ARUP

SSD

Project Echidna

Stormwater and Flooding Report

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Appendices

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Glossary of Terms & Abbreviations

Glossary of Terms

100 year flood	A flood that occurs on average once every 100 years. Also known and a 1% flood or 1% Annual Exceedance Probability (AEP).
20 year flood	A flood that occurs on average once every 20 years. Also known as a 5% flood or 5% Annual Exceedance Probability (AEP).
Annual exceedance probability (AEP)	AEP (measured as a percentage) is a term used to describe flood size. It is a means of describing how likely a flood is to occur in a given year. For example, a 1% AEP flood is a flood that has a 1% chance of occurring, or being exceeded, in any one year.
Catchment	The area of land draining through the main river, as well as tributary systems.
Flood Hazard	The potential for damage to property or risk to persons during a flood. Flood hazard is a key tool used to determine flood severity and is used for assessing the suitability of future types of land use.
Freeboard	A factor of safety expressed as the height above the design flood level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as embankment settlement.
Local Environmental Plan (LEP)	A Local Environmental Plan is a plan prepared in accordance with the Environmental Planning and Assessment Act, 1979 that defines zones, permissible uses within those zones and specifies development standards and other special matters for consideration with regard to the use or development of land.
Overland Flow Path	The path that floodwaters can follow if they leave the confines of the main flow channel or surcharge from a piped stormwater system.
Probable Maximum Flood (PMF)	The largest flood likely to ever occur. The PMF defines the extent of flood prone land.

Abbreviations

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AR&R	Australian Rainfall & Runoff
ARI	Average Recurrence Interval
BCC	Blacktown City Council
BoM	Bureau of Meteorology
DCP	Development Control Plan
DEM	Digital Elevation Model
DPIE	Department of Planning, Industry and Environment
DBYD	Dial Before You Dig
EP&A Act	Environmental Planning and Assessment Act 1979
ESCP	Erosion and Sediment Control Plan
FFL	Finished Floor Level
FPL	Flood Planning Level
GPT	Gross Pollutant Trap
LEP	Local Environmental Plan
LGA	Local Government Area
LiDAR	Light Detection and Ranging
mAHD	metres Australian Height Datum (AHD)
m/s	metres per second. Unit used to describe the velocity of floodwater
m^3/s	Cubic metres per second. Unit measurement of river flows
OSD	On Site Detention
PMF	Probable Maximum Flood
SEARS	Secretary's Environmental Assessment Requirements (Section 78A(8A) of the Environmental Planning and Assessment Act)
SSD	State Significant Development
WSC	Water Services Coordinator
WSUD	Water Sensitive Urban Design

1. Introduction

1.1 Proposal Components and Key Terms

1.1.1 Key Terminology and Project Details

Table 1: Terminology and Project Details

Term	Definition
Proposal	Construction of a two-storey data centre comprising of data halls, mechanical and electrical equipment rooms, offices, other ancillary support spaces, and external/rooftop mechanical and electrical equipment.
Proposal area	The building has a total area of approximately 9,000 square metres comprising two data floors (Ground Floor + Level 1).
Site	The proposal is located at 10 Eastern Creek Drive, Eastern Creek NSW, legally described as Lot 4001, DP 1243178. The site is situated within the Blacktown Local Government Area.
Concept Design Approval	A previous DA (SPP-19-00013) was approved on site for the industrial development of a Detailed Design Stage 1 and a Concept Design Approval of an outline for Stage 2, which is the subject of this Proposal.
State Significant Development (SSD) Trigger	The data centre building will have a capacity of over 10MW, which triggers the proposal as a State Significant Development under the Schedule 1 of the State Environmental Planning Policy (Planning Systems) 2021.

1.1.2 Proposal Overview

Arup, on behalf of the Proponent, is seeking development consent to construct a data centre (the Proposal) at 10 Eastern Creek Drive, Eastern Creek NSW, legally described as Lot 4001 DP 1243178 (the Site). The Proposal involves the construction of a two-storey data centre comprising of data halls, mechanical and electrical equipment rooms, offices, other ancillary support spaces, and external/rooftop mechanical and electrical equipment. The Site is situated within the Blacktown Local Government Area (LGA) on the corner of Eastern Creek Drive and Old Wallgrove Road.

The parcel of land is currently vacant, and the site gross floor area (GFA) is of approximately 9,000 square metres.

The design of the Data Centre is based on the end-client's reference design as well as applicable Australian Standards and will deliver capacity for approximately 35.2MW of IT equipment. Utility power will be delivered via a dedicated on-site electricity substation (subject to a separate development application), with emergency backup power provided by a combination of lithium-ion battery systems and standby generators. Cooling will be delivered by highly efficient fresh air free-cooling systems to ensure energy consumption is minimised as far as practical.

The two (2) level facility will reach a building height of approximately 25m including all significant plant and rooftop equipment. The facility will include two (2) levels of data hall space and supporting plantrooms, and supporting administrative spaces incorporating secure entry facilities, loading dock, storage, staff offices and the like. The standby generators will occupy an external equipment yard to the west of the main building, and some mechanical equipment will be located at roof level. The site will be served from a private on site substation, located to the west of the proposed data centre building and subject to a separate development application.

Landscaped areas are also proposed, where mature local trees will be used to improve aesthetics and amenity for local businesses.

On-site car parking spaces will be provided for staff and visitors, including disabled and electric vehicle parking.

Figure 1 shows the Site and surrounding context. Figure 2 shows an overview of the site

1.1.3 Permissibility and Approval Pathway

Division 4.7 of Part 4 of the EP&A Act covers State significant development (SSD). The Proposal is identified as SSD by virtue of meeting thresholds defined under Schedule 1, Clause 25 of the *State Environmental Planning Policy (Planning Systems) 2021*. Specifically, the Proposal is appropriately classified as a data storage development with a capacity of more than 10 megawatts (see Chapter 4 (Strategic context) for further detail).

The proposed data centre is permissible with consent within a light industrial zone pursuant to the provisions outlined in Section 2.31 of State Environmental Planning Policy (Transport and Infrastructure) 2021.

Given the proposal has a capacity that is greater than 10 MW, the proposal classifies as State Significant Development (SSD) pursuant to the provisions outlined in Schedule 1 of the *State Environmental Planning Policy (Planning Systems) 2021*.

1.1.4 Development history

The previous planning approvals relevant to the subject SSDA and proposed development include:

- **DA-18-00196:** Consent was granted for the *'Torrens Title subdivision of 1 lot into 1 industrial lot and 1 residue lot'* of Lot 532, DP 1236811 which created the subject lot.
- **DA-18-00938:** On 6 December 2018 consent was granted for 'Bulk earthworks entailing cut and fill across the site to facilitate suitable site levels for future built form (subject to future approval)'. The associated Construction Certificate is CC-19-00320. These earthworks have been completed on site. The subject development proposed has been designed to respond to these works.
- **DA-18-01592:** On 20 June 2019 consent was granted for the construction of a warehouse and distribution facility comprising 33,250 square metres of GFA, 266 vehicles and site landscaping. Construction of this project has not commenced at this time.
- **DA-20-10387:** On 15 September 2020 consent was granted for the installation of 4 temporary electricity kiosks for interim power supply for an approved data centre.
- **SPP-19-00013:** A previous DA was approved on site for the industrial development of a Detailed Design Stage 1 and a Concept Design Approval of an outline for Stage 2, which are further discussed in Section 4 of this report. This Proposal includes works for Stage 2 of the development. It is intended that this SSDA will supersede the existing Concept Design Approval for Stage 2.

1.1.5 Proposal Need and Benefits

The proposed development, construction and operational use of the Data Centre will serve Sydney and the wider region in providing for increasing cloud-based storage and compute requirements. The Data Centre will positively impact the social and economic conditions of Eastern Creek and the Blacktown City Council LGA, creating jobs during both construction and operation.

Arup and the Client are committed to delivering a high-quality development with economic and employment benefits for the Eastern Creek District and the residents and visitors of the region through effective collaboration with key stakeholders, including State government agencies and Blacktown City Council.

Figure 1: Site Context

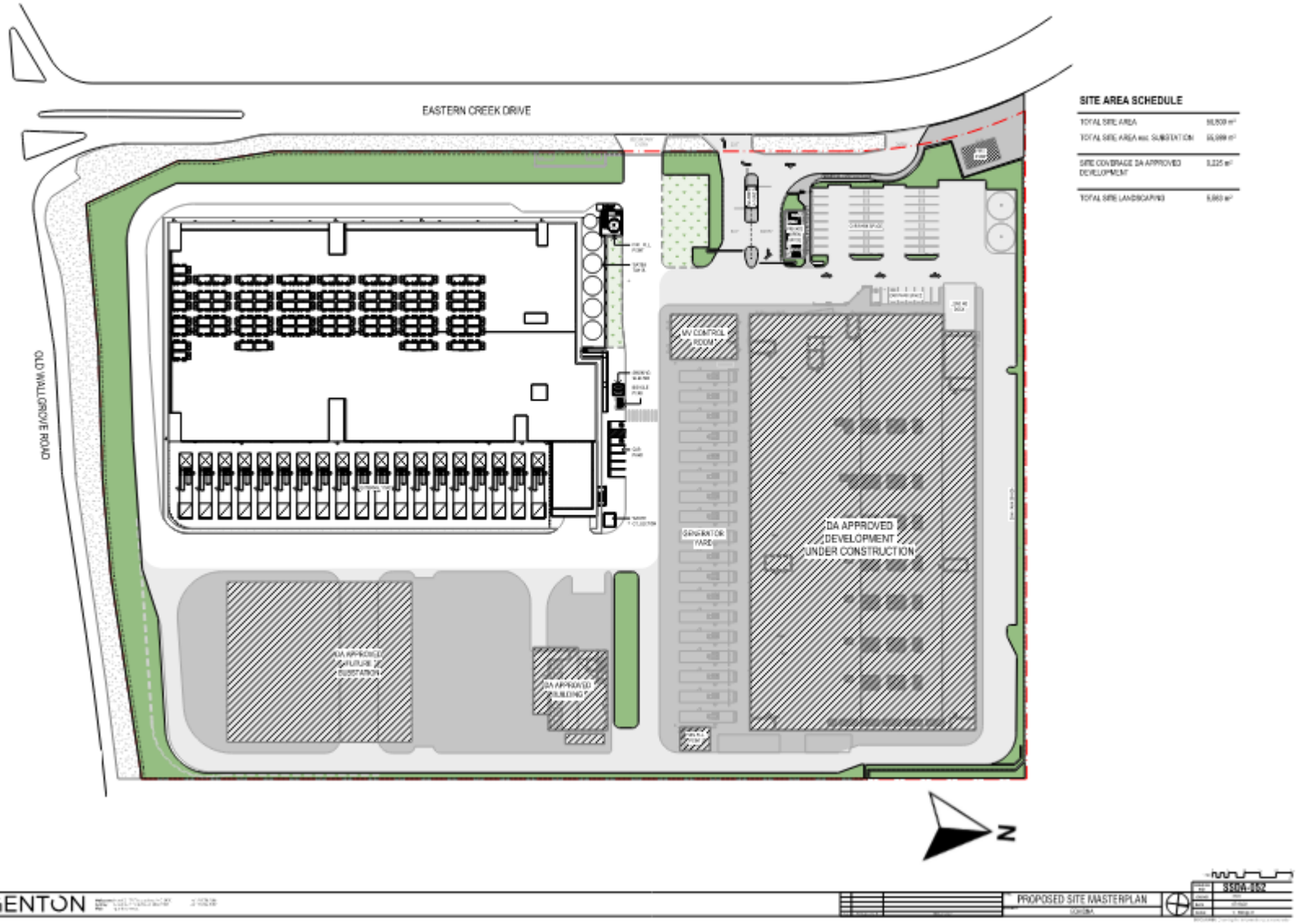

Figure 2: Site Figure

1.2 SEARs and DCP requirements relevant to this report

Table 2 identifies the SEARs and DCP requirements which are relevant to this technical assessment.

Table 2: SEARs and DCP requirements for hydrology and flooding

SEARs relevant to this technical report	Where addressed in this technical report
Ground and Water Conditions	
Provide an assessment of the potential impacts on soil resources, including related infrastructure and riparian lands on and near the site.	Section 5.7
Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets, and watercourses.	For assessment of groundwater impacts, refer to Geotechnical Report Section 5.3 and 5.4
Identify predicted water discharge points to surface / groundwater and consider discharge quality against relevant water quality criteria.	Section 5.3 and 5.4
Provided a detailed site water balance including identification of water requirements for the life of the development, and measures to ensure an adequate and secure water supply.	Section 5.6
Provide an assessment of salinity and acid sulphate soils impacts.	Refer to Geotechnical Report
Stormwater and Wastewater	
Provide an Integrated Water Management Plan for the development that: Is prepared in consultation with the local council and any other relevant drainage or water authority. Details the proposed drainage design for the site including any on-site detention facilities, water quality management measures and the nominated discharge points, on-site sewage management, and measures to treat, reuse or dispose of water. Demonstrates compliance with the local council or other drainage or water authority requirements and avoid adverse impacts on any downstream properties.	Section 5.3, Section 5.4 and Section 5.6
Where drainage infrastructure works are required that would be handed over to local council, or other drainage or water authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority.	Section 5.3
Flooding Risk	
Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Manual.	Section 4.6
Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operation procedures to mitigate flood risk where required.	Section 4.6

2. Policy and planning context

The following policies, guidelines and plans have been considered when undertaking the surface water impact assessment:

- Blacktown Local Environmental Plan (LEP) (Blacktown City Council, 2015)
- State Environmental Planning Policy (Infrastructure, 2007)
- NSW Floodplain Development Manual (NSW Government, 2005)
- Managing Urban Stormwater: Soils & Construction Volume 1 (Landcom, 2004)
- Managing Urban Stormwater: Council Handbook Draft (EPA, 1997)
- Managing Urban Stormwater: Treatment Techniques (DECC, 2006)
- Managing Urban Stormwater: Source Control (NSW EPA, 1997)
- Technical Guidelines: Bunding & Spill Management (DECC, 1998)

The following are other policies, guidelines and plans that have also been considered within this assessment:

- Blacktown City Council Development Control Plan (Blacktown City Council, 2015)
- Engineering Guide for Development (Blacktown City Council, 2005)
- WSUD Developer Handbook (Blacktown City Council, 2020)
- Water Quality and Water Conservation – WSUD Developer's Handbook Part 4
- Australian Rainfall and Runoff: A Guide to Flood Estimation (Ball et al, 2019)
- NSW MUSIC Modelling Guidelines (BMT WBM, 2015)

The primary considerations in assessing and designing the stormwater drainage and water quality management strategies for the site are within the Blacktown City Council Development Control Plan (DCP). Relevant requirements related to the flood planning levels are included in the Blacktown City Council Local Environment Plan (LEP). The following sections describe the relevant requirements related to the hydrology and flooding in this report.

2.1 Blacktown City Council Development Control Plan (Blacktown City Council, 2014) & Engineering Guide for Development (Blacktown City Council, 2005)

The Blacktown City Council DCP and Engineering Guide for Development (2005) provides requirements for the site drainage design standards, on-site detention requirements and water quality. These requirements form the basis of the proposed stormwater management strategy and the water quality strategy. Relevant Blacktown City Council DCP requirements are summarised in the following sections.

2.1.1 Stormwater Drainage Design Requirements

The BCC Engineering Guide for Development (2005) Appendix D requires the development to be designed and constructed to ensure that the minor system is designed for the 20yr ARI (approx. 5% AEP) and major system for the 100yr ARI (approx. 1% AEP).

2.1.2 On-Site Detention Design & Waterway Stability Requirements

The Blacktown City Council DCP (2015) Part J Section 2.1 and 4.4 outline requirements for On-site detention and waterway stability.

On-site detention and waterway stability controls apply to all business and industrial development, excluding subdivisions with a development footprint of greater than 150 square metres and that is located within an on-site stormwater detention area as defined by the on-site stormwater detention map on Council's website.

All developments must manage post development peak flows in accordance with BCC Engineering Guide for Development (2015).

The comparison of post development and pre-development stream forming flows referred to as the Stream Erosion Index (SEI) duration shall be no greater than 3.5 times the pre-development flows.

2.1.3 Freeboard

The BCC Engineering Guide for Development (2005) Appendix D requires a design freeboard level of 0.5m above the 1:100 ARI (approx. 1% AEP) storm for trunk drainage, creeks and open channels.

2.1.4 Water Quality

The BCC DCP (2015) Part J Section 4.2 requires developments shall achieve a minimum percentage reduction of the post development average annual load of pollutants as follows:

Table 3: Stormwater Pollutant Load Reduction Table

Baseline Model	% Targets
Gross Pollutants	90%
Total Suspended Solids	85%
Total Phosphorus	65%
Total Nitrogen	45%
Total Hydrocarbons	90%

To demonstrate compliance, the mean annual pollutant loads have been modelled in MUSIC in accordance with the WSUD Developer Handbook (Blacktown City Council, 2020).

2.1.5 Erosion, sediment, and pollution control

The BCC DCP (2015) Part J Section 4.5 requires all developments must have all works and activities undertaken in accordance with Managing Urban Stormwater: Soils and Construction (The Blue Book).

2.1.6 Council consultation

Council has been contacted in October 2022 and again in March 2023 in regards to reviewing the stormwater design for this development. On 3 March 2023, it was confirmed with Council they will review the project during the exhibition stage of the SSD process once they are informed by DPIE.

3. Methodology

This Section outlines the methodology used to review the proposed design and consider any potential impacts on surface water. Both the construction and operation phases have been considered in this assessment.

The assessment considers the baseline topography and Stage 1 works and the following actions were undertaken to complete this assessment:

Topography and Earthworks:

- Review of the baseline site environment that will be provided by the Stage 1 works to the proponent, including but not limited to the topography and utility connections.
- Identify any changes that are required to suit the proposed data centre development.
- Develop a bulk earthworks and site grading plan.
- Develop an erosion and sediment control plan in accordance with Soils and Construction (Landcom, 2004).

Surface Water:

- Review the interaction between the proposed site and overall site stormwater infrastructure.
- Develop a drainage strategy to minimise the impacts on receiving watercourses and riparian land.
- Review the overall site water quality MUSIC model and develop a water quality treatment system for the proposed site within the overall site, following relevant water quality guidelines.
- Develop a proposed case hydraulic model to assess the development impacts with respect to infrastructure requirements and overland flows within the site.

Water Cycle Management:

- Review water recycling and re-use opportunities for the development.
- Calculate the site water balance.
- Develop a strategy to minimise the water use on site.

Flooding:

- Undertake a qualitative review of the flood assessment undertaken as part of the Stage 1 works and confirm that the proposed Finished Floor Levels (FFLs) are positioned above the Flood Planning Levels (FPLs) for the site.
- Develop a hydraulic model of the site to assess the performance of the existing and proposed site stormwater drainage network.

The groundwater impacts in relation to the proposed development are detailed within the Geotechnical Report. The drinking water, wastewater and recycled water arrangements (if required) are detailed within the Infrastructure Requirements Report

4. Existing Environment

This Section describes the existing hydrological, surface water and flooding conditions at the Eastern Creek site.

4.1 Development Site Location

The proposed development site is located on the southwest section of the overall site at 10 Eastern Creek Drive, Eastern Creek otherwise known as Lot 4001 DP1243178. Refer to Figure 2 above for overall site boundary extents.

4.2 Baseline Site Topography

The baseline site has been subjected to bulk earthworks as part of the Stage 1 development (DA-18-00938 & DA-18-01592). As a result, the baseline site has been prepared to fall from south to north with ridgelines providing fall to the east and west of the site. Temporary stormwater channels traversing the site south to north and a sediment basin are currently located on the site.

The maximum height of site in the southern end is 70.0mAHD and 67.5mAHD at the northern end of the site. The site longitudinal fall south to north is approximately 2.5%, while the crossfall east west from the ridge lines to channels is approximately 1.5%.

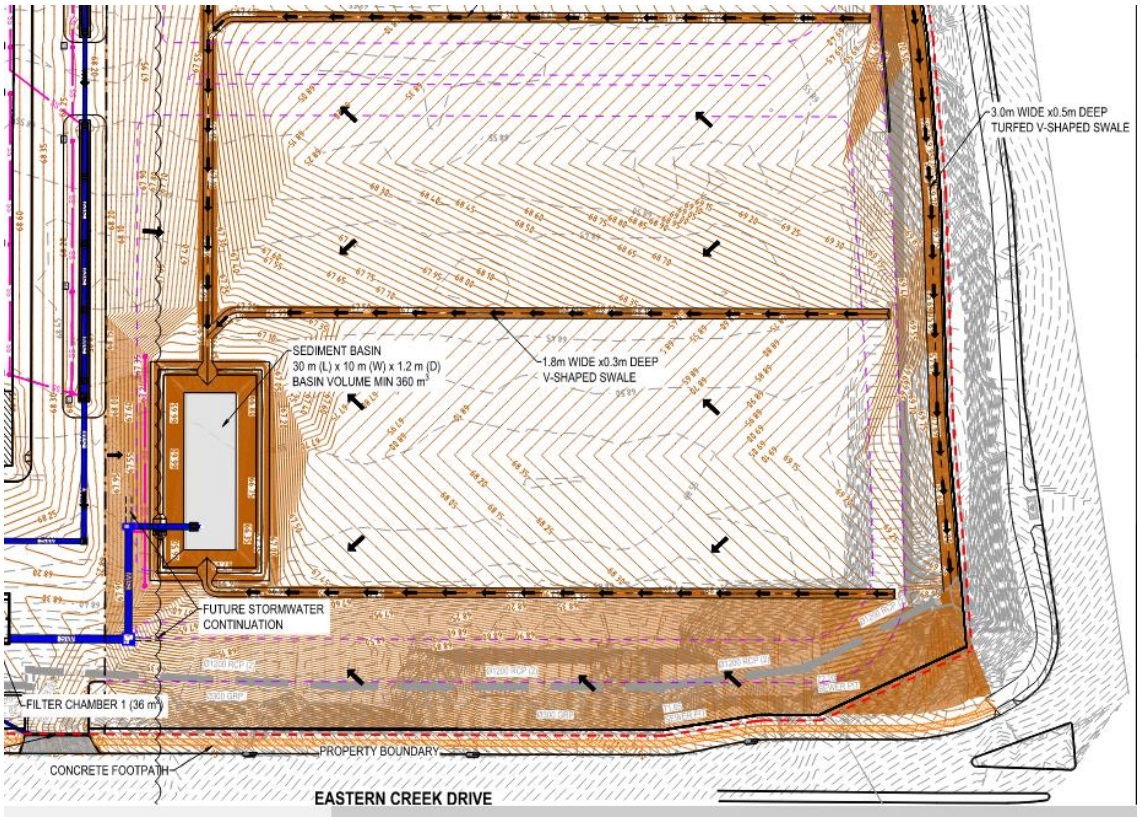

Figure 3: Baseline Site Topography

4.3 Rainfall and Climate

Temperature and rainfall data for the site has been sourced from the Bureau of Meteorology Prospect Reservoir (067019) and Erskine Park (067066) Reservoir meteorological stations nearby to the site.

The mean maximum temperature annually is 23.3°C using data for all years.

The wettest month at this site has been observed to be March, whilst the driest month is in May.

Table 4: Monthly Mean Maximum Temperature & Monthly Mean Rainfall

Month	Mean Maximum Temperature (°C)	Mean Rainfall (mm)
Jan	28.6	74.9
Feb	28.0	109.2
Mar	26.4	183.1
Apr	23.8	60.0
May	20.4	27.0
Jun	17.4	62.4
Jul	16.9	28.7
Aug	18.8	42.9
Sep	21.5	30.2
Oct	24.0	56.8
Nov	25.6	76.4
Dec	27.6	72.7
Annual	23.3	772.0

The proposed stormwater drainage network was sized using the Australian Rainfall and Runoff (ARR 2019) method which selects the median of 10 temporal patterns for each storm design event.

The Intensity-Frequency-Duration (IFD) data used in the hydraulic modelling was sourced from the Bureau of Meteorology (BOM):

Table 5: Intensity-Frequency-Duration (IFD) data

	Annual Exceedance Probability (AEP)						
Duration							
1 min	2.05	2.33	3.21	3.82	4.42	5.23	5.86
2 min	3.35	3.74	5.03	5.95	6.88	8.09	9.11
3 min	4.66	5.22	7.06	8.36	9.66	11.4	12.8
4 min	5.87	6.6	8.98	10.7	12.3	14.5	16.3
5 min	6.96	7.86	10.7	12.8	14.8	17.5	19.6
10 min	11.1	12.6	17.4	20.8	24.1	28.5	31.9
15 min	13.8	15.7	21.8	26	30.1	35.7	39.9
20 min	15.8	18	24.9	29.7	34.4	40.7	45.6
25 min	17.4	19.7	27.3	32.5	37.7	44.6	49.9
30 min	18.7	21.2	29.2	34.8	40.3	47.6	53.4
45 min	21.6	24.4	33.4	39.7	46	54.4	61
1 hour	23.8	26.8	36.5	43.3	50.1	59.2	66.5
1.5 hour	27.2	30.5	41.1	48.7	56.3	66.7	75.1
2 hour	30	33.5	44.9	53.1	61.4	72.9	82.2
3 hour	34.5	38.4	51.3	60.6	70.2	83.5	94.4
4.5 hour	40	44.5	59.5	70.4	81.7	97.6	111
6 hour	44.7	49.9	66.9	79.3	92.2	110	125
9 hour	52.7	59	79.8	95.1	111	133	151
12 hour	59.3	66.7	91.2	109	128	154	174
18 hour	70.1	79.4	110	133	157	189	214
24 hour	78.6	89.6	126	153	181	218	247
30 hour	85.5	97.9	140	170	202	243	275
36 hour	91.3	105	151	185	220	264	299
48 hour	100	116	169	208	249	298	336
72 hour	113	131	192	238	286	341	384
96 hour	120	139	205	255	306	365	409
120 hour	125	145	213	263	317	377	422
144 hour	129	149	217	267	321	382	427
168 hour	132	152	219	268	321	383	427

4.4 Baseline Stormwater Infrastructure

4.4.1 Existing Site Drainage Infrastructure

The Stage 1 works has provided stormwater drainage infrastructure at the northern end of the overall site including provisions for future development in the southern end of the site for the Stage 2 works.

As outlined in the Stage 1 report titled Development Application Stormwater Management Plan (Aurecon dated 26/8/2020) the stormwater drainage has been designed in accordance with BCC Engineering Guide for Development, 2005 (2018 version) and the following requirements:

- National Construction Code 2019
- Australian Rainfall and Runoff 2019 (ARR)
- Australian Standard AS3500.3 (2018), National Plumbing and Drainage Code, Part 3 – Stormwater Drainage.

The stormwater drainage system provides two future points of connection for future buildings and substation complex on the south-eastern and western areas of the overall site. The two future connection points are located adjacent to the temporary sediment basin on the north-west of the site.

Upstream of the future connection point temporary diversions channels and a sediment retention basin have been provided to manage site runoff.

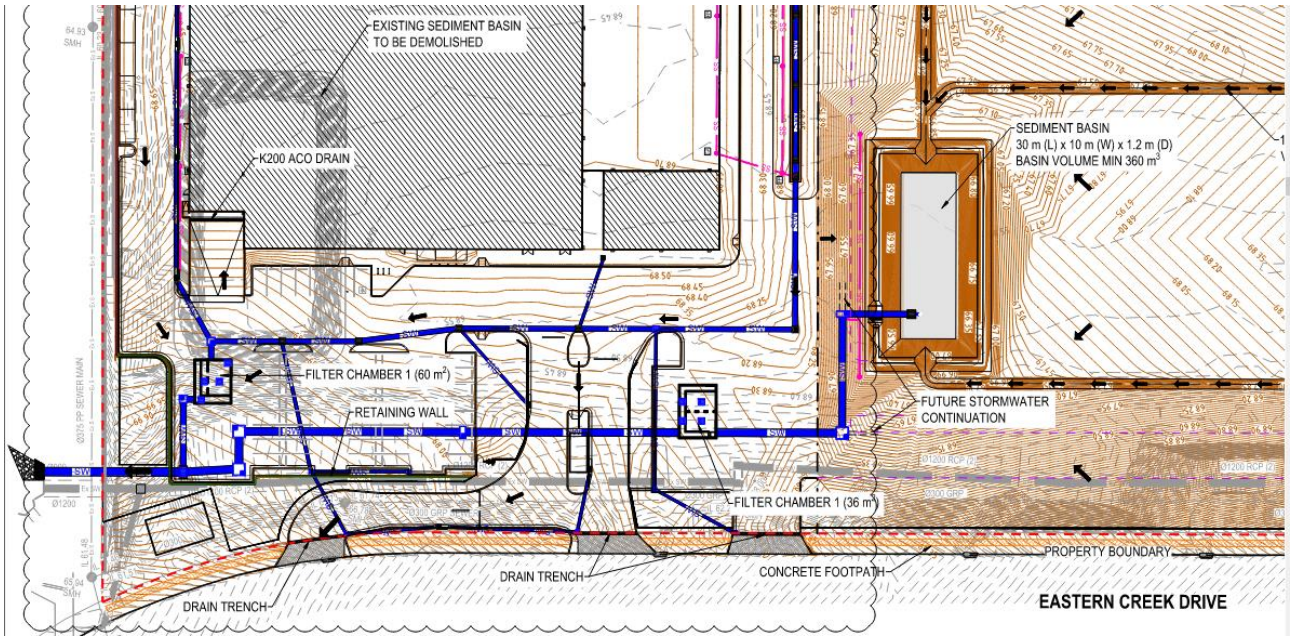

Figure 4: Existing Site Drainage Infrastructure

Table 6: Baseline Stormwater Drainage Connection Points Summary

Future Stormwater Connection Location	Diameter (mm)	Approximate Invert Level (mAHD)
Pit D\05 (Stage 1)	1050	64.320
Pit D\06 (Stage 1)	1200	64.480

4.4.2 Council Drainage Infrastructure

On the western side of the site a 1200 diameter council stormwater trunk drainage pipe traverses the site south to north. The trunk drainage inlet is near the intersection of Old Wallgrove Road and Eastern Creek Drive and outlet on the adjoining site to the north. The pipe is located within a registered easement 3m wide.

There is an existing channel within the site along the southern boundary that diverts any external catchment flows toward the trunk drainage inlet structure in the southwest corner of the site. Two existing headwalls discharge flow from the external catchment into a concrete channel on site upstream of the trunk drain inlet structure.

The trunk drainage discharges into an existing channel on the adjacent Lot to the north. Stormwater flows are then directed to an existing regional detention basin to the east.

The trunk drainage was installed as part of an early works package under DA-18-00938 and constructed in 2019. The trunk drainage conveys external catchments only and therefore has no connections from the internal site drainage network. It is understood analysis undertaken to support the development application of the Stage 1 (Aurecon report titled Development Application Stormwater Management Plan dated 26/8/2020) works that this trunk drainage pipe has capacity to convey the 1% AEP flows through the site without surcharging when a 50% blockage is applied.

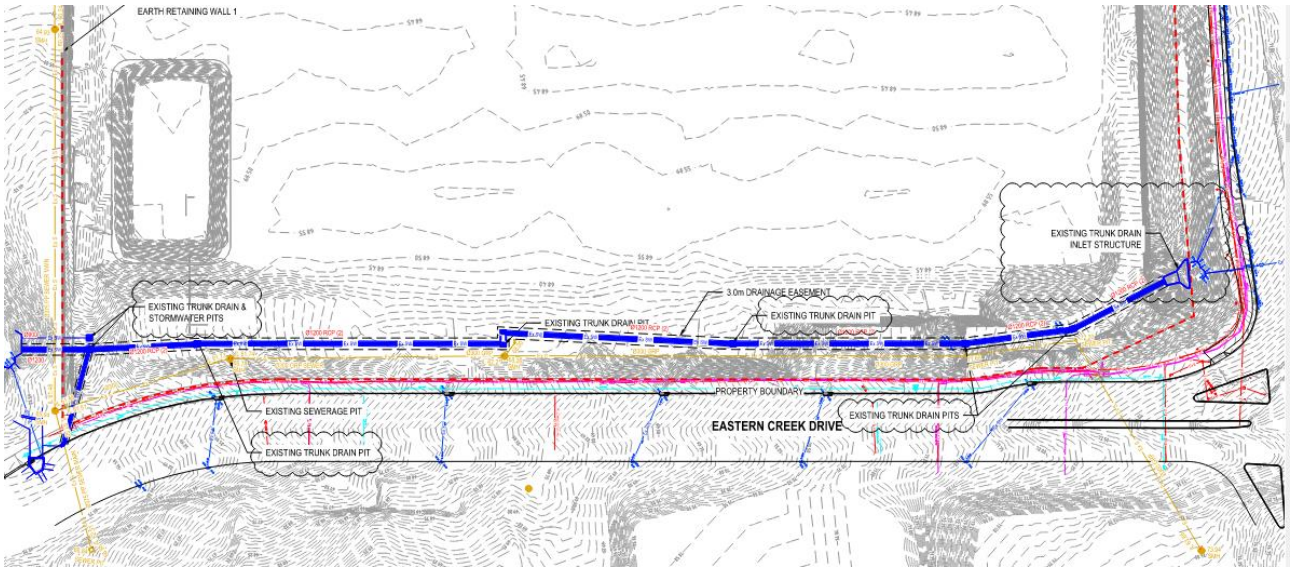

Figure 5: Existing Council Drainage Infrastructure

4.5 Baseline Water Quality

Water quality for the overall site was assessed during design of the estate using MUSIC to evaluate water quality treatment effectiveness of Water Sensitive Urban Design (WSUD) systems. Provisions were made in this assessment for treatment of the future development sites within this Lot to be delivered in Stage 2 (eg Echidna, Building 1A and Substation).

The MUSIC modelling was undertaken using the following MUSIC-link configuration:

- Blacktown Development.mlb Version 6.3.3
- MUSIC Version 6.30.

MUSIC rainfall data, runoff parameters and pollutant concentrations are set by BCC via the MUSIC-link configuration. Treatment nodes were provided by product manufacturers and reviewed with BCC.

The Stage 1 works for the site that includes Building 1 only while the Stage 2 works includes Building 1A, Substation and Echidna. The Stage 1 works provided two filter chambers on the northeast area of the site, one for Stage 1 works (northern chamber) and the other for the Stage 2 works (southern chamber).

Baseline water quality modelling has been undertaken by others for the Building 1 and Building 1A sites only. As the Stage 1 works (Building 1) water quality is independent of the Stage 2 works no further assessment has been undertaken for this site.

The baseline water quality for the Stage 2 works has assumed that Building 1A and Substation are operational, and that Echidna has been developed to formation level only. The Echidna site baseline also contains stormwater diversions channels and a sediment basin. As the Substation is only currently at 30% design phase, the 30% design drawings have been used to determine catchment size and composition for the baseline.

The Building 1 and Building 1A site primary water treatment consists of rainwater harvesting tanks at specific buildings and Ocean Guard™ litter traps at stormwater drainage pits. The Tertiary treatment system is provided by the two Stormfilter™ filter cartridge system within the chambers. The baseline MUSIC modelling results for the overall site are outlined in the table below and Appendix A:

Table 7: Stage 1 (Building 1 only) Catchment Areas

Stage 1	Type	Area (ha)	% IMP Area
S1.1 Building (RWT)	Roof	0.410	100
S1 Building	Roof	0.455	100
S1 Hardstand	Sealed Road	1.808	100
S1 Landscape	Revegetated land	0.179	50
S1.1 Bypass	Roof	0.008	100
S1.2 Bypass	Revegetated Land	0.162	50
Stage 1 Totals		3.118	95

Table 8: Stage 1 (Building 1 only) Water Quality MUSIC model Results

Baseline Model	% Reduction	% Targets
Total Suspended Solids (kg/yr)	86	85
Total Phosphorus (kg/yr)	65.3	65
Total Nitrogen (kg/yr)	45	45
Gross Pollutants (kg/yr)	96	90

Table 9: Stage 2 (Building 1A, Substation & Undeveloped Echidna) Catchments

Stage 2	Type	Area (ha)	% IMP Area
Building 1A	Roof	0.0563	100
Building 1A Hardstand	Sealed Road	0.1955	100
Building 1A Bypass	Revegetated Land	0.008	50
Substation Building / Control Room	Roof	0.0354	100

Stage 2	Type	Area (ha)	% IMP Area
Substation Hardstand	Sealed Road	0.6714	100
Substation Landscape	Revegetated Land	0.0589	50
Substation Bypass	Revegetated Land	0.0949	50
Echidna Undeveloped	Mixed	2.1356	0
Stage 2 Totals		3.256	30

Table 10: Stage 2 (Building 1, Building 1A & Undeveloped Echidna) MUSIC Model Results

Baseline Model	% Reduction	% Targets
Total Suspended Solids (kg/yr)	91.1	85
Total Phosphorus (kg/yr)	74.7	65
Total Nitrogen (kg/yr)	43.0	45
Gross Pollutants (kg/yr)	93.3	90

The MUSIC water quality model was developed using the Blacktown City Council MUSIC-Link model as recommended within the Water Sensitive Urban Design Technical Guidelines (Blacktown City Council, 2020). The rainfall data utilised within the MUSIC-Link model is fixed at a continuous 6-minute interval time step at 067035 Liverpool (Whitlam) rainfall station between 1967 to 1976. The mean annual rainfall at this meteorological station is 857mm. The MUSIC-Link model also fixes the monthly evapotranspiration data for Blacktown based on the average monthly data for Sydney.

4.6 Baseline Flooding

A review of the Blacktown City Council flood maps indicates that the proposed development is not located within an identified flooding precinct.

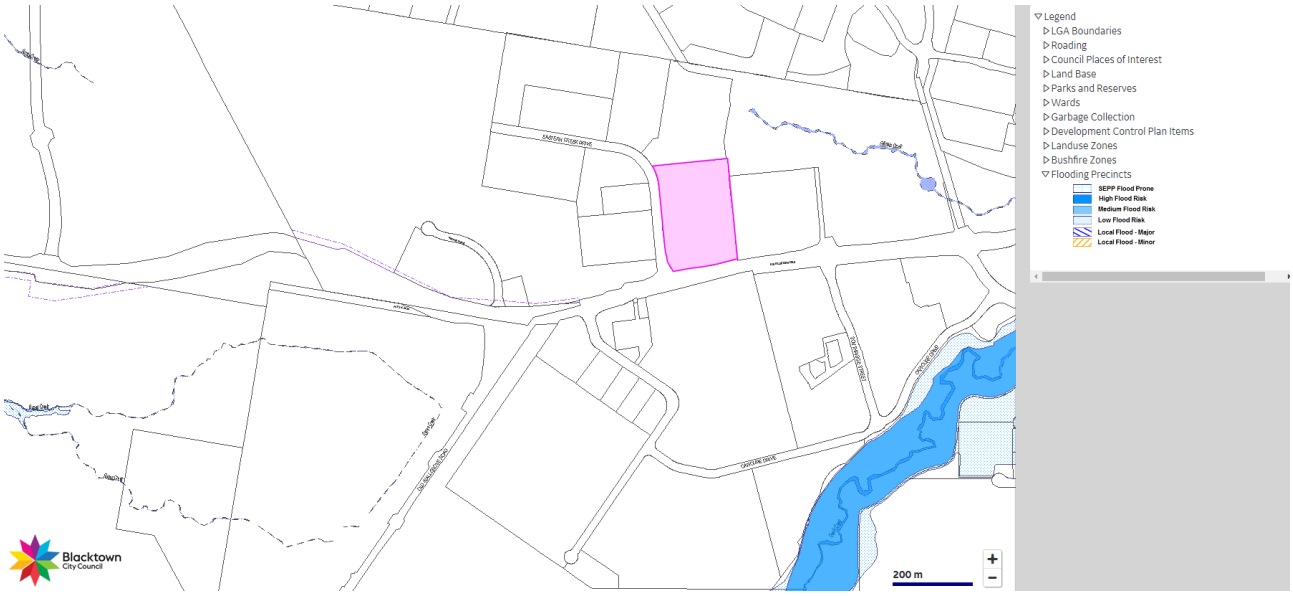

Figure 6: Flooding

The potential flooding source for the site is the catchment area of the overland flow path that is now catered for by the existing council trunk main. Prior to works under DA-18-00938 the overall site was a greenfield site with an overland flow path running through the site from the southwest corner to the northeast corner.

The catchment area of the overland flow path was approximately 6.3 ha, with much of this catchment located south of Old Wallgrove Road.

Works undertaken for DA-18-00938 included bulk earthworks, site remediation, retaining walls and an overland flow diversion. The overflow diversion replaced the open channel traversing the site with the council stormwater trunk main along the western boundary.

Although the trunk main has been designed with a blockage factor, the Development Application Stormwater Management Report (Aurecon, 2019) indicates a flood planning level on the 1% AEP as follows “design freeboard of 0.5m to land and floor levels”. This is consistent with typical flood planning level requirements of the NSW Floodplain Development Manual and the BCC Engineering Guideline for Development (2005).

5. Civil Engineering Design

5.1 Site Layout

The internal access road network developed by the Stage 1 works surrounds the subject site partially along the northern and eastern boundaries. The site layout proposes to widen the existing roads and a provide new circulation around the building on the southern and western sides.

The primary entrance/exit to the site will be off Eastern Creek Drive and located at the north-western area of the overall site that has been provided in the Stage 1 works. A secondary entrance/exit is located approximately 50m south of the primary entrance. These entrance/exits are currently in construction as part of the Stage 1 works.

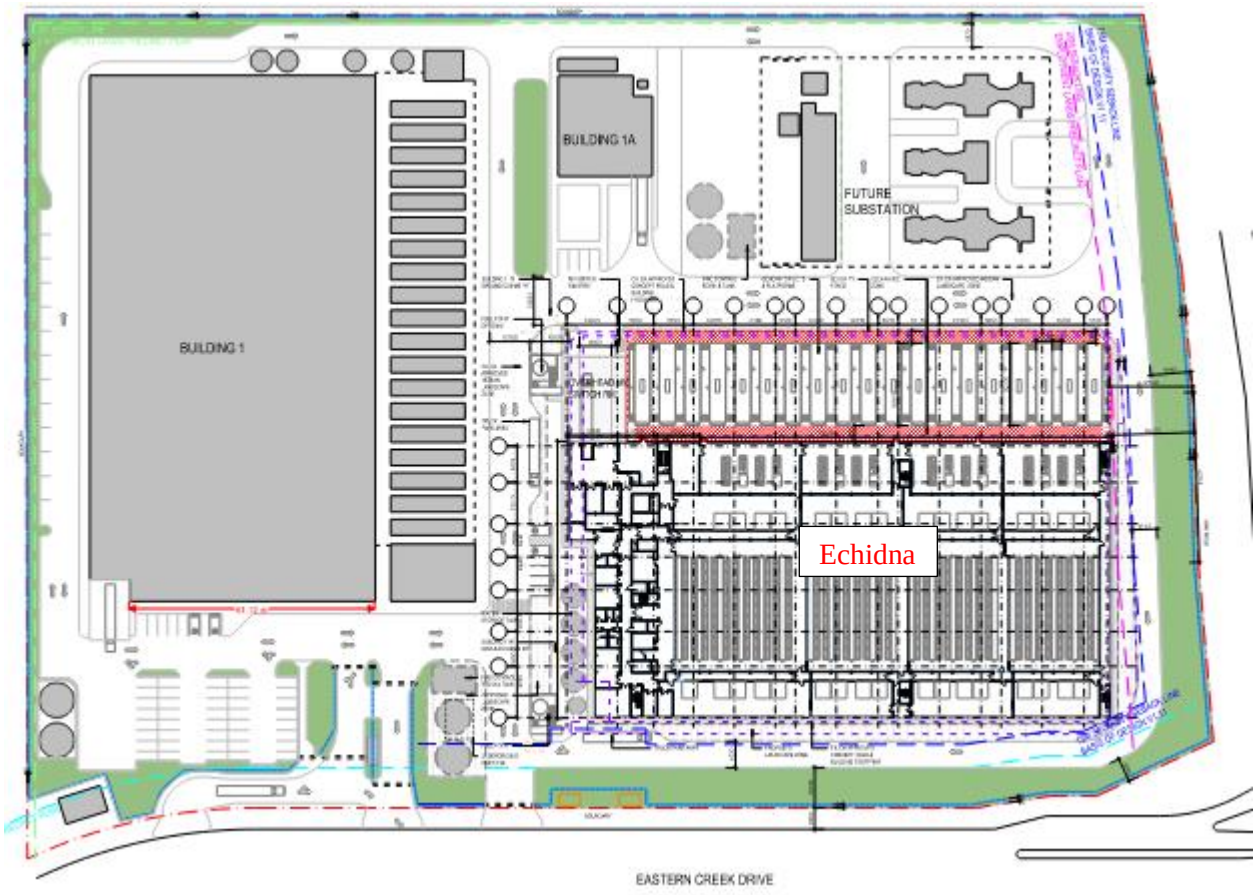

Figure 7: Site Layout

5.2 Site Levels and Grading

The Echidna building has been set with a consistent finished floor level to ease the transportation of equipment throughout all data halls. The building level has been selected to ensure fall away from the building towards the drainage infrastructure in the roads on all sides and to be at least 0.5m above the inlet structure level of the council trunk drainage inlet structure at RL 68.90.

A key operation requirement for the building is to provide close to level access between the data hall and circulation roadway on the southern end of the building. This will cater for the primary movement path of critical equipment to and from the data halls.

On the northern side of the site the crossfall of the existing road will be extended on grade to achieve the additional road width. An existing temporary channel will be removed to cater for the road widening. The footpath area between the building and road will grade north toward the road. The floor level of the building

will be approximately 1.5m above the footpath level on the northern side, therefore retaining walls will be required in this location, along with stairs and ramps for access to the building.

The eastern side of the building and generator yard will grade away from the building toward the road to the east. The existing road generally falls from south to north and has been designed to the centreline only. The existing road will be widened toward the generator yard in the location. It is expected the road will have two way crossfall with the widened section falling toward the kerb that separates the road, footpath and generator yard. A retaining wall will be required between the generator yard and road to manage the level difference between the northern section of generator yard and existing road to the east. The wall will vary between 0m at the southern end and up to approx. 1.5m at the northern end adjacent to the loading dock.

On the southern side of the building the road will fall toward the southern boundary with Old Wallgrove Road. The road levels in the is location will be set at a level that enables access to the data hall for operational requirements. The longitudinal fall of the road will be from the east to the west and then toward then north along the western side of the building.

Along the western side of the building, a batter will develop between the footpath on the outside of the building and the road. On the outside of the road a retaining wall and then batter will be required to manage the level difference between Eastern Creek Drive and the circulation road.

Footpaths are provided around the site for circulation and are generally set down 100mm adjacent to buildings or matched to the road levels elsewhere. All accessible paths have been designed to comply with allowable grades and lengths outlined in AS1428.1 (2009).

5.2.1 Bulk Earthworks

Although bulk earthworks were completed as part of the Stage 1 works, further earthworks will be required to enable a consistent building finished floor level and to construct the internal roads at suitable gradients.

The building finished floor levels have been set to interface with existing roads on site (Building 1) and designed buildings (Building 1A, Future substation). The road levels have also been set to meet operational requirements for access to the data halls and set above the flood level of the existing trunk drainage culvert inlet structure in the southwest corner of the site.

The proposed development will require filling to bring the earthworks platform level up to the proposed building platform level. This fill material will be sourced from existing surplus material on site from previous stages, a significant cutting adjacent to the western boundary and from pavement, utility, and stormwater drainage construction. If required suitable import material will be sourced to manage any deficit.

5.2.2 Flood Planning Levels

The NSW Floodplain Development Manual generally recommends a flood planning level set to 1% AEP flood event level with a 0.5m freeboard. This is consistent with BCC Engineering Guide to Development Appendix D (2005).

Subject to further design and detailed assessment the flood planning level for this site has been initially set at 0.5m above the trunk drainage inlet structure (RL 68.90) in the southwest corner of the site. The circulation road around the building on the southern and western sides will have crossfall away from the building and longitudinal fall to the west and then to the north. The roadway grading will provide additional protection against overland flow resulting from storms exceeding than the 1% AEP or incidents such as blockage of the inlet structure or existing trunk stormwater pipe.

In events larger than a 1% AEP flood event, the overland flow path will travel along the internal access road from south to north, ultimately discharging in the north-west entrance of the site. Overland flows will then flow toward the existing overland flow path on the Lot immediately adjacent to the north and then to the existing regional detention basin.

There may be some localised flooding within sag locations in extreme rainfall events, however, this will be minor and does not present a flooding hazard to the building occupants.

5.3 Proposed Stormwater Drainage

5.3.1 Drainage Strategy

The proposed stormwater drainage network consists of a pit and pipe network designed to drain toward the north and existing drainage network connections provided by the Stage 1 works. The proposed pipe network will connect to two stormwater stubs provided near the north-west corner of the site.

The existing connection to the north will also be used as a connection point for the proposed developments on the eastern boundary of the site (Building 1A and Substation). The overall site discharges near the north-west boundary corner to an existing regional detention basin. Refer to drawings in Appendix A for stormwater drainage network and catchment plan.

The Echidna site drainage network will generally be in the roads that circulate the building and will service the:

- Northern, eastern, southern, and western internal access roads.
- Carpark.
- Generator yard.
- Echidna roof.
- Connections from existing drainage from Building 1A and substation.
- Hardstands and landscaped areas between buildings and access roads.
- Landscaped areas between access roads and site boundaries.
- Fuel unloading bay.

The northern section of road will modify and reuse the existing pit sumps, replacing the pit lids in the temporary channel with new drainage pit lids aligned to the new kerb line. As the existing road to the north of the site has limited longitudinal grade these pits will likely be supplemented with grated drains with internal fall along the kerb line fall to carry flows to the inlets. This area will continue to discharge via the existing filter treatment chamber within the northern car park.

The eastern road is anticipated to be widened to the west from the existing crown and graded toward a new kerb. A pit and pipe network will capture flows on the western side of the road. The existing drainage network on the eastern side of the road will be retained and connected to the existing drainage network near the intersection with the access road to the north.

The drainage on the western side of the road will be drained by a new pipe along the northern boundary of building (and separate to the existing road drainage). This pipe will be connected to the existing stub to the northwest of the Echidna site and discharged via an existing filter treatment chamber near the secondary entrance.

On the western and southern sides of the building, drainage will away from the building to a pit and pipe network in the road. This pipe drainage network will follow the grade of the road o the north of the site and connect to existing stub near the intersection with the existing access road. The drainage will then continue to the north also discharging from the site via the filter treatment chamber near the secondary entrance.

An existing stormwater channel that intercepts external catchments along the southern boundary and discharges to the council trunk drainage inlet structures will be retained.

The generator yard has been designed to capture flows in a series of the subsoil drains beneath the proposed unsealed gravel surfaces. The subsoil pipe will be connected via collector pipes to the proposed stormwater drainage network on the road to the east.

Building connection points will be provided in various locations to cater for direct connections between the roof and surface drainage systems. There will also be a connection between the overflow from the rainwater harvesting tank and drainage network in the northwest of the site.

A fuel unloading bay will be provided adjacent to the northwest corner of the building. The bay will be graded away from the road and toward the building. Potential spills will be managed by an inground storage tank providing for up to 10000L of fuel spill. The storage tank will be fitted with detectors and will automatically close its outlets to the downstream drainage system in the event of a spill. The fuel storage tank will be fitted with a pit that will drain stormwater but automatically close in the event of a spill. A similar pit will be provided at the downstream end of the generator yard prior to connection to the road drainage network to the north of the site

The pipe network has been sized for a 5% AEP minor storm event, while the site drainage system, inclusive of overland flow paths will be designed to cater for the 1% AEP major storm event in accordance with BCC requirements.

5.3.2 Roof Drainage

A portion of the Echidna roof catchment will be diverted to in a rainwater harvesting tank, located on the northwest of the Echidna site. The rainwater will be used by the evaporative cooling and irrigation systems.

A Gross Pollutant Trap (GPT) will be provided upstream of the rainwater tank to remove larger pollutants and sediments. The remaining Echidna roof catchment will be conveyed to the site's stormwater drainage system where it will be discharged through the north-west connection stub into the overall site drainage network.

Refer to drawings in Appendix A and Hydraulic drawing package for roof drainage layout and tank location.

5.3.3 On-Site Detention & Waterway Stability Requirements

No on-site detention is required for the proposed development as this development is within a catchment area where "No permanent or temporary OSD required (regional facilities provided)" as outlined in DCP Part J Figure 1.

The Stream Erosion Index (SEI) was calculated using the MUSIC software to assess the pre and post development conditions and mean annual flow loading. The SEI is calculated in accordance with the method (Method 2) set out within BCC's Water Sensitive Urban Developer Handbook (Version 1.6 26/6/2020), Section 13.

Table 11: SEI Music Results

Development Condition	Type
Pre-development flows (annual mean)	12.2 ML/year
Post-development flows (annual mean)	22.5 ML/year
Stream Erosion Index	SEI=1.84 <3.5

5.3.4 Flooding Risk and Climate Change

The site is not located within an identified flooding precinct. Flooding potential is therefore limited to local overland flooding impacts limited to the existing council stormwater trunk main or the internal site drainage network. The site grading and road design accommodates overland flows to the inground stormwater system. A hydraulic analysis (DRAINs) has been undertaken and is summarised as follows:

- 1% AEP (100 year ARI)
    - The hydraulic grade lines of the proposed network and existing trunk main within the site are generally all below the finished surface levels, with the exception of the carriageway outside of the loading dock (refer to next point).
    - The carriageway outside of the loading dock experiences overland flow in a small area with a depth of 170 mm and a flow depth X velocity of 0.1 m^2/s. This is acceptable and in accordance with Blacktown City Council Engineering Guide for Development (2005)

Appendix A page A-7 stormwater calculation requirement of depth X velocity being under 0.4 m^2/s. Refer to Figure 8 for the DRAINs overland flow results.

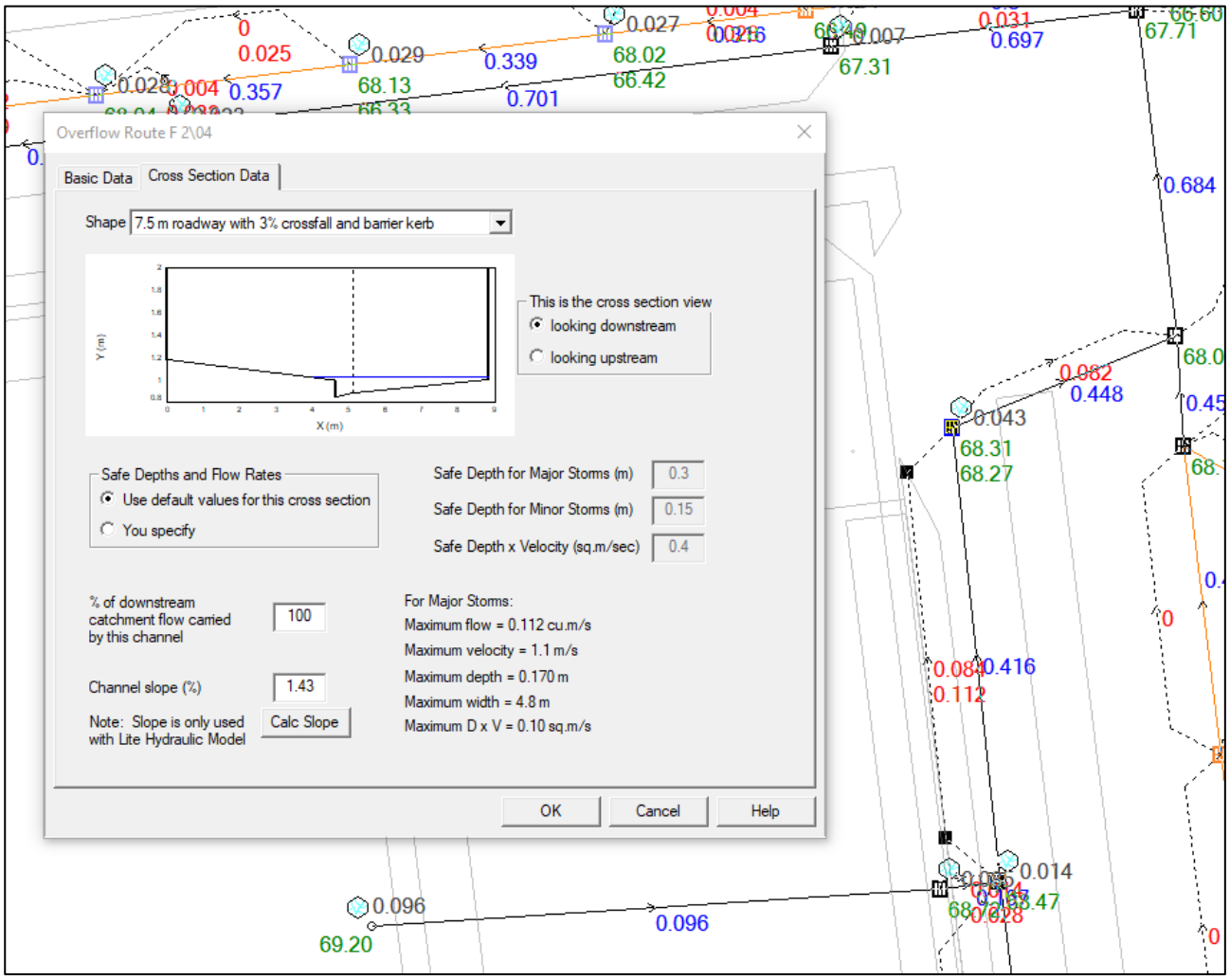

Figure 8: 1% AEP storm overland flow (DRAINs)

- 1% AEP (100 year ARI) plus climate change (+20%)
    - The hydraulic grade lines of the proposed network and existing trunk main within the site are generally all below the finished surface levels, with the exception of the carriageway outside of the loading dock (refer to next point).
    - The carriageway outside of the loading dock experiences overland flow in a small area with a depth of 240 mm and a flow depth X velocity of 0.15 m^2/s. This is acceptable and in accordance with Blacktown City Council Engineering Guide for Development (2005) Appendix A page A-7 stormwater calculation requirement of depth X velocity being under 0.4 m^2/s. Refer to Figure 9 for the DRAINs overland flow results.

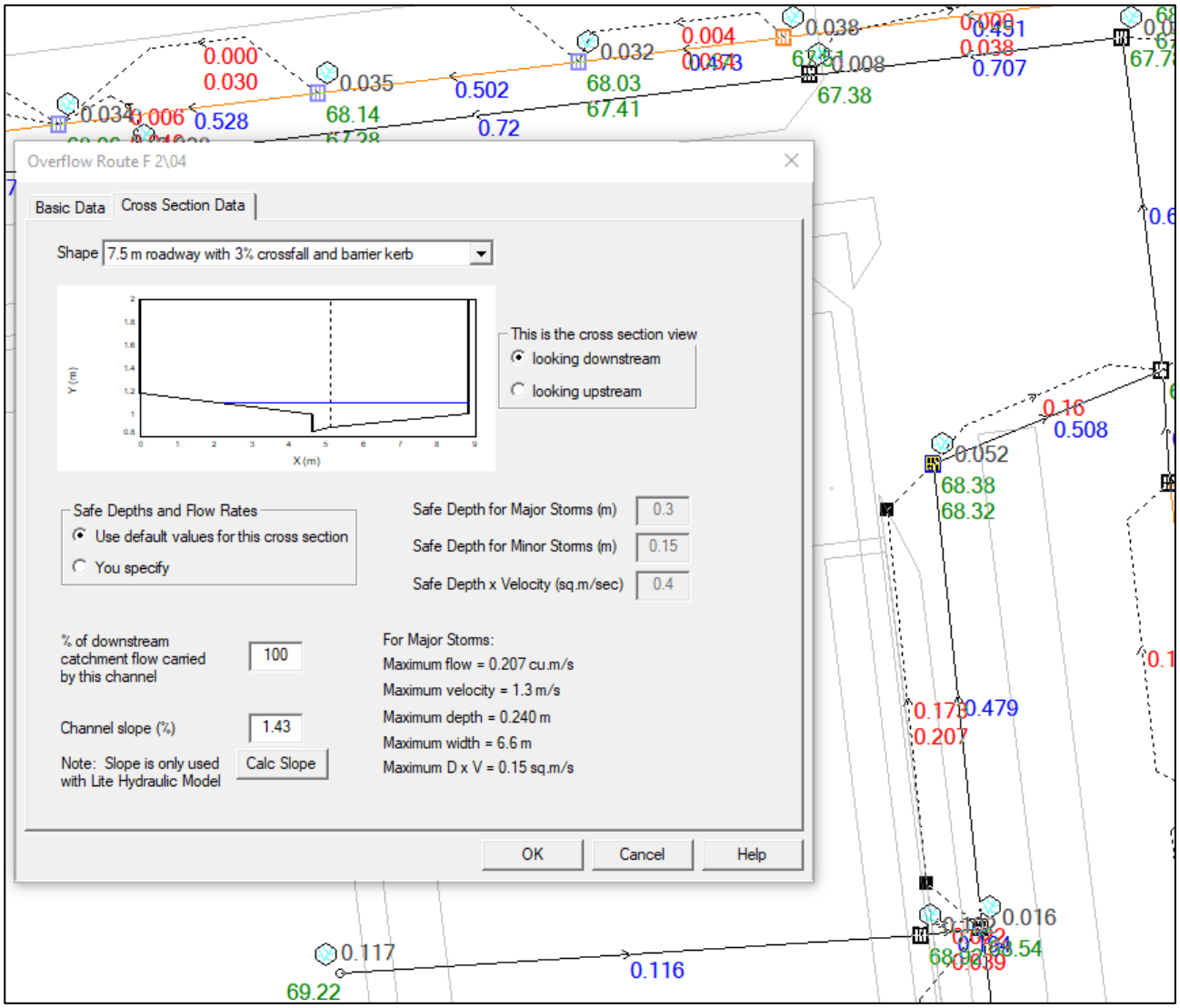

Figure 9: 1% AEP + climate change (+20%) storm overland flow (DRAINs)

5.4 Proposed Water Quality

The Stage 1 (Building 1) works included in pit GPT's and downstream filter chambers to improve the quality of stormwater discharge for the overall site.

The Stage 2 works that include Building 1A, Future Substation and Echidna discharge to a separate downstream filter chamber from Stage 1 works. Therefore, no further assessment of Stage 1 has been undertaken as the water quality for this site is managed independently of the Stage 2 works.

The Echidna stormwater drainage system will discharge to existing drainage stubs located at the northwest of site and converge with flows from Building 1A and Substation. The connection stubs connect to an existing filter chamber located adjacent to the site secondary entry, installed as part of the Stage 1 works. The filter chamber treats stormwater prior to discharge from the site to the northeast corner of the overall site.

Building 1A water quality had currently been assessed in the detailed design by Aurecon and has therefore formed the basis for water quality modelling. As the substation is currently at the 30% design, assumptions on composition of the site catchment areas have been based on the 30% design drawings by Jacobs.

The baseline condition assumes both Building 1A and substation have been constructed with works on the Echidna site limited to temporary diversion channels and a sedimentation basin. The proposed drainage network will connect Building 1A and substation to the new drainage network, removing the need for a temporary sediment basin and diversion channels.

The proposed capacity of the rainwater tank is 50 kL. If feasible and beneficial, the size of the rainwater tank will be increased during detailed design. The rainwater tank proposed to capture runoff from the Echidna roof catchment and treat the runoff for re-use within the site, such as evaporative cooling, flushing, washdown and irrigation.

Oil and water separators are proposed to serve connections from the generator yard and bunded fuel storage areas. At the fuel fill bay an underground tank with fuel spill containment and automatic shutoff will be provided This ensures any accidental fuel spillages will be captured prior to entering the site stormwater network.

MUSIC modelling has been undertaken to demonstrate water quality treatments measures required. The results of this modelling are presented in the tables below and Appendix A:

Table 12: Stage 2 (Building 1A, Substation & Developed Echidna) Catchments

Stage 2	Type	Area (ha)	% IMP Area
Building 1A	Roof	0.0563	100
Building 1A Hardstand	Sealed Road	0.1955	100
Building 1A Bypass	Revegetated Land	0.008	50
Substation Building / Control Room	Roof	0.0354	100
Substation Hardstand	Sealed Road	0.6714	100
Substation Landscape	Revegetated Land	0.0589	50
Substation Bypass	Revegetated Land	0.0949	50
Echidna	Roof to RWT	0.4704	100
Echidna	Roof	0.4321	100
Echidna Hardstand	Sealed Road	0.8985	100
Echidna Generator Yard	Unsealed Road	0.3125	50
Echidna Bypass	Revegetated Land	0.0222	50
Stage 2 Totals		3.2560	95

Table 13: Stage 2 (Building 1A, Substation & Developed Echidna) MUSIC Model Results

Baseline Model	% Reduction		% Targets
	Baseline	Post-dev	
Total Suspended Solids (kg/yr)	90.9	87.5	85
Total Phosphorus (kg/yr)	74.7	66.5	65
Total Nitrogen (kg/yr)	43	46.1	45
Gross Pollutants (kg/yr)	93.3	97.3	90

5.5 Stormwater Maintenance Schedule

All stormwater infrastructure assets within the site boundary will be privately owned and maintained by the Proponent.

In addition to any specific maintenance requirements specified in the relevant Operating and Maintenance O&M manuals provided by the manufacturers, the general maintenance tasks are summarised in Table 14.

The Proponent will oversee the maintenance of the estate stormwater drainage and water quality infrastructure.

Table 14: General Maintenance Schedule Summary

Item	Maintenance Task	Frequency	Procedure
Inlet & Junction Pits	Inside of pits	6 months	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris and litter.
	Outside of pits	4 months and after heavy rainfall events	Clean the grate of any collected sediment, debris, litter and vegetation.
General Stormwater System	General inspections of the complete stormwater drainage system	2 years	Inspect all drainage infrastructure recording any dilapidation in structures and carry out repairs that are required.
Gross Pollutant Traps	Inspect and remove accumulated litter	3-6 months depending on pollutant loads	Remove the lid and inspect the sump. Remove litter with a vacuum hose or mechanical grab.

5.6 Water Balance

A water balance assessment has been undertaken for the site to estimate annual potable water demands, sewage discharges and stormwater runoff from the site. The water balance used 10 years of rainfall data from 1967 to 1976 at the Liverpool (Whitlam) rainfall station (067035). Further detail regarding utility demands and connections is included in the Infrastructure Requirements Report.

5.6.1 Water Demand

5.6.1.1 Process Water

The operations consist of an evaporative cooling system with a variable process demand. The evaporative cooling system will be used when ambient temperature exceeds 28.4°C. Therefore, the daily water demand will vary depending on temperature.

In the final configuration (Phase 7 & 8 refer to Table 15), the estimated average annual water demand for the evaporative cooling system is 18.0 ML/year, equating to an average daily water demand of 1019 kL/day.

In the initial configuration (Phase 1 & 2 refer to Table 15), the estimated average annual water demand for the evaporative cooling system is 4.7 ML/year, equating to an average daily water demand of 254.9 kL/day. Water collected by the rainwater tank will be used to supply this demand initially, with the remainder to be supplied by potable water.

To minimise water usage, the non-evaporated process water has three cycles of concentration.

5.6.1.2 Potable Water

The potable water demand for staff facilities such as bathrooms, kitchens and cleaning is estimated to be 2.5 kL/day. The total water demand for the final configuration that includes process water is estimated to be 18.9 ML/year.

5.6.2 Water Supply

5.6.2.1 Rainwater Harvesting

A 163 kL rainwater tank will collect runoff from a portion of the Echidna roof. Rainwater collected in the tanks will be re-used as process water for evaporative cooling, toilet flushing, external washdown and irrigation. Rainwater will be used whenever it is available. It is estimated that on average 2.87 ML of rainwater can be harvested and reused each year.

5.6.2.2 Potable Water

Potable water will be used to supply staff amenities, and general site demands and as process water for evaporative cooling where rainwater is insufficient to meet demands. The estimated total annual demand is 18.9 ML.

5.6.2.3 Recycled Water

Consideration was given to the option of supplying the site with recycled water to service the process water demand for evaporative cooling. Currently, there are no recycled water mains in the wider precinct. It is understood an Advanced Water Recycling Centre is proposed by Sydney Water within 8km of the site, which may be used to supply recycled water to future phases of the development pending confirmation of the quality of the recycled water. At this stage recycled water has not been pursued further.

5.6.3 Water discharge

The sewer discharge from the site will be equal to the staff facilities and site maintenance/washdown demand of 1.5 kL/day and the remaining process water from the evaporative cooling process, which is estimated to be 262.1kL/day. Therefore, the total sewer discharge from the site will be approximately 263.6kL/day which equates to an average annual discharge of 9.1 ML.

Table 15: Water Demand, Supply & Discharge

Item	Use / Source	Quantity	Comments
Demand			
Process Water	Evaporative cooling	Final Phase 7 & 8 (Oct 2025) 1019 kL/day 18.0 ML/year Phase 1 & 2 (Feb 2024) 254.9 kL/day 4.7 ML/year Phase 3 & 4 (June 2025) 509.7 kL/day 9.1 ML/year Phase 5 & 6 (Aug 2025) 764.6 kL/day 13.6 ML/year	Evaporative cooling only used when ambient temperatures above 28.4 °C Water supply from potable water and harvested rainwater. Three (3) cycles of concentration.
Potable Water	Bathrooms, kitchens, and cleaning.	2.5 kL/day 0.9 ML/year	
Water Supply			
Rainwater Harvesting	Echidna roof	163 kL tank size 2.87 ML/yr harvested water	Roof catchment 4385m2 Average annual rainfall 779mm
Potable Water	Staff amenities, general site demands, process water for evaporative cooling	893.98 kL/day 16.03 ML/year	Potable water for domestic use and process water.
Recycled Water	Evaporative cooling	0.0076 kL/day 2.78 ML/year	This is an expected value based off assumptions and limitations. The value is subject to change.
Water Discharge			
Water Discharge	Staff Facilities, site maintenance, washdown	1.5kL/day 0.5ML/year	
Water Discharge	Evaporative cooling	Final Phase 7 & 8 (Oct 2025) 262.1kL/day 8.6ML/year Phase 1 & 2 (Feb 2024) 65.5 kL/day 2.3 ML/year Phase 3 & 4 (Jun 2025) 131.0 kL/day	

Item	Use / Source	Quantity	Comments
		4.4 ML/yr Phase 5 & 6 (Jun 2025) 196.6 kL/day 6.5 ML/yr	

5.6.4 Site Stormwater Runoff

The site stormwater runoff will be conveyed to the overall site stormwater drainage network located to the north of the site via the site drainage network. This will include overflow from the rainwater tanks when they are full.

The estimated annual site stormwater discharge from rainfall on the site is 13.6 ML. An additional 0.6 ML per year is estimated to be lost to soil infiltration from pervious areas at the site.

A summary of the results of the site water balance in the final configuration is included in the table below.

Table 16: Site Water Balance Summary

Water source/demand	Average annual total (kL)	
	Inflow	Outflow
Rainfall on site	17,100	
Rainwater used for process		2,900
Stormwater discharge from site		13,600
Stormwater infiltration and evapotranspiration on pervious areas		600
Potable water supply	16,000	
Potable water used for process		6,900
Discharge to sewer		9,100

To validate these results, the estimated annual rainwater reuse was verified using the MUSIC water quality model. Average annual estimates from each method are within 25% of each other, which is considered acceptable. Detailed water balance calculations are included in the appendices.

5.7 Erosion and Sediment Control

As the development site is greater than 2,500m^2, a Soil and Water Management Plan must be prepared and implemented prior to the construction of the development. All erosion and sediment control measures will be provided on-site prior to the commencement of any earthworks or development works, in accordance with the approved Soil and Water Management Plan. The plan must be prepared for the construction stage with reference to relevant guidelines, in particular, *Managing Urban Stormwater Soils and Construction Volume 1* (Landcom, 2004).

The plan will set out erosion and sediment control measures for various phases of construction, including the clearing, excavation, stockpiling and filling stages to mitigate the impacts. Potential strategies that may be outlined in the Soil and Water Management Plan include:

- Stockpiles

- Earth bank collection and diversion drains
- Stabilised site entry/exits
- Sediment fencing
- Check dams
- Sediment basin
- Mesh and gravel & geotextile inlet filters

A preliminary sediment and erosion control plan has been prepared for the site, included in the appendices.

6. Assessment of Potential Construction Impacts

6.1 Erosion and Sediment Control

During construction, a Soil and Water Management Plan must be implemented to prevent scouring and the displacement of exposed soils and construction wastes such as sedimentation, hydrocarbons, litter and other pollutants entering the receiving waterways via overland flow or the drainage network.

To mitigate these impacts, in addition to implementing the erosion and sediment controls described in the Soil and Water Management Plan, site facilities should be located away from any temporary overland flow paths at the site.

Given that the elevated finished ground levels of the baseline site will be located outside of the flood extents of the 1% AEP event + 0.5m freeboard, the construction site for the proposed development is not anticipated to encounter any flooding impacts.

6.2 Existing Stormwater Network

Existing stormwater located within the site is limited to a council trunk main on the western boundary and the Stage 1 works (Building 1) located in the northern area of the overall site.

7. Assessment of Potential Operational Impacts

7.1 Stormwater Management

7.1.1 Water Quantity

There will be a slight overall reduction in water quantity produced from the site due to the rainwater harvesting in the evaporative cooling process. The site is serviced by a downstream regional detention basin and therefore does not require on-site detention to account for the site's increase in impervious area and associated increase in stormwater runoff.

7.1.2 Water Quality

The development includes gross pollutant traps and an existing filter cartridge chamber to improve the quality of stormwater discharge for the entire estate. MUSIC modelling has been completed which demonstrates that no additional on-site water quality treatments measures are required. The site includes a rainwater harvesting tank for water cycle management, which will further improve the quality of stormwater discharge.

7.2 Post-development Flooding

The site is not located within an identified flooding precinct, however there is an existing council trunk main that traverses the site. While the existing trunk main has been designed with additional capacity, building levels and road grading have been developed to provide freeboard in accordance with BCC requirements.

8. Environmental Management Measures

This section will provide a summary of the construction and operational risks pre-mitigation described in Section 6 and 7 and the appropriate mitigation measures required for these risks. These are summarised within Table 17.

Table 17: Environmental Management measures for surface water impacts

ID	Impacts	Mitigation	Responsibility	Timing
SW1	Water Quality at outlet due to the potential discharge of sediment and other pollutants from construction bulk earthworks and work areas.	Soil and Water Management Plan As part of the Construction Management Plan (CMP), an Erosion and Sediment Control Plan (ESCP) will be prepared in accordance with QA Specification G38. The Plan will identify all reasonably foreseeable risks relating to soil erosion associated with the various construction activities involved and describe how these risks will be mitigated and minimised during the construction phase. This includes provisions for managing the pollution risks associated with spillage or contamination on the site and surrounding areas. The plan will incorporate controls such as: Stockpiles Earth bank collection and diversion drains Stabilised site entry/exits Sediment fencing Check dams Sediment basin Mesh and gravel & geotextile inlet filters These controls in place will ensure that the site is fully protected.	Proponent / Contractor	Pre-construction/ Detailed Design

ID	Impacts	Mitigation	Responsibility	Timing
SW2	Water Quality impacts at outlet due to the potential discharge of sediment and other pollutants from construction in remaining phases and localised flooding and water quality impacts for initial operational phases.	Implement erosion, sediment and water quality controls Implement the ESCP control measures consistent with the plan to minimise the risks associated with erosion and sedimentation and entry of construction materials and waste into the drainage systems and receiving waters. These may include, but not limited to: Sediment fencing to contain and manage the sediment runoff within the subject site. Re-use of the temporary sediment basin to collect the runoff on the construction site. Re-use of the stormwater collected in the temporary sediment basin for dust suppression. Divert or capture the overland flow water for filtration prior to discharge. Appropriate locations of stockpiles and compounds, construction materials, fuels and chemicals, including bunding where required. Installation of stabilised site entry /exit and wheel wash bays to minimise the transportation of construction materials onto adjoining roads. Maintenance Plan Implementation of a maintenance plan for the site and estate stormwater network.	Proponent / Contractor / Party responsible for maintaining estate stormwater network	Construction / Operation
SW3	Localised stormwater flooding	Stormwater Drainage Design The stormwater drainage network has been sized appropriately to ensure the drainage network won't become inundated with localised stormwater flooding. The paved areas have all been graded to direct runoff towards a drainage infrastructure (i.e. pits, catch drains). An overland flow path has been included in the internal road network to discharge to the estate road network.	Proponent	Detailed Design
SW4	Flooding from existing trunk stormwater.	The site has been set at least 0.5m above the inlet structure of the trunk main with road grading providing an overland flow path to cater for blockages or events that exceed the trunk main capacity.	Proponent	Detailed Design

ID	Impacts	Mitigation	Responsibility	Timing
SW5	Fuel Spills	Design Measures Tanks will be double skinned to prevent leakage and downstream water and oil separators. A spill containment tank with automatic shut off will be provided at the fuel fill bay. Management Plan Implementation of a fuel filling management plan that will be monitoring, reviewing and updated throughout the operation phase.	Proponent	Detailed Design / Operation

9. Summary of Residual Impacts

This section provides a summary of the construction and operational risks both pre-mitigation and any residual impacts remaining after the implementation of the management measures describe in Section 7. Pre-mitigation and residual impacts are summarised in Table 18.

Table 18: Summary of Pre-mitigation and residual impacts

Stage	Potential pre-mitigation adverse impact	Relevant management measures	Potential residual impact after implementation of management measures	Comment on how any residual impacts would be managed
Construction	Water Quality impacts at the outlet due to the potential discharge of sediment and other pollutants from construction bulk earthworks and work areas.	Implementation of the approved Erosion and Sediment Control Plan (ESCP)	Water pollution may occur if the Erosion and Sediment Control Plan (ESCP) is not implemented correctly.	The implementation of the Erosion and Sediment Control Plan (ESCP) will be monitored throughout the construction phase.
Operation	Localised flooding and water quality impacts	Implementation of an approved stormwater network maintenance plan	Localised flooding and water pollution may occur if the site stormwater network is not inspected and maintained routinely in accordance with the stormwater network maintenance plan.	The implementation of the stormwater network maintenance plan will be monitored throughout the operation phase.
	Fuel spills from fuel filling	Implementation of an approved fuel filling management plan	Water pollution may occur if the fuel filling management plan is not implemented correctly.	The implementation of the fuel filling management plan will be monitoring, reviewing and updated throughout the operation phase.

10. References

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