4.55	inf	1% AEP, 5 min burst, Storm 1
oPr1F	0.477	0.496	1.072	0.165	0.25	4.72	inf	1% AEP, 5 min burst, Storm 1
oPr1G	0.921	0.967	1.187	0.213	0.35	5.91	inf	1% AEP, 5 min burst, Storm 1
oPr2A	0.032	0.029	1.004	0.071	0.07	1.51	1.05	1% AEP, 5 min burst, Storm 1
oPr2B	0.346	0.345	0.834	0.126	0.26	3.34	2.07	1% AEP, 5 min burst, Storm 1
oPr3A	1.748	1.753	0.959	0.229	0.59	6.34	2.57	1% AEP, 5 min burst, Storm 1
oPr3B	0.158	0.226	0.973	0.119	0.18	3.11	inf	1% AEP, 30 min burst, Storm 5
oPr3C	1.129	1.15	1.174	0.224	0.39	6.21	inf	1% AEP, 10 min burst, Storm 7
oPr3D	0.614	0.644	1.535	0.216	0.23	6.01	inf	1% AEP, 10 min burst, Storm 1
oPr3E	0.323	0.323	1.102	0.148	0.2	4.07	1.39	1% AEP, 5 min burst, Storm 1
oPr1A_bas	1.721	2.08	0.903	0.235	0.68	6.47	inf	1% AEP, 5 min burst, Storm 1
oPr1B_bas	1.824	1.861	0.857	0.221	0.65	6.12	inf	1% AEP, 5 min burst, Storm 1
oPr1C_bas	3.866	3.857	0.848	0.283	1.05	7.67	3.77	1% AEP, 5 min burst, Storm 1
oPr1D_bas	1.541	1.61	0.975	0.225	0.88	6.24	inf	1% AEP, 5 min burst, Storm 1
oPr1E_bas	0.412	0.463	1.033	0.157	0.25	4.54	inf	1% AEP, 5 min burst, Storm 1
oPr1F_bas	0.477	0.497	1.072	0.165	0.25	4.72	inf	1% AEP, 5 min burst, Storm 1
oPr1G_bas	0.911	0.912	0.848	0.175	0.42	4.99	inf	1% AEP, 5 min burst, Storm 1
O3	0.061	0.061						1% AEP, 5 min burst, Storm 1
W Basin2_I	0.853	0.853						1% AEP, 5 min burst, Storm 1
W1	2.891	2.891						1% AEP, 5 min burst, Storm 1
O2								
O1	0.158	0.158						1% AEP, 5 min burst, Storm 1

DETENTION BASIN DETAILS

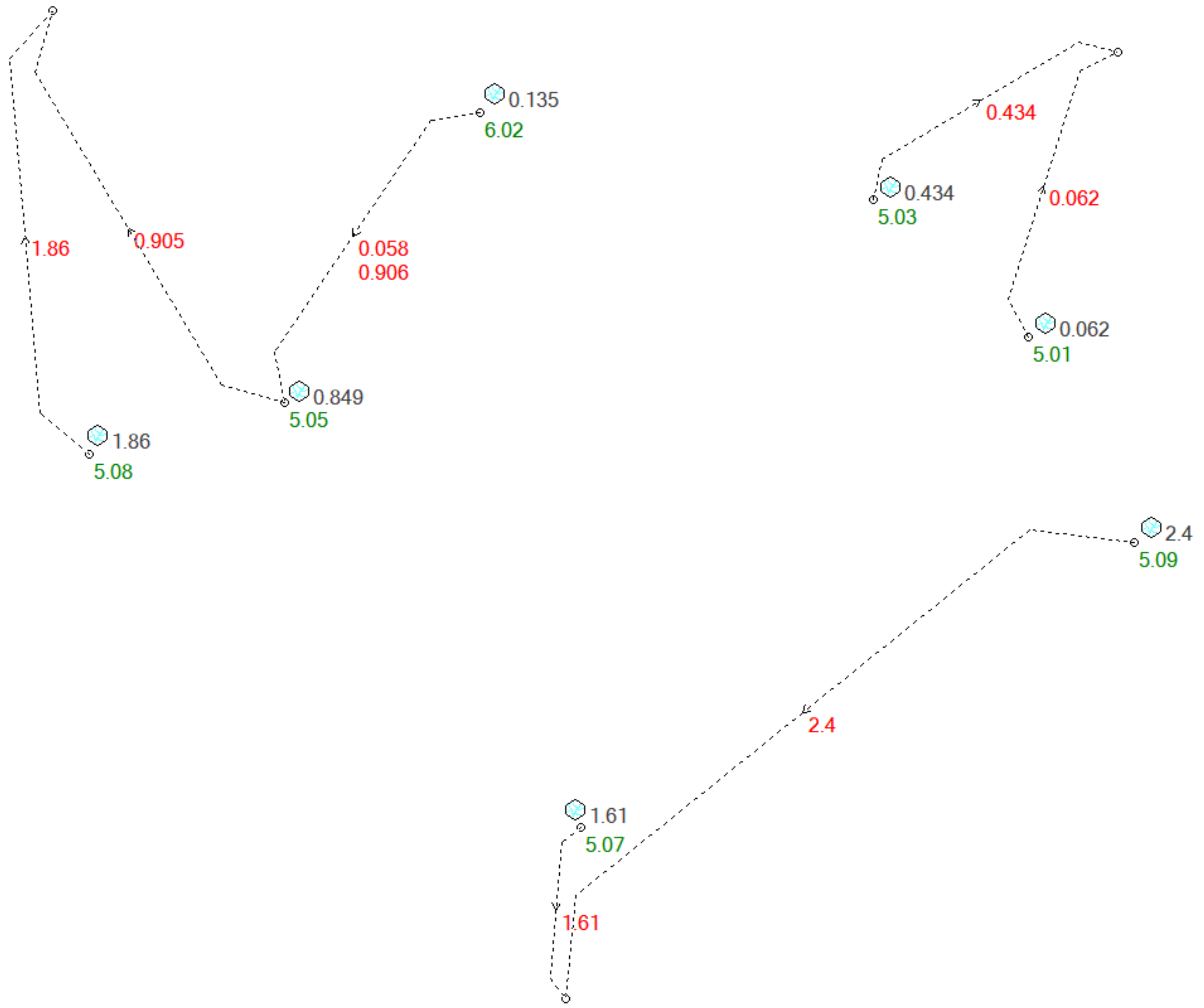
Name	Max WL	MaxVol	Max Q	Max Q	Max Q
			Total	Low Level	High Level
Basin2_bas	5.57	1263.9	0.914	0	0.914
Basin1_bas	5.86	6027	3.049	0	3.049

Run Log for DRAINS v2023.11.8726.15750 - 240708_basin1_outlet_design FINAL

{\colortbl;\red0\green0\blue0;\red192\green0\blue0;}Run Log for DRAINS v2023.11.8726.15750 - 240708_basin1_outlet_design FINAL.drn run at 10:34:40 on 10/7/2024 using Watercom Drains v2023.11.8726.15750

No water upwelling from any pit.
Freeboard was adequate at all pits.

The maximum flow in these overflow routes is unsafe: oPr1A, oPr1B, oPr1C, oPr1D, oPr3A, oPr1A_bas, oPr1B_bas, oPr1C_bas, oPr1D_bas, oPr1G_bas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0.905
0.058
0.906
0.849
5.05
1.86
5.08
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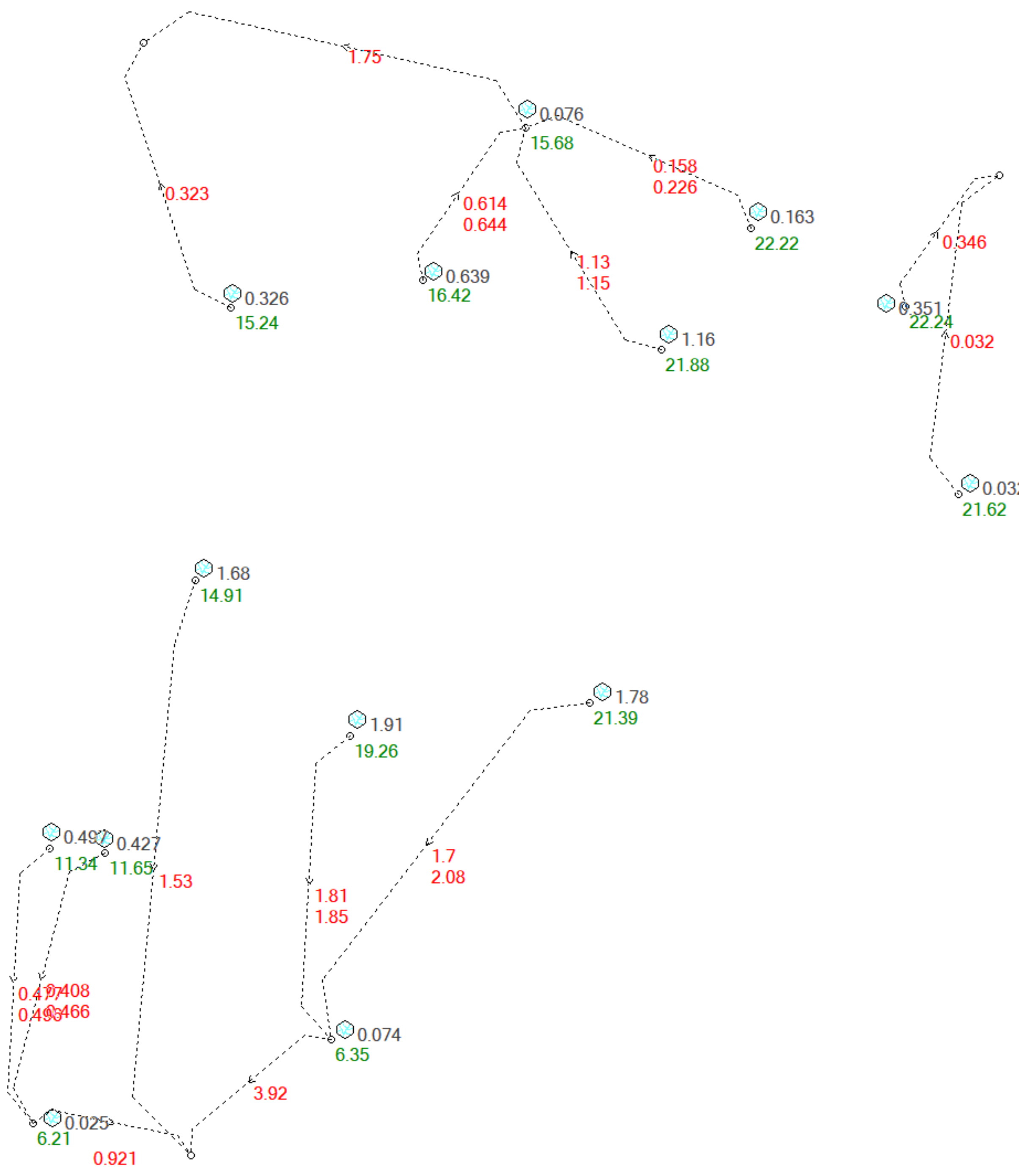
0.062
0.062
5.01
2.4
5.09
2.4
1.61
5.07
1.61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0.639
16.42
0.326
15.24
0.351
22.24
0.032
1.16
21.88
0.032
21.62
1.68
14.91
1.78
21.39
1.91
19.26
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11.34
11.65
1.53
1.7
2.08
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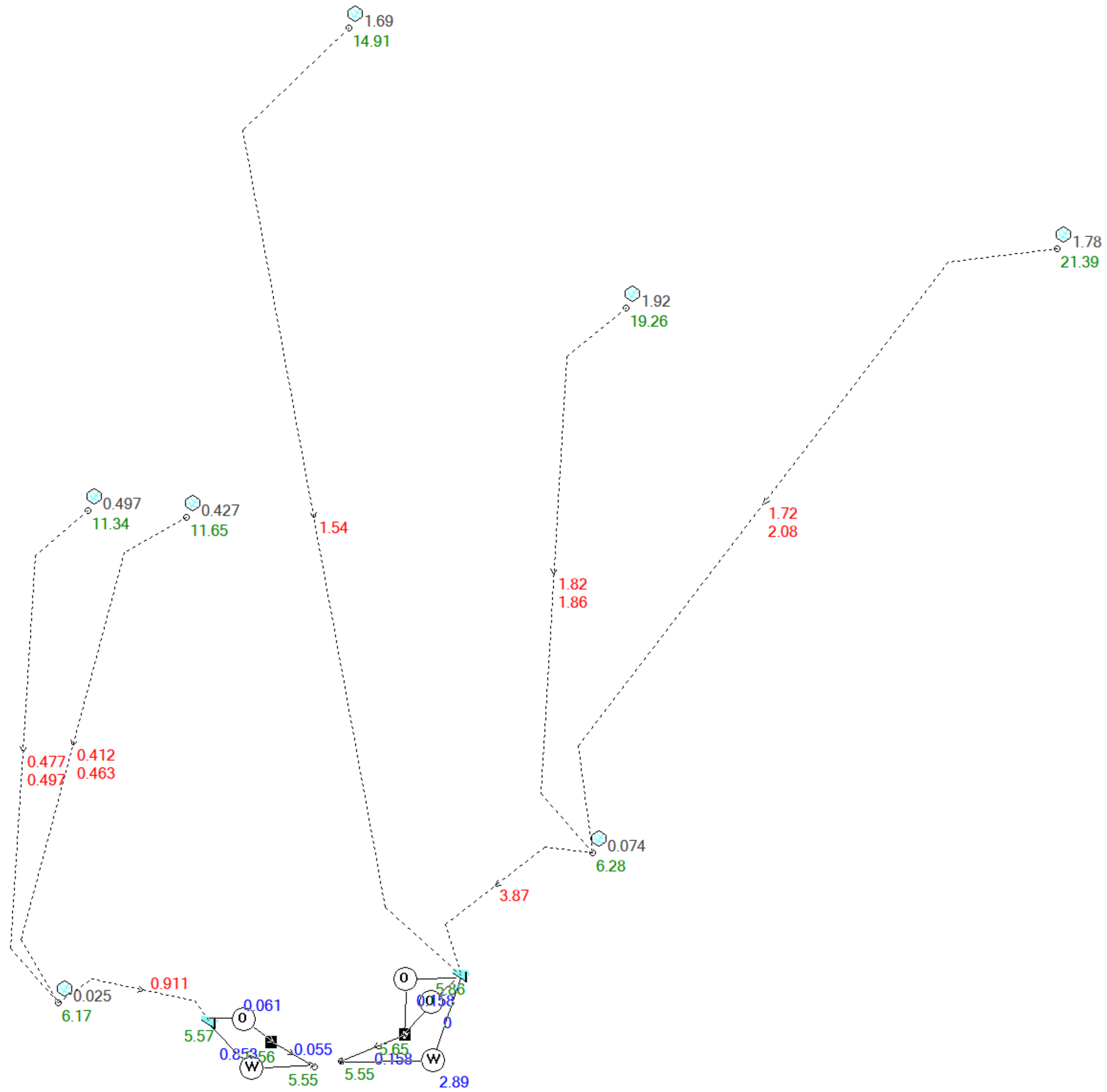
6.21
0.921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1.82
1.86
0.477
0.497
0.412
0.463
0.074
6.28
3.87
0.025
6.17
0.911
5.57
0.061
0.055
5.55
5.86
0
2.89
5.55

APPENDIX F: MUSIC LINK SUMMARY RESULTS (LIVERPOOL COUNCIL)

LIVERPOOL CITY COUNCIL

music link

MUSIC-*link* Report

Project Details		Company Details	
Project:	2 Bullecourt Avenue, Milperra, NSW - Stage 1	**Company:**	Beveridge Williams
Report Export Date:	22/05/2024	**Contact:**	
Catchment Name:	Receiving 60	**Address:**	
Catchment Area:	0.603ha	**Phone:**	
Impervious Area*:	84.7014925373134%	**Email:**	
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	Six minutes		
Modelling Period:	01/01/67 - 31/12/1976 11:54:00 PM		
Mean Annual Rainfall:	856.622mm		
Evapotranspiration:	1171.074mm		
MUSICX Version:	1.30.0.13025 (5.30.0.13025)		
MUSIC-link data Version:	5.0		
Study Area:	Liverpool City Council		
Scenario:	Liverpool Development		

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

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node:	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	33.122%	Rainwater Tank Nodes	1	Urban_Roof Nodes	2
TSS	94.284%	Bioretention Nodes	1	Urban_Residential Nodes	1
TP	88.772%				
TN	79.488%				
GP	100%				

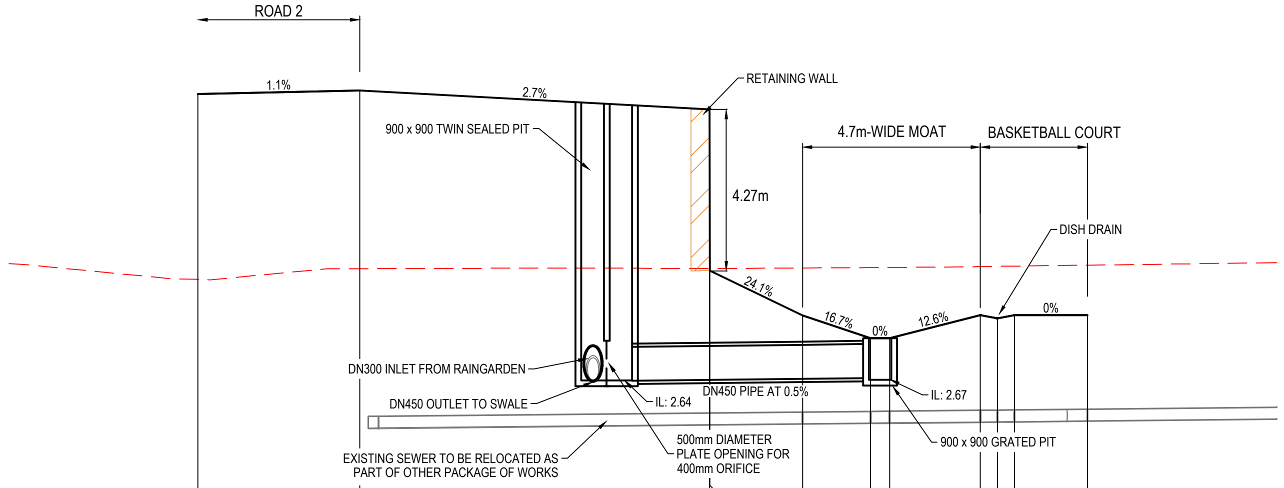
Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bioretention	Temp Basin Stage 1	Exfiltration Rate	0	None	0 mm/h
Bioretention	Temp Basin Stage 1	High Flow Bypass	0	None	100 m^3/s
Bioretention	Temp Basin Stage 1	Orthophosphate Content of Filter Media	0	55	30
Bioretention	Temp Basin Stage 1	PET Scaling Factor	2.1	2.1	2.1 proportion
Bioretention	Temp Basin Stage 1	TN Content of Filter Media	1	800	600
Rainwater	Stage 1 RWT	% Reuse Demand Met	None	None	29.201 %
Receiving	Receiving 60	Flow Reduction	None	None	33.122 %
Receiving	Receiving 60	GP Reduction	90	None	100 %
Receiving	Receiving 60	TN Reduction	45	None	79.488 %
Receiving	Receiving 60	TP Reduction	65	None	88.772 %
Receiving	Receiving 60	TSS Reduction	85	None	94.284 %
Urban_Residential	Stage 1 Yard	Impervious Area	None	None	0.031 ha
Urban_Residential	Stage 1 Yard	Pervious Area	None	None	0.092 ha
Urban_Residential	Stage 1 Yard	Total Area	None	None	0.123 ha
Urban_Roof	Stage 1 (Roof ex RWT)	Impervious Area	None	None	0.12 ha
Urban_Roof	Stage 1 (Roof ex RWT)	Pervious Area	None	None	0 ha
Urban_Roof	Stage 1 (Roof ex RWT)	Total Area	None	None	0.12 ha
Urban_Roof	Stage 1 (Roof to RWT)	Impervious Area	None	None	0.36 ha
Urban_Roof	Stage 1 (Roof to RWT)	Pervious Area	None	None	0 ha
Urban_Roof	Stage 1 (Roof to RWT)	Total Area	None	None	0.36 ha

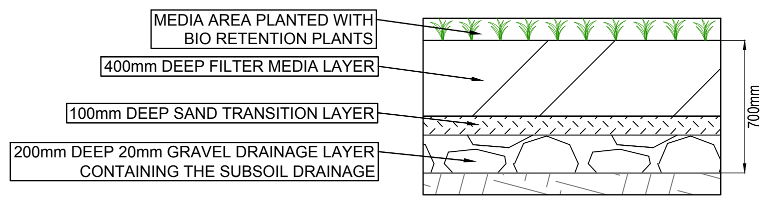
Only certain parameters are reported when they pass validation

APPENDIX G: BASIN PLANS



DATUM1.0													
DESIGN SURFACE	6.427	6.475	6.225	4.090	3.500	3.200	3.200	3.503	3.463	3.503	3.503
EXISTING SURFACE	3.976	4.119	4.121	4.121	4.127	4.133	4.135	4.146	4.149	4.152	4.165
OFFSET	0.000	4.277	13.530	13.541	15.995	17.796	18.296	20.698	21.149	21.600	23.532

SECTION D



DETAIL B
RAINGARDEN DETAIL
NOT TO SCALE

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P1	ISSUED FOR INFORMATION	08.08.24	S.F.	S.F.

mirvac

0 2.5 5 10 15 20
SCALE 1:250 AT A1 SIZE

Designed S.FERGUSON
Date 08.08.2024
Drawn S.FERGUSON
Approved S.GRAY
Date 08.08.2024
PS Number -

Beveridge Williams
32 Iolanthe St
Campbelltown NSW 2560
ph: 02 46255055
www.beveridgewilliams.com.au

Project Details: 2 BULLECOURT AVENUE, MILPERRA
OVERALL ESTATE
MIRVAC

Drawing Title: BASIN 1
LAYOUT PLAN & TYPICAL SECTIONS
(SHEET 1 OF 2)

Sheet 01 of 02
Scale 1:250 @ A1

Project Ref	Stage No	Drawing No	Rev
2301879	00	960	P1

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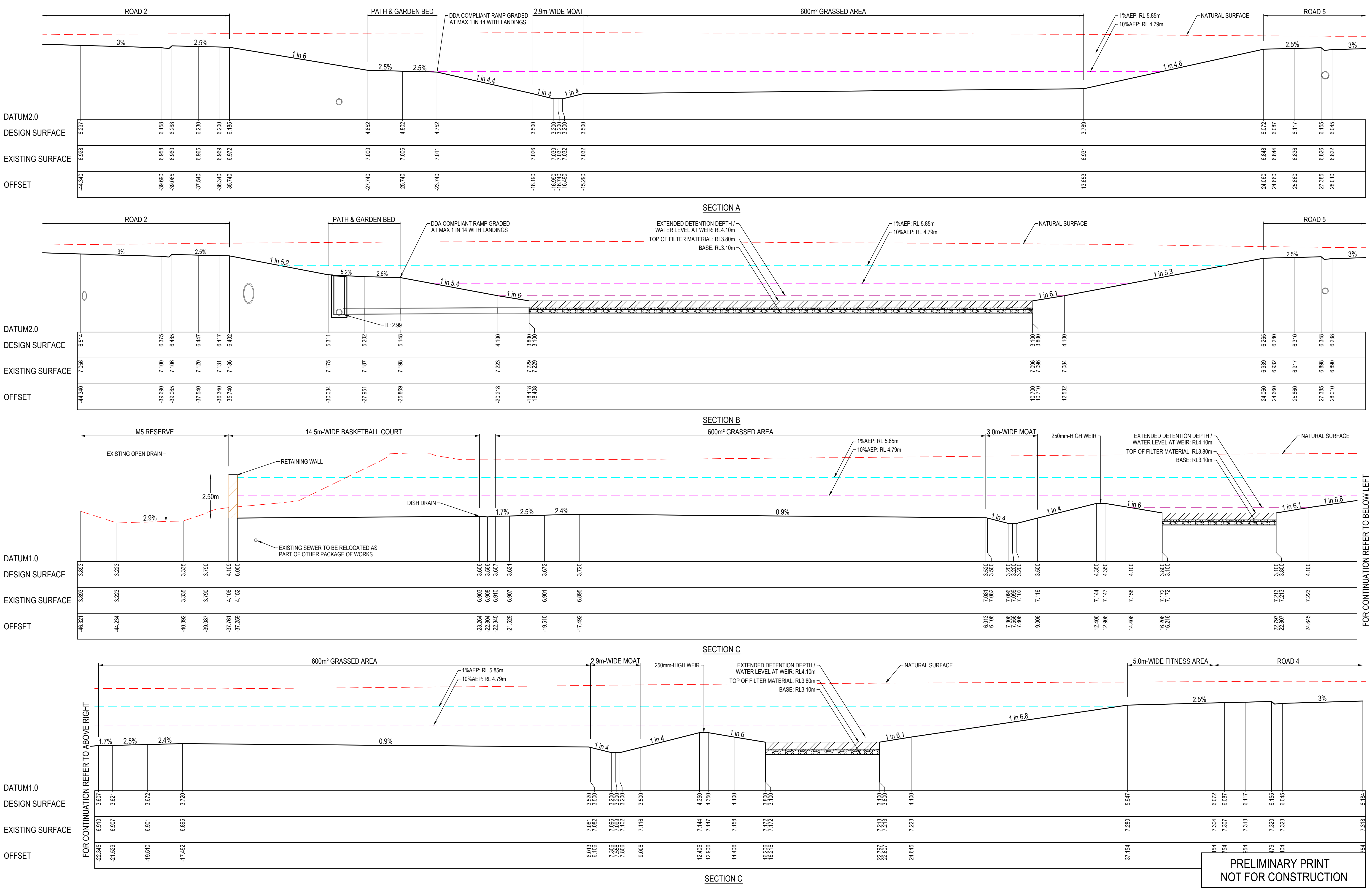

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P1	ISSUED FOR INFORMATION	08.08.24	S.F.	S.F.

mirvac

HORIZ. 1:100 — 0 1 2 4 6
VERT 1:1 — 0 1 2 4 6
SCALE AT A1 SIZE

Designed S.FERGUSON Date 08.08.2024
Drawn S.FERGUSON
Approved S.GRAY Date 08.08.2024
PS Number -

Beveridge Williams
32 Iolanthe St
Campbelltown NSW 2560
ph: 02 46255055
www.beveridgewilliams.com.au

Project Details: 2 BULLECOURT AVENUE, MILPERRA
OVERALL ESTATE
MIRVAC

Drawing Title: BASIN 1
TYPICAL SECTIONS
(SHEET 2 OF 2)

Sheet 02 of 05
Scale 1:100 H 1:1 V @ A1

Project Ref	Stage No	Drawing No	Rev
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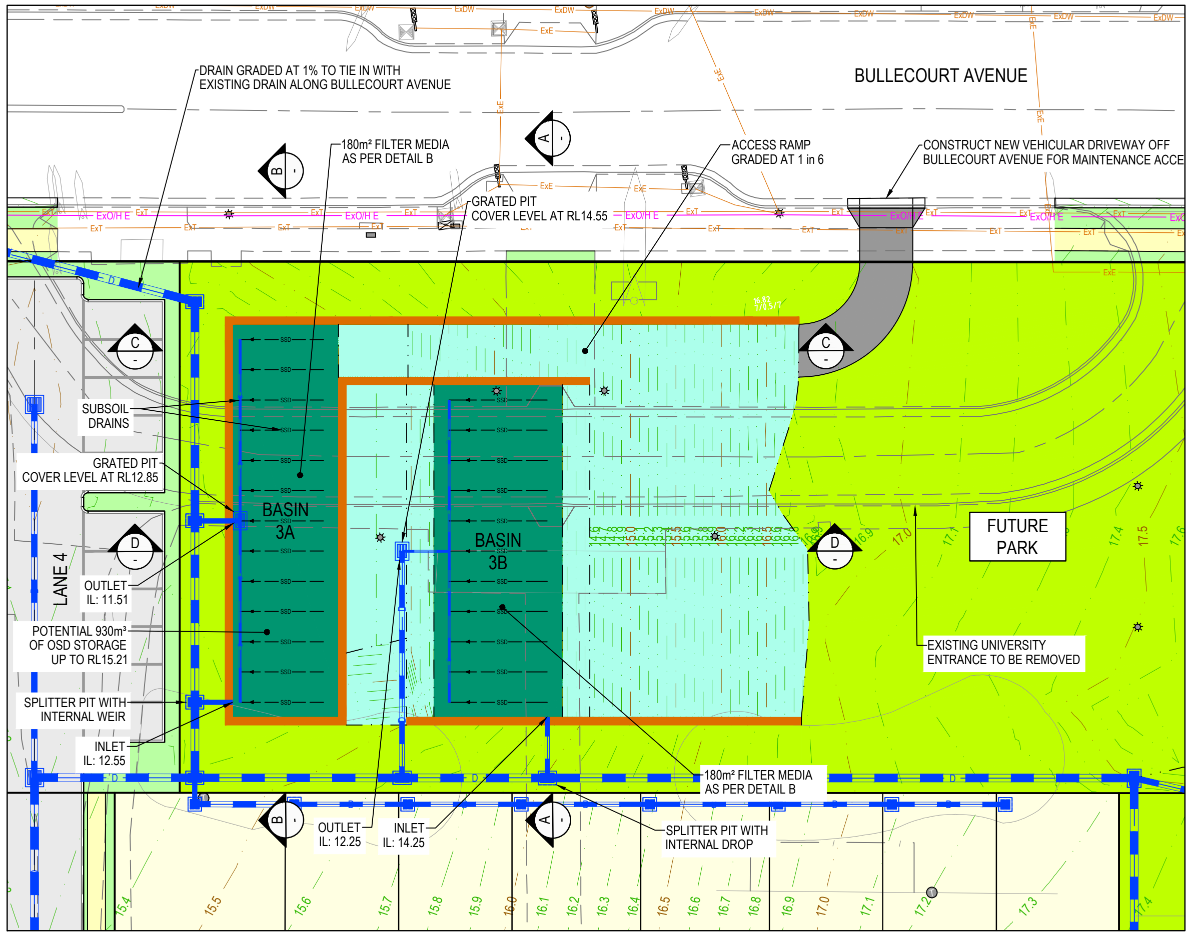

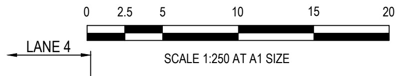

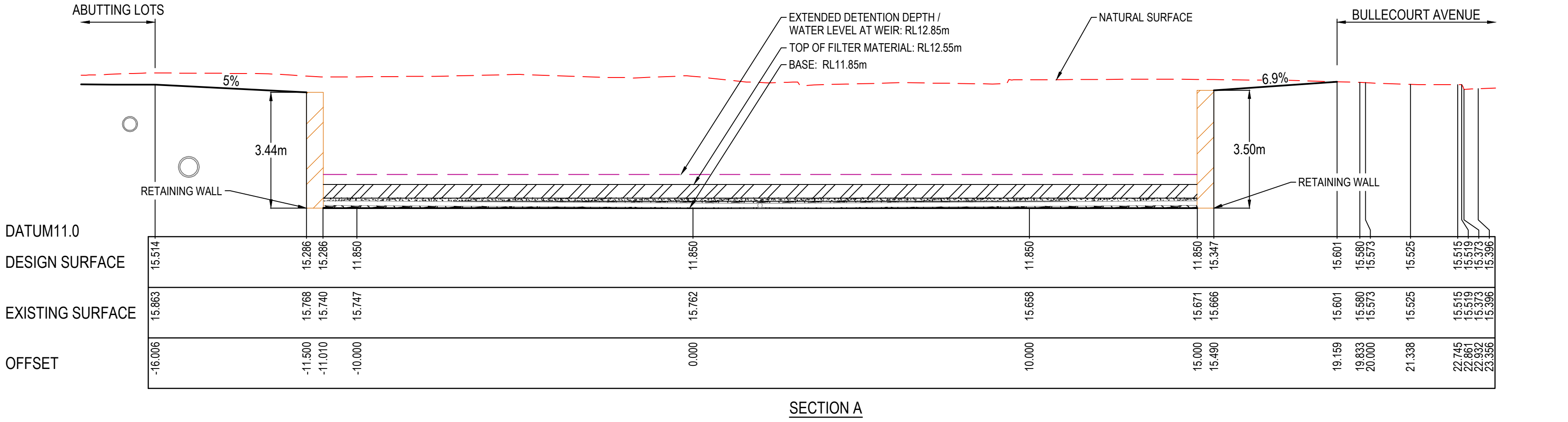

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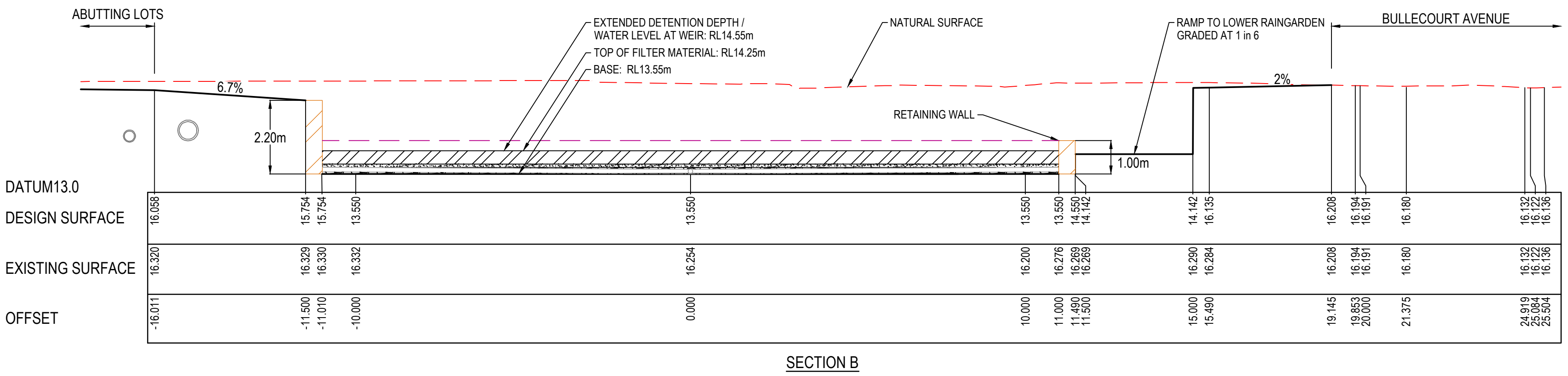

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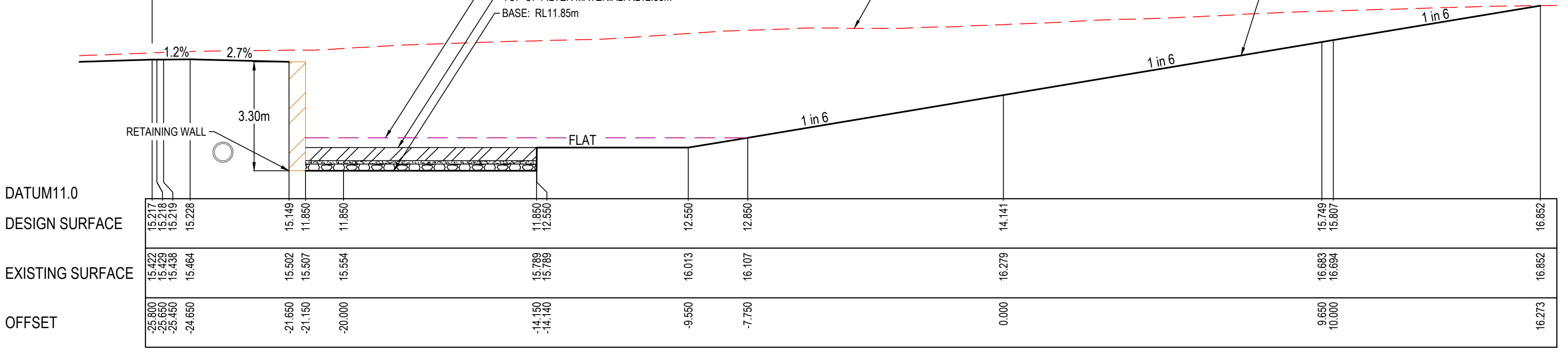

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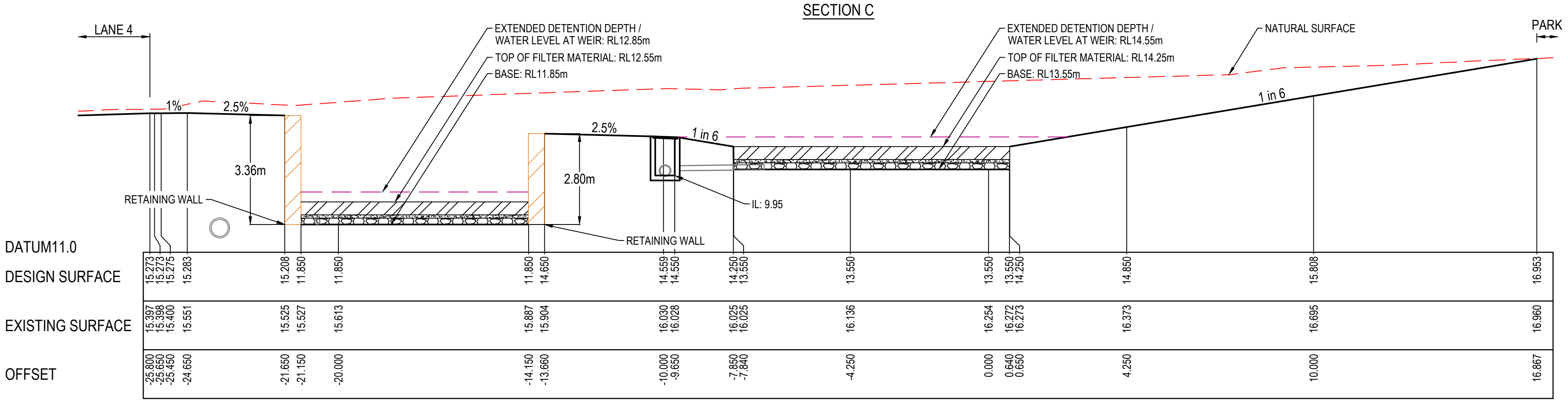

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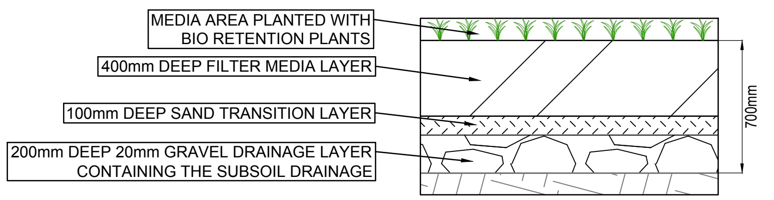

DETAIL B
RAINGARDEN DETAIL
NOT TO SCALE

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P1	ISSUED FOR INFORMATION	08.08.24	S.F.	S.F.

mirvac

HORIZ. 1:100 0 1 2 4 6
VERT 1:1 0 1 2 4 6
SCALE AT A1 SIZE

Designed / Date: S.FERGUSON 08.08.2024
Drawn: S.FERGUSON
Approved / Date: S.GRAY 08.08.2024
PS Number: -

Beveridge Williams
32 Iolanthe St
Campbelltown NSW 2560
ph: 02 46255055
www.beveridgewilliams.com.au

Project Details: 2 BULLECOURT AVENUE, MILPERRA
OVERALL ESTATE
MIRVAC

Drawing Title: BASIN 3
LAYOUT PLAN &
TYPICAL SECTIONS

Sheet 05 of 05
Scale: 1:100 H 1:1 V @ A1
Project Ref: 2301879 | Stage No: 00 | Drawing No: 965 | Rev: P1

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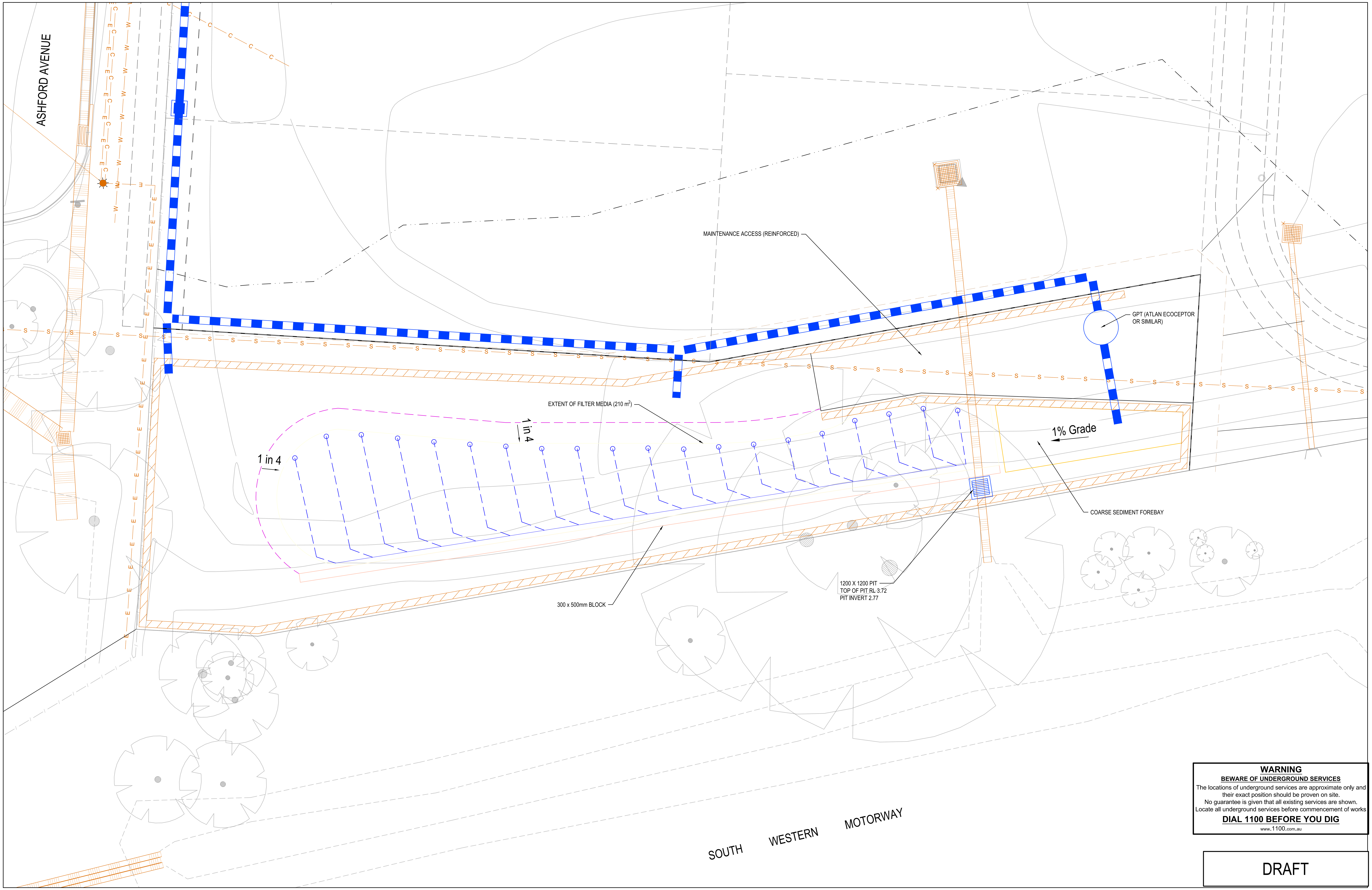

WARNING

BEWARE OF UNDERGROUND SERVICES

The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown.
Locate all underground services before commencement of works

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DRAFT

REV	DESCRIPTION	DATE	DRN.	APP.	REV	DESCRIPTION	DATE	DRN.	APP.
A	ISSUED TO CLIENT FOR REVIEW	08.03.24	JB	SG					

mirvac

0 5 10 20 30 40

SCALE 1:500 AT A1 SIZE

Designed	S. FERGUSON
Date	08.03.2024
Drawn	J. BIRD
Approved	S. GRAY
Date	08.03.2024
DA Number	-

Beveridge Williams
Development & Infrastructure Consultants
32 Iolanthe St
Campbelltown NSW 2560
ph: 02 46255055
www.beveridgewilliams.com.au

Project Details: WSU MILPERRA, LOT 2 IN DP1291984
2 BULLECOURT AVE, MILPERRA
STAGE 1 SUBDIVISION

Drawing Title: DETENTION BASIN LAYOUT PLAN

Sheet 11 of 14

Scale: 1:500 @ A1

Project Number	Reference	Drawing No	Revision
2301879	303	301	A

N

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