Western Parkland City Authority

Bradfield City Centre
Master Plan Application

Integrated Water Cycle Management Plan

Prepared by AECOM

October 2023

wpca.sydney

NSW GOVERNMENT

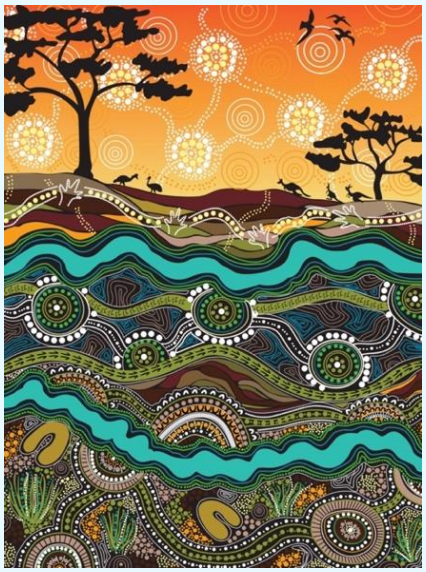
Acknowledgement of Country

Aboriginal people have had a continuous connection with the Country encompassed by the Western Parkland City (the Parkland City) from time immemorial. They have cared for Country and lived in deep alignment with this important landscape, sharing and practicing culture while using it as a space for movement and trade.

We Acknowledge that four groups have primary custodial care obligations for the area: Dharug/Darug, Dharawal/Tharawal, Gundungurra/Gundungara and Darkinjung. We also Acknowledge others who have passed through this Country for trade and care purposes: Coastal Sydney people, Wiradjuri and Yuin.

Western Sydney is home to the highest number of Aboriginal people in any region in Australia. Diverse, strong and connected Aboriginal communities have established their families in this area over generations, even if their connection to Country exists elsewhere. This offers an important opportunity for the future of the Parkland City.

Ensuring that Aboriginal communities, their culture and obligations for Country are considered and promoted will be vital for the future of the Parkland City. A unique opportunity exists to establish a platform for two-way knowledge sharing, to elevate Country and to learn from cultural practices that will create a truly unique and vibrant place for all.



Garungarung Murri Nuru
(Beautiful Grass Country)
Artwork created by Dalmarri artists Jason Douglas and Trevor Eastwood for the Western Parkland City Authority

Version	Status	Date	Prepared By	Reviewer	Comments
01	DRAFT	11/11/2022	CR/PQ	XP/JvZ/GR	
02	DRAFT	19/06/2023	CR/PQ	XP/JvZ/GR	
03	FINAL	31/07/2023	CR	GR	
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05	Publish	17/08/2023	----	JA (WPCA)	
06	Publish	12/09/2023	----	HG (WPCA)	
07	Publish	19/10/2023	----	HG (WPCA)	

Executive Summary

The new Bradfield City Centre is located within the Western Sydney Aerotropolis, complementing the metropolitan cluster of centres including Penrith, Liverpool and Campbelltown and will be a diverse, dynamic and sustainable global city precinct supporting a curfew free airport, delivering attractive places for workers, residents and visitors. It has the potential to deliver 50,000 – 60,000 jobs, leveraging the positive economic impact of the Western Sydney International (Nany Bird Walton) Airport, creating Greater Sydney's next global gateway.

The Western Parkland City Authority (WPCA) is the NSW Government agency responsible for delivering, coordinating and attracting investment to the Western Parkland City. A key component of the WPCA's work is the delivery of the Bradfield City Centre. The Authority has been granted permission by the NSW Department of Planning and Environment (DPE) to prepare a master plan for the Bradfield City Centre.

The Bradfield City Centre precinct is a greenfield site with no existing formal drainage infrastructure present. As such AECOM has prepared the preliminary design of the new drainage network in compliance with water quality and water quantity targets with a clear focus on water sensitive urban design (WSUD) policies. The purpose of this report is to present the proposed drainage design strategy for the Bradfield City Centre and demonstrate an option for compliance with required targets.

The works completed on this project provide a high-level assessment of the requirements of the drainage strategy of the Bradfield City Centre. This work has focused on both water sensitive urban design (WSUD), water quality and water quantity and identified primary drainage paths and water management basins. AECOM has prepared MUSIC and DRAINS models to establish the requirements to manage both the stormwater quality and quantity targets in the Bradfield City Centre.

A summary of bioretention and on-site detention (OSD) basin sizes are detailed in **Table 1** below. OSD and WSUD basins are considered in isolation and basin volumes listed in **Table 1** are the estimated peak stored volume, not total basin capacity. Approximate wetland areas required for each of the discharge points are included in the table for comparison. Future modelling should consider wetlands as treatment measures in combination with bioretention basins to optimise performance.

Table 1 – Basin Sizing

Precinct	Catchment Area (ha)	OSD			Bioretention Basin		Wetland Footprint (m^2)
		Footprint (m^2)	Depth (m)	Volume (m^3)	Footprint (m^2)	Depth (m)	
1	14.82	3,000	1.20	3,840	3,800	0.25	26,500
2	6.88				NIL		
3	11.62		NIL		3,800	0.25	16,500
4	4.2	1,000	1.20	1,200	3,500	0.25	5,000
5	14.94	3,000	1.20	3,840	7,000	0.25	19,000
6	12.37		NIL		5,000	0.25	16,000
7	9.97	1,500	1.50	2,250	2,450	0.25	17,000
8	14.74	2,000	1.20	2,400	7,000	0.25	22,000
9	11.90	2,000	1.20	2,400	6,000	0.25	18,000
10	12.38	1,800	1.20	2,000	6,000	0.25	14,000
11	6.39	2,000	1.50	3,000	4,200	0.25	9,000

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Glossary of Terms

AEP	Annual Exceedance Probability
AGRD	Austroads Guide to Road Design
ARR	Australian Rainfall and Runoff
AS	Australian Standard
Aerotropolis	Western Sydney Aerotropolis
BC Act	Biodiversity Conservation Act 2016
BOM	Bureau of Meteorology
CIV	Capital Investment Value
DA	Development Application
DCP	Development Control Plan
DP	Deposited Plan
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EHG	Environment and Heritage Group
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
GFA	Gross Floor Area
GME	Ground Monitoring Event
GPT	Gross Pollutant Traps
IFD	Intensity-Frequency-Duration
LCC	Liverpool City Council
LEP	Local Environmental Plan
LGA	Local Government Area
MPR	Master Plan Requirements

MUSIC	Model for Stormwater Improvement Conceptualisation
NRAR	NSW Department of Natural Resources Access Regulator
NSW	New South Wales
NSW Government	State Government for NSW
OSD	On-site Detention
PMF	Probable Maximum Flood
RCP	Representative Concentration Pathways
SEPP	State Environmental Planning Policy
SOCC	Streets Opening Coordination Council
SSD	State Significant Development
TfNSW	Transport for New South Wales
WPCA	Western Parkland City Authority
WSAP	Western Sydney Aerotropolis Plan
WSPP	Western Sydney Planning Partnership
WSUD	Water Sensitive Urban Design

References

Ref	Title	Author	Date
4	*Review of water sensitive strategies for Wianamatta South Creek*	*DPE*	

1 Introduction

1.1 Purpose of this Report

This report accompanies the Master Plan Application for the Bradfield City Centre submitted to the Department of Planning and Environment (DPE).

The purpose of this report is to present the proposed drainage design strategy for the Bradfield City Centre and demonstrate an option for compliance with required targets.

In preparing this report consultation was undertaken with the following organisations:

- Liverpool City Council – Re: Master Planning request from WPCA for 215 Badgerys Creek Road, (Ref. MP-2/2022)
- Sydney Water – RE: Master Plan Requirements for Bradfield City Centre, Aerotropolis Core (MP02)

1.2 The Western Sydney Aerotropolis

The Western Sydney Aerotropolis is an 11,200-hectare region set to become Sydney's third city (the Western Parkland City), and the gateway and economic powerhouse of Western Sydney.

The Aerotropolis comprises of the new Western Sydney (Nancy-Bird Walton) International Airport surrounded by five initial precincts which include the Aerotropolis Core, Wianamatta– South Creek Northern Gateway, Agri-business and Badgerys Creek outlined in **Figure 1** below.

The final Aerotropolis planning package, including the Precinct Plan and State Environmental Planning Policy (SEPP) Amendment, was gazetted by DPE in March 2022 and the Development Control Plan Phase 2 was finalised in November 2022. These documents have been used to inform the preparation of the Bradfield City Centre Master Plan.

The proposed Master Plan Application for the site has also been prepared using the Western Sydney Aerotropolis Master Plan Guideline and Master Plan Requirements.

2 Bradfield City Centre

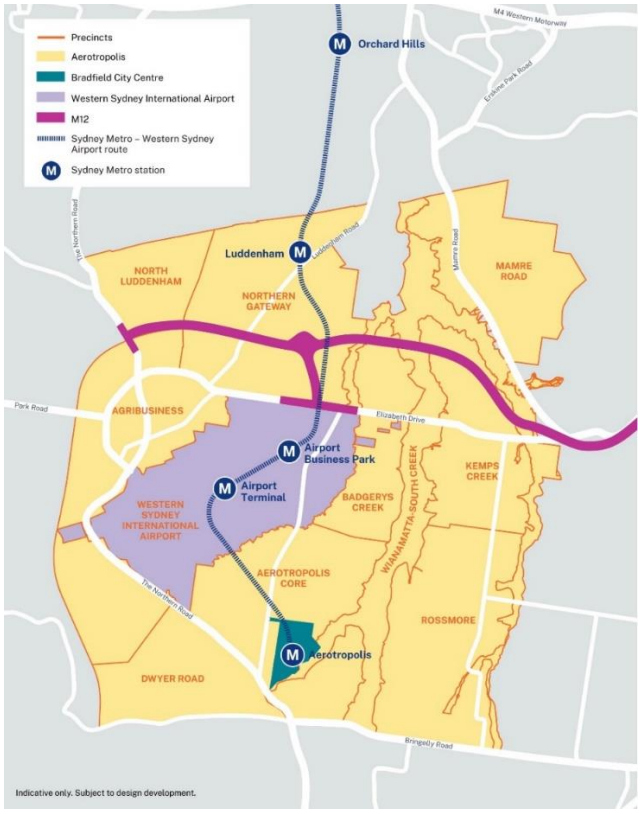
2.1 Strategic Context

The Bradfield City Centre is located to the south-east of the new Western Sydney International (Nancy-Bird Walton) Airport at the intersection of Badgerys Creek Road and The Northern Road (see **Figure 1** below).

The Sydney Metro Western Sydney Airport line runs through the site, providing connections from the key centre of St Marys through to stations at Orchard Hills, Luddenham, Airport Business Park, Airport Terminal and the Aerotropolis which is located within the site.

The site is surrounded by several key roads and infrastructure corridors including Bringelly Road, Badgerys Creek Road, Elizabeth Drive, M12 and The Northern Road.

Figure 1 – Strategic Context



Set on natural waterways, Bradfield City Centre presents a rare opportunity to showcase the best urban design and to create a thriving, blue and green, connected City in which Australians will want to live, learn and work. The Bradfield City Centre will be a beautiful and sustainable 22nd Century City. It will foster the innovation, industry and technology needed to sustain the broader Aerotropolis and fast track economic prosperity across the Western Parkland City.

2.2 The Master Plan Site

The street address for Bradfield City Centre is 215 Badgerys Creek Road, Bradfield (the Site) within the Liverpool Council Local Government Area (LGA). The site is legally described as Lot 3101 DP 1282964 and has an area of 114.6 hectares, with road access to Badgerys Creek Road located at the north-western corner. The site spans across the Aerotropolis Core and Wianamatta-South Creek Precinct, within Western Sydney Aerotropolis. The Site is outlined in **Figure 2** below.

The Site is predominantly zoned Mixed Use under the Western Parkland City SEPP, with a small portion of Enterprise zoned land located on the north-western corner of the site. The site also includes Environment and Recreation zoned land mostly along Thompson Creek.

Figure 2 – Master Plan Site

2.3 The Bradfield City Centre Master Plan

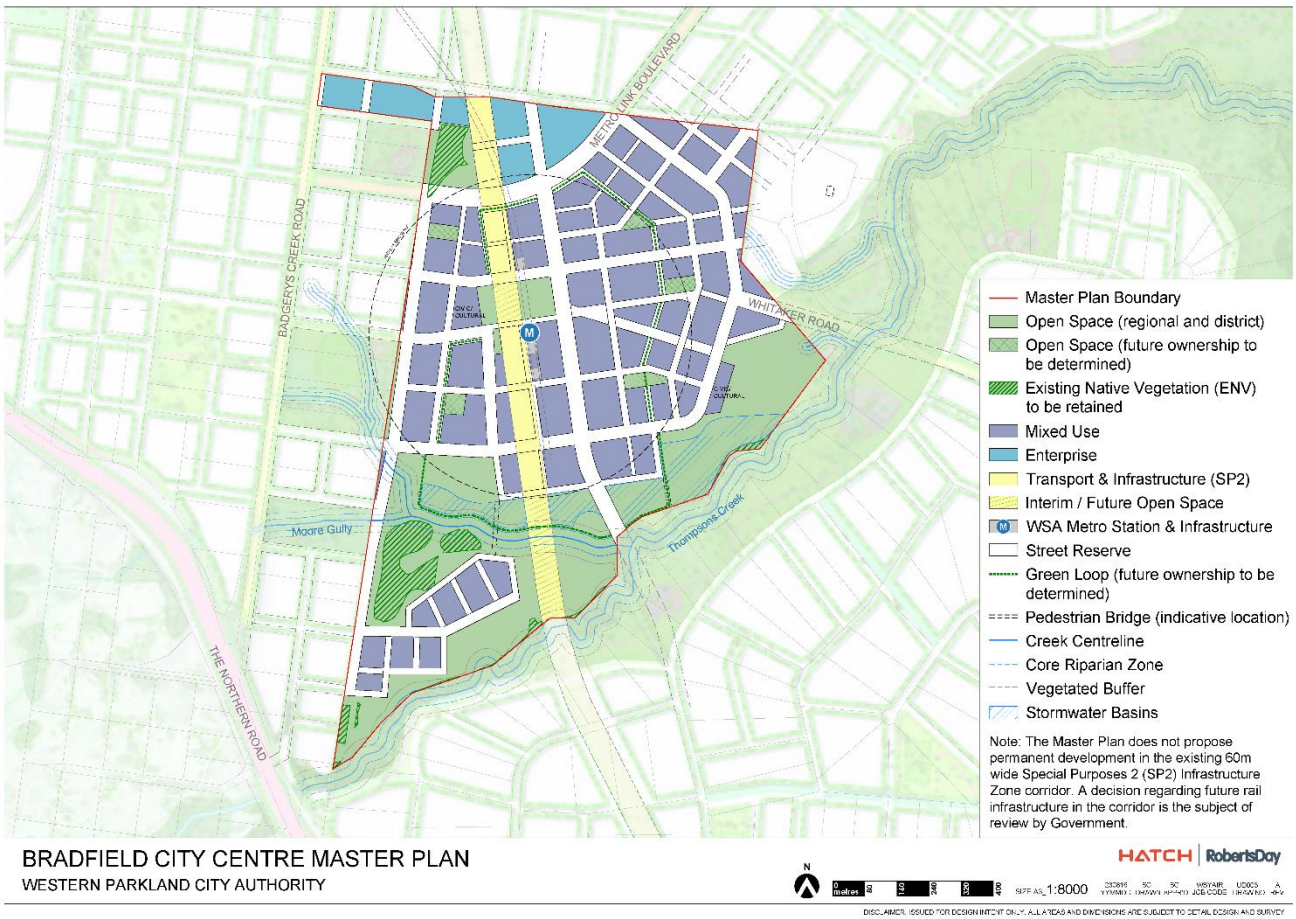
The Western Parkland City Authority has prepared a Master Plan (Figure 3 below) in accordance with the DPE Master Plan Requirements.

The Master Plan sets out a framework for future development within the Bradfield City Centre which includes:

- Road network, key connectors to adjoining land and the regional road network (existing and future)
- Block structure
- Indicative open space network
- Sustainability strategy

- Social and infrastructure strategy
- Arts and culture strategy
- Infrastructure servicing strategy

Figure 3 – Master Plan



2.4 The Proposal

The Bradfield City Centre Master Plan is intended to facilitate the growth of the centre over time. The Master Plan has established the following three planning horizons for technical assessments, as shown in **Table 2**.

Table 2 - Planning & Development Horizons

Phase	Indicative Timeframe	Estimated employment	Estimated residential population	Estimated Gross Floor Area (cumulative)
Immediate	2026	1,000 - 1,200 jobs	0 residents	48,500 sqm
Medium-term	2036	8,000 - 8,300 jobs	3,000 - 3,100 residents	341,000 sqm
Long-term	2056	20,000 – 24,000 jobs	15,000 – 15,200 residents	1,258,000 sqm

Note: The table above is an estimate of the population and employment forecast used for the purposes of modelling only.

The master plan has the capacity to accommodate ~10,000 residential dwellings. In accordance with NSW Government policy a proportion of the residential dwellings will be affordable housing. The timing and delivery of residential dwellings will be subject to market demand and future master plan reviews that consider the impact of additional population on the scope and timing of social and physical infrastructure.

3 Baseline Investigations

3.1 Technical Baseline Site Consideration

The Bradfield City Centre is located on Badgerys Creek Road, Bringelly in the western regions of Sydney within the Liverpool Council Local Government Area (LGA). The Bradfield City Centre is located to the south-east of the new Western Sydney International (Nancy bird Walton) Airport at the intersection of Badgerys Creek Road and The Northern Road is outlined in **Figure 1** above.

The Sydney Metro Western Sydney Airport line runs through the site, providing connections from the key centres of St Marys through to stations at Orchard Hills, Luddenham, Airport Business Park, Airport Terminal and the Aerotropolis which is located within the site.

The site is surrounded by several key roads and infrastructure corridors including Bringelly Road, Badgerys Creek Road, Elizabeth Drive, M12 and The Northern Road.

The site for the Bradfield City Centre is located on the Wianamatta South Creek Corridor – the major waterway in Western Sydney. Moore Gully runs through the site and Thompsons Creek runs directly along the eastern border of the site. Both Moore Gully and Thompsons Creek form part of the Wianamatta South Creek corridor. Moore Gully is classified as Strahler 4th Order creek, with Thompsons Creek a 5th Order creek both with a 40m Vegetated Riparian Offset from the top of bank (Biosis, Nov 2022). The vegetation buffers for the existing offsets as shown in **Figure 4.**

The areas surrounding the existing water bodies in this site have been designated as open space and parkland locations.

There are various old farm dams around the site and upstream within the lots fronting Badgerys Creek Road. Desktop investigations suggest these dams provide water storage facilities for private lots and are maintained by individual lot owners. Dams on the Commonwealth land have had limited maintenance in recent history.

The site is currently a greenfield site, containing no developments. The Site is predominantly zoned Mixed Use under the SEPP (Precincts - Western Parkland City), with a small portion of Enterprise zoned land located on the north-western corner of the site. The site also includes Environment and Recreation zoned land mostly along Thompsons Creek.

Figure 4 – Existing Environmental Infrastructure (TURF 2022)

3.2 Catchment Analysis

3.2.1 Sub-Regional Catchment

Catchment analysis began with identification of the local sub-regional catchment area within which the site was located. Topographic data from Lidar surveys of the area (RPS April 2020 – Ref# PR146456-DET_001a) were analysed in terms of the existing ridges and valleys, to determine the expected flow directions towards local watercourse networks.

The presence of major roads, such as The Northern Road, Bringelly Road and Badgerys Creek Road, were taken as being breaks within this catchment area with the assumption that any catchment areas bounded by these roads would be expected to be captured and directed into a local watercourse directly rather than across to a neighbouring sub-catchment area.

Figure 5 shows the general topography, watercourses, major roads, and sub-regional catchment.

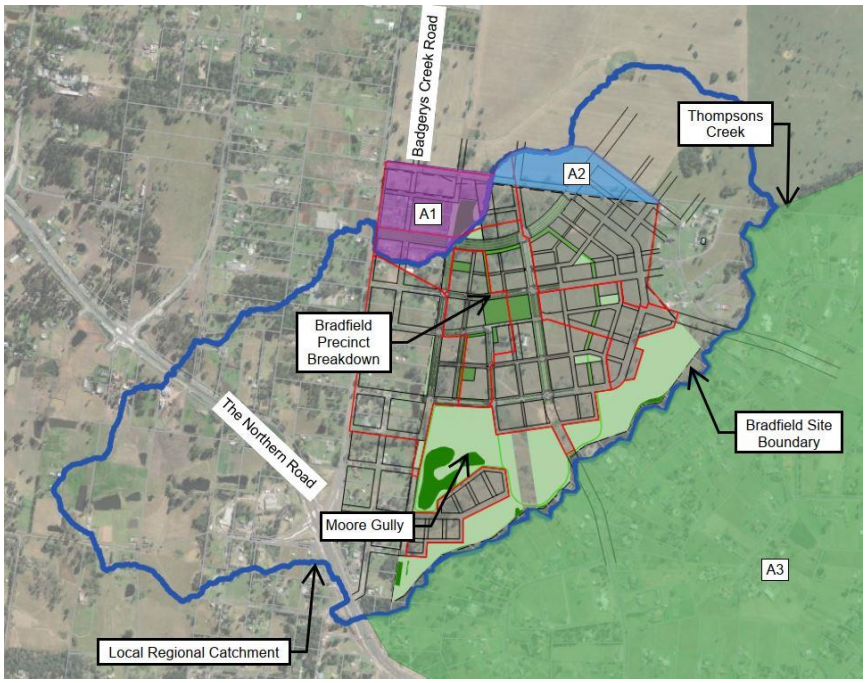
Figure 5 – Regional Catchment Study Area

3.2.2 Study Area Definition

The limits of the catchment study area were determined by selecting a location within Thompsons Creek that is sufficiently downstream to reflect the effects of the development site. As a result of the proposed layout, some fringe and external areas have either been excluded or added to the catchment study. Additions and omissions are shown in **Figure 6**.

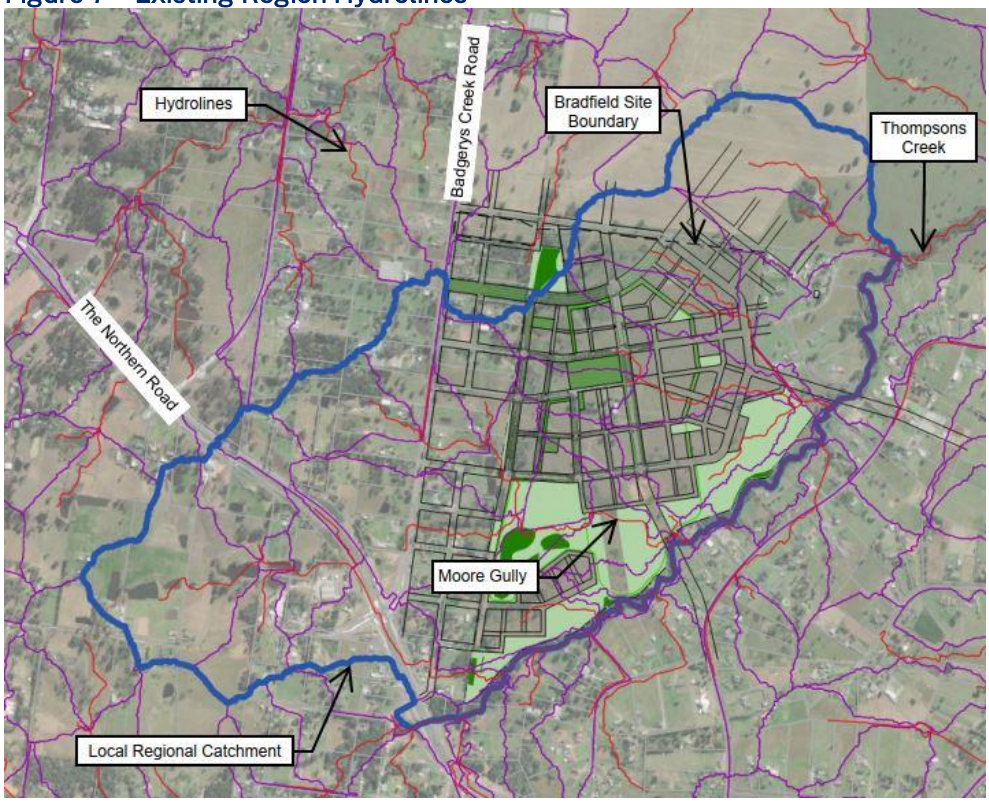
- (A1) does not naturally flow through the site towards Moore Gully, though the proposed road layout will result in this additional area being included in the analysis.
- (A2) has been identified as part of the study area but due to the expected road layout and existing level differences, it is expected that these areas will ultimately not be connected to the site to minimise changes to the natural topography and maintaining consistency with 'Designing with Country' broader objectives.
- (A3) and all other areas south of Thompsons Creek are excluded from this study and are expected to be reflected in flood studies for the area conducted by others.

Figure 6 – Refinement of Catchment Study Area



To facilitate greater alignment in the design with the natural catchment behaviour, the existing hydrolines and discharge points were analysed with respect to the extent of the proposed masterplan layout and its integration with the adjacent Moore Gully watercourse. These hydrolines and their respective catchments are shown in **Figure 7** and demonstrate general compliance with this effort.

Figure 7 – Existing Region Hydrolines



3.2.3 Catchment Analysis

The findings of the catchment analysis are summarised in **Table 3** below.

Table 3 – Catchment Properties

Catchment Property	Value	Comment
Total area	309 ha	Regional catchment including areas external to site
Site-affected catchment area	120 ha	Total catchment used for consideration
Highest RL of study area	65 m AHD	At the top of the regional catchment
Highest RL of the site area	39 m AHD	Within the site bounds
Lowest RL of study area	16 m AHD	Top of bank at the end of the site
Site grade range	3 - 7%	Some portions of low-lying areas at 1 - 3%
Estimate of existing imperviousness	5 - 10%	Of the site affected catchment
Composition		Of total regional catchment. The proposed site sits predominately within the farmland area.
— Open pasture or farmland	80.5 ha	
— Rural residential	16 ha	
— Vegetated (trees)	12 ha	
— Road infrastructure	6.5 ha	
Length (in general flow direction)	2.85 km	Measured west to east
Width	1.15 km	Measured north to south

3.3 Hydrological Information

3.3.1 Rainfall Data

Rainfall data and parameters have been obtained from the Bureau of Meteorology (BOM) and Australian Rainfall and Runoff (ARR) Data Hub. Rainfall Intensity-Frequency-Duration (IFD) charts (**Figure 8**) have been obtained from BOM. Storm losses and climate change factors have been adopted from the ARR Data Hub.

Historic trends for rainfall patterns and flooding have been excluded from this Report and are covered in a separate Flood Study prepared as part of the Master Plan. Information of rainfall data over time for use with

water quality modelling has been supplied by the Environment and Heritage Group (EHG) within the Department of Planning and Environment (DPE) within the supplied Wianamatta Toolkit.

Figure 8 – IFD Design Rainfall Depth (mm)

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.96	2.25	3.16	3.80	4.44	5.32	6.01
2 min	3.20	3.62	5.00	5.98	6.96	8.30	9.38
3 min	4.45	5.04	6.99	8.36	9.75	11.6	13.1
4 min	5.59	6.36	8.86	10.6	12.4	14.8	16.7
5 min	6.63	7.56	10.6	12.7	14.8	17.7	20.0
10 min	10.5	12.1	17.1	20.6	24.1	28.8	32.5
15 min	13.1	15.1	21.4	25.8	30.2	36.1	40.8
20 min	15.1	17.3	24.5	29.5	34.5	41.3	46.7
25 min	16.6	19.0	26.8	32.3	37.8	45.3	51.1
30 min	17.8	20.4	28.7	34.6	40.5	48.4	54.7
45 min	20.6	23.5	32.9	39.5	46.2	55.3	62.5
1 hour	22.7	25.8	35.9	43.1	50.3	60.2	68.1
1.5 hour	25.8	29.2	40.4	48.3	56.4	67.5	76.4
2 hour	28.3	32.0	44.0	52.5	61.2	73.3	83.0
3 hour	32.5	36.6	49.9	59.6	69.4	83.1	94.2
4.5 hour	37.6	42.2	57.5	68.6	79.9	95.8	109
6 hour	41.9	47.1	64.3	76.6	89.4	107	121
9 hour	49.3	55.6	76.1	91.0	106	127	144
12 hour	55.5	62.8	86.5	104	121	146	165
18 hour	65.6	74.7	104	126	147	177	200
24 hour	73.7	84.4	119	144	170	203	230
30 hour	80.4	92.4	132	160	188	226	255
36 hour	86.0	99.2	142	173	205	245	276
48 hour	94.9	110	160	195	231	277	311
72 hour	107	125	183	224	267	318	358
96 hour	114	133	196	241	287	342	384
120 hour	119	139	203	249	297	354	398
144 hour	122	142	206	253	301	360	404
168 hour	125	144	207	253	301	361	405

3.3.2 Climate Change

Climate change parameters have been recorded from data supplied by the ARR Data Hub in accordance with ARR2019. This data is based on various climate change scenarios, or Representative Concentration Pathways (RCPs).

While no explicit requirement is outlined in DCP2 or Stormwater and Water Cycle Management Interim Report, a best practice approach has been adopted by using the climate projection year for 2090 RCP8.5 value for preliminary sizing of the masterplan stormwater network to ensure future assets are adapted to climate change projections.

The full range of interim climate change factors related to each RCP are presented below in **Table 4**.

Table 4 – Interim Climate Change Factors

Projection Year	RCP4.5	RCP6	RCP8.5
2030	0.869 (4.3%)	0.783 (3.9%)	0.983 (4.9%)
2040	1.057 (5.3%)	1.014 (5.1%)	1.349 (6.8%)
2050	1.272 (6.4%)	1.236 (6.2%)	1.773 (9.0%)
2060	1.488 (7.5%)	1.458 (7.4%)	2.237 (11.5%)
2070	1.676 (8.5%)	1.691 (8.6%)	2.722 (14.2%)
2080	1.810 (9.2%)	1.944 (9.9%)	3.209 (16.9%)
2090	1.862 (9.5%)	2.227 (11.5%)	3.679 (19.7%)

3.4 Existing Waterbodies, Drainage Infrastructure and Flooding Details

3.4.1 Waterbodies

There are six (6) water bodies, small farm dams, within the Bradfield City Centre site and surrounding sites. Desktop assessment of these dams concluded that they were likely for private water storage of the respective properties and played no formal role in the dynamics of the local catchment.

The dams are shown in **Figure 9** and their size and location are outlined in **Table 5** (below).

Figure 9 – Existing Waterbodies (Source: SixMaps)

Table 5 – Dam Location and Sizing

Dam ID	Location	Width (m)	Length (m)	Approximate Area (m^2)
1	-33.921144, 150.740813	13	10	130
2	-33.923704, 150.741500	10	4	40
3	-33.927658, 150.737033	10	40	400
4	-33.927453, 150.732341	50	100	5,000
5	-33.925922, 150.73136	32	54	1,640
6	-33.926617, 150.731413	23	53	1,250

As previously discussed, dams on the Commonwealth land have had limited maintenance in recent history. No dam break assessments have been completed to date. Noting their location upstream of the site, a dam break assessment may be required to understand future risks where basins remain intact, and development occurs around them.

3.4.2 Stormwater Drainage Infrastructure

The Bradfield City Centre precinct is a greenfield site with no existing formal drainage infrastructure present. Existing pipes and drainage infrastructure is present along the Northern Road to the south of the precinct and Badgerys Creek Road (being only culvert crossings) to the west.

Currently, Badgerys Creek Road does not have kerb and gutter or a formal trunk drainage system. Instead, road drainage relied on roadside table drains which collect at headwalls and discharge directly into natural hydrolines that feed Moore Gully. This includes one instance of a discharge point directing collected water through the southern corner of the Bradfield City Centre site. Presently there are culverts along Badgerys Creek Road.

With the future upgrade of Badgerys Creek Road, it is expected that a formal drainage system will be installed and direct water into the watercourse, rather than having uncontrolled discharge enter the Bradfield City Centre site over what is expected to be an open sports field. Coordination of stormwater and flooding conditions in these areas will be required in future stages of design to mitigate any overlap in discharge requirements in interim development stages.

3.4.3 Watercourses

Moore Gully is classified as Strahler 4th Order Creek, with Thompsons Creek a 5th Order creek both with a 40m Vegetated Riparian Offset from the top of the bank (Biosis, Nov 2022).

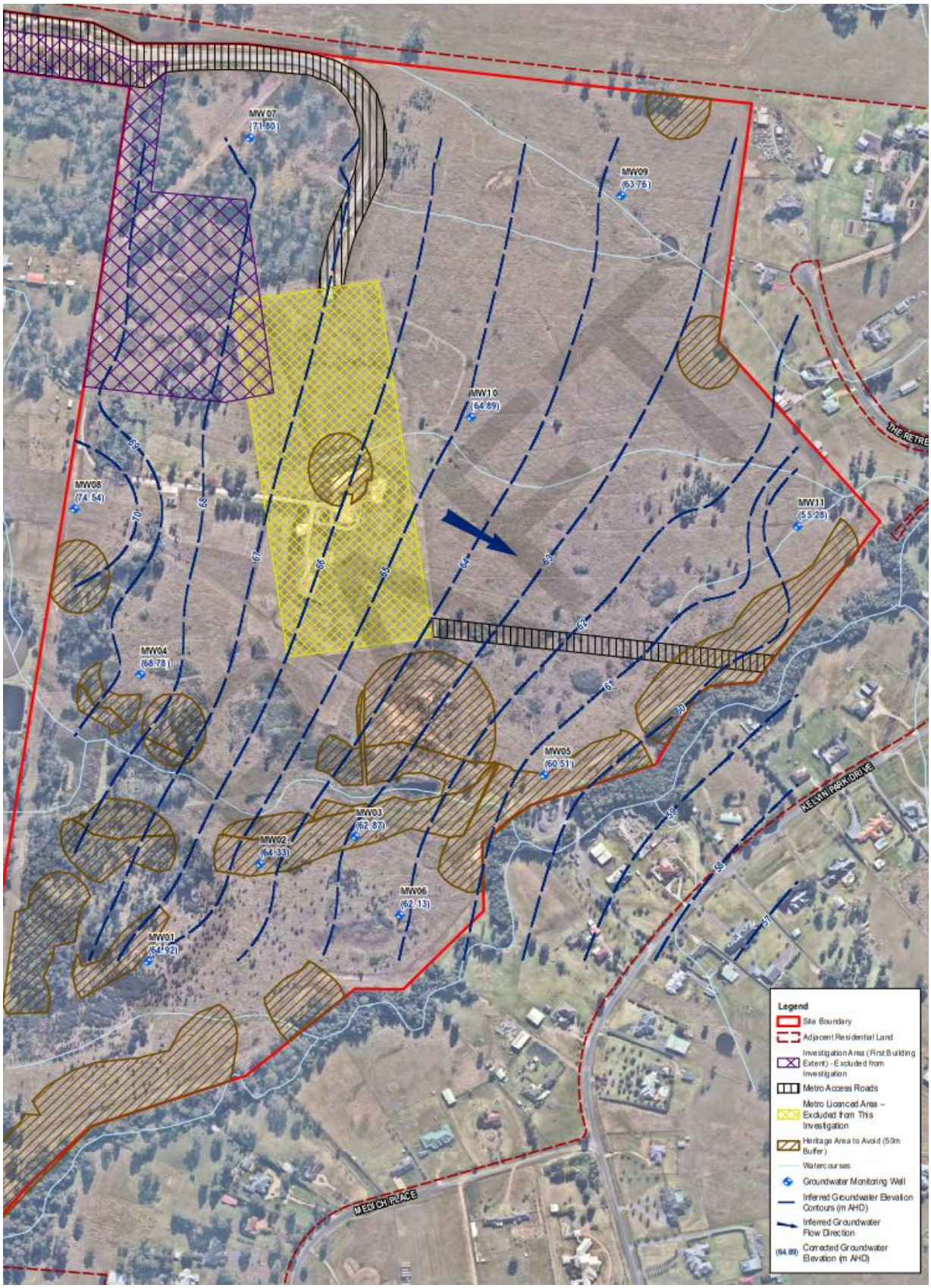
3.5 Environmental

No dedicated environmental studies or investigations have been undertaken as part of the integrated water cycle analysis. All major considerations for special restrictions on use of land for drainage infrastructure have been informed based on the ecological study by the Biodiversity Strategy and Impact Assessment (Biosis, 2022), prepared to support the Master Plan approval.

3.6 Groundwater

ERM undertook detailed site investigations, which included groundwater monitoring. To assess groundwater within the site, ERM undertook a Ground Monitoring Event (GME) in June 2022. This included the installation of 11 groundwater monitoring wells to a maximum depth of 12m below ground. During this investigation, groundwater was identified at depths ranging from 2.110m (MW08) to 5.954m (MW04) below ground level (ERM, 2022). An excerpt of the groundwater flows for the site is provided in **Figure 10**.

Figure 10 – Site Groundwater Conditions (ERM 2022)



3.7 Site Investigations

Various site investigations and studies by external parties have been considered in the civil and stormwater design of the Bradfield City Centre Master Plan as summarised in **Table 6.**

Table 6 – Site Investigations

Document and Source	File Names	File Date	Date Received
Detail & Lidar Survey (RPS)	• PR146456-DET_001a.pdf • PR146456-DET_001a.dwg • PR146456-DET_001a.12daz	25 May 2020	03 Nov 2020
Land Tenure Mapbook – The Commonwealth Land (RPS)	PR146456-1-LTMB.pdf and miscellaneous attachments	30 Jul 2020	03 Nov 2020
LiDAR Survey – Extraction of Embankments, Thompsons Creek Bringelly (RPS)	PR146456-DET_004a.pdf	25 Aug 2020	03 Nov 2020
Review of water sensitive urban design strategies for Wianamatta South Creek prepared by DPE	Review-of-water-sensitive-design-strategies-for-wianamatta-south-creek.pdf	2 Nov 2022	Nov 2022

3.8 Area of Focus

The works completed on this project provide a high-level assessment of the requirements of the drainage strategy of the Bradfield City Centre. This work has focused on both water sensitive urban design (WSUD), water quality and water quantity and identified primary drainage paths and water management basins. AECOM has prepared MUSIC and DRAINS models to establish the requirements to manage both the water stormwater quality and quantity targets in the Bradfield City Centre. The Master Plan layout dated 5th June 2023 from Hatch Roberts Day has been adopted for drainage analysis and has been used in both the MUSIC and DRAINS models.

The following are key focus areas which have been analysed as a part of this report:

- **Hydraulic and Water Quality assessment:** AECOM has conducted assessments of the site for water quality and quantity. The hydraulic assessment for the site has been completed in DRAINS and the water quality assessment has been completed in MUSIC. Both the hydrological and water quality have been completed considering water quality and quantity targets as set by the Western Sydney Aerotropolis Development Control Plan 2022 (DCP2) (November 2022).
- **Moore Gully Waterfront:** End of line treatment infrastructure must be integrated with the Moore Gully Waterfront design. The Moore Gully Waterfront is intended to be a landscaped public interface with public swimming pool and walkways. OSD and Bioretention storage basins must be designed to be integrated with vision for the Moore Gully Waterfront area. Further, the proximity of the site to natural watercourses, such as Moore Gully and Thompsons Creek, makes the site potentially susceptible to flood events. This has been taken into consideration in the drainage and flood design.
- **Road trunk drainage and overland flow paths:** Road drainage systems, including pit and pipe networks, have been preliminarily designed as a part of this report. Lot-based stormwater infrastructure has not been

included in this design. Overland flow paths have been assessed for minimum pooling in minor flood events and safe access throughout the site during emergency events.

4 Assessment Requirements and Policy Context

There are several relevant applicable policies that have been identified which have impacted the design of the Bradfield City Centre Master Plan. The relevant policies are summarised in **Table 7** below.

Table 7 – Relevant Policies and Standards

Policy	Description	Relevant Sections of Policy
	State Government Plans/ Policies	
Australian Rainfall and Runoff (ARR) 2019	The Australian Rainfall and Runoff (ARR) 2019 Guide to Flood Estimation provides recommended practices on the prediction of peak design flows and prediction of full hydrographs under current conditions and changing climatic conditions.	▪ Book 1 Chapter 3 – Major / Minor Drainage Concept ▪ Book 2 Chapter 5 – Temporal Patterns ▪ Book 5 Chapter 3 – Initial losses
	Western Sydney Aerotropolis	
Western Sydney Aerotropolis Plan (WSAP), September 2020	The WSAP is a government strategic planning framework for the Western Sydney Aerotropolis and developed by the Western Sydney Planning Partnership, a local government-led initiative that brings Blacktown, Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly councils together with key State agencies. The plan includes landscape, urban design and planning principles to give effect to the objectives to promote productivity, sustainability, infrastructure and collaboration, and liveability. The proposed landscape-led approach recognises the importance of blue and green infrastructure – major waterways, parks or green spaces – by retaining water in landscape, preserving and restoring the green, locating transit corridors within walking distance to landscape amenity, orientating urban development towards landscape amenity and transit corridors, and adopting urban typologies that ensure urban development retains water in landscape. The WSAP also emphasises	▪ All Sections

Policy	Description	Relevant Sections of Policy
	Connecting with Country approach to sustainably manage First Nations culture and heritage in the built environment.	
State Environmental Planning Policy (SEPP) (Western Sydney Aerotropolis) 2020	The Aerotropolis SEPP, an environmental planning instrument created under the Environmental Planning and Assessment Act 1979, commences on 1 Oct 2020. It aims to facilitate development in the Western Sydney Aerotropolis in accordance with the objectives and principles of the Western Sydney Aerotropolis Plan, to promote sustainable, orderly and transformational development in the Western Sydney Aerotropolis, to protect, maintain and enhance, and to minimise the impact of development on, trees and vegetation, soil quality and the health of waterways and to contribute to the conservation of biodiversity, to recognise and protect the ecological and cultural value of Wianamatta–South Creek etc.	▪ Part 4.26 ▪ Part 4.27
Western Sydney Aerotropolis Development Control Plan 2022 (DCP2), November 2022	The DCP2 provides controls to supplement the WSAP, Aerotropolis SEPP, Aerotropolis Precinct Plan, and inform the preparation and assessment of master plans and development applications. The DCP2 was endorsed by the Department of Planning and Environment in November 2022. The DCP2 uses a flexible performance-based approach, by providing objectives, performance outcomes and benchmark solutions.	▪ Section 2.1.1 ▪ Section 2.3.1 ▪ Section 2.3.2 ▪ Section 2.3.3 ▪ Section 2.13
Western Sydney Engineering Design Manual, December 2020	The Western Sydney Engineering Design Manual, along with the Western Sydney Street Design Guidelines, have been developed as part of the Uniform Local Engineering and Design Standards project. It has been prepared to enable designers, councils, and consultant teams to prepare compliant designs for civil infrastructure work, including landscaping of streets.	▪ Section 3 – Landform ▪ Section 4 – Streets ▪ Section 8 – Integrated Stormwater Management ▪ Section 9 – Flow Management ▪ Section 10 – Water Sensitive Urban Design ▪ Section 11 – Stormwater Drainage ▪ Section 12 – Trunk Drainage
Western Sydney Aerotropolis Master Plan Guidelines, December 2021	Pursuant to clause 43(7) of the Aerotropolis SEPP, the Master Plan Guidelines establish the steps in the preparation of a master plan for proponents, the community, councils, and government agencies. The guidelines set forth requirements for the Master Plan preparation process including content of the masterplan and review process.	▪ Section 3.2- Bulk Earthworks and Site Regrading ▪ Section 7.3 – Urban Design ▪ Section 8 – Integrated

Policy	Description	Relevant Sections of Policy
		Stormwater Management ▪ Section 9 – Flow Management ▪ Section 10 – Water Sensitive Urban Design ▪ Section 11 – Stormwater Drainage ▪ Section 12 – Truck Drainage

4.1 Master Plan Requirements

The Department of Planning and Environment have issued Secretary's Master Plan Requirements (MPRs) to the Authority for the preparation of a Master Plan for Bradfield City Centre. This report has been prepared to address the following MPRs.

Table 8 – Master Plan Requirements

Reference	Master Plan Requirement	Where Addressed
15	Describe the existing surface (e.g. Creeks and farm dams) and groundwater resources (including ecological values, cultural values and reliance by users) likely to be impacted by the project.	Section 0
	Outline potential or known impacts of future development on surface and groundwater hydrology, riparian land, water-related infrastructure and systems and other water users in accordance with the current guidelines	Section 3.2
	A discussion on WSUD strategy for flooding, stormwater quantity, water way health and quality management of the site	Section 6.2
	Detail stormwater treatment options and footprints relevant to the site	Section 6.1, Section 6.2
	Detail on connections and servicing via reticulated/interim reticulated sewerage service	Please see report 10– Infrastructure and Utilities for details on services connections.
	Detail considerations on how amendments to road alignments may impact on the design and delivery of	Please see Item 10 – Infrastructure and Utilities

Reference	Master Plan Requirement	Where Addressed
	trunk drinking and recycled water trunk mains delivered by Sydney Water	for details on services connections.
	Have regard to the long-term management and ownership of riparian corridors	Section 7.1.1
	Demonstrate how the master plan achieves the NSW Government Wianamatta South Creek waterway health objectives and stormwater management targets	Section 6.2
	Enable the design and delivery of potential multi-functional stormwater infrastructure, including trunk drainage channels and treatment wetlands to the satisfaction of Sydney Water as identified in the Precinct Plan and WPC SEPP. Where a variation occurs, demonstrate how this achieves a superior outcome.	Section 6.1, Section 6.2
	Demonstrate compliance with the Water Management Act 2000 and NRAR and Guidelines for controlled activities on waterfront land for riparian corridors.	Section 7.1.2

Table 9 – Agency and Council Comments

Reference	Master Plan Requirement	Where Addressed
Liverpool Council	WSUD strategy must be developed for stormwater quantity & quality management of the master plan development. Stormwater of the development must be treated before discharging into receiving waters and Council's/Precinct's water quality treatment targets must be achieved. Treatment measures must be designed with MUSIC modelling analysis. Performance of treatment measures must be verified using Council's MUSIC Link.	Section 6.1 and Section 6.2
Liverpool Council	Stormwater quantity discharges from the development must be controlled to be no greater than the predevelopment up to the 1 %AEP storm event. An OSD system and detention basin system need to be developed to control stormwater quantity discharges. Sizing and locations of detention basins to be consistent with those proposed in the Aerotropolis precinct	Section 6.1
Sydney Water	The master plan must respond to the relevant stormwater requirements in the WC Precincts SEPP and the Regional Stormwater Scheme and must not preclude the efficient delivery of regional stormwater infrastructure.	Section 6.1 and Section 6.2
Sydney Water	As part of future development, the proponent may need to design and deliver multi-functional stormwater	Section 6.1 and Section 6.2

Reference	Master Plan Requirement	Where Addressed
	infrastructure including trunk drainage channels and treatment wetlands to the satisfaction of Sydney Water. Trunk drainage channels are identified in the Aerotropolis Precinct Plan and IWCM Strategy and your master plan should respond to these.	
Sydney Water	The stormwater management system for the master plan must be designed such that future development will have the ability to meet NSW Government waterway health objectives through a combination of on-lot and on-street measures and connection to the Regional Stormwater Scheme. Your master plan should be designed in consideration of the following: - The site coverage and permeability targets established in the Aerotropolis Phase 2 Development Control Plan (DCP); - Design of streets to accommodate necessary stormwater infrastructure including Wianamatta Street trees in accordance with the requirements of the Aerotropolis Phase 2 DCP and Sydney Water design specifications; - Connection to the Regional Stormwater Scheme including potential for delivery of regional stormwater infrastructure as mapped in the WP SEPP, Aerotropolis Precinct Plan and IWCM Strategy.	Section 5.4 and Section 6.2
NSW EPA (Item 4)	...the Western Parklands City Authority ought to consider how the Bradfield City Centre Master Plan will contribute to the establishment of the blue-green infrastructure framework in accordance with the Precinct Plan (Section 4.5) and apply the recommended stormwater quality and quantity targets for new developments. Instructions on how the targets should be used and where they apply is provided in the DCPs and the NSW Government 'Technical guidance for achieving Wianamatta-South Creek stormwater management targets' (DPE, 2022b).	Section 6.1 and Section 6.2
DPE Water	An Integrated Water Cycle Management Plan must be prepared by a suitably qualified engineer for the development that: is prepared in consultation with the local council and the Stormwater Drainage Authority.	Section 6.1 and Section 6.2
DPE Water	details the proposed drainage design for the site including all pits and pipes, overland flow paths, on-site	Section 6.1 and Section 6.2. pit and pipe sizing will be

Reference	Master Plan Requirement	Where Addressed
	detention, discharge locations, creek lines and riparian zones.	developed as part of a subsequent stage
DPE Water	details the pervious and impervious areas (including roof areas), to show compliance with DCP requirements.	**Section 5.4**
DPE Water	details a site water balance with water demands and supplementary sources, such as stormwater and recycled water, to ensure an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. Details how alternative water sources will be prioritised for greening and cooling.	**Section 5.4** and Item 10 – Infrastructure and Utilities for recycled water demands
DPE Water	details the impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.	**Section 6.1 and Section 6.2**
DPE Water	details of connections to the regional stormwater system, or interim staged measures where the regional stormwater system is not operational at the time of lodgement. Where no satisfactory interim staged measures are proposed or agreed, development consent may be deferred until the required regional stormwater system is delivered.	**Section 6.1 and Section 6.2**
DPE Water	undertake an assessment of any impacts of salinity and sodic soils. This includes irrigation or other water discharges to soils and groundwater systems.	**Section 5.4**
DPE Water	detail the proposed approach to demonstrate compliance with operational phase stormwater management targets within the DCP and include: i. design detail of each WSUD/stormwater system to show compliance with DCP requirements. ii. details of connections to any relevant regional stormwater infrastructure and recycled water system. iii. proposed initial and ongoing maintenance and management of WSUD assets. iv. staging plan (if relevant) to illustrate how each WSUD system will be delivered with the development stages to ensure compliance with the stormwater targets.	**Section 6.1 and Section 6.2.** Ongoing maintenance and management will be developed as part of detailed design phases.
DPE Water	Where regional stormwater and recycled water systems are not operational at the time of lodgement, the details	**Section 6.2**

Reference	Master Plan Requirement	Where Addressed
	of the interim WSUD strategy must be provided to ensure the waterway objectives set out in the Precinct Plan and stormwater management targets are achieved, as per the DCP.	
DPE Water	Note, where any stormwater or water infrastructure works as a result of any of the above points are required to be handed over to the local council, or the Stormwater Drainage Authority, hydraulic modelling, detailed plans and specifications of proposed works must be provided, demonstrating compliance with the local council or Stormwater Drainage Authority requirements.	Handover of these details is considered part of Development Application process
DPE EHG	The Master Plan must demonstrate how it achieves the NSW Government Wianamatta South Creek waterway health objectives and stormwater management targets. The water quality and flow objectives are requirements in the Western Sydney Aerotropolis Precinct Plan and the stormwater targets are performance outcomes and benchmark solutions in the draft Aerotropolis Phase 2 Development Control Plan.	**Section 6.1 and Section 6.2**

4.2 Western Sydney Aerotropolis

Table 10 – DCP2 Performance Outcomes: Stormwater, Water Sensitive Urban Design and Integrated Water Management

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
Waterway Health and Riparian Corridors			
PO1	Development retains and restores native vegetation and riparian corridors	1. Development maintains and protects waterways in accordance with the following guidelines: a. Strahler Order 1 watercourses with a catchment area of less than 15 hectares can be re-constructed and /or piped, providing stormwater modelling demonstrates the pipe and street network is capable of accommodating flows up to and including the 100 year AEP storm event. b. Naturalised trunk drainage paths are to be provided when the contributing catchment exceeds 15 hectares or when 1% AEP	This assessment has considered existing major creeks – Moore Gully (Order 4) and Thompsons Creek (Order 5) to remain with appropriately vegetated riparian zones integrated with future regional stormwater basins. It is intended to seek amendment to the Aerotropolis Phase 2 DCP to make the following changes: 1. Removal of Clause 2.3.1 Performance Outcome PO1 Benchmark Solution 1b. 2. Removal of Clause 2.3.2 Performance Outcome PO7

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
		overland flows cannot be safely conveyed overland as described in Australian Rainfall and Runoff – 2019. c. Waterways of Strahler Order 2 and higher will be maintained in a natural state, including the maintenance and restoration of riparian areas and habitat, such as fallen debris. d. Where a development is associated with, or will affect, a waterway of Strahler Order 2 or higher, rehabilitation will occur to return that waterway to a natural state. 4. Retain areas of the Proteaceae shrubs for the Eastern Pygmy Possum Cercartetus nanus along or adjacent to riparian areas to improve and maintain habitat connectivity. 5. Weeds from creeks, streams and riparian areas are removed and replaced with appropriate native planting. 6. Locate stormwater infrastructure including pipelines and detention basins wholly on certified-urban capable land consistent with the Plan's biodiversity consistent with the Plan's biodiversity certification approvals. Stormwater infrastructure is not to be located within land identified as avoided or land managed as a reserve.	Benchmark Solutions 2, 3 and 4 This is justified as: a) While the preliminary stormwater catchment strategy currently indicates that there are no catchments >15ha, there is potential that some catchments may slightly exceed the 15ha threshold before the need for naturalised drainage channels. b) All catchments within the Bradfield City Centre will be draining into the Regional Stormwater Basins (managed by Sydney Water) for treatment and detention prior to discharging into Moore Gully and Thompsons Creek. As a result, the quantity and quality of the stormwater discharging into the waterways will be managed in order to meet the relevant DCP requirements for waterway health. c) The runoff up to the 1% AEP can be conveyed between the kerbs along streets in accordance with the standard requirements of the Australian Rainfall and Runoff Guidelines. d) The use of naturalised drainage channels in a high density, urban area such as the Bradfield City Centre are not appropriate due to the volume of pedestrian and active transport movements across the City Centre and the likely number of access/egress points from buildings. Furthermore, the Bradfield City Centre has been designed as a parkland city

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
			incorporating a landscaped Green Loop around the City Centre, provision of parks and extensive landscaping along the streetscape, in addition to extensive stormwater wetlands and basins along Moore Gully and Thompsons Creek to achieve the blue-green loop vision set out in the Western Sydney Aerotropolis Precinct Plan.
PO3	Development provides increased connectedness to high quality passive open space and the blue-green grid.	1. Road crossings across a waterway of Strahler Order 2 or higher are to be designed to minimise impacts to vegetated riparian areas and species movements in accordance with NSW Department of Primary Industries' requirements to maintain fish passage.	Bridge crossings are planned for the site to span the natural watercourse towards the southern end of the site. Refer to masterplan layout diagrams. Site grading will generally follow the existing topography where practical within expectations of safe road design and other similar constraints.
Stormwater Management and Water Sensitive Urban Design			
PO1	Development applications must demonstrate compliance with the stormwater quality targets at all times through interim stormwater management measures incorporated within the development, or by connection to the regional stormwater system once	1. Compliance with the water quality targets below are satisfied where development applications demonstrate: a. To the satisfaction of the Stormwater Management Authority and the consent authority that stormwater discharge from the development will flow into the regional stormwater system; and a. To the satisfaction of the Stormwater Management Authority and the consent authority that stormwater discharge from the development will flow into the regional stormwater system; and b. The requirements of PO4 in Section 2.3.2 are met. 2. Where the Stormwater Management Authority indicates that the regional stormwater system will not be in place to service the development interim	Site wide water treatment has been considered as part of the masterplan design and can be seen in detail in **Section 5.4** and **Section 6.2** of this report. Subsequent developments within the site will require coordination with the targets set out by the DCP and measures nominated by this masterplan design. WSUD design and strategy for the site have been incorporated into the stormwater and road design for the site. Refer to **Section 6.2** of the report for details.

<table>
<tr><th>Numeric Section</th><th>Performance Outcome</th><th>Benchmark Solution</th><th>Master Plan Consideration and Comment</th></tr>
<tr><td></td><td>operational.</td><td>measures must be included to achieve the waterway health objectives of the Aerotropolis Precinct Plan. Interim stormwater management measures are to be designed to achieve the stormwater quality targets listed in the table below:
Note: A proponent may opt to undertake works-in-kind to deliver the regional stormwater system in accordance with the Stormwater Management Authority's requirements.
<table><tr><th>Parameter</th><th>Stormwater Quality Target – Operational Phase</th></tr><tr><td colspan="2">Option 1: Annual Load Reduction</td></tr><tr><td>Gross Pollutants (anthropogenic litter >5mm and coarse sediment >1mm)</td><td>90%</td></tr><tr><td>Total Suspended Solids (TSS)</td><td>90%</td></tr><tr><td>Total Phosphorus (TP)</td><td>80%</td></tr><tr><td>Total Nitrogen (TN)</td><td>65%</td></tr><tr><td colspan="2">Option 2: Allowable Loads</td></tr><tr><td>Gross Pollutants (anthropogenic litter >5mm and coarse sediment >1mm)</td><td>< 16 kg/ha/y</td></tr><tr><td>Total Suspended Solids (TSS)</td><td>< 80 kg/ha/y</td></tr><tr><td>Text Total Phosphorus (TP)</td><td>< 0.3 kg/ha/y</td></tr><tr><td>Total Nitrogen (TN)</td><td>< 3.5 kg/ha/y</td></tr></table></td><td></td></tr>
<tr><td>PO2</td><td>Development applications must demonstrate compliance with the stormwater flow targets at all times through interim stormwater management measures incorporated within the development, or by connection to the regional stormwater system once</td><td>1. Compliance with the stormwater flow targets below are satisfied where development applications demonstrate:
a. To the satisfaction of the Stormwater Management Authority and the consent authority that stormwater discharge from the development will flow into the regional stormwater system, and
b. The requirements of PO4 in Section 2.3.2 are met.
2. Where the Stormwater Management Authority indicates that the regional stormwater system will not be in place to service the development interim measures must be included to achieve the waterway health objectives of the Aerotropolis Precinct Plan. Interim stormwater management measures to be</td><td>Stormwater attenuation in the form of regional basins has been designed to limit peak storm discharges for all storm events up to major 1% AEP events to less than existing conditions at all discharge points.

Refer to Section 5.4 and Section 6.2 for details regarding attenuation structures.

Individual site discharge targets are to be addressed within subsequent development application stages for the proposed super lots.</td></tr>
</table>

<table>
<tr><th>Numeric Section</th><th>Performance Outcome</th><th>Benchmark Solution</th><th>Master Plan Consideration and Comment</th></tr>
<tr><td></td><td>operational.</td><td>designed to achieve the following stormwater flow targets:
<table><tr><th>Parameter</th><th>Stormwater Flow Target – Operational Phase</th></tr><tr><td colspan="2">Option 1: Mean Annual Runoff</td></tr><tr><td>Mean Annual Runoff Volume (MARV)</td><td>≤ 2 ML/ha/year at the point of discharge to the local waterway</td></tr><tr><td>90%ile flow</td><td>1,000 to 5,000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>50%ile flow</td><td>5 to 100 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>10%ile flow</td><td>0 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td colspan="2">Option 2: Flow Duration Curve Approach</td></tr><tr><td>95%ile flow</td><td>3,000 to 15,000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>90%ile flow</td><td>1,000 to 5,000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>75%ile flow</td><td>100 to 1,000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>50%ile flow</td><td>5 to 100 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>Cease to flow</td><td>Cease to flow to be between 10% to 30% of the time</td></tr></table></td><td></td></tr>
<tr><td>PO3</td><td>Development applications must include a Water Management Strategy (WMS).</td><td>1. The WMS is to provide details of:
a. The approach to WSUD (including conceptual design details of the stormwater drainage, WSUD systems and on-site detention) and how the approach will be implemented, including detail of ongoing management and maintenance responsibilities. This includes if the system is to be fenced, landscaped and maintained for the entirety of the operation of the system.
b. Where required under PO1 and PO2, how the approach to WSUD complies with the water quality and flow objectives and targets consistent with the Technical guidance for achieving Wianamatta-South Creek stormwater management targets (DPE, 2022).</td><td>This study considers site wide water treatment. The masterplan design and can be seen in detail in Section 5.4 and Section 6.2 of this report.

Subsequent developments should review the targets required by individual stages and catchments and demonstrate achievement of relevant targets (and concept designs) as part of DA designs. Where appropriate DA designs should reflect accepted standard details and treatments as accepted by the Western Sydney Engineering Design Manual.</td></tr>
<tr><td>PO4</td><td>The regional stormwater system includes requirements for on lot as well as streetscape</td><td>1. Development includes the following stormwater management measures within each lot created by the development:
a. Minimum pervious areas to meet the requirements of PO8.</td><td>As a conservative approach, lot-based treatment measures have been excluded from this assessment. Developments of superlots and campuses could consider supplementary infrastructure but should demonstrate compliance with</td></tr>
</table>

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
	measures to ensure the Targets in PO1 and PO2 are met.	b. Gross pollutant traps (GPTs) designed in accordance the Regional Stormwater Authority technical guidance. c. Passively irrigated street trees are provided in accordance with the provisions of clause 2.4.5 of this DCP.	Wianamatta guidelines.
P06	Development must not increase existing urban salinity or result in increased salt loads in waterways, wetlands, drainage line or soils.	1. A salinity and or sodicity hazard assessment is required to ensure no impacts to both the waterways and built infrastructure. 2. All WSUD systems must incorporate an impervious liner, unless a detailed Salinity and Sodicity Assessment demonstrates infiltration of stormwater will not adversely impact the water table and soil salinity (or other soil conditions).	No WSUD elements are nominated that will increase salinity infiltration of the site. Subsequent lot developments will need to maintain these measures during future design stages.
P07	Drainage is designed to safely convey overland flows.	1. Designs shall ensure that flows are safely conveyed to avoid unsafe conditions for pedestrians and vehicles and to meet the requirements of Australian Rainfall & Runoff Guidelines 2019. 2. Trunk drainage capable of conveying 1% AEP flow shall be designed as naturalised channels connecting to the existing stream system. 3. Trunk drainage is to be located through natural creek lines or constructed natural drainage channels to help detain flows and contribute to biodiversity, public amenity and safety. 4. Naturalised trunk drainage channels will commence when 15 ha of catchment contribute runoff flows.	Sitewide stormwater design has been designed to maintain overland stormwater discharges within the road reserve. All precinct catchments in stormwater analysis are less than 15ha in size prior to discharging to the natural watercourses at the bottom of the site. All overland flow paths within the road have been designed to maintain safe access throughout the site. Refer to **Section 6.1** for details. Future considerations of overland flow paths through super lots may be introduced in subsequent stage development but will need to maintain strategies outlined in this report.

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
P08	Lots achieve minimum perviousness to meet stormwater drainage manager requirements and green and cooling objectives.	1. Development is to demonstrate that the perviousness rates identified below are achieved. Development in the Mixed Use Zone: Development in the Enterprise and Agribusiness Zone: Development in the Enterprise and Agribusiness Zone: Development in the Enterprise and Agribusiness Zone: iii. Employment – business, commercial, light industrial (three storeys and above) – 30% iv. Employment – Large format industrial and light industrial (up to two storeys) – 15% Note 1: If there is more than 1 building on a lot, the number of storeys for the purposes of this clause must be determined in accordance with the Business Zone Design Guide dated December 2021 and published on the NSW planning portal. Note 2: Where an application includes the delivery of streets, streets are to be included in the pervious surface area calculations 1. The site area pervious requirement is to be calculated in accordance with the following index: • Deep soil (one metre or more in depth, connected subsoil) – 100% • Shallow soil (less than one metre in depth, not connected to subsoil) – 75% • Permeable pavement – 50% Hardstand – 0% Note: as an example of application of the above ratios: i. Site area (comprising development lots and streets) is 1,000 square metres in a large format industrial area (up to 2 storeys) ii. 150 square metres of pervious area would be required if it is 100% deep soil	Imperviousness applied across the site follows layout allocation from Hatch Roberts Day, to facilitate a site total perviousness of 40%. Refer to **Section 5.2.1**. Subsequent development applications will need to consider these imperviousness targets as an objective within their planning. Permeable paving solutions are considered inappropriate for the Bradfield site, due to saline and dispersive soil conditions.

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
		iii. 300 square metres of pervious area would be required if it is 100% permeable pavement iv. Areas of deep soil, shallow soil and permeable pavement can be used in combination to achieve the equivalent required pervious area.	
Management and access to Regional Stormwater Infrastructure and Waterways			
PO1	Regional infrastructure Stormwater assets (including land and infrastructure) are managed and maintained by the stormwater drainage manager.	1. Where land for regional infrastructure stormwater assets (including open drainage corridors as a part of riparian streets) are not identified for acquisition on the Land Reservation Acquisition Map in State Environmental Planning Policy (Precincts – Western City) 2021 development is to: a. Provide an allocation of sufficient, suitably located land area to allow for stormwater assets in agreement with the stormwater drainage manager. b. Where stormwater assets are not dedicated to Sydney Water, appropriate legal access rights are required for ongoing management and maintenance. The legal right of access must be undertaken in consultation with the Regional Stormwater Authority, Sydney Water. c. All costs associated with the value of land and easement creation are to be borne by the developer.	Addressed in civil design with allocation of assets in future public domain areas that will be dedicated to the stormwater authority. Refer to **Section 6** for details.

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
PO2	Development provides management access to the stormwater drainage manager.	1. The design of development shall ensure where a riparian zone is identified in the Riparian Plan or Drainage Scheme Plan the landowner is to provide a legal right of access for the stormwater drainage manager to undertake required revegetation, management, and maintenance works. 2. The maximum area of land to be designated for access for this purpose is the vegetated riparian zone or the 1% AEP, whichever the greater, for all waterways. All costs associated with the value of land and easement creation are to be borne by the developer. Note: The stormwater drainage manager will only be responsible for undertaking defined waterway, stormwater, and riparian zone management activities on this land.	Proposed layout of stormwater assets within the masterplan includes for contingency space required for uses such as future access, earthworks and interface requirements. The ultimate detailed design of the basins should consider specific maintenance vehicles and their relevant clearance and turnpaths.

Table 11 – DCP2 Performance Outcomes: Erosion and Sediment Control

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
PO1	Development is to ensure 80% of all flows leaving the construction site achieves total suspended solids of 50mg/L or less and a pH of 6.5-8.5 during the construction and building phases until the site is stabilised and landscaped	1. An Erosion and Sediment Control Plan (ESCP) must be submitted for sites less than 2,500sqm and a Soil and Water Management Plan must be submitted for sites greater than 2,500sqm. These plans must be prepared in accordance with Appendix D.21. 2. The ESCP or CPESC must demonstrate compliance with the construction phase targets, outlined in the table in PO1 of page 39 of DCP2 throughout the construction and building phases until the site is stabilised and landscaped 3. The ESCP or CPESC must illustrate that appropriate controls have been planned which will, when implemented, minimise erosion of soil from the site and, accordingly, sedimentation of drainage systems	Performance outcome is relevant to construction phase of project will need to be addressed in detail as part of subsequent ESCPs. ESCPs must be site specific and provide controls relevant to specific construction staging.

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
		and waterways.	

Table 12 – DCP2 Performance Outcomes: Smart Places

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan Consideration and Comment
PO2	Pit and pipe infrastructure support future requirements to service smart city infrastructure.	4. Where developments are providing pit and pipe infrastructure, specifications in the *Digital Infrastructure Technical Report: Western Parkland City* are met to accommodate future smart city infrastructure.	Conceptual pit and pipe networks have been designed in DRAINS to accommodate precipitation and meet flow targets. See **Section 5.3** and **Section 6.1** for more details. There will be opportunity to integrate SMART Cities solutions into the drainage maintenance system through the principles proposed in the Smart Cities Implementation Plan.

4.3 Other Relevant Technical Standards

Table 13 – Other Relevant Technical Standards

Policy	Description	Relevant Sections
Blacktown City Council WSUD Developer Handbook	The Blacktown City Council WSUD Developer Handbook provides technical guidelines for methods and assumptions to adopt when carrying out Model for Stormwater Improvement Conceptualisation (MUSIC) water quality modelling. MUSIC modelling is undertaken for Bradfield City Centre Masterplan design to predict the performance of stormwater quality management systems and assists in the planning and design of stormwater strategies. The MUSIC model for the Bradfield City Centre Masterplan site has been developed in conjunction with the Wianamatta Toolkit as provided by DPE. Where the Wianamatta Toolkit does not cover certain areas, such as acceptable treatment depths for filter media, the models deferred to Blacktown City Council WSUD Developer Handbook.	▪ All Sections

Policy	Description	Relevant Sections
Liverpool City Council DCP and Development Design Specification	The Liverpool Council Development Control Plan (DCP) applies to all land in Liverpool Local Government Area (LGA) and provides detailed provisions for regulating the carrying out of development.	▪ Chapter 6: Water Cycle Management ▪ Development Design Specification D1: Geometric Road Design (Urban and Rural)
Guide to Codes and Practices for Streets Opening	The Guide to Codes and Practices for Streets Opening is published by the NSW Streets Opening Coordination Council (SOCC) to document industry practice and provide essential information and guidance on managing street openings for the provision of underground utility services.	▪ Chapter 4 – Nominal Depth of Cover of Utility Services in Road Reserves ▪ Chapter 5 – Utility / Service Provider Allocation

5 Technical Approach / Framework

5.1 Technical Approach / Framework

AECOM has conducted a technical assessment of the Bradfield City Centre related to water quality and quantity (hydraulics):

- The hydraulic assessment for the site has been completed in DRAINS. DRAINS is a hydraulic water modelling software which allows users to design and analysis stormwater drainage systems. This is informed by catchment hydrology. A DRAINS model has been used in this report to build a pit and pipe network to manage water flow from associated catchments. Overland flow paths are also able to be analysed in DRAINS and allows for drainage systems and OSD basins to be designed to reduce the size of these overland flow paths.
- Water quality assessment and WSUD modelling has been completed in MUSIC. MUSIC is a water quality modelling software designed to simulate rainfall and pollution generation which allows urban stormwater professionals to visualise a range of possible strategies for tackling the hydrology and pollution impacts of urban stormwater runoff. It also simulates flow reduction and pollution removal through rain harvesting, sediment basins, bioretention, wetlands, proprietary filtration devices and many other stormwater management systems.

5.2 Catchment Hydrology

5.2.1 Catchment Areas

For both the hydraulic and water quality assessment, the development area has been broken into eleven individual precincts that match closely to the natural topography of the site taking into consideration proposed road and lot grading shown in **Figure 11.** Precinct two, a planned open space, is considered to bypass the catchment infrastructure for analysis purposes.

Each precinct's network is designed to be independent of each other, which is supported by the grading of the site, and includes the isolation of overland flow paths from surcharging into neighbouring precinct stormwater networks. Further, the drainage design has assumed a consistent grading of the super lots to fall from road-to-road and in a nominally south-eastern or south-western direction depending on existing catchment behaviour.

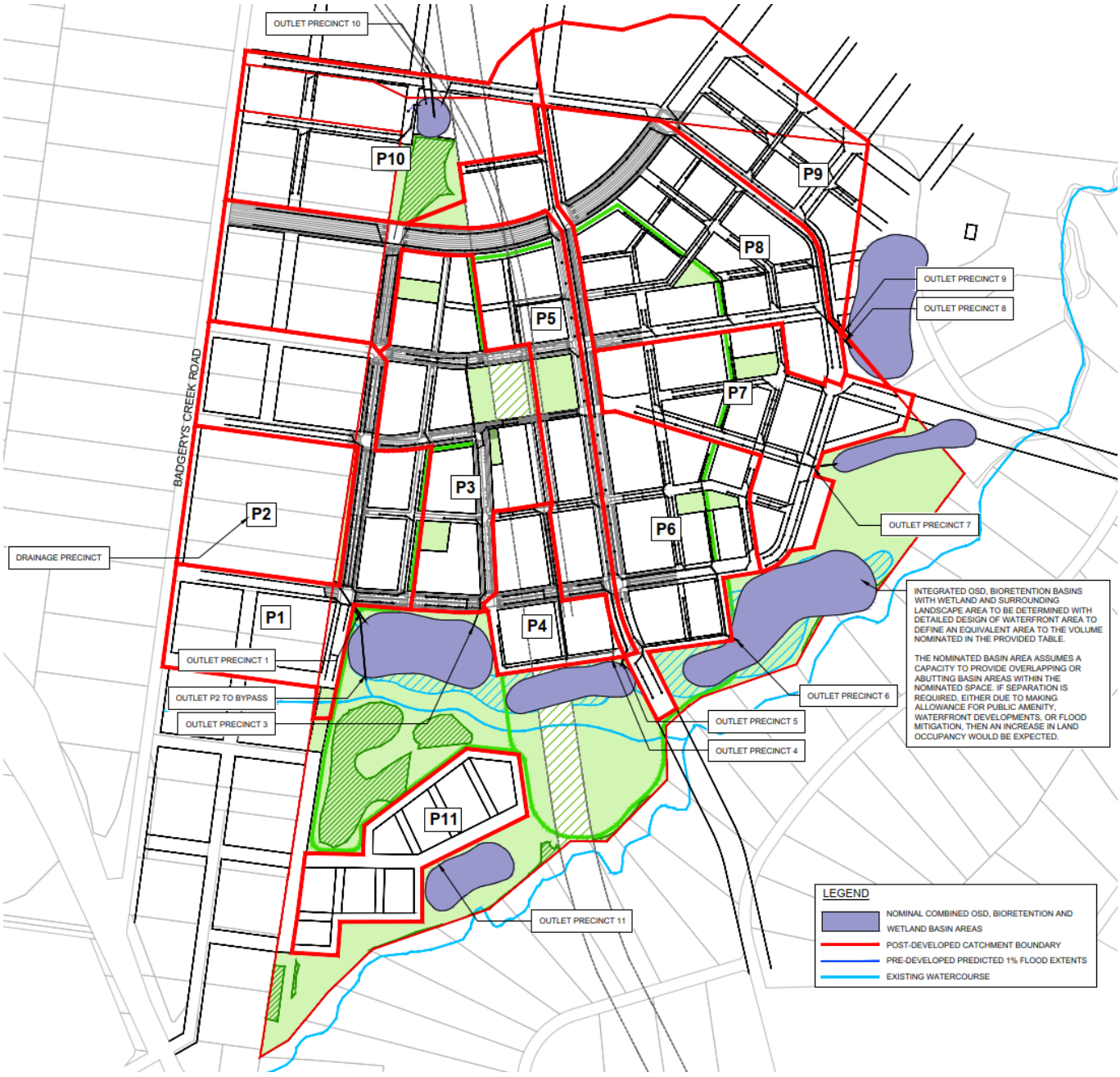
The catchment areas of these precincts are displayed in **Table 14**. Each catchment has been modelled with the same parameters shown in **Table 17** with the same hydraulic criteria as discussed in **Section 5.3.1**.

Table 14 - Catchment Areas

Precinct	Catchment Area (ha)
1	14.82
2	6.88
3	11.62
4	4.20
5	14.94
6	12.37
7	9.97
8	14.74
9	11.90
10	12.38
11	6.39

External catchments further to the west of Badgerys Creek Road are assumed to be captured and redirected by Badgerys Creek Road and discharge to Moore Gully with no connection to the Aerotropolis Bradfield site networks. External catchments between Badgerys Creek Road and the site, as well as additional catchment area to the north-east, have been considered in the drainage analysis based on anticipated future road connections and likely grading outcomes of external lot areas.

Figure 11 – Bradfield Precinct Breakdown



The volume of flow paths from upstream external catchments have been taken into consideration in the stormwater quantity and DRAINS analysis however it is assumed that these external catchments will ultimately be treated prior to discharge into the site so that their pollutant levels meet the required targets and therefore are not included in the MUSIC model however, for the purposes of analysis, it has been assumed that these additional areas are further developed site areas following similar imperviousness characteristics as the site proper.

5.2.2 Catchment Characteristics

Catchment characteristics have been detailed in the Western Sydney Aerotropolis Development Control Plan 2021, Phase 2 (Section 2.3.2, PO8) and have served as the basis for site impervious calculations by Hatch Roberts Day (HRD), with the intent on achieving a 40% perviousness across the whole of site and should be read in conjunction with this report. These calculations have been used to provide adjusted impervious percentages for use in catchment properties in modelling and are reflected in the table below:

Table 15 – Sub-area Impervious Values

Source Node	Impervious Area (%) (DCP 2)	Impervious Area (%) (HRD)
Super Lots	65	**84**
Parks & Open Spaces	10	**16**
Road Reserves	65	**75**

5.2.3 Major and Minor Storm Event Criteria

The hydraulic assessment within DRAINS has been conducted under the minor and major events approach as shown in **Table 15** below.

Table 16 – DRAINS Storm Events

Storm Event	AEP Event
Major	1%
Minor	5%

5.3 Hydraulic Assessment

The hydraulic assessment of the Bradfield City Centre was completed in DRAINS. As previously noted, each precinct is treated individually and have been modelled in separate models.

5.3.1 Hydraulic Requirements

The aim of the hydraulic assessment is to manage the volume water within the site, designing suitable pit and pipe networks and OSD basins.

- OSD basin sizes have been designed to cater for all design storm events up to and including the major event to reduce peak post development discharges to equivalent or lesser discharges than the predeveloped. No consideration has been included for additional storage of water in the nominal sizing.
- All precincts stormwater drainage pit and pipe networks have been designed on a high level, aimed to reduce the overland flow paths travelling on roads in the precinct in minor storm events.

- The design criteria for overland flow paths in major storm events have a clear focus on safety rather than elimination and have been reduced to safe sizes, less than 3m in width, in which roads are still accessible by emergency vehicles.
- Ideally, a designated length of road would be dedicated as an overland flow route channel, however due to space limitations and a lack of available dedicated flow routes for major storm flows, overland flow routes for the major storm events have been relegated to the road carriageway. The design criteria applied then was focused on maintaining safe access around the site for vehicles during high rainfall periods.
- This approach has aimed to keep the width of the overland flow path under 3m within roads that have multi-lane carriageways and less than 1m in the minor, single lane roads. This has been achieved in most areas except for the intersections at the southern ring road running parallel to the waterfront area. In these areas there is no encroachment of surface water through the intersection which is typically considered acceptable. Remaining oversized flow paths will be resolved in future basin design progressions and integration with the water from design.

5.3.2 DRAINS Parameters

The DRAINS Model parameters have been adopted from the First Building's models, which referred to Talavera Road as a default hydrological model. These parameters have been adopted by all precinct models.

Table 17 – DRAINS Model Parameters

Drains Parameters	
Hydrological Model	Talavera Road
Soil type	3
Depression storage, grass (mm)	5
Depression storage, paved (mm)	1
Climate Change	19.7% (2090 RCP8.5)
Rainfall Model	
Storm Data	ARR2019 Storm Ensemble
Pipe Parameters	
Type of Pipe	RCP
Pipe roughness	0.13
Minimum grade (%)	1.0
Pit Parameters	
Type	TfNSW standard type SA1 and SA2
Blocking Factor	0

Catchment Parameters	
Percentage area of impervious (%)*	60 (for total site)
Time of Concentration of impervious areas (min)	5
Time of Concentration of pervious areas (min)	Varies: 7.5 standard, 12 max
Overland Flow Parameters	
Overland Flow Path Shape	Road carriageway with 3% crossfall against barrier kerb. Restricted to single lane width within main road
Minimum channel slope (%)	0.5
Safe Depth for Major Storms (m)	0.15
Safe Depth for Minor Storms (m)	0.15
Safe Depth x Velocity (sq. m/sec)	0.6

** Note: the percent impervious has been applied as 60%. Site-wide impervious area calculations based on the calculations undertaken by Hatch Roberts Day and provided to AECOM on 21/06/2023 utilising equivalent areas in GFA study, balance the site impervious against this 60% requirement.*

5.3.3 Assumptions and Limitations

The stormwater assessment completed to date is a high-level assessment of the stormwater needs of the Bradfield City Centre. It provides a general strategy for the design of the overall stormwater network as well as OSD and water quality basins.

- Basin sizing is based on minimising discharge to the existing watercourse to pre-development levels, while location and configuration suggested in this analysis is indicative only. Further designs will need to be coordinated with landscape designs and any works within the riparian corridor to maximise the overlap in footprint area for stormwater management measures. Future developments, such as the proposed entertainment area in the south east corner near Thompsons Creek, have not been included in this analysis and further analysis will need to be completed to understand the impact and of these developments on the drainage networks.
- The OSD basin design excludes considerations for lot-based measures such as smaller on-site OSDs, ponds, gardens, tree pits or rainwater tanks. Required footprints nominated for each of the end-of-line WSUD treatment measures are based on bioretention basins providing the primary means of treatment and exclude considerations of wetland combination and the use of GPT devices upstream or lot-based measures for re-use.
- OSD basins have been sized to be partially in cut in relation to the existing terrain, with additional bunded portions situated above the existing natural topography. This balances the needs of stormwater drainage throughout the development roads and allows connections to existing creek inverts. Nominated depths of basins are the maximum depth from invert to spill levels. Nominated bioretention basin depths exclude filter media layers and are a measure of the basin finished surface to the surrounding bund level.

5.4 Water Quality

To date, the study assumes that water quality objectives would be met on a precinct level. Objectives and performance have not been analysed for individual lots in smaller sub-lot catchments at this stage. These would otherwise consider lot-specific water treatment solutions and/or measures such as gardens and rainwater tanks.

The outcome for the water quality assessment is to appropriately size bioretention basins and wetlands to treat runoff water and reduce pollutants from the water in the catchment to meet water quality targets outlined by DCP2, utilising parameters from the Wianamatta Toolkit. Second to the water quality targets are site flow objectives, targeting the balance of water retention within the local system across a range of percentile flow occurrences. WSUD objectives have therefore been assessed in a series of MUSIC models for each precinct, for the total site area.

5.4.1 Music Modelling Toolkit - Wianamatta

All MUSIC model parameters have been adopted from the Wianamatta Music Modelling Toolkit which provides source node pollutant parameters, rainfall data and included impervious and pervious values. This toolkit (2022) prepared by the EHG of DPE supports assessments and development of proposals for State Significant Developments (SSD). It provides:

- Stormwater management targets
- Confirmed and final construction and operational phase targets for the Western Sydney Aerotropolis and Mamre Road Precincts
- Recommended rainfall and potential evapotranspiration for MUSIC models
- Source Node assumptions for developing MUSIC models under the developed scenario
- Flow Duration Curve Tool for assessing compliance against Stormwater Flow Targets at the development scale
- MUSIC model file which provides the rainfall, PET and Source Node Assumptions to support assessments and development of WSUD strategies in Wianamatta-South Creek
- Water Demand and Irrigation Data
- Indicative WSUD strategies for Large Format Industrial typologies.

For further information refer to the Music Modelling Toolkit – Wianamatta on the Department of Planning and Environment website.

5.4.2 Water Quality Targets

Water quality modelling has been completed to meet the pollutant reduction targets provided by the Department of Planning and Environment in the Wianamatta Music Modelling Toolkit. These water quality targets are shown in **Table 18** and **Table 19** below.

Table 18 – Operational Phase Stormwater Quality Targets Option 1: Annual Load Reduction

Parameter	Target: Reduction in Mean Annual Load from Unmitigated Development
Gross Pollutants (anthropogenic litter >5mm and coarse sediment >1mm)	90%
Total Suspended Solids (TTS)	90%
Text Total Phosphorus (TP)	80%
Total Nitrogen (TN)	65%

Table 19 – Operational Phase Stormwater Quality Targets Option 2: Allowable loads

Parameter	Target: Allowable Mean Annual Load from Development
Gross Pollutants (anthropogenic litter >5mm and coarse sediment >1mm)	< 16 kg/ha/y
Total Suspended Solids (TSS)	< 80 kg/ha/y
Text Total Phosphorus (TP)	< 0.3 kg/ha/y
Total Nitrogen (TN)	< 3.5 kg/ha/y

The assessment is also required to meet the water quantity targets outlined in DCP2, with two options for analysis. The approach adopted by this study has been Option 1. These water quantity targets are shown in **Table 19** and **Table 20** below:

Table 20 – Operational Phase Stormwater Quantity (Flow) Targets Option 1: MARV

Parameter	Target: MARV
Mean Annual Runoff Volume (MARV)	≤ 2 ML/ha/y at the point of discharge to the local waterway
90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway
50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway
10%ile flow	0 L/ha/day at the point of discharge to the local waterway

Table 21 – Operational Phase Stormwater Quantity (Flow) Targets Option 2: Flow Percentiles

Parameter	Target: Flow Percentiles
95%ile flow	3000 to 15000 L/ha/day at the point of discharge to the local waterway
90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway
75%ile flow	100 to 1000 L/ha/day at the point of discharge to the local waterway
50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway
Cease to flow	Cease to flow to be between 10% to 30% of the time

5.4.3 MUSIC Model Concept

The MUSIC model has been designed using Gross Pollutant Traps (GPTs), bioretention basins and wetlands working in concert to address conflicting demands from the end of line system for water quality and flow objectives.

In-line GPTs at the outlet of each precinct's stormwater drainage network serve several roles: to act as an initial filter for water quality, protect the downstream vegetated basins from excess larger contaminants, and provide flow control in various runoff magnitude. This flow control has proved to be critical in achieving both water quality targets and competing demands from the flow objectives by proportioning the treatable water between the bioretention basin and wetlands.

An initial, small, bioretention basin partition is used as a second layer of flow control with a low flow bypass to direct very low order discharges through the main bioretention basin as a primary treatment path. This mechanism has allowed the leveraging of the higher performing bioretention basins for pollutant reduction and then passing water to the wetland to manage site flow objectives and the remainder of treatment.

Figure 12 shows the MUSIC model concept that was adopted for all precincts.

Figure 12 – MUSIC Model Concept

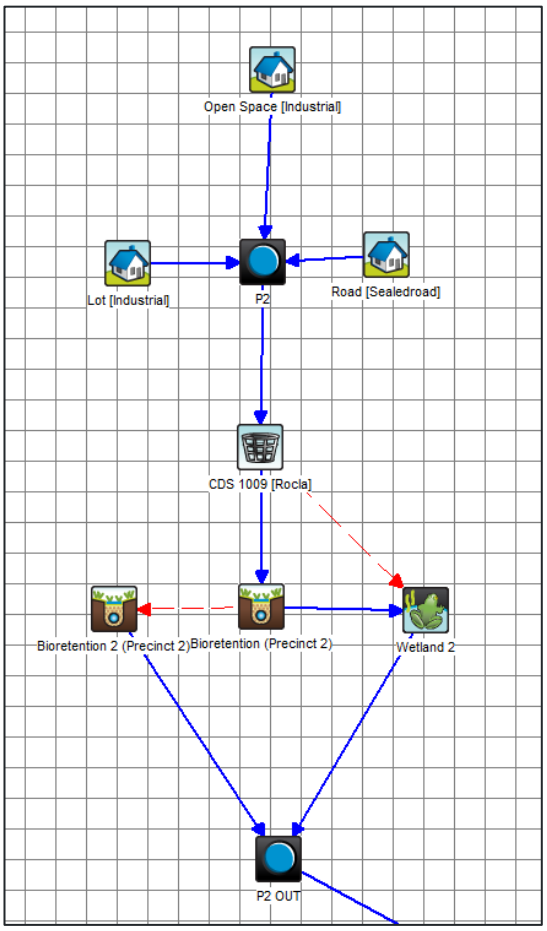
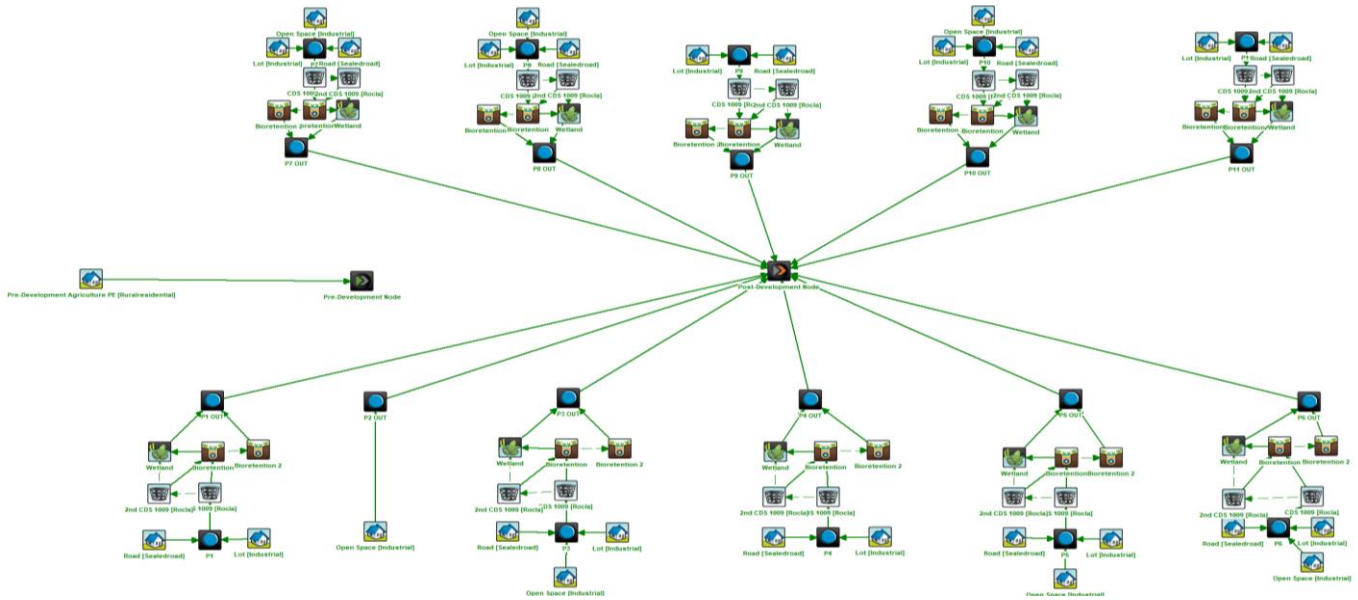


Figure 13 – MUSIC Masterplan Model Concept



5.4.4 MUSIC Model Parameters – Source Nodes

Three types of source nodes are included in the hydrological model:

- Roads
- Open Spaces
- Lots

Surface areas for each source node have been taken from the Bradfield City Centre Master Plan. Detailed source node parameters are displayed in **Table 22**, **Table 23** and **Table 24** below:

Table 22 – Source Node Parameters: Road

Source Node Parameters: Road	
Impervious %	75 (Per HRD assessment)
Impervious Area Properties	
Rainfall threshold (mm/day)	1
Pervious Area Properties	
Soil Storage Capacity	10
Initial Storage (% of Capacity)	30
Field Capacity (mm)	130
Infiltration Capacity Coefficient- a	175
Infiltration Capacity Coefficient- b	2.5
Groundwater Properties	
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow (%)	1.4
Daily Deep Seepage (%)	0
Total Suspended Solids- Base Flow Concentration Parameters	
Mean (log mg/L)	1.2
Std Dev (log mg/L)	0.17
Total Suspended Solids- Storm Flow Concentration Parameters	
Mean (log mg/L)	2.430
Std Dev (log mg/L)	0.32
Total Phosphorous- Base Flow Concentration Parameters	
Mean (log mg/L)	-0.85
Std Dev (log mg/L)	0.19
Total Phosphorous- Storm Flow Concentration Parameters	
Mean (log mg/L)	-0.3
Std Dev (log mg/L)	0.25

Total Nitrogen- Base Flow Concentration Parameters	
Mean (log mg/L)	0.11
Std Dev (log mg/L)	0.12
Total Nitrogen- Storm Flow Concentration Parameters	
Mean (log mg/L)	0.34
Std Dev (log mg/L)	0.19

Table 23 – Source Node Parameters: Open Space

Source Node Parameters: Open Space	
Impervious %	16 (Per HRD Assessment)
Impervious Area Properties	
Rainfall threshold (mm/day)	1
Pervious Area Properties	
Soil Storage Capacity	150
Initial Storage (% of Capacity)	30
Field Capacity (mm)	130
Infiltration Capacity Coefficient- a	175
Infiltration Capacity Coefficient- b	2.5
Groundwater Properties	
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow (%)	1.4
Daily Deep Seepage (%)	0
Total Suspended Solids- Base Flow Concentration Parameters	
Mean (log mg/L)	1.2
Std Dev (log mg/L)	0.17
Total Suspended Solids- Storm Flow Concentration Parameters	
Mean (log mg/L)	2.15
Std Dev (log mg/L)	0.32
Total Phosphorous- Base Flow Concentration Parameters	
Mean (log mg/L)	-0.85
Std Dev (log mg/L)	0.19
Total Phosphorous- Storm Flow Concentration Parameters	
Mean (log mg/L)	-0.6
Std Dev (log mg/L)	0.25
Total Nitrogen- Base Flow Concentration Parameters	

Mean (log mg/L)	0.11
Std Dev (log mg/L)	0.12
Total Nitrogen- Storm Flow Concentration Parameters	
Mean (log mg/L)	0.3
Std Dev (log mg/L)	0.19

Table 24 – Source Node Parameter: Lots

Source Node Parameters: Lots	
Impervious %	84 (Per HRD Assessment)
Impervious Area Properties	
Rainfall threshold (mm/day)	1
Pervious Area Properties	
Soil Storage Capacity	150
Initial Storage (% of Capacity)	30
Field Capacity (mm)	130
Infiltration Capacity Coefficient- a	175
Infiltration Capacity Coefficient- b	2.5
Groundwater Properties	
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow (%)	1.4
Daily Deep Seepage (%)	0
Total Suspended Solids- Base Flow Concentration Parameters	
Mean (log mg/L)	1.2
Std Dev (log mg/L)	0.17
Total Suspended Solids- Storm Flow Concentration Parameters	
Mean (log mg/L)	2.15
Std Dev (log mg/L)	0.32
Total Phosphorous- Base Flow Concentration Parameters	
Mean (log mg/L)	-0.85
Std Dev (log mg/L)	0.19
Total Phosphorous- Storm Flow Concentration Parameters	
Mean (log mg/L)	-0.6
Std Dev (log mg/L)	0.25
Total Nitrogen- Base Flow Concentration Parameters	
Mean (log mg/L)	0.11

Std Dev (log mg/L)	0.12
Total Nitrogen- Storm Flow Concentration Parameters	
Mean (log mg/L)	0.3
Std Dev (log mg/L)	0.19

5.4.5 MUSIC Model Parameters- Treatment Nodes

Only three treatment nodes are used to treat runoff water to reduce pollutant loads and meet water quality targets. Treatment node parameters are outlined in **Table 25**, **Table 26** and **Table 27**. Parameters for size and detention depths or bypasses are indicative only for a single precinct, managing flow and quality constraints for each precinct results in different values for each precinct.

Table 25 – Wetland Parameters

Properties of Wetlands	
Inlet Properties	
Low Flow By-Pass (m3/s)	0
High Flow By-Pass (m3/s)	100
Inlet Pond Volume (m3)	0
Storage Properties	
Extended Detention Depth (m)	0.25
Vegetation Cover (% of surface area)	50
Exfiltration Rate (mm/hr)	0
Evaporation loss as % of PET	125
Outlet Properties	
Equivalent Pipe Diameter (mm)	5
Overflow Weir Width (m)	3
Notional Detention Time (hrs)	59.6E3

Table 26 – Bioretention Basin Parameters

Properties of Bioretention Basin	
Inlet Properties	
Low Flow By-Pass (m3/s)	0 (Varies for first flow control basin)
High Flow By-Pass (m3/s)	100
Storage Properties	
Extended Detention Depth (m)	0.15
Filter and Media Properties	
Unlined Filer Media Perimeter (m)	0.01
Saturated Hydrohalic Conductivity (mm/hr)	100

Properties of Bioretention Basin	
Filer Depth (m)	0.7
TN Content of Filter Media (mg/kg)	800
Orthophosphate Content of Filter Media (mg/kg)	40.0
Infiltration Properties	
Exfiltration Rate (mm/hr)	0
Outlet Properties	
Is base lined?	Yes
Vegetation Properties	Vegetated with Effective Nutrient Removal Plants
Overflow Weir Width (m)	3

Table 27 – GPT Parameters

Properties of GPT	
Low Flow By-Pass (m3/s)	0
High Flow By-Pass (m3/s)	0.100
Target Element	Gross Pollutants (kg/ML)
Concentrating Based Capture Efficiency	
Input	100
Output	2
Flow Based Capture Efficiency	
Inflow	1
% Capture	100

5.4.6 Assumptions and Limitations

The Master Plan has been developed on the following basis, with reference to water quality:

- The water quality assessment has been completed on a high level, similar to the hydraulic model.
- An exfiltration rate of 0.0 mm/hr has been adopted, assuming bioretention basins and wetlands are either lined to manage potential salinity risks or the in-situ soil lacks capacity to accept infiltration of water, as outlined within the *Review of water sensitive urban design strategies for Wianamatta South Creek* prepared by DPE. This assumption will need to be confirmed with soils testing during detailed design development and may alter the final size of wetlands due to the sensitivity of the flow targets to the inclusion or exclusion of soil exfiltration.
- The sizing of treatment basins and wetlands has been based on the required footprint area to meet flow and pollutant targets. It has not taken into consideration the integration needed with the natural landscape. Further detailed coordination with the landscape design of the waterfront area will be necessary to fully integrate with the OSD and bioretention basins.
- As a conservative approach no lot-based treatment infrastructure has been considered for the private lots as a part of the MUSIC model (i.e., the model considers treatment for the whole Precinct). On-lot treatment infrastructure such as those outlined within the *Review of water sensitive urban design strategies for Wianamatta South Creek,* prepared by DPE, could be considered in future hydrological models. The effect of

taking on-lot infrastructure into consideration would be a reduction in flow rates in the stormwater drainage system, and a reduction in the stormwater network infrastructure sizing including a reduction in basin sizes.

6 Technical Assessment

Based on the approach outlined in **Section 5**, the Bradfield City Centre area has been assessed in eleven individual drainage precincts. The stormwater drainage networks in each of these precincts are assessed as being independent of each other, including for overland flow routes.

Each precinct has their own outlets, OSD and WSUD mitigation measures. The basins that have been sized in these MUSIC and DRAINS models have been sized as an estimation, at a high level and their indicated size is to be used as an estimate only pending future coordination with other developments of the site.

6.1 Hydraulic Assessment Results

Results presented in this report follow the modelling of the proposed masterplan conceptual drainage infrastructure in DRAINS.

6.1.1 Pit and Pipe Sizing

Initial pipe sizing as part of the conceptual design was initiated to determine anticipated outlet sizing requirements, to better inform on the nature of basin sizing, outlet location and whether there were potential overland flooding issues within the site.

Pipe sizing has been designed for each respective precinct in isolation from the other precinct areas. Generally, drainage lines within the site converge from minor roads to centralised trunk lines that run under main roads that convey the largest quantities of water and consist of the largest pipe sizes. Outlet pipes at the downstream end of the catchment's outlet to end-of-line above ground OSD basins that have been designed to manage the volume of water and attenuate discharges to at or below pre-developed conditions.

Table 28 provides the outlet pipe size extents for each precinct along with general gradings and velocities through pipes in both major and minor storm events. The properties refer to sizes and properties that inlet into the OSD basins and will be subject to changes during detailed design in future project phases.

Table 28 – Outlet Pipe Size Extents (OSD Inlet)

Precinct	Pipe Diameter	Pipe Grade (%)	Peak Velocity (Minor Storm Event) m/s	Peak Velocity (Major Storm Event) m/s
Precinct 1	2 x 1500mm	2.1	2.0	1.9
Precinct 2	Bypass to Moore's Gully			

Precinct	Pipe Diameter	Pipe Grade (%)	Peak Velocity (Minor Storm Event) m/s	Peak Velocity (Major Storm Event) m/s
Precinct 3	1200mm	2.5	2.5	3.1
Precinct 4	900mm	1.0	2.2	1.5
Precinct 5	2 x 1500mm	1.0	2.1	2.4
Precinct 6	2 x 1500mm	1.0	1.9	2.1
Precinct 7	2 x 750mm	1.0	2.7	3.4
Precinct 8	3 x 1200mm	1.0	2.9	3.2
Precinct 9	2 x 1200mm	1.0	3.0	3.2
Precinct 10	1200mm	1.0	3.3	3.7
Precinct 11	600mm	1.0	3.2	4.0

Based on preliminary peak velocities shown above, it is considered a requirement that energy dissipation measures be designed as part of the next stage of design.

6.1.2 OSD Basin Sizing

OSD Basins have been sized to meet the hydraulic requirements and shown for each precinct in **Table 29**. OSD basin volumes listed in the table are the estimated peak stored volume, not total basin storage capacity or required area taking into consideration of batters and other grading requirements

Table 29 – OSD Basin Sizing

Precinct	Catchment Area (ha)	OSD		
		Footprint (m^2)	Depth (m)	Volume (m^3)
1	14.82	3,000	1.20	3,840
2	6.88		NIL	
3	11.62		NIL	
4	4.20	1,000	1.20	1,200
5	14.94	3,000	1.20	3,840
6	12.37		NIL	
7	9.97	1,500	1.50	2,250
8	14.74	2,000	1.20	2,400
9	11.90	2,000	1.20	2,400

10	12.38	1,800	1.20	2,000
11	6.39	2,000	1.50	3,000

There is potential scope to refine the sizing requirements for each of these basins but is subject to coordination with the regional flood study.

6.1.3 Pre and Post discharges

The drainage network in all precincts have been designed to minimise post development discharge volumes to pre-development levels or lower. Where these targets are not achieved at individual precinct outlets, they have been compensated for in neighbouring precinct decreases. **Table 30** and **Table 31** display the pre and post development discharge volumes for all precincts in major and minor storms respectively. Precincts 1, 3-7 are expected to become part of the integrated waterfront area and as such are appropriate to assess as an aggregate of the performance. Marginal increases in some precincts are balanced by decreases in others, towards an aggregate balance in flows.

Table 30 – Discharge Rates: Major Storm Event

Precinct	Pre-development discharge (cu.m/s)	Post-development Discharge (cu.m/s)	% Change
Precinct 1	2.34	2.47	5.6 increase
Precinct 2		NIL	
Precinct 3	2.33	2.41	3.4 increase
Precinct 4	0.66	0.81	22.7 increase
Precinct 5	2.36	2.37	0.4 increase
Precinct 6	1.95	1.86	4.6 decrease
Precinct 7	2.67	2.61	2.2 decrease
Precinct 8	2.32	2.28	1.7 decrease
Precinct 9	1.87	1.87	NIL
Precinct 10	3.27	3.07	6.1 decrease
Precinct 11	1.25	1.21	3.2 decrease
Site Total	**21.0**	**21.0**	**0.3% decrease**

Table 31 – Discharge Rates: Minor Storm Event

Precinct	Pre-development discharge (cu.m/s)	Post-development Discharge (cu.m/s)	% Change
Precinct 1	3.89	3.05	21.6 decrease
Precinct 2		NIL	
Precinct 3	3.16	3.29	4.1 increase

Precinct 4	1.10	1.01	8.2 decrease
Precinct 5	3.91	3.61	7.7 decrease
Precinct 6	3.24	2.50	22.8 decrease
Precinct 7	1.60	1.55	3.1 decrease
Precinct 8	3.86	3.74	3.1 decrease
Precinct 9	3.11	2.67	14.1 decrease
Precinct 10	1.97	1.08	45.2 decrease
Precinct 11	0.93	0.96	6.5 increase
Site Total	**26.8**	**23.5**	**12.4 decrease**

6.1.4 Future Focus Areas

There are several areas in the Bradfield City Centre hydraulic drainage system that require further consideration and coordination with studies by external parties as the project moves into detailed design:

- Precinct 10 naturally discharges across the site's northern boundary, rather than being included in the network connected to Moore Gully. While this area generally drains naturally in this direction, there may need to be consideration of redirecting this flow into the Bradfield City Centre Site until such time as the adjacent site to the north is further developed.
- The main east-west running 'ring road' at the south of the proposed Bradfield City Centre, directly adjacent to the waterfront area, creates a distinct termination of permissible overland flow routes. As the site is generally designed with the intent of providing safe access through all major roads during significant storm events, the intersections on this ring road cannot have overland flow across the road carriageway. Resolving this will require further consideration of drainage infrastructure constructed at the intersections to ensure during 1% AEP event that the network will function as intended and not surcharge across the road.
- A review of post-development hydraulic performance based on tailwater conditions obtained from detailed flood modelling following the production of a post-developed flood model.
- Integration with further design development of the waterfront area and the inclusion of WSUD structures within a combined effort for use of the area. This is to be developed within a detailed 3D model of the surface grading and pipe network arrangement.
- Ongoing consultation with Sydney Water will be required during detailed design for coordination of stormwater infrastructure assets.
- The proposed realignment of Moore's Gully within the development, including the establishment of a formalised watercourse channel and vegetated riparian corridor. Coordination of this aspect with outlets of basins and waterfront development will be required.

6.2 Water Quality Results

6.2.1 Bioretention and Wetland Sizing

A summary of bioretention and wetland basin sizes is detailed in **Table 32** for each precinct. WSUD basins have been considered in isolation and have been sized to ensure that water in each precinct meet the pollutant reduction and site flow targets stipulated by the DCP.

Wetland sizing is primarily driven by the flow targets for the site, having to provide significantly larger surface areas than would normally be required in order to retain water for evaporation back into the local system.

Table 32 – Bioretention and Wetland Sizing

Precinct	Catchment Area (ha)	Bioretention Basin		Additional Wetland Footprint (m^2)
		Footprint (m^2)	Depth (m)	
1	14.82	3,800	0.25	26,500
2	6.88		NIL	
3	11.62	3,800	0.25	16,500
4	4.2	3,500	0.25	5,000
5	14.94	7,000	0.25	19,000
6	12.37	5,000	0.25	16,000
7	9.97	2,450	0.25	17,000
8	14.74	7,000	0.25	22,000
9	11.9	6,000	0.25	18,000
10	12.38	6,000	0.25	14,000
11	6.39	4,200	0.25	9,000

6.2.2 Treatment Train Effectiveness

The effectiveness of the treatment trains in each precinct have been analysed through ability of infrastructure nodes to reduce pollutants in the network. The overall catchment pollution treatment effectiveness, shown in **Table 33**, meets the pollution reduction targets outlined in **Section 5.4.2.**

The pollutant reduction for each individual precinct is shown in **Table 34** to **Table 38** below and are compared to the pollutant reduction targets previously discussed. Precincts 1, 3-7 are expected to become an integrated solution with OSD and the future waterfront area so are assessed in combination as well as individual precincts. The overall performance of the combined effort is as shown in **Table 33**.

Table 33 – Combined Waterfront Area Catchment Pollution Reduction

Pollutant	Source Load	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	17,400	361	97.9	90
Total Suspended Solids (kg/yr)	137,000	6,580	95.2	90
Total Phosphorus (kg/yr)	225	22.4	90.0	80
Total Nitrogen (kg/yr)	1,250	187	85.1	65

Table 34 – Precinct 1 Pollutant Reduction

Pollutant	Source Load	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	2,320	0	100	90
Total Suspended Solids (kg/yr)	19,100	202	98.9	90
Total Phosphorus (kg/yr)	31.2	2.2	93	80
Total Nitrogen (kg/yr)	169	22.7	86.5	65

Table 35 – Precinct 3 Pollutant Reduction

Pollutant	Source Load	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	1,650	0	100	90
Total Suspended Solids (kg/yr)	12,600	703	94.4	90
Total Phosphorus (kg/yr)	20.5	2.3	88.6	80
Total Nitrogen (kg/yr)	118	18.8	84	65

Table 36 – Precinct 4 Pollutant Reduction

Pollutant	Source Load	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	663	0	100	90
Total Suspended Solids (kg/yr)	4,940	105	97.9	90
Total Phosphorus (kg/yr)	8.1	0.66	91.9	80
Total Nitrogen (kg/yr)	48.2	5.97	87.6	65

Table 37 – Precinct 5 Pollutant Reduction

Pollutant	Source Load	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	2,230	0	100	90
Total Suspended Solids (kg/yr)	19,100	1,070	94.4	90
Total Phosphorus (kg/yr)	31.5	3.27	89.6	80
Total Nitrogen (kg/yr)	161	24.4	24.4	65

Table 38 – Precinct 6 Pollutant Reduction

Pollutant	Sources	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	1,850	0	100	90
Total Suspended Solids (kg/yr)	14,600	490	96.6	90
Total Phosphorus (kg/yr)	24	2.1	91.3	80
Total Nitrogen (kg/yr)	133	17.8	86.6	65

Table 39 – Precinct 7 Pollutant Reduction

Pollutant	Sources	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	1,530	0	100	90
Total Suspended Solids (kg/yr)	12,400	529	95.7	90
Total Phosphorus (kg/yr)	20.2	1.84	90.9	80
Total Nitrogen (kg/yr)	111	15	86.5	65

Table 40 – Precinct 8 Pollutant Reduction

Pollutant	Sources	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	2,300	0	100	90
Total Suspended Solids (kg/yr)	18,000	869	95.2	90
Total Phosphorus (kg/yr)	29	2.93	89.9	80
Total Nitrogen (kg/yr)	166	23.6	85.8	65

Table 41 – Precinct 9 Pollutant Reduction

Pollutant	Sources	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	1,870	0	100	90
Total Suspended Solids (kg/yr)	14,900	461	96.9	90
Total Phosphorus (kg/yr)	24.3	2.1	91.5	80
Total Nitrogen (kg/yr)	136	17.1	87.4	65

Table 42 – Precinct 10 Pollutant Reduction

Pollutant	Sources	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	1,670	0	100	90
Total Suspended Solids (kg/yr)	12,100	360	97	90
Total Phosphorus (kg/yr)	19.9	1.64	91.7	80
Total Nitrogen (kg/yr)	118	14.6	87.6	65

Table 43 – Precinct 11 Pollutant Reduction

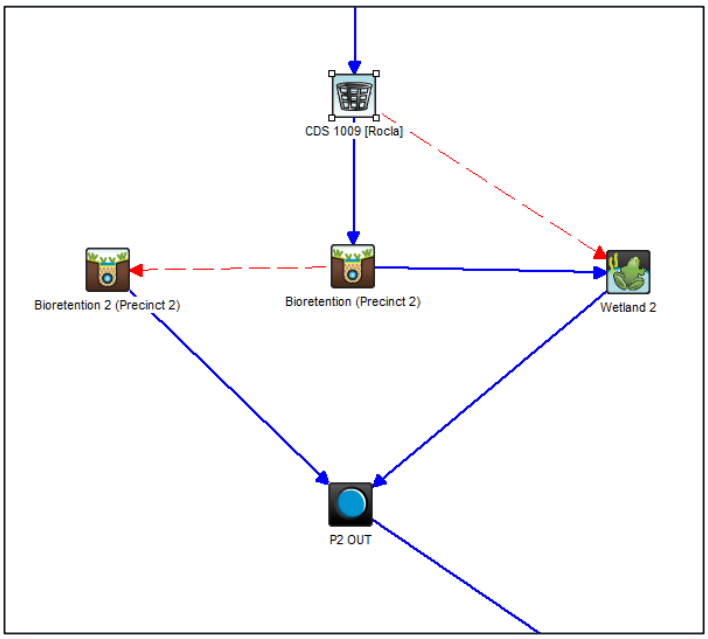
Pollutant	Sources	Residual Load	Reduction	Target Reduction
Gross Pollutants (kg/yr)	1,000	0	100	90
Total Suspended Solids (kg/yr)	8,100	247	97	90
Total Phosphorus (kg/yr)	13.3	0.98	92.6	80
Total Nitrogen (kg/yr)	71.6	8.14	88.6	65

6.2.3 Flow Control and Reductions

The general concept of the WSUD infrastructure connection to the stormwater drainage network begins at an upstream GPT, to provide first pass for treatment and protection of the downstream vegetated basins. The GPT is intended to be an in-line solution that will also act as a flow control device, controlling the direction of high and low flow quantities to either the bioretention system or adjacent wetlands.

A secondary flow control mechanism will exist in the low flow path from the GPT, composed of a small bioretention basin that will further direct low and high flow quantities while also providing pollutant treatment. It's this mechanism that has facilitated the compliance with all flow target requirements while also meeting pollutant reductions which acts to reduce the size required if wetlands were used in isolation. This layout is depicted in **Figure 14**.

Figure 14 – High Flow and Low Flow Bypass



The performance of this system, with respect to flow targets for the site, is presented in **Table 44**. This is representative of the approach for each precinct as the solution is highly scalable based on input catchments and flows.

Table 44 – Targets Alternative 2 for P1

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.97	Yes	≤ 2
90%ile	3316	Yes	1000 to 5000 L/ha/day
50%ile	69	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 45 – Targets Alternative 2 for P3

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.98	Yes	≤ 2
90%ile	4060	Yes	1000 to 5000 L/ha/day
50%ile	74	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 46 – Targets Alternative 2 for P4

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.99	Yes	≤ 2
90%ile	4122	Yes	1000 to 5000 L/ha/day
50%ile	60	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 47 – Targets Alternative 2 for P5

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.99	Yes	≤ 2
90%ile	3947	Yes	1000 to 5000 L/ha/day
50%ile	85	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 48 – Targets Alternative 2 for P6

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.96	Yes	≤ 2
90%ile	3717	Yes	1000 to 5000 L/ha/day
50%ile	96	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 49 – Targets Alternative 2 for P7

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.89	Yes	≤ 2
90%ile	4551	Yes	1000 to 5000 L/ha/day
50%ile	97	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 50 – Targets Alternative 2 for P8

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	2.00	Yes	≤ 2
90%ile	4002	Yes	1000 to 5000 L/ha/day
50%ile	85	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 51 – Targets Alternative 2 for P9

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.96	Yes	≤ 2
90%ile	3930	Yes	1000 to 5000 L/ha/day
50%ile	97	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 52 – Targets Alternative 2 for P10

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.55	Yes	≤ 2
90%ile	2964	Yes	1000 to 5000 L/ha/day
50%ile	78	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

Table 53 – Targets Alternative 2 for P11

Indices	Result	Compliance	Target
MARV (ML/ha/yr)	1.66	Yes	≤ 2
90%ile	3488	Yes	1000 to 5000 L/ha/day
50%ile	73	Yes	5 to 100 L/ha/day
10%ile	0	Yes	0 L/ha/day

6.2.4 Additional Treatment Options

While performance objectives for treatment and flow can be achieved with end-of-line infrastructure in the form of wetlands and bioretention basins, the footprint requirements are extensive, resulting in overtreatment for pollutant loads, and may need to be balanced against the intent for public amenity in the waterfront area.

Alternate measures could be considered during detailed design development, of either regional works or individual super-lots and campuses, to contribute to managing urban runoff and reduce the footprint of the final basins. This would need to be done in consultation with future developments, authorities and retain compliance with the nominated Wianamatta guidelines for the region.

6.2.5 Future Focus Areas

Further development of the water quality infrastructure design will be required to account for several key considerations:

- No consideration has been given towards on-lot water quality and re-use measures that are likely to be incorporated as each lot is developed. While this area will be an ongoing consideration, next steps for the conceptual modelling will be to include an approximate re-use demand for each precinct based on estimated Gross Floor Area (GFA), as nominated in masterplan studies.
- Spatial design via detailed 3D modelling of the integrated waterfront area, with particular focus on the physical requirements to ensure the flow control systems can be safely integrated in the proposed landscape areas and whether these proposed landscape designs will require modification. Refinement of the bioretention and wetland area requirements following an integrated flow control system being implemented and coordinated with OSD requirements.
- Ongoing consultation with Sydney Water will be required during detailed design for coordination of stormwater infrastructure assets.

7 Impacts and Mitigation Assessment

Below summarises the recommendations for future actions to further develop the integrated water approach and optimise the strategy proposed in this report.

Table 54 - Recommendations

Ref	Recommendation	Timeframe	Responsible
1	Establishing requirements of on-lot stormwater treatment to optimise regional downstream treatment trains	Prior to DA submission	WPCA / Sydney Water
2	Establishing requirements for on-lot water detention optimise regional downstream OSD basins	Prior to DA submission	WPCA / Sydney Water
3	Detailed 3D modelling of drainage basins to establish spatial requirements and assess flood impacts	Prior to DA submission	AECOM
4	Refinement of assumptions around private lot permeability to refine models	Prior to DA submission	AECOM
5	Inclusion of active irrigation strategy from treatment wetlands to optimise bioretention basins	Prior to DA submission	WPCA / Sydney Water
6	Further refinement of project staging to evaluate basin delivery	Prior to DA submission	WPCA / Sydney Water
7	Options review of integration with regional treated wastewater streams	Prior to DA submission	WPCA / Sydney Water

7.1.1 Ownership and Maintenance

The NSW Government has nominated Sydney Water Corporation to be the trunk drainage authority for the Aerotropolis. As the trunk drainage authority, Sydney Water Corporation will be responsible for managing and maintaining the regional stormwater network. This trunk drainage network will include the major pit and pipe networks within the Bradfield City Centre as well as the water quality and water quantity basins along the

various creek lines. To achieve this, it expected that a property acquisition scheme or works in kind agreement will need to be arranged between the proponent and Sydney Water Corporation. Within the development boundaries of the Bradfield City Centre, WPCA will ultimately liaise with Sydney Water Corporation on required land take as based on *SEPP (Precincts — Western Parkland City) 2021 Land Reservation Acquisition Map — Aerotropolis Sheet LRA_001*).

7.1.2 Water Management Act 2000

The Water Management Act 2000 aims to:

Provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular —

- *a) to apply the principles of ecologically sustainable development, and*
- *b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality, and*
- *c) to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including —*
  - *i. benefits to the environment, and*
  - *ii. benefits to urban communities, agriculture, fisheries, industry and recreation, and*
  - *iii. benefits to culture and heritage, and*
  - *iv. benefits to the First Nations people in relation to their spiritual, social, customary and economic use of land and water,*
- *d) to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,*
- *e) to provide for the orderly, efficient and equitable sharing of water from water sources,*
- *f) to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,*
- *g) to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,*
- *h) to encourage best practice in the management and use of water.*

This water management strategy aims to meet the above by establishing a set of water control and treatment measures that improve the quality of water and mitigate negative impacts of uncontrolled discharge to downstream stakeholders. While this strategy looks at achieving its water management targets at a precinct level – it has been established with sufficient flexibility to integrate further with treatment and storage measures on individual lots to further encourage better management and use of water at an individual lot level.

8 Conclusion

The proposed design approach utilises regional-based infrastructure in the form of above-ground grassed bioretention basins and wetlands integrated within the proposed waterfront area along Moore Gully. In modelling, this approach demonstrates capacity to adequately meet hydraulic and hydrological targets for the site including pollutant reduction, peak flow discharges and water flow retention across the water cycle.

The proposed drainage infrastructure can be constructed in a manner respecting the natural topography and existing catchment characteristics with minor deviations resulting from the presence of the Metro Station.

The integration with existing Moore Gully and Thompsons Creek minimises ecological and riparian impact from overlapping requirements of water infrastructure but will require further design development to better adopt the future waterfront area and intended realignment of Moore Gully.

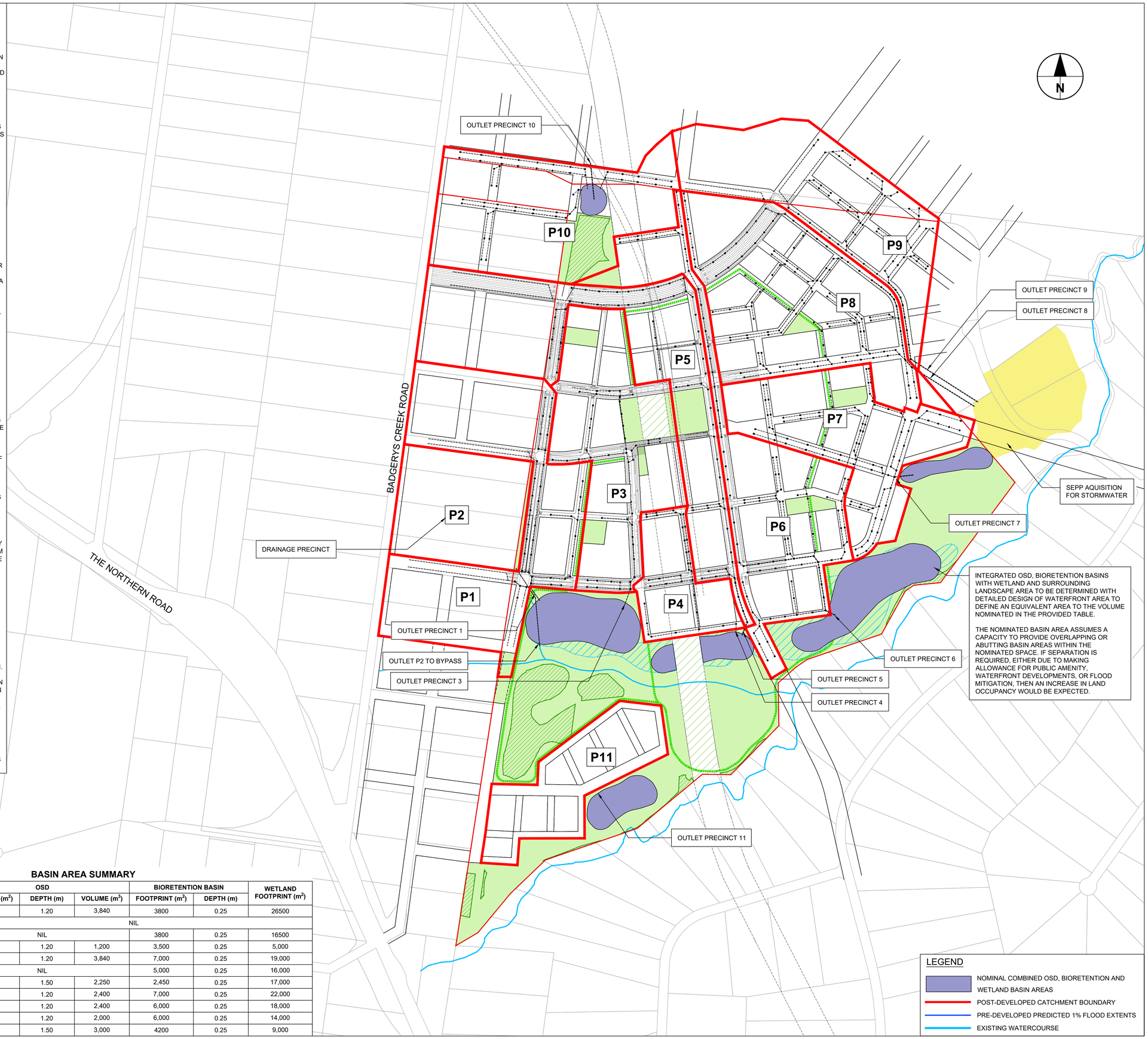
This stage of analysis does not consider the on-lot infrastructure that will provide additional measures for stormwater retention, reuse and treatment and should be considered as part of future design development to optimise the design. Any supplementary treatment measures will still need to comply with Wianamatta guidelines for managing water, regardless of influence from regional works.

Adoption of the proposed masterplan layout can be safely managed with respect to potential overland stormwater flow routes within the Bradfield City Centre but will require future coordination of post development flood models that have not been conducted as part of this study.

Appendix 1 – Precinct Catchment Plan

NOTES

- MASTERPLAN LAYOUT DATED 05-06-2023 FROM HATCH/ROBERTS DAY HAS BEEN ADOPTED.
- FOOTPRINT AREAS OF BASINS AS SHOWN ON PLAN ARE INDICATIVE ONLY FOR SIZING AND SHAPE - TO BE COORDINATED FURTHER IN DETAILED DESIGN.
- OSD BASIN SIZES ARE DESIGNED TO CATER FOR ALL DESIGN STORM EVENTS UP TO AND INCLUDING THE 1% AEP MAJOR EVENT IN ORDER TO REDUCE PEAK POST-DEVELOPMENT DISCHARGES TO EQUIVALENT OR LESSER DISCHARGES THAN THE PRE-DEVELOPED - NOT TO MAXIMISE STORAGE OF WATER.
- OSD BASIN DESIGN EXCLUDES CONSIDERATIONS FOR LOT-BASED MEASURES SUCH AS SMALLER ON-SITE OSDS, PONDS OR RAINWATER TANKS.
- OSD BASIN FOOTPRINT ASSUMED TO OVERLAP WITH NOMINAL WSUD AREAS SHOWN.
- OSD BASIN VOLUMES LISTED IN THE TABLE ARE THE ESTIMATED PEAK STORED VOLUME, NOT BASIN CAPACITY.
- REQUIRED FOOTPRINTS NOMINATED FOR EACH OF THE END-OF-LINE WSUD TREATMENT MEASURES ARE BASED ON A COMBINED EFFORT OF BIORETENTION BASINS, WETLANDS AND GPT UNITS WHILE EXCLUDING ANY LOT-BASED MEASURES FOR RE-USE OR TREATMENT.
- BASIN SIZING, LOCATION AND CONFIGURATION NOTIONAL ONLY - FURTHER DESIGN WILL NEED TO BE COORDINATED WITH LANDSCAPE DESIGNS AND ANY WORKS WITHIN THE RIPARIAN CORRIDOR TO MAXIMISE THE OVERLAP IN FOOTPRINT AREA FOR THE TWO 'STRUCTURES'.
- OSD BASINS HAVE BEEN SIZED TO SIT PARTIALLY DUG INTO THE EXISTING TERRAIN WITH ADDITIONAL BUNDED PORTIONS SITTING ABOVE THE EXISTING NATURAL TOPOGRAPHY TO BALANCE THE NEEDS OF STORMWATER DRAINAGE THROUGHOUT THE DEVELOPMENT AND TO ALLOW CONNECTION TO EXISTING CREEK INVERTS. NOMINATED DEPTHS OF BASINS ARE THE MAXIMUM DEPTH FROM INVERT TO SPILL LEVELS.
- NOMINATED BIORETENTION BASIN DEPTHS EXCLUDE FILTER MEDIA LAYERS AND ARE A MEASURE OF THE BASIN FINISHED SURFACE TO THE SURROUNDING BUND LEVEL.
- CATCHMENTS HAVE BEEN DETAILED BASED ON SITE IMPERVIOUSNESS STUDY BY HATCH ROBERTS DAY, DERIVED FROM DCP 2 LOT ACCOMMODATIONS AND HAVE BEEN SUMMARISED BELOW:
  - SUPERLOTS = 84%
  - OPEN SPACES = 16%
  - ROAD RESERVES = 75%
- SITE IMPERVIOUSNESS CALCULATIONS BY HRD HAVE BEEN COMPLETED WITH THE INTENT OF ACHIEVING 40% PERVIOUSNESS SITE-WIDE.
- DRAINAGE DESIGN HAS ASSUMED A NOMINAL GRADING OF THE SUPERLOTS TO FALL ROAD-TO-ROAD AND IN A NOMINALLY SOUTH-EASTERN DIRECTION.
- EXTERNAL CATCHMENTS CONSIDERED IN THE DRAINAGE ANALYSIS ARE BASED ON ANTICIPATED FUTURE CONNECTIONS AND GRADING CONCERNS OF EXTERNAL LOT AREAS.
- EXTERNAL CATCHMENTS FURTHER TO THE WEST OF BADGERYS CREEK ROAD ARE ASSUMED TO BE ENTIRELY CAPTURED BY BADGERYS CREEK ROAD AND DIRECTLY CONNECTED TO MOORES GULLY.



BASIN AREA SUMMARY

PRECINCT	CATCHMENT (ha)	OSD			BIORETENTION BASIN		WETLAND FOOTPRINT (m^2)
		FOOTPRINT (m^2)	DEPTH (m)	VOLUME (m^3)	FOOTPRINT (m^2)	DEPTH (m)	
P1	14.82	3,000	1.20	3,840	3800	0.25	26500
P2	6.88	NIL					
P3	11.62	NIL			3800	0.25	16500
P4	4.20	1000	1.20	1,200	3,500	0.25	5,000
P5	14.94	3,000	1.20	3,840	7,000	0.25	19,000
P6	12.37	NIL			5,000	0.25	16,000
P7	9.97	1,500	1.50	2,250	2,450	0.25	17,000
P8	14.74	2,000	1.20	2,400	7,000	0.25	22,000
P9	11.90	2,000	1.20	2,400	6,000	0.25	18,000
P10	12.38	1,800	1.20	2,000	6,000	0.25	14,000
P11	6.39	2,000	1.50	3,000	4200	0.25	9,000

AECOM

PROJECT

AEROTROPOLIS CORE PRECINCT BRINGELLY

CLIENT

NSW GOVERNMENT Western Parkland City Authority

CONSULTANT

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PROJECT MANAGEMENT INITIALS

PQ	CR	GR
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

I/R	DATE	DESCRIPTION
F	31.07.2023	FOR INFORMATION
E	13.07.2023	FOR INFORMATION
D	03.07.2023	FOR INFORMATION
C	29.06.2023	FOR INFORMATION
B	-	ISSUE FOR INFORMATION
A	05.08.2022	ISSUE FOR INFORMATION

SCALE BAR

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PROJECT NUMBER

60646285

SHEET TITLE

MASTER PLAN
CONCEPT STORMWATER CATCHMENT & BASIN PLAN EXTENDED SCENARIO

SHEET NUMBER

60646285-SKE-00-0000-CI-0152

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