

Local Water Management Strategy

Bentley Technology Park Precinct Structure Plan

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Executive Summary

Development WA (DevWA) (the 'proponent') is progressing a precinct structure plan (PSP) for the development of Bentley Technology Park (BTP) (herein referred to as 'the site'). The proposal intends support the Bentley Curtin Specialised Activities Centre Plan (BCSACP) which was endorsed by the Western Australian Government in 2018. The site is located within both the City of South Perth (CoSP) and the Town of Victoria Park (ToVP) and is approximately 7.8 km south of the Perth central business district. The 58 ha site is bounded by Hayman Road to the west and south, and Jarrah Road to the east. Kent Street bisects the two proposed development areas by running north-south through the site.

This Local Water Management Strategy (LWMS) details the water management approach to support the development of the site. The LWMS is intended to satisfy the requirements of *Better Urban Water Management* (BUWM) (WAPC 2008a), address the typical expectations of the Department of Water and Environmental Regulation (DWER), recognise Water Corporation (WC) infrastructure and supports relevant CoSP and ToVP policies regarding water management.

In summary, the existing environmental investigations conducted to date indicate that.

- The site experiences an average annual rainfall of 776 mm, with most of it received between May and August.
- The topography of the site is variable, ranging from 29 m Australian height datum (mAHD) in the north of the site to localised lows of 8 mAHD to the south of the site.
- The site is underlain by the Bassendean Sands dunal soil system which generally comprises of highly permeable sandy soils.
- The site has a 'moderate to low' of acid sulfate soils (ASS) risk of occurring within 3 m of the natural surface.
- The site is located within the sewerage sensitive area (SSA) of the Swan and Scott coastal plains.
- Two local pit and pit networks have been constructed independently by CoSP and ToVP to manage stormwater within the site. Runoff not detained within the site is conveyed to the existing WC drainage network located to the south of the site.
- Maximum groundwater levels within the site ranges from 7 mAHD at the eastern boundary of the site to 5 mAHD along the western boundary. Depth to maximum groundwater ranges from 3 m below ground level (mBGL) to 22 mBGL.
- There are no registered heritage places within the site.

Water supply and conservation

Water conservation within the site will be achieved through the implementation of fit-for-purpose principles and best management practices (BMP) so that scheme water is not wasted. These measures will utilise waterwise landscaping, and water efficient fixtures/appliances to reduce water demand.

Stormwater management

Stormwater will be managed by mimicking the existing pre-development hydrology. This will be achieved by retaining all runoff within private lots up to the major storm event and providing water quality treatment (i.e. first 15 mm) of runoff generated from road reserves before being discharged

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from the site towards WC compensating basins within and downstream of the site. This will be achieved through the use of infiltration-based water sensitive urban (WSUD) measures, which may include:

- Soak wells / subsurface storage (i.e. within private lots).
- Tree pits located within road verge.
- Bio-retention areas (BRA) within designated landscaped areas/reserves.

Groundwater Management

Groundwater will be managed by ensuring that inverts of drainage infrastructure are set to provide appropriate protection from groundwater inundation. The adoption of an infiltrate at source approach combined with non-structural measures to address water quality will help maintain or improve groundwater quality.

This LWMS demonstrates that the concepts previously described can be achieved within the spatial layout of the site. It also provides guidance for future development/design stages to ensure that the water management criteria proposed can be achieved, and to ensure that an integrated water cycle management and best practise WSUD approach can be achieved by the implementation of the PSP.

The design criteria and the manner in which the detailed designs achieve compliance with the design criteria are provided in **Table E 1**.

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Table E 1: Water management criteria and compliance

Management Element	Criteria Number	Criteria Description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
Water Conservation	WC1	Minimise the use of water within the site.	Utilise waterwise landscaping gardening in landscaped areas of the development.	Proponent	Detailed drainage design
			Promote the use of water efficient fixtures and appliances (WEFA).	Proponent	Post construction
Stormwater Management	SW1	Manage the small event runoff (i.e. first 15 mm) as close to source as practicable.	Small rainfall events (first 15 mm) will be managed within lots and road reserves through infiltration into permeable surfaces, subsurface storage (i.e. soakwells) and bio-retention areas (BRAs) within landscaped areas.	Proponent	Construction
	SW2	Major rainfall event (1 % AEP) peak flow rates leaving the site to be consistent with the pre-development environment.	Runoff from lots up to the major rainfall event (1% AEP) will be retained within lots via on-lot storage. Runoff from road reserves greater than the small rainfall event will overtop BRAs and discharge directly into the existing WC drainage network. The drainage strategy has been developed to provide all post-development catchments a drainage pathway, to detain up to the 1% AEP onsite and to discharge at rates no greater than pre-development rates.	Proponent	Construction
	SW3	Finished floor levels must have a minimum of 500 mm clearance from the major rainfall event flood levels in surface storage.	Finished floor levels (FFL) of lots adjacent to the WC compensating basins will be set at 500 mm above the major event top water level (TWL) .	Proponent	Detailed drainage design
	SW4	Apply appropriate non-structural measures to reduce nutrient loads.	<ul style="list-style-type: none"> • Minimising fertiliser use to establish and maintain vegetation within landscaped areas (both lots and road verges). • Use of drought tolerant species that require minimal water and nutrients. • Street sweeping. • Maintenance of stormwater infrastructure to remove sediments and other pollutants. 	Proponent	Construction
	SW5	Design infiltration areas to avoid creating mosquito habitat	Stormwater infrastructure will be designed to ensure all runoff is infiltrated within 96 hours.	Proponent	Detailed drainage design

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Table E 1: Water management criteria and compliance (continued)

Management Element	Criteria Number	Criteria Description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
Groundwater Management (continued)	GW1	Use WSUD approaches to treat groundwater and to recharge the superficial aquifer.	Directing stormwater to vegetated swales/BRAs adjacent to carparks, in road reserves or dedicated drainage reserves.	Proponent	Detailed drainage design
			The adoption of WSUD measures (which adopt infiltrate at source techniques) will provide contemporary water quality treatment and will assist with localised groundwater infiltration.	Proponent	Detailed drainage design
	GW2	Infiltration structures to have inverts set 300 mm above maximum groundwater level	Groundwater levels for the site are >2 m below the natural surface.	Proponent	Detailed drainage design and implementation
	GW3	Maintain or improve the existing groundwater quality	<ul style="list-style-type: none"> Directing stormwater to vegetated swales adjacent to carparks, in road reserves or dedicated drainage reserves. Minimise fertiliser use to establish and maintain vegetation within designated landscaped areas. Undertake street sweeping of carpark and road pavement areas to remove sediment bound pollutants Design subsurface storage areas so that pre-treatment of runoff is achieved. Remove accumulated sediments from vegetated swales (in carpark areas) and subsurface storage cells. 	Proponent	Detailed drainage design

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Bentley Technology Park: Concept Design

Appendix B

Water Corporation Runoff Model Link Node dDiagram

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Modelling Assumption Report

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
BoM	Bureau of Meteorology
CoSP	City of South Perth
DBCA	Department of Biodiversity, Conservation and Attractions
DevWA	Development WA
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation (formally DoW)
DoW	Department of Water
ToVP	Town of Victoria Park
WAPC	Western Australian Planning Commission
WC	Water Corporation

Table A2: Abbreviations – General terms

General terms	
AEP	Annual exceedance probability
ASS	Acid sulfate soils
BMP	Best management practices
BRA	Bio-retention area
LWMS	Local water management strategy
POS	Public open space
TWL	Top water level
UWMP	Urban water management plan
WEFA	Water efficient fixtures and appliances
WSUD	Water sensitive urban design
WWG	Waterwise gardening

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Table A3: Abbreviations – units of measurement

Units of measurement	
ha	hectare
kL/yr	kilolitre per year
km	kilometre
m	metre
m ²	square metre
m ³	cubic metre
mAHD	m in relation to the Australian height datum
mBGL	m below ground level
mm	millimetre
m ³ /s	cubic metres per second

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1 Introduction

1.1 Background

Development WA (DevWA) (the 'proponent') is progressing with a precinct structure plan (PSP) for the development of Bentley Technology Park (BTP) (herein referred to as 'the site'). The proposal intends to support the Bentley Curtin Specialised Activities Centre Plan (BCSACP) which was endorsed by the Western Australian Government in 2018.

The site is located within both the City of South Perth (CoSP) and the Town of Victoria Park (ToVP) and is approximately 7.8 km south of the Perth central business district. The 58 ha site is bounded by Hayman Road to the west and south, and Jarrah Road to the east. Kent Street bisects the two proposed development areas by running north-south through the site, as shown on **Figure 1**.

1.2 Planning context

The site is currently zoned as 'Special Use' under the ToVP Local Planning Scheme (LPS) No.2 (ToVP 2024a) and 'Centre' under the CoSP LPS No.7 (CoSP 2024).

1.3 Purpose

It is important that the manner in which water will be managed is clearly documented early in the planning process, and this should be considered in a manner which avoids flooding and protects the environment. This approach provides the framework for actions and measures to achieve the desired outcomes during development.

This Local Water Management Strategy (LWMS) aims to set in place guidance for future development of private lots within the site, and to demonstrate a conceptual approach that can meet the relevant water management requirements. The LWMS aims to satisfy the requirements of *Better Urban Water Management* (BUWM) (WAPC 2008a), address the expectations of the Department of Water and Environmental Regulation (DWER) and to provide a stated position regarding CoSP and ToVP expectations for water management from future development areas.

1.4 Policy framework

There are a number of State and Local Government policies, strategies and guidance documents of relevance to the site. These include:

- *State Planning Policy 2.9: Water Resources* (WAPC 2006a)
- *Draft State Planning Policy 2.9: Planning for Water* (DPLH 2021)
- *Statement of Planning Policy No. 3: Urban Growth and Settlement* (WAPC 2006b)
- *State Water Plan* (Government of WA 2007)
- *Liveable Neighbourhoods (4th Edition)* (WAPC 2009, 2015)
- *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA 2008)
- *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan* (DWER 2023)
- *City of South Perth Local Planning Scheme No. 7* (CoSP 2024)

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- *Town of Victoria Park Local Planning Scheme No. 2 (ToVP 2024a)*
- *Town of Victoria Park – Onsite Stormwater Drainage Requirements Sheet (ToVP 2024b).*

In addition to the above policies, there are several published guidelines and standards available that provide direction regarding the water discharge characteristics that urban developments should aim to achieve. These are key inputs that relate either directly or indirectly to the site and include:

- *Australian Rainfall and Runoff (Ball 2019)*
- *Australian Runoff Quality (Engineers Australia 2006)*
- *Better Urban Water Management (WAPC 2008b)*
- *Developing a Local Water Management Strategy (DoW 2008a)*
- *Decision Process for Stormwater Management in Western Australia (DWER 2017)*
- *National Water Quality Management Strategy (NWQMS) (ANZECC and ARMCANZ 2000)*
- *Stormwater Management Manual for Western Australia (DWER 2022).*

1.5 Stakeholder consultation

Prior to the commencement of the LWMS key stakeholders were identified and invited to provide feedback on the development of the LWMS. These stakeholders include:

- DWER
- Water Corporation (WC)
- CoSP
- ToVP.

1.5.1 Department of Water and Environmental Regulation

DWER are a relevant stakeholder as they are the approval agency for structure plans, an advice agency for clearance of subdivision conditions (typically relating to drainage), provide advice regarding discharges to waterways, and manage the State's water resources via application of the *Rights in Water and Irrigation Act 1914* (RIWI Act). DWER have advised that they have no comments regarding the development of the site but would like to review the LWMS when available.

1.5.2 Water Corporation

Being the primary provider of water, wastewater and drainage services for the state, WC provided initial comments to consider in the development of the LWMS. These included:

- Confirmation that the site is connected to and discharges stormwater runoff into the existing WC pit and pipe network found within Hayman Road to the south of the site.
- There are no fixed allowable discharge flow rates into the WC drainage network. However, post-development flows must not exceed pre-development flows. This requirement must be clearly demonstrated by the LWMS. If necessary, WC will incorporate the proposed local drainage strategy from the LWMS into its broader catchment-scale model to assess whether the strategy meets the required standards.
- The WC drainage network is designed to provide flood protection in accordance with the Water Services Licence, which includes protection for rainfall events with intensities up to 20% AEP or 10% AEP, depending on land use. Any intensification of land use or increase in impervious

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surfaces will result in additional runoff. This runoff must be retained or detained within the development to maintain the current level of flood protection. This requirement reinforces the importance of the previous point.

- For rainfall events exceeding the minor storm thresholds (20% or 10% AEP), stormwater may surcharge the drainage system and flow into major drainage infrastructure such as road reserves and low-lying catchment areas. As these areas are managed by the Local Authority, it is their responsibility to ensure that flows from major storm events (up to 1% AEP) are appropriately managed. They are also responsible for setting minimum floor levels based on the 1% AEP flood level and required freeboard.

1.5.3 City of South Perth

The CoSP are a relevant stakeholder as they are involved in the implementation of land use planning and development control for water management. They are also involved in the design and maintenance of drainage infrastructure within the urban environment. The CoSP have provided available mapping for known drainage infrastructure located within the road reserves for land to the west of Kent Street within the site.

1.5.4 Town of Victoria Park

The ToVP are a relevant stakeholder as they are involved in the implementation of land use planning and development control for water management. They are also involved in the design and maintenance of drainage infrastructure within the urban environment. The ToVP has not provided feedback regarding the development of the site.

1.6 Previous studies

1.6.1 Bentley-Curtin Specialised Activity Centre Plan

The BCSACP and Greater Curtin Master Plan (B) documents offer guidance for the development of the greater Bentley-Curtin area, inclusive of the site. Included within the document is a summary of the water management objectives for the Bentley-Curtin area therefore providing the structure, vision and objectives in which this LWMS aims to adopt. These objectives include:

- Provide a broad level stormwater management framework to support future development within the site.
- Maintain the existing hydrological regime.
- Manage all stormwater runoff from within the development.
- Ensure that the approach to managing stormwater is well developed and documented.
- Develop a water conservation strategy for the site that will ensure the efficient use of all water resources.
- Incorporate appropriate best management practices (BMPs) and water sensitive urban design (WSUD) approaches into the development that address environmental and water management issues identified.
- Protect lot scale infrastructure from flooding during major rainfall events.
- Integrate the water management approach with surrounding WC catchments and drainage systems.

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- Provide a clear expectation of CoSP and ToVP requirements that future development of private lots will adhere to.
- Gain support from DWER, WC, CoSP and ToVP for the proposed method to manage stormwater within the site.

Detailed objectives for water management within the site are further discussed in **Section 4**.

2 Proposed Development

The proposed Bentley Technology Park (BTP) PSP (**Appendix A**) incorporates an existing commercial precinct consisting of various research and development facilities operated by:

- Department of Biodiversity, Conservation and Attractions (DBCA)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Pawsey Supercomputing Centre
- Innovation Centre of WA
- Technology Park Function Centre.

The BTP development does not seek to significantly modify the land uses already identified within the site. Rather, it seeks to clarify the requirements for future development within private lots and any redevelopment of road drainage infrastructure that may be required in the future.

The stormwater management plan for the site proposes the following WSUD features (discussed further in **Section 6**):

- Subsurface storage within lots
- Tree pits within road reserves
- Bio-retention areas (BRAs).

3 Existing Environment

3.1 Climate

The site experiences a Mediterranean climate which is characterised by warm dry summers and mild winters. Long term climatic averages indicate that the site is located in an area of moderate rainfall, with the majority of rainfall received between May and August.

The closest weather station is the Gosnells weather station (BoM site #009106) which is located approximately 10 km to the southeast of the site, and this site indicates an average annual rainfall of approximately 776 mm (BoM 2025).

3.2 Topography

The topography of the site is variable, ranging from 29 m Australian height datum (mAHD) in the north of the site to localised lows of 8 mAHD to the south of the site. The majority of the site is between 11 mAHD and 20 mAHD, as shown on **Figure 2**.

3.3 Geotechnical conditions

3.3.1 Regional geology and soils

A review of the *Western Australian Geological Survey* (DMIRS 2018) indicates that the site is underlain by soils associated with the Bassendean Sands dunal system, as shown on **Figure 3**. These sandy soils are characterised by their highly permeable and nutrient poor nature. They are mainly composed of S₈ sands, which can be described as fine to medium-grained, sub-rounded quartz, moderately sorted of eolian origin. These soils typically have high infiltration capacity and therefore infiltrate at source approaches to manage stormwater runoff are considered appropriate.

3.3.2 Acid sulfate soils

Acid sulfate soils (ASS) risk mapping (**Figure 3**) (DWER 2024a) shows that the entire site exhibits a moderate to low risk of encountering ASS within 3 m of the natural surface.

3.4 Contaminated sites

A review of the DWER *Contaminated Sites Database* (DWER 2024b) indicates that Lot 18 on plan 23438 (Site No. 37632) located adjacent to Burvill Court is a contaminated site. This site has been classified as 'Remediated for Restricted Use' due to historic contamination and remediation activities that have occurred within this lot (DWER 2025a) as per the *Contaminated Sites Act 2003* (CS Act). The location of this contaminated site is shown on **Figure 3**.

3.5 Sewerage sensitive areas

The site is located within the estuary catchment on the Swan and Scott Coastal Plains, which are classified as a sewerage sensitive areas (SSA) (DPLH 2019).

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The definition of the site being within a SSA is relevant as the default expectation from the Government Sewerage policy (GSP) is that developments will connect to a reticulated sewer network where it is available. It is expected that any future development within the site will be connected to the existing WC reticulated sewer system.

3.6 Surface water

3.6.1 Surface water features and wetlands

The site is already urbanised with no natural surface water features.

3.6.2 Local drainage

Based on publicly available data, an existing pit and pipe network on the eastern side of Kent Steet is the primary method of stormwater conveyance throughout the ToVP portion of the site, as shown on **Figure 4**. Excess runoff from impervious surfaces (i.e. runoff from roads) is conveyed towards an existing WC compensating basin (CB / corner of Hayman Road and Kent Street) or underground storage located at localised low points, where it is infiltrated or detained until its ultimately discharge to the Collier Park North CB, south-west of Hayman Road.

Similarly, the drainage on the western side of Kent Street is managed by the CoSP, and based on data provided, there is an existing series of pits located throughout. However, it is unclear if these pits are self-contained or there is an existing pipe network that helps convey the stormwater through the site. There is a local connection that allows the conveyance and detention of flows from the southern portion of the CoSP side of the site into the WC drainage network and which ultimately discharges to the Collier Park North CB.

3.6.3 Water Corporation drainage network

WC has an existing broad scale catchment scale 1D model which represents the existing WC drainage catchments and pipe network within the area. The model is shown diagrammatically in **Appendix B**.

Based on the WC model the site is divided into seven drainage catchments, one for lots within the CoSP and six for lots within the ToVP. The southern half of Kent Street and the eastern portion of Hayman Road (which joins onto Kent Street) were also delineated as drainage catchments which contribute to the site. Based on the WC model, surface runoff which is not retained within each catchment is conveyed to the Hayman Road CB via overland flows and connection to the WC pipe network south of the site. Water detained in the Hayman Road CB is then discharged beneath Kent Street and Hayman Road via the WC pipe network to the downstream Collier Park North CB.

On review of the WC model, three discharge locations (all located in the ToVP) connect the local drainage to the WC drainage network that runs along Hayman Road to the south of the site, as shown on **Figure 4**. **Table 1** describes the locations of each of the local connection points.

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Table 1: Local connection discharge point locations

Discharge location	Description
Location 1	Corner of Hayman Road and Brodie-Hall Drive (east) – discharge into WC pipe network
Location 2	Corner of Hayman Road and Brodie-Hall Drive (west) – discharge into WC pipe network
Location 3	North of Hayman Road CB – discharge directly in compensating basin

3.6.4 Pre-development modelling

A 1D model has been prepared using XPSWMM software to provide a representation of the existing environment of the site based on the WC model and drainage infrastructure information from ToVP and CoSP. As part of the stakeholder consultation with WC (N Rajapakse [Water Corp.] 2025, *pers. comm.*, 30 July) the following information was provided to establish pre-development hydrology for the site:

- An initial loss (IL) value of 10 mm for lots and 1 mm for road reserves to represent on-site soakage within the site.
- Runoff co-efficient of 0.25 for catchments east of Kent Street.
- Runoff co-efficient of 0.50 was assumed for road reserves.
- 1% AEP outflow hydrographs for three local drainage discharge locations into the WC pipe network located beneath Hayman Road within the ToVP.
- 1% AEP outflow rate of 0.228 m³/s leaving the Hayman Road CB which is conveyed to the Collier North CB downstream of the site. This will be the overall site discharge which will need to be maintained in the post-development scenario.
- Catchment areas and associated runoff coefficients to calibrate the pre-development model.

As part of the model development additional upstream catchment areas were noted to be contributing to surface runoff within the site. These areas include:

- A small area of residential development to the north of the ToVP catchments which were connected to the site via a pipe.
- The northern portion of Kent Street which extends north of the site.
- The eastern portion of Hayman Road.

The additional catchment areas have been included as part of the pre-development modelling for the site to provide a robust understanding of the existing hydrology.

Table 2 summarises the pre-development discharge flow rates from the WC pre-development model and a comparison to the pre-development model (developed to support this LWMS) at the three site discharge locations as well as the outflow from the Hayman Road CB

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Table 2: Pre-development discharge rates

Discharge location	Description	WC 1 % AEP peak flow discharge (m ³ /s)	Emerge 1% AEP peak discharge (m ³ /s)
Discharge 1	Eastern portion of ToVP side of site – (Ct-E5 and Ct-E6). Discharges directly into Hayman Road drainage network	1.34 ⁺	0.64
Discharge 2	Central portion of ToVP side of site – (Ct-E3 and Ct-E4). Discharges directly into Hayman Road drainage network.	0.58 [*]	0.41
Discharge 3	Hayman Road CB inflow. This is a culmination of the flows from the western portion of ToVP (Ct-E1 and Ct-E2), CoSP catchment (Ct-W1), and flows from Kent St and Hayman Road (east).	1.10	1.55 [~]
Total site outflow		0.228	0.208

⁺ Pre-development 1% AEP peak flow rate based on 15min storm duration piped flow and 20min overland flow

^{*} Pre-development 1% AEP peak flow rates were based on a 15min storm duration

[~] Post-development 1% AEP peak flows based on 15min storm duration and identified contributing catchment area for Kent Street.

The results presented in **Table 2** show some variation at discharge locations, however overall the results adequately represent WC pre-development modelling for the purposes of assessing the relative change resulting from implementation of the proposed water management criteria.

3.7 Groundwater

3.7.1 Groundwater resource

The *Water Register* (DWER 2025c) indicates that the site is split across the CoSP, ToVP and Perth South Confined sub-areas of the Perth Groundwater Management Area. These sub-areas are comprised of the following aquifers:

- Superficial Swan Aquifer (unconfined)
- Leederville (confined)
- Yarragadee North (confined)
- Mullaloo Aquifer (confined).

The Superficial Swan aquifer is the primary aquifer of interest for development within the site, as this is the aquifer most likely impacted by water management practices, and also the most likely to be accessed for local use.

3.7.1.1 Groundwater availability

Like many groundwater areas on the Swan Coastal Plain the Yarragadee North and Leederville resources are fully allocated, however there is available allocation within the Superficial aquifer beneath the site. There are also multiple existing licenses associated with the site which are summarised in **Table 3**. These may potentially be available to meet future non-potable needs within this site.

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It is noted that the Mullaloo aquifer is used by CSIRO to support the cooling of the PAWSEY supercomputer and is not intended to be accessed for non-potable supply.

Table 3: Summary of existing groundwater licenses available

Licence No.	Aquifer	Allocation Limit (kL/yr)	Parties	Expiry
GWL 175551	Perth – Mullaloo	0	Commonwealth Scientific & Industrial Research Organisation	8/2/2034
GWL 204636	Perth – Superficial Swan	15,000	Commonwealth Scientific & Industrial Research Organisation	10/8/2030
GWL 64179	Perth – Superficial Swan	18,750	DBCA	26/11/2028
GWL 45914	Perth – Superficial Swan	564,790	Town of Victoria Park	17/12/2030
GWL 151647	Perth – Superficial Swan	21,400	Department of Jobs, Tourism, Science and Innovation	17/5/2028
GWL 209334	Perth – Superficial Swan	8,500	Bridgewest Perth Real Estate Pty Ltd.	21/11/2033

3.7.1.2 Groundwater levels

The *Perth Groundwater Map* (DWER 2025b) indicates that the maximum groundwater level beneath the site ranges from 7 mAHD at the eastern boundary to 5 mAHD along the western boundary of the site, as shown of **Figure 2**. Groundwater flows in a westerly direction beneath the site towards the Swan River. Depth to groundwater beneath the site varies from approximately 3 m below ground level (mBGL) to 22 mBGL depending on location.

3.8 Aboriginal heritage

A review of the Aboriginal Heritage Inquiry System (DPLH 2023) indicates that there are no registered heritage places within the site.

3.9 Summary of existing environment

In summary, the existing environmental investigations conducted to date indicate that.

- The site experiences an average annual rainfall of 776 mm, with most of it received between May and August.
- The topography of the site is variable, ranging from 29 mAHD in the north of the site to localised lows of 8 mAHD to the south of the site.
- The site is underlain by the Bassendean Sands dunal soil system which generally comprises of highly permeable sandy soils.
- The site has a 'moderate to low' of ASS risk of occurring within 3 m of the natural surface.
- The site is located within the SSA of the Swan and Scott coastal plains.
- Two local pit and pit networks managed independently by CoSP and ToVP manage stormwater within the site. Runoff not detained within the site is conveyed to the existing WC drainage network located to the south of the site.

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- Maximum groundwater levels within the site ranges from 7 mAHD at the eastern boundary of the site to 5 mAHD along the western boundary. Depth to maximum groundwater ranges from 3 mBGL to 22 mBGL.
- There are no registered heritage sites within the site.

4 Design Criteria and Objectives

This section outlines the objectives and design criteria that future water planning must achieve. The water management strategy includes water conservation, stormwater management and groundwater management.

4.1 Integrated water cycle management

The *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan 3* (Government of WA 2023), draft State Planning Policy 2.9 (DPLH 2022) and BUWM (WAPC 2008a) endorses the promotion of integrated water cycle management and application of WSUD principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

The key principles of integrated water cycle management include:

- Integrating water use with natural water processes
- Considering all water sources, including wastewater, stormwater and groundwater
- Integrating water and land use planning
- Allocating and using water sustainably and equitably
- Adopting a whole catchment integration of natural resource use and management.

Integrated water cycle management addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Water management design objectives should therefore seek to deliver better outcomes in terms of:

- Water conservation
- Stormwater management
- Groundwater management.

The first step in applying integrated water cycle management in urban catchments is to establish environmental characteristics/values. The existing environmental context of the site has been discussed in **Section 3** of this document. Guidance regarding environmental values and criteria is provided by a number of national and state policies/guidelines and site-specific studies undertaken in and around the site which were detailed in **Section 1.6**. Any feedback from stakeholders (see **Section 1.5**) which need to be considered for the development of water management planning have also been considered.

The design criteria discussed in the following sections are based on the assessment of the existing environment within the site and surrounds, and with the aim of achieving the integrated water cycle outcomes discussed above.

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4.2 Water conservation

This LWMS proposes the following water conservation criteria:

Criteria WC1 Minimise the use of water within the site.

The manner in which this objective will be achieved is further detailed in **Section 5**.

4.3 Stormwater management

Stormwater management criteria are summarised below.

Criteria SW1 Manage the small event runoff (i.e. first 15 mm) as close to source as practicable.

Criteria SW2 Major rainfall event (1 % AEP) peak flow rates leaving the site to be consistent with the pre-development environment.

Criteria SW3 Finished floor levels must have a minimum of 500 mm clearance from the major rainfall event flood levels in surface storage areas.

Criteria SW4 Apply appropriate non-structural measures to reduce nutrient loads.

Criteria SW5 Design infiltration areas to avoid creating mosquito habitat.

The manner in which these objectives will be achieved is further detailed in **Section 6**.

4.4 Groundwater management

Proposed groundwater management criteria are summarised below.

Criteria GW1 Use WSUD approaches to treat groundwater and to recharge the superficial aquifer.

Criteria GW2 Infiltration structures to have inverts set 300 mm above the maximum groundwater level.

Criteria GW3 Maintain or improve the existing groundwater quality.

The manner in which the groundwater management objectives will be achieved is further detailed in **Section 7**.

5 Water Conservation Strategy

5.1 Fit-for-purpose water use

Conservation of water through fit-for-purpose use and BMPs is encouraged so that scheme water is not wasted. Fit-for-purpose describes the use of water that is of a quality suitable for the required use of the water. Fit-for-purpose principles have been utilised in the water conservation strategy for the site and will achieve **Criteria WC1**.

5.1.1 Scheme water

Potable water will be available via a reticulated network operated by the WC. This will be utilised for all potable water needs and may potentially be used for some lot-scale non-potable needs.

5.1.2 Groundwater

Groundwater allocations are available within the site through existing licences (**Section 3.7.1.1**) or potentially via additional allocation from the Perth Superficial Swan aquifer. These could be used to meet irrigation demand across the site.

5.2 Water conservation measures

Private lot development and road reserves should utilise water wise gardening (WWG) principles. Whilst road reserves will be unirrigated in the longer term, a key landscaping approach for both private lots and road reserves will be to undertake landscape planting within winter months to ensure that these can be sustained by rainfall and ideally established prior to the following summer (dry) period.

Water efficient fixtures and appliances (WEFA) are important approaches to ensure that potable water use is minimised within private lots. These measures are further discussed in the following Sections.

5.2.1 Water efficient fixtures and appliances

The water conservation strategy for the site proposes that all lots implement WEFA. Water efficient fixtures will be mandated through the building licence, while uptake of water efficient appliances can be encouraged through educational materials educational workshops/campaigns provided by the proponent at point of sale.

5.2.2 Water wise gardening

Water use efficiency measures can significantly reduce the total water consumption for irrigation purposes. Water requirements can be reduced both within private lots and road reserve areas by employing WWG measures including:

- Retain remnant native trees and vegetation where possible.
- Where possible adopt xeriscaped and unirrigated landscaped approaches.

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- The species palette will adopt local native waterwise species, adapted to the seasonal changes and tolerant against dry months with little to no rainfall.
- Landscape planting to occur during the winter months (i.e. May to September), where rainfall can supplement the establishment of vegetation.
- Where required, soil shall be improved with soil conditioner certified to Australian Standard AS4454 to a minimum depth of 150 mm.
- Mulch landscape areas to 75 mm with a product certified to Australian Standard AS4454.
- Implementation of hydro-zoning design practices, which will group plant species with similar / same water requirements.

WWG principles are encourage for adoption within private lots (which is generally surrounding carpark areas) and will be utilised within any landscaped road reserves or drainage areas within the site.

6 Stormwater Management

With the site currently urbanised, the driving principle for the stormwater management is to maintain the existing hydrology. As part of the pre-development environment there is allowance for stormwater to discharge from the site into the existing WC drainage network. These pre-development flow rates at the existing discharge connections have been assessed as part of the pre-development hydrology (see **Section 3.6.4**). The WC expectation is that the major (1% AEP) rainfall event peak flow rates discharging from the site will be consistent with the pre-development environment.

This will be achieved by ensuring that runoff from road reserves during the small (i.e. first 15 mm) rainfall event is managed and treated within vegetated BRAs located throughout the stormwater network, upstream of WC infrastructure. Runoff from road reserves exceeding the small rainfall event, and up to the major (1% AEP) rainfall event, will overtop the BRAs and discharge from the site via existing local connections into the WC network at rates that do not exceed pre-development flows determined by the LWMS modelling.

The site has predominately highly permeable sandy soils, therefore the primary approach to stormwater management is to maximise treatment as close to source as possible via infiltration to local groundwater resources. Considering the site is already urbanised the existing local drainage network is assumed to be generally at capacity. Therefore, it will be an expectation from both WC, ToVP and CoSP that any new developments within the site will be required to retain all stormwater runoff within lots.

WSUD measures that will be utilised to manage stormwater runoff within the site include:

- Subsurface storage within lots
- Tree pits within road reserve
- BRAs.

6.1 Lot drainage

Lots will be required to manage up to the major (1% AEP) rainfall event which will primarily be via a combination of on-lot sub-surface/infiltration structures (soakwells or other proprietary storage devices) and infiltration into landscaped areas. It is acceptable that the amount of stormwater management provided via subsurface storage can vary as this is dependent on the overall design and layout of the proposed development – as long as the retention of the 1% AEP event is achieved. Lots will be provided with an appropriate level of fill coupled with groundwater control measures to ensure that lots have the intended functionality.

There are several measures that can be adopted to achieve subsurface storage. All have the benefit of utilising the infiltration capacity of the underlying soils, provided proximity to groundwater is considered. Soakwells are the more traditional and common form of subsurface storage, however there are also a number of other proprietary products that can be adopted. This may include products such as Ecoaid, Stormtrap, Tunnelwell, Atlantis and others, however individual designs and products will need to be installed considering pre-treatment requirements, future maintenance

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access, vehicle loading and any measures proposed must be approved by CoSP and ToVP prior to installation.

The implementation of on-lot storage will assist in achieving **Criteria SW2**.

6.2 Development drainage

6.2.1 Road drainage network

The existing road network within the site is presumed to have been sized to convey runoff up to the minor (20% AEP) rainfall event. In events greater than the minor event and up to the major (1% AEP) rainfall event, runoff will be conveyed by the existing pipe network and road pavement to the downstream discharge locations prior to entering the WC drainage network.

6.2.2 Tree pits

Tree pits are a localised water quality treatment measure that can be used to capture a portion of the small runoff event (i.e. first 15 mm) from road reserves. The specific number, location and storage capacity of tree pits are yet to be determined, but if required they would be placed higher in the catchment within road reserves. Their adoption will be considered at detailed civil and landscape design. If implemented, the designs will need to comply with the requirements of CoSP or ToVP (as relevant), and this would be outlined in future water planning documentation.

6.2.3 Bio-retention areas

Runoff from small rainfall events (i.e. first 15 mm) from road reserves should be preferentially managed within a BRA. BRAs are vegetated treatment areas that would generally be designed with side slopes of 1:3 and a maximum depth of up to 500 mm. Runoff from the small event will be treated through interaction with vegetation and adsorption to sand particles via infiltration. The BRAs will be located in open space areas and will be densely vegetated with species known to uptake nutrients. The BRAs may be underlain with 300 mm of appropriate soil with a high phosphorous retention index (PRI > 10) to enable pollutant removal. The BRAs will be designed to dry out within 96 hours following the small rainfall event so that they do not create a mosquito breeding risk. The location of BRAs are shown on **Figure 5**.

The use of BRAs will assist in achieving **Criteria SW1, SW4 and SW5**.

6.2.4 Compensating basin

The WC drainage network is comprised of CB which are utilised to detain major rainfall event runoff to lower peak flow rates within the drainage network. The Hayman Road CB (located centrally within the site) collects runoff from contributing catchments within, and adjacent to, the site where it is detained/infiltrated prior to conveyance to the downstream Collier Park North CB via the existing WC drainage network. The Hayman Road CB is not designed to be permanently wet.

An infiltration rate of 4 m/day has been adopted for the conceptualisation of the of the CB for the site. Nearby adjacent lot finished floor levels (FFLs) within the site will be at least 500 mm above the top water level (TWL) within the CB to ensure adequate protection from flooding during extreme

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rainfall events. The size and spatial requirements for CBs are available from WC with the Hayman Road CB having the following dimensions:

- TWL: 7.2 mAHD
- Depth: 1 m
- Existing TWL surface area: 2,900 m²
- Design TWL surface area: 3,530 m².

6.3 Stormwater management design

6.3.1 Hydrological and hydraulic modelling

The assessment of stormwater management infrastructure for this LWMS has been determined using XPSWMM hydrological and hydraulic modelling software. The post development model has been based on the Emerge LWMS pre-development modelling (see **Section 3.6.4**). The post-development model generally aligns with the WC model by using an “initial loss” value and runoff coefficients for consistent comparison of the pre-development and post-development environments.

The pre-development peak flow rates modelled during preparation of this LWMS are close to but not an exact match for those determined by the WC model. This is not of concern as the demonstration of compliance provides comparison between the LWMS pre-development peak flow rates and the LWMS post-development peak flow rates. The modelling assumptions and parameters are detailed in the modelling assumptions report provided in **Appendix C**.

6.3.2 Small rainfall event

As previously discussed, runoff from the small rainfall event (first 15mm) from the road reserves will be conveyed via an already established pit and pipe network to BRAs to be located in open space areas within the site to provide water quality treatment. The management of the small rainfall event will occur on-lot via subsurface storage and permeable landscape areas.

The size and spatial requirements of the proposed BRAs are provided in **Table 4** and the locations of these structures shown on **Figure 5**. BRAs will assist in achieving **Criteria SW1, SW4, GW1 and GW3**.

Table 4: Stormwater treatment assets size and spatial requirements.

Sub catchments	Treatment asset	Side slope	Depth (m)	TWL surface area (m ²)	Volume (m ³)
Ct-E5, Ct-E6	BRA	1:3	0.50	535	235
Ct-E3, Ct-E4	BRA	1:3	0.50	215	85
Ct-E1, Ct-E2	BRA	1:3	0.50	380	160
Ct-W1	BRA	1:3	0.50	775	345

6.3.3 Minor and major rainfall event

Major event runoff (i.e. up to the 1% AEP) will bypass the BRAs and be conveyed to the Hayman Road and Collier Park North CB via the WC drainage network. **Table 5** summarises the LWMS post-

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development flows in comparison to the LWMS pre-development flows at the existing site discharge locations.

Table 5: Pre-development versus post development discharge flow rates

Discharge location	1% AEP peak discharge (m ³ /s)	
	Pre-development	Post-development
Discharge 1	0.64	0.06
Discharge 2	0.41	0.24
Discharge 3	1.55	1.84*
Site outflow	0.208	0.154

* Increase in outflow can be attributed to the contributing impervious area in the post-development environment.

The results of the surface runoff modelling indicates that the LWMS post-development 1% AEP peak flow rates are maintained/improved compared to the LWMS pre-development modelling, with the overall site discharge reducing from 0.208 m³/s to 0.154 m³/s. Therefore, the total flow leaving the site is attenuated and will assist in achieving **Criteria SW2**.

It should be noted that any new developments within lots adjacent to existing CB will be designed to have a minimum clearance of 500 mm above the 1% AEP TWL within these structures, and this will assist in achieving **Criteria SW3**.

6.4 Non-structural stormwater management measures

A number of non-structural measures will be implemented across the site to help reduce nutrient loads within stormwater runoff.

These measures include:

- Minimising fertiliser use to establish and maintain vegetation within landscaped areas (both lots and road verges).
- Use of drought tolerant species that require minimal water and nutrients.
- Street sweeping.
- Maintenance of stormwater infrastructure to remove sediments and other pollutants.

These measures will assist in achieving **Criteria SW4**.

7 Groundwater Management

7.1 Groundwater management approach

The principle behind groundwater management is to maintain the existing hydrology across the site by infiltrating at source, provide appropriate protection from groundwater inundation and to maintain or improve groundwater quality.

7.2 Groundwater level management

The adoption of WSUD measures (which adopt infiltrate at source techniques) will provide contemporary water quality treatment, will assist with localised groundwater infiltration and will help to achieve **Criteria GW1**.

The groundwater levels across the site range between 3 mBGL to 22 mBGL and therefore are unlikely to affect the compliance with **Criteria GW2**.

7.3 Groundwater quality management

The main objective for groundwater quality management is to maintain or improve the existing groundwater quality. Water quality treatment will be most effective when runoff is managed by surface based vegetated systems, however a subsurface infiltration-based system will also provide a level of treatment.

Groundwater that originates from the site is predominately surface runoff from impervious surfaces (i.e. local roads and carpark areas) that has infiltrated into the soil profile from permeable areas, BRAs and subsurface storage areas. Therefore, improving groundwater quality can be achieved by treatment of the surface runoff prior to infiltrating to groundwater.

The reduction of the pollutant load to the groundwater can be achieved by:

- Directing stormwater to vegetated swales adjacent to carparks, in road reserves or dedicated drainage reserves.
- Minimise fertiliser use to establish and maintain vegetation within designated landscaped areas.
- Undertake street sweeping of carpark and road pavement areas to remove sediment bound pollutants
- Design subsurface storage areas so that pre-treatment of runoff is achieved.
- Remove accumulated sediments from vegetated swales (in carpark areas) and subsurface storage cells.

The above measures will improve the quality of water prior to it infiltrating into the underlying groundwater and will achieve **Criteria GW3**.

8 Future Water Management Plans

The requirements to undertake preparation of more detailed water management plans can either be imposed as a condition of subdivision or development approval. Regardless of the planning approval mechanism, the development of any future water management plans should follow the guidance provided in *Urban Water Management Plans: Guidelines for preparing plans and for Complying with Subdivision Conditions* (DoW 2008b) and will need to comply with this LWMS and contemporary CoSP and ToVP policies and guidelines.

While strategies have been provided within this LWMS that address planning for water management within the site, it is a logical progression that future civil/landscape designs and the supportive water management plans will clarify details not provided within the LWMS. The main areas that will require further clarification within future plans include:

- Landscape concepts
- Geotechnical investigations
- Surface runoff modelling
- Implementation of water conservation strategies
- Groundwater level monitoring
- Non-structural water quality improvement measures.

These are discussed in more detail in the following sections.

8.1 Landscape concepts

It is expected that future water management plans will provide landscape concepts which demonstrate the extent of permeable areas, integration of BRAs and landscape typology. They should also support estimates of water use that will be documented in the supporting water management plans.

8.2 Geotechnical investigations

It is acknowledged that no current/recent geotechnical investigation has been carried within the site and soil information documented within this LWMS is based on broadscale regional soil/geology mapping. Future geotechnical investigations should also include permeability testing at the location of intended stormwater infiltration infrastructure.

It is expected that future water management plans/designs will summarise site specific geotechnical investigations prior to subdivision approval, as this may result in evolution of the form of storage volumes or detailed civil design approach.

8.3 Surface runoff modelling

It is acknowledged that the water management strategies documented in this LWMS are based upon broad-scale assumptions and, to some extent, regional data. These assumptions are considered adequate for development of this LWMS and are of an appropriate level of detail. However,

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verification of proposed drainage designs will be undertaken once the final layout of individual land uses is confirmed. This should also include consideration of site-specific infiltration testing to verify design infiltration rates.

It is expected that future water management plans will update surface runoff modelling as appropriate, and this may result in evolution of the form of storage volumes or detailed civil design approach.

8.4 Implementation of water conservation strategies

A number of potential measures to conserve water have been presented within this LWMS (see **Section 5**). These water conservation strategies will be incorporated into the design and the ongoing maintenance of the landscaped areas. Landscape design measures that will be incorporated into the water conservation strategy should be further detailed within future water management plans.

The manner in which the proponent intends to promote water conservation measures discussed in this LWMS to future and owners/users should also be considered and compliance with any measures determined by CoSP and ToVP should be documented within a future water management plan.

8.5 Groundwater monitoring

The groundwater level information presented in this LWMS is based on regional groundwater contours. Site specific information can vary, and where the base of infiltration structures is likely to be within 1 m of the regional maximum groundwater level (MGL) it is recommended that site specific groundwater measurement is undertaken to confirm the design datum. This LWMS intends to adopt MGL as the design datum, however it should also be acceptable to adopt a less conservative annual average MGL provided that the datum used considers the potential for future groundwater level rise and provides a justification for the datum adopted in the future water management plan.

Groundwater level monitoring is recommended to better understand the groundwater condition of the site and to capture the seasonal peak. The measured seasonal peak should then be calibrated to a nearby long-term record (typically a DWER bore) to provide the calibrated MGL/average annual maximum groundwater level (AAMGL).

Pending timing of year, it may be difficult to capture a seasonal peak level (typically August to October each year) and in this instance it should be acceptable to adopt a calibrated reading at any time of the year as long as the calibration to the long-term record is concurrent (i.e. the reference bore is monitored at the same time) and subsequently further verified by the seasonal peak discussed above. The acceptance of MGL versus AAMGL or the uses of single measurement will be at the sole discretion of CoSP and ToVP.

8.6 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the *Stormwater Management Manual for Western Australia* (DWER 2022). The structural water management measures will require ongoing maintenance, and it is expected that future water management plans will recommend management practices and will identify the key actions and responsibilities. It is expected that any privately managed development areas will be managed by the developer of the land or another appropriate management body.

9 Monitoring

Due to the full infiltration of stormwater runoff on-site, there is no need for post-development surface water quality monitoring and reporting. However, pending land uses proposed, the CoSP or ToVP may require post-development monitoring of groundwater quality to confirm that appropriate outcomes are being achieved. If this were the case monitoring should adopt an upstream/downstream comparison of physio-chemical parameters and laboratory analysis of nutrients. The trigger for contingency/responsive actions should be an increase in nutrient concentrations of > 20 % upstream to downstream or recording physio-chemical values outside the default trigger values in the National Water Quality Management Strategy for lowland rivers in the southwest of Western Australia. This should all be documented in a future water management plan.

In addition to groundwater quality monitoring, condition monitoring of drainage infrastructure is recommended to be carried out by the proponent and/or the CoSP and ToVP. A visual assessment of the drainage assets should occur on a bi-annual basis, with the aim to ascertain that maintenance activities are achieving the overall objectives of the development. The parameters that will be monitored and remedial actions that will be implemented if required are detailed in **Table 6**.

Table 6: Condition monitoring parameters and remedial actions

Parameter	Trigger for remedial action	Remedial action
Gross pollutants	If present	Remove gross pollutants and dispose of at approved facility
Sediments	If present	Remove sediments

The management and maintenance objectives will be detailed within future water management plans.

9.1 Contingency action plan

In the event of a significant storm event, drainage assets (including WSUD structures) should be visually assessed and the removal of any gross pollutants or sediments that may have built up during the storm that will impact the performance of the drainage assets should be undertaken.

10 Implementation

The LWMS is a key supportive document for the development of the site and to guide future development within private lots as to the expectations and requirements of CoSP and ToVP. The development of the LWMS has been undertaken with the intention of providing a structure within which subsequent development can occur consistent with an integrated water cycle management approach and CoSP and ToVP policies. It is also intended to provide overall guidance to the general stormwater management principles for the area and to guide the development of future water management planning.

10.1 Roles and responsibility

The LWMS provides a framework that the proponent can utilise to assist in establishing stormwater management methods that have been based upon site-specific investigations, are consistent with relevant State and Local Government policies and have been endorsed by DWER, WC, CoSP and ToVP. The responsibility for working within the framework established within the LWMS rests initially with the proponent of individual lot developments, and it is anticipated that future water management documentation will be developed in consideration of other relevant policies and documents. For existing and future public infrastructure (roads, pits, pipes, drainage reserves) the responsibility for maintenance and management will continue to be with CoSP and ToVP.

10.2 Funding

The cost of implementing the management strategies outlined in this LWMS will be borne solely by the proponent, with the exception of lot scale measures, which will be borne by the lot owner.

10.3 Review

It is not anticipated that this LWMS will be reviewed unless the BTP PSP undergoes significant changes in the future. If the proposed layout or land uses within the site are substantially modified, the surface runoff modelling undertaken for this LWMS may need to be reviewed and the criteria revised to ensure that all are still appropriate.

The next stage of development will be subdivision, and the subdivision conditions would likely require the preparation of a UWMP. Minor changes to the water management approach can be reported/updated within the civil designs, landscape designs and the UWMP. While the ongoing lot-based measures are unlikely to be enforced at this stage, their implementation is expected from landowners by CoSP and ToVP.

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11.1 General references

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11.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 11.1**, with access date information provided in **Table R 1**.

Local Water Management Strategy

Bentley Technology Park Precinct Structure Plan



Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
(BoM 2025)	6 May 2025	Climate Data Online
(DBCA 2024)	6 May 2025	Geomorphic Wetlands – Swan Coastal Plain
(DMIRS 2018)	6 May 2025	1:50,000 Environmental Geology Series
(DPLH 2023)	6 May 2025	Aboriginal Heritage Sites database
(DWER 2024a)	6 May 2025	Acid Sulfate Soils (dataset)
(DWER 2024b)	6 May 2025	Contaminated Sites Database
(DWER 2025a)	6 May 2025	Groundwater Map
(DWER 2025b)	6 May 2025	Water Register

Figures



Figure 1: Site Location

Figure 2: Topographic and Groundwater Contours

Figure 3: Regional Geology, Acid Sulfate Soil Mapping and Contaminated Sites

Figure 4: Existing Hydrology and Local Drainage Network

Figure 5: Stormwater Management Plan

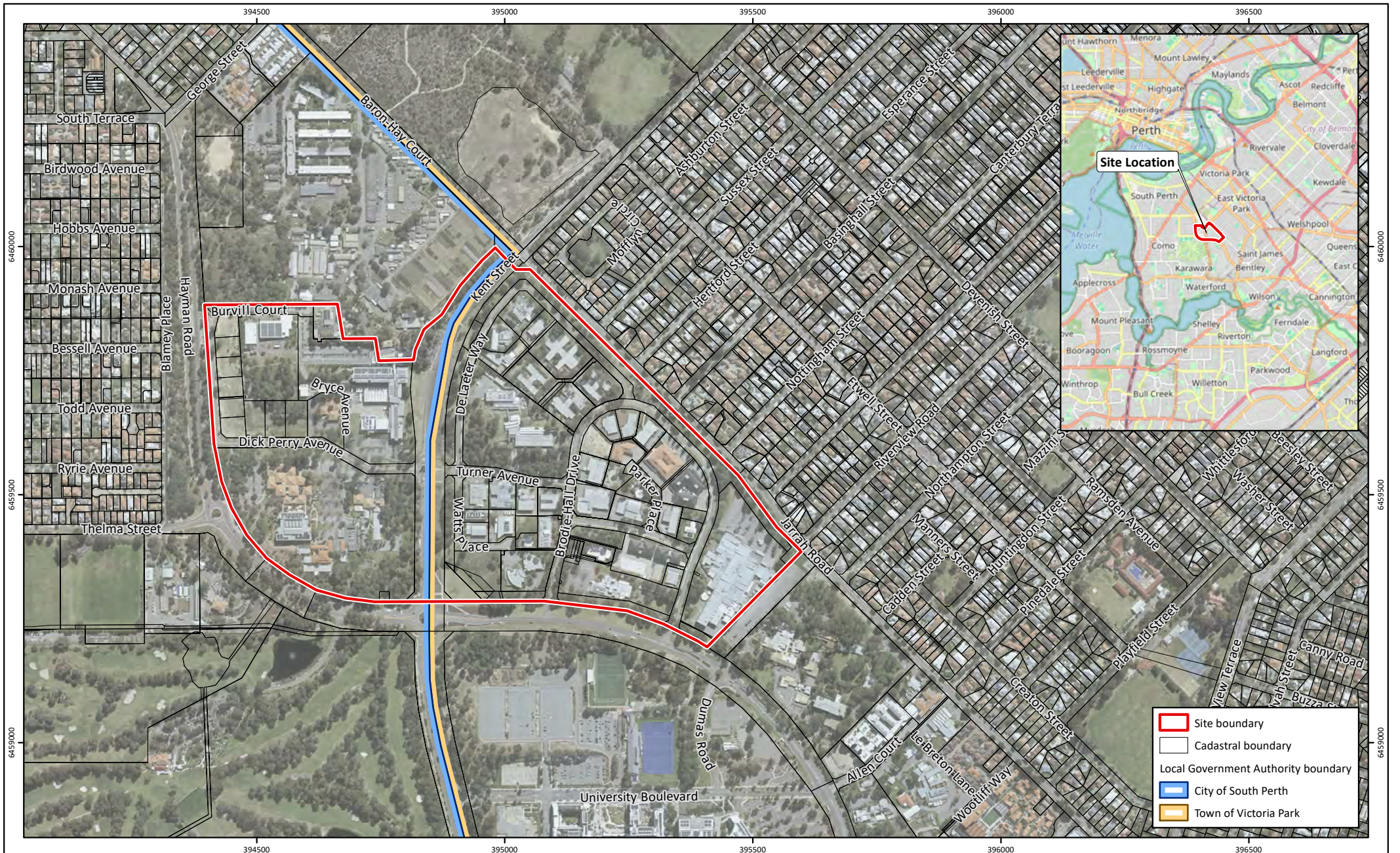


Figure 1: Site Location

Project: Local Water Management Strategy
Bentley Technology Park - Development Support
Client: Development WA

Plan Number:
EP24-058(01)--F01
Drawn: CTH
Date: 28/05/2025
Checked: MDB
Approved: BPB
Date: 15/09/2025



0 2,200 4,400 6,600
Metres
Scale: 1:10,000@A4
GDA2020 MGA Zone 50





Figure 2: Topographic and Groundwater Contours

Project: Local Water Management Strategy
Bentley Technology Park - Development Support
Client: Development WA

Plan Number:
EP24-058(01)--F02
Drawn: CTH
Date: 28/05/2025
Checked: IMDB
Approved: BPB
Date: 15/09/2025



0 2,750 5,500 8,250
Metres
Scale: 1:5,000@A4
GDA2020 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2025).

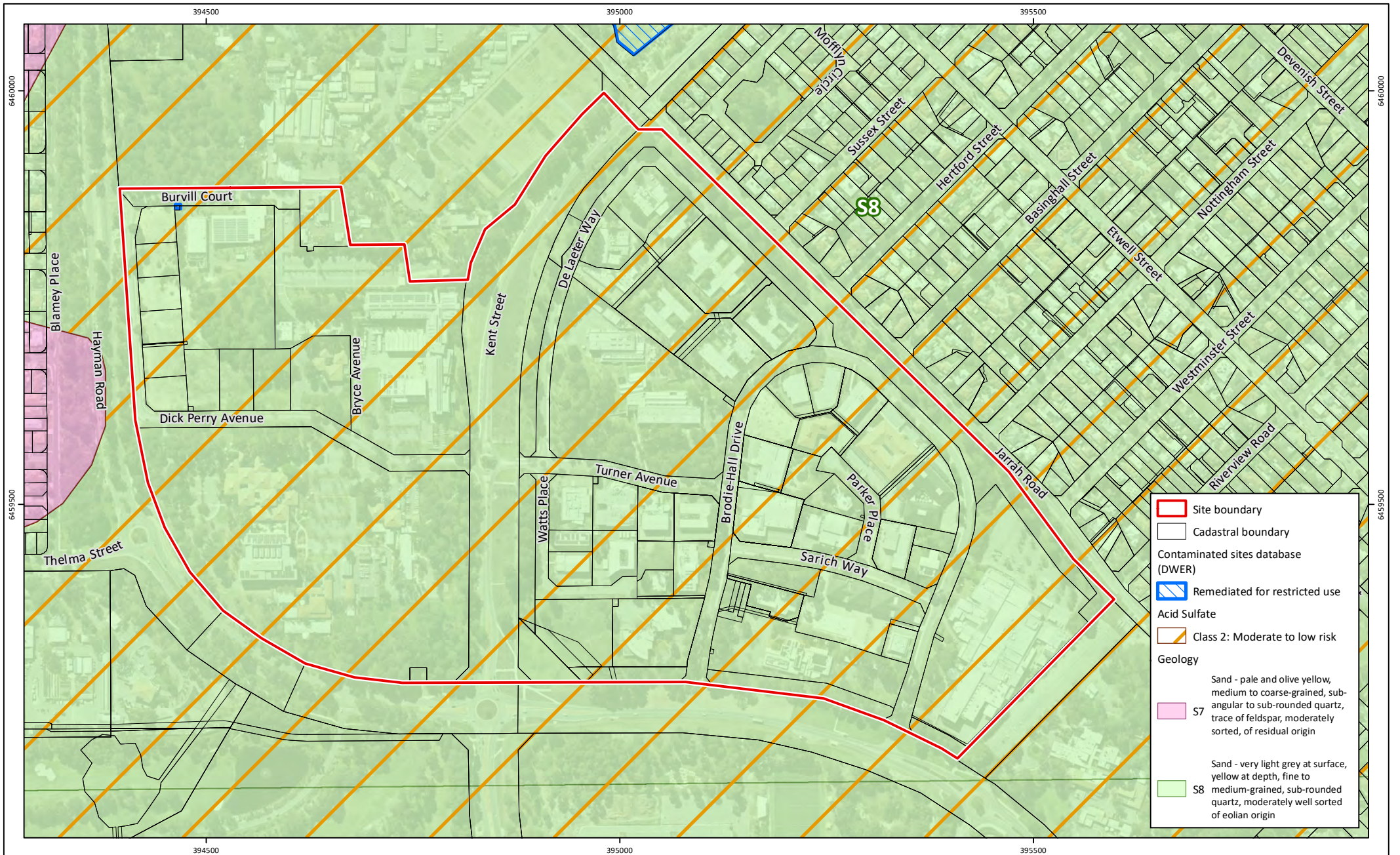


Figure 3: Regional Geology, Acid Sulfate Soil Mapping and Contaminated Sites

Project: Local Water Management Strategy
Bentley Technology Park - Development Support
Client: Development WA

Plan Number: EP24-058(01)--F03a
Drawn: GAR
Date: 20/11/2025
Checked: IMDB
Approved: BPB
Date: 20/11/2025

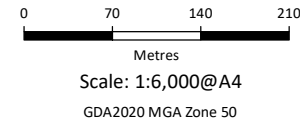
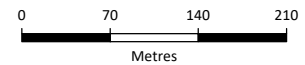




Figure 4: Existing Hydrology and Local Drainage Network

Project:	Local Water Management Strategy Bentley Technology Park - Development Support
Client:	Development WA

Plan Number:	EP24-058(01)--F04
Drawn:	CTH
Date:	28/05/2025
Checked:	IMDB
Approved:	BPB
Date:	15/09/2025



Scale: 1:6,000@A4
GDA2020 MGA Zone 50



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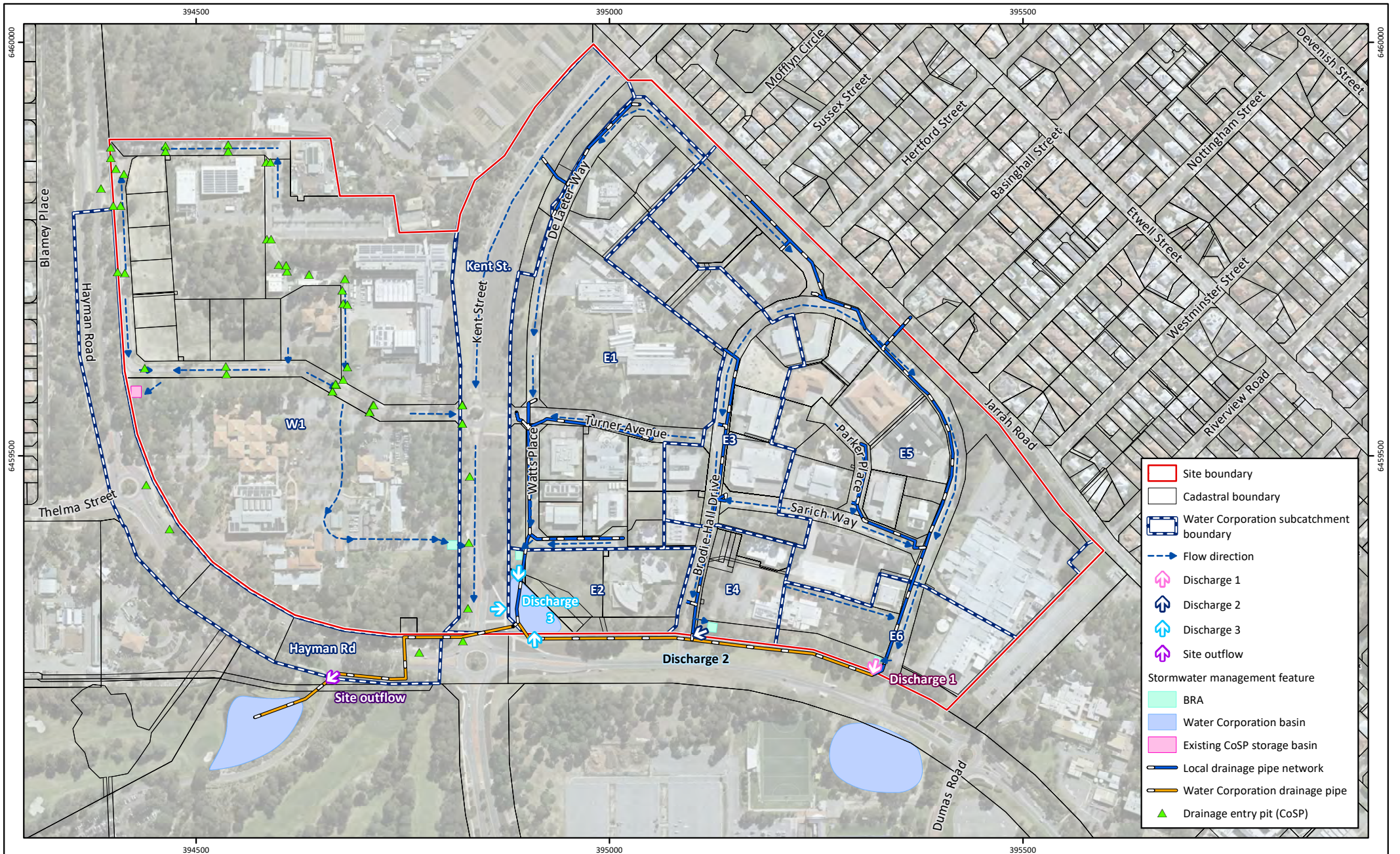


Figure 5: Stormwater Management Plan

Project: Local Water Management Strategy
Bentley Technology Park - Development Support
Client: Development WA

Plan Number:
EP24-058(01)--F05
Drawn: CTH
Date: 28/05/2025
Checked: MDB
Approved: BPB
Date: 15/09/2025



0 75 150 225
Metres
Scale: 1:6,000@A4
GDA2020 MGA Zone 50



Appendix A

Bentley Technology Park: Concept Design





Existing Situation

BENTLEY TECHNOLOGY PARK

A DevelopmentWA Project

scale / 1:10000@A4 | 1:5000@A2



plan / 20_054_014A

date / 28/04/2025

Taylor Burrell Barnett Town Planning & Design
 Level 7, 160 St Georges Terrace, Perth WA 6000
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Taylor
Burrell
Barnett



LEGEND

- Precinct Structure Plan Boundary
- Entertainment Land Uses Focus Area
- Public Open Space
- Potential New Public Open Space
- State Gov. Land Made Available for Development
- Existing Trees
- Standard Street Trees
- Feature Street Trees
- Existing Roads
- Potential New Roads
- New Walking and Cycling Links
- Existing Buildings
- Proposed Buildings
- Water Detention Areas

URBAN STRUCTURE NOTES (U)

KEY STRUCTURAL MOVES

- 1 New street connection through to future redevelopment of Department of Agriculture site by Others.
- 2 New connection to the south across Hayman Road facilitating stronger synergies between Technology Park and Curtin University. Encourage bike / e-mobility access.
- 3 Make State Government freehold land between De Laeter Way and Kent Street available for development of Office spaces and other complementary land uses to support future transit.
- 4 Allowance for new street connection from Burvill Court, to create a public link that supports future development and better connection to future residential to the north.
- 5 New east-west connection to Hayman Road as an extension of a re-routed Dick Perry Avenue, with potential to utilise and convert existing tree-lined internal access into a public road. Allowance for drainage west of new road.
- 6 Re-orientated public open space to run north-south in order to retain existing trees, and enhance 'campus-like' landscape character upon entry to the Precinct.
- 7 Encourage complementary entertainment land uses to cluster around the Hub and create a high quality public setting to support the business and research community.
- 8 New 12m road reserve to create vehicle access to sites abutting new north-south entry Public Open Space to minimise crossovers to Brodie-Hall Drive.
- 9 10m wide Public Access Way to improve walkability and access to future transit along Kent Street, facilitated by redevelopment of lots either side (5m wide strip of land on each side of the lot boundary).

FURTHER OPPORTUNITIES

- 10 Enhance walking and cycle experience and connectivity through the PSP area and to surrounding residential and educational areas and future transit stops.
- 11 Approximately 15m wide linear Publicly Accessible Private Open Space to enhance existing streetscape and east-west green linkage, to retain east-west landscape and biodiversity corridor.
- 12 Indicative new public access through the large State Gov. landholding, including internal gathering spaces or squares connected by linear routes between buildings (either public or private, to be determined).
- 13 Maintain generous landscape buffer adjacent Hayman Road and Kent Street to retain existing character and green linkages adjacent major movement corridors.

Draft Concept Plan BENTLEY TECHNOLOGY PARK

A DevelopmentWA Project

plan:
20/054/0281

scale:
1:4000@A3 | 1:2000@A1

0 40 80m

date:
28/04/2024

grid:
PCG 94

airial:
Mar 2024

designed:
ED

checked:
BDM

drawn:
CR

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Appendix B

Water Corporation Runoff Model Link Node Diagram



Appendix C

Modelling Assumption Report

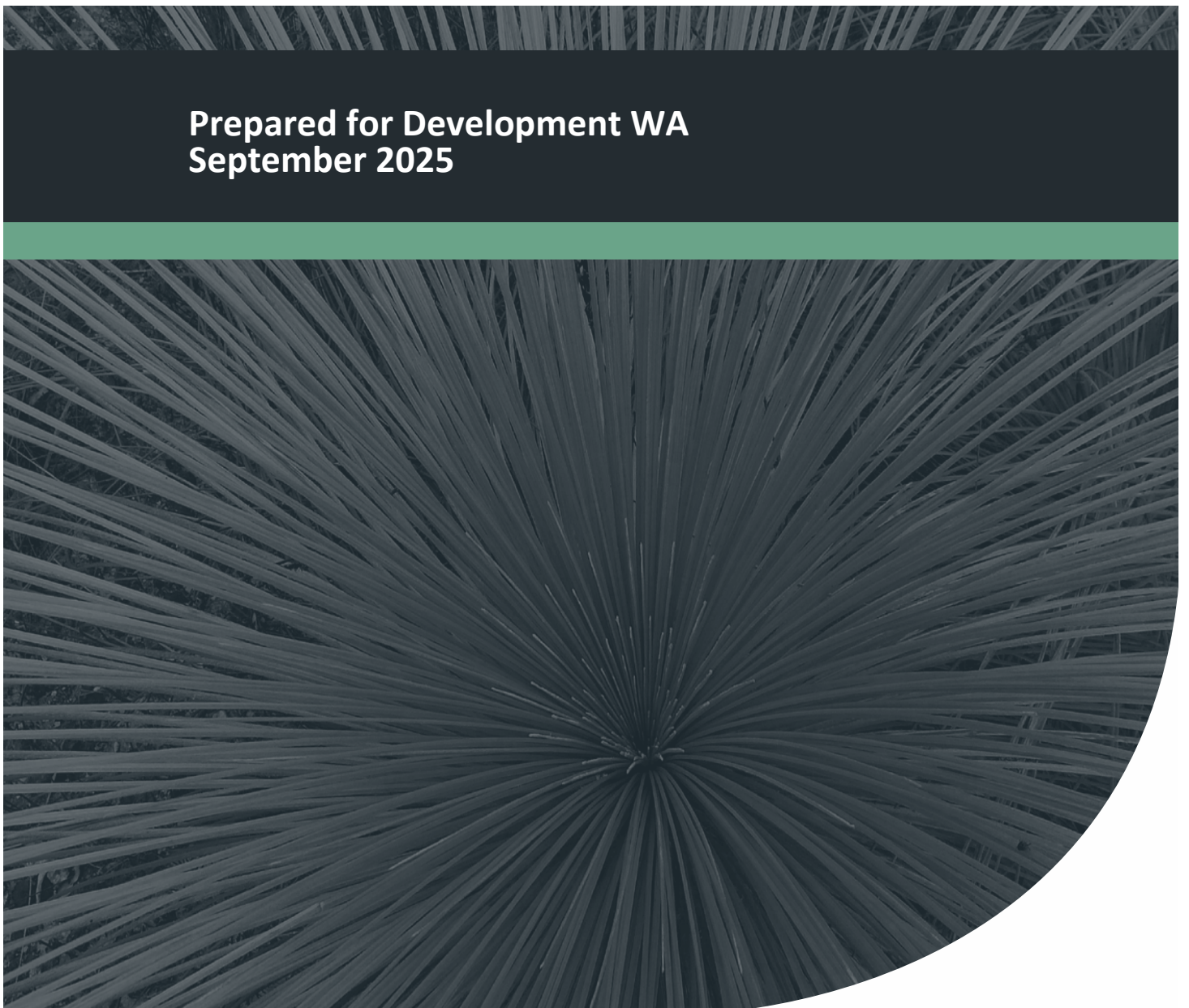


Modelling Assumptions Report

Bentley Technology Park Precinct Structure
Plan

Project No: EP24-058(01)

**Prepared for Development WA
September 2025**



Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



Document Control

Doc name:	Modelling Assumptions Report Bentley Technology Park Precinct Structure Plan				
Doc no.:	EP24-057(01)--007 MDB				
Version	Date	Author		Reviewer	
1	September 2025	Mark Bretnall	MDB	Ben Brash	BPB
	Included as an appendix of the LWMS				

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Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



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Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



1 Background

This report provides a summary of the assumptions adopted by the detailed hydrological and hydraulic modelling that was undertaken to inform the Bentley Technology Park (BTP) local water management strategy (LWMS) and to support the BTP Precinct Structure Plan (PSP) to demonstrate that the development is capable of managing the drainage requirements for the major (1% Annual Exceedance Probability (AEP)) rainfall event and maintaining the existing hydrology.

The site is approximately 58 ha in size and is 7.8 km south of the Perth central business district (CDB). The site is bounded by Hayman Road to the west and south, and Jarrah Road to the east.

2 Methodology

XPSWMM hydrologic and hydraulic modelling software (v21.3) was used to calculate the surface water runoff volumes within the road reserves and lots associated with the development of BTP.

The hydrologic component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrologic model include:

- Runoff is proportional to slope, area, infiltration and percentage of imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from surveyed topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Generally, assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a 1% annual exceedance probability (AEP)). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.015 (Manning's n) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Where relevant median swales, bio-retention areas (BRAs), and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.

2.1 Rainfall

The ensemble temporal patterns obtained from the Australian Rainfall and Runoff (AR&R) Data Hub (AR&R 2019) were used for the rainfall analysis. Up to eight durations ranging between 15 mins and 72 hours were tested, with the peak flood elevation being assessed as the determining result.

Following the process suggested by AR&R (Ball J et al. 2019), the highest mean duration was selected as the critical duration. AR&R also recommends that when it is not practical to run the entire ensemble array, the ensemble that produces the result closest to the mean (for the critical duration) should be adopted.

- Pre-development 1% AEP event critical duration was the 15min duration ensemble 8.
- Post development 1% AEP event critical duration was the 15min duration ensemble 8.

Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



3 Pre-development model

3.1 Pre-development model

The catchment parameters and have been provided by Water Corporation (WC) and have been used as the basis for the pre-development modelling of the site. This includes the using in an initial loss (IL) value to represent on-site soakage and runoff coefficients for the determination of runoff generated within the site. It should be noted that the IL for lot impervious areas has increased when compared to WC modelling to better represent on-lot soakage when calibrating to the WC model.

An initial loss-continuing loss model was adopted to account for catchment losses. Loss values, roughness and runoff coefficients were based on the surrounding environment of the site and is shown in **Table 1**.

Table 1: Pre-development model parameters

Land type	Initial loss (mm)	Continuing loss (mm)	Manning's n
Road surface	1	0	0.02
Road verge	10	0	0.05
Lot impervious (WC)	1	0	0.02
Lot impervious (Emerge)	23.5	0	0.02
Lot pervious	10	0	0.05

The pre-development catchment area was assumed to be made up of the following sub catchments defined by WC. These are summarised in **Table 2**.

Table 2: Pre-development catchment areas (ha)

Catchment	Pervious (ha)	Impervious (ha)
Ct-E1	5.60	1.87
Ct-E2	1.61	0.54
Ct-E3	2.54	0.85
Ct-E4	1.02	0.34
Ct-E5	7.40	2.47
Ct-E6	2.47	0.57
Ct-W1	18.18	0.19
Kent St	3.24	1.03
Hayman Rd (W)	2.21	2.21
Hayman Rd (E)	1.95	0.84

Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



3.1 Discharge

The 1% AEP rainfall event discharge for each of the discharge locations is shown in **Table 3**.

Table 3: Pre-development discharges

Discharge location	Sub catchments	Pre-development discharge (m ³ /s)
		1% AEP event
Discharge 1	Ct-E5, Ct-E6	0.64
Discharge 2	Ct-E3, Ct-E4	0.41
Discharge 3	Ct-E1, Ct-E2	0.73
Discharge 4	Hayman Rd (east)	0.35
Discharge 5	Kent St	0.47

Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



4 Post-development model

An initial loss-continuing loss model was adopted to account for post-development catchment losses. The post-development catchment area remained the same as the pre-development catchment areas provided by WC land types and loss values were based on the structure plan design, typical infiltration rates for the soils which occur onsite and based on project team experience. The total area of impervious surface has increased to represent the increase development within the site in the post-development environment. **Table 4** summarises the loss parameters used within the post-development model.

Table 4: Post-development parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Road Surface	1	0	0.02
Road Verge	10	0	0.05
Lot impervious	23.5	0	0.02
Lot pervious	10	0	0.05

A summary of the post-development catchment information is provided in **Table 5** with the catchment plan and basin location shown in **Figure 5** of the LWMS.

Table 5: Post-development catchment areas (ha)

Catchment	Pervious (ha)	Impervious (ha)
Ct-E1	4.62	4.62
Ct-E2	1.08	1.08
Ct-E3	2.05	2.05
Ct-E4	0.81	0.81
Ct-E5	5.96	5.96
Ct-E6	1.58	1.58
Ct-W1	10.36	10.36
Kent St	2.13	2.13
Hayman Rd (W)	2.21	2.21
Hayman Rd (E)	1.95	0.84

The following assumptions were incorporated into the model:

- Storage
 - BRAs retains runoff from events up to and including the frequent event (i.e. first 15 mm).
 - BRAs have 1:3 side slopes and maximum depth of 500mm.

Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



- Infiltration
 - A hydraulic conductivity of 2 m/day is assumed for the BRAs (inclusive of a 50% clogging factor) and 4 m/day for the existing Hayman Rd WC compensating basin.
 - Infiltration through base area and side slopes of the basins are considered in the overall infiltration rating curve for these areas.

Modelling Assumptions Report

Bentley Technology Park Precinct Structure Plan



5 References

5.1 General references

The references listed below have been considered as part of preparing this document.

5.2 Online references

Australian Rainfall and Runoff (AR&R) 2021, ARR Data Hub, viewed 6 March 2025, Available from: <https://data.arr-software.org/>.

Bureau of Meteorology (BoM) 2021a, Climate Data Online, viewed 6 March 2025, Available from, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.

Bureau of Meteorology (BoM) 2021b, Design Rainfall Data System (2016), viewed 4 February 2025, Available from, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.