Appendix E

Draft Urban Water Management Plan

Prepared for:

ACOTT EQUITIES PTY LTD

Lot 12 Sultana Road East, Forrestfield

Urban Water Management Plan

September 2024

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Document Version	Issue Date
J7456a	23 May 2024
J7456b	18 September 2024

	Name	Signature	Date
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Approved by	Jim Davies		18 September 2024

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1. EXECUTIVE SUMMARY

This Urban Water Management Plan (UWMP) has been prepared by JDA Consultant Hydrologists on behalf of Acott Equities Pty Ltd for urban development of Lot 12 Sultana Road East, Forrestfield. This document has been prepared to support subdivision and has been prepared in accordance with Better Urban Water Management (WAPC, 2008).

A summary of the development design and compliance to objectives for UWMP is provided in Table 1.

TABLE 1: SUMMARY OF UWMP DESIGN PRINCIPLES AND CRITERIA

Key Guiding Principles		
• Facilitate implementation of sustainable best practice in urban water management. • Encourage environmentally responsible development. • Provide integration with planning processes and clarity for agencies involved with implementation. • To minimise public risk, including risk of injury or loss of life. • Protection of infrastructure and assets from flooding and inundation. • To maintain the total water cycle.		
Category	**UWMP Objective**	**Design and Compliance to Objective**
Water Conservation and Sustainability	• Consider alternative fit for purpose water sources where appropriate and cost-effective. • Aim to achieve the State Water Plan target for water use of 100 kL/person/yr. • Streetscape areas to be at least 50% native plants. • Buildings are to comply with water efficiency standards introduced into the building code.	• All houses built to current NCC guidelines including include water efficient fixtures and fittings. • Local native plants will constitute a minimum of 50% of landscape and streetscape treatment.
Stormwater Management	• Runoff from the 'small' event or first 15 mm of rainfall from roads to be treated and infiltrated at-source where possible. • Runoff for events up to the 1% AEP to be managed and conveyed to a suitable flood detention area. • Manage surface water flows from major events to protect infrastructure from flooding and inundation. • Use of subsoil beneath drainage areas to facilitate adequate drainage of stormwater runoff.	• All Lots connected to the road drainage network to convey the first 15 mm of rainfall. • Roadside swales treat internal road runoff for the first 15 mm of rainfall. • Stormwater runoff from internal roads for the minor and major events discharge to the Hales Estate detention storage in Crumpet Creek. • Finished floor levels minimum 0.5 m above the 1% AEP top water level of the Hales Estate detention storage and 0.3 m from the adjacent road network.
Groundwater Management	• Protection of infrastructure and assets from flooding and inundation by high seasonal groundwater levels, perching and/or soil moisture. • Managing and minimising changes in groundwater levels and groundwater quality following development. • Installed subsoil drainage where intercepting and capturing groundwater is to be treated prior to discharge to the downstream system.	• Residential lots have a minimum separation of 1.5 m from the design groundwater level. • Subsoil drainage proposed in road reserve to protect against any potential rise in perched water table and capture infiltrated water from roadside swales.
Water Quality	• Establishment of 'small' event vegetated treatment areas to treat a minimum of 2% of connected impervious areas of road catchments. • Non-structural controls to reduce applied nutrient loads.	• Structural and non-structural controls used to form a treatment train approach for water quality management. • Use of local native plants in streetscape treatments and street sweeping to manage sediment and nutrients in road runoff. • The 'small event' storage treated in vegetated roadside swales. It is underlain with minimum 300 mm of amended soil material with PRI ≥ 10 and minimum saturated hydraulic conductivity of 5 m/day.

A number of assumptions have been made in the preparation of this report, with the relevant sections of this report highlighted in Table 2. Other assumptions and parameters are more comprehensively documented in this report.

TABLE 2: KEY HYDROLOGICAL PARAMETER VALUES USED IN THIS REPORT

Parameters	Section	Value or Source
Design Rainfalls	5	Bureau of Meteorology (2016)
Rainfall temporal patterns	5	Australian Rainfall & Runoff (Ball et al., 2019)
Hydraulic conductivity of imported fill	6	minimum 5 m/day

2. PROPOSED SUBDIVISION

Lot 12 Sultana Road East, Forrestfield is a proposed residential development located within the south-east corridor of the Perth Metropolitan Region in the City of Kalamunda, approximately 12 km east of the Perth CBD, Figure 1. The Study Area is bound by Sultana Road East to the northeast, Hales Estate to the southwest and future residential development to the northwest and southeast, Figure 1.

The proposed subdivision will create 18 Residential Lots with size ranging from 180 m^2 to 391 m^2 and a Group Housing site with 10 Lots of average size of 278 m^2, Figure 1.

Table 3 provides a breakdown of the proposed land use areas within the Study Area.

TABLE 3: LAND USE BREAKDOWN

Land Use Description	Area (ha)
R25 Residential Lots	0.16
R30 Residential Lots	0.38
R40 Residential Lots	0.23
Road Reserve	0.23
Total	1.00

3. PLANNING APPROVALS

3.1 Regional Planning

The Study Area is currently zoned *Urban* in the Metropolitan Region Scheme (WAPC, 2015) and *Urban Development* in the City of Kalamunda Local Planning Scheme No. 3 (City of Kalamunda, gazetted 22 March 2007).

3.2 Local Structure Plan

The Study Area falls within the Forrestfield U7 Outline Development Plan (ODP) which was adopted in February 2013 and provides strategic direction to coordinate the land use and development of the area.

A Local Structure Plan (LSP) was prepared for Lots 14, 15, 515, 3000 and 9502 Hawtin Rd, Forrestfield that provided an updated development layout from that shown in the ODP (Rowe Group, 2016). From a water management perspective, the LSP was supported by the *Local Structure Plan – The Hales, Lots 14, 15, 515, 3000 and 9502 Hawtin Rd, Forrestfield, WA - Local Water Management Strategy* (JDA, 2016b) that outlined peak flows in Crumpet Creek, detention basin design and minor creek modifications.

3.3 Subdivision

This UWMP has been prepared to support the *Lot 12 Sultana Rd, Forrestfield - Subdivision Concept Plan* (Taylor Burrell Barnett, 2024) (Appendix A) in accordance with the water management reporting process outlined in Better Urban Water Management (WAPC, 2008).

4. EXISTING SITE CHARACTERISTICS

4.1 Climate

The Forrestfield area is characterised by a Mediterranean climate with hot dry summers and cool wet winters.

Rainfall data has been obtained from the Bureau of Meteorology for the nearby *Perth Airport* rain gauge (Site ID. 009021) located 5.5 km north-west of the Study Area, Figure 2.

The average annual rainfall, 1945 to 2022, for Jandakot Aero was 760 mm, with 30-year and 10-year averages of 686 mm and 668 mm, respectively. This represents a 9.7% (30-year average) and 12.1% (10-year average) decrease from the average annual rainfall for Jandakot Aero. The general decline in rainfall observed across Perth Airport rain gauge is consistent with the decreasing rainfall trend across south-west Western Australia (DoW, 2015). The seasonal rainfall distribution has also altered since 1990, with a reduction of average monthly totals in the winter months, but no reduction or increase in the summer months.

Average annual pan evaporation is estimated at 1,770 mm for the Study Area from pan evaporation data (2002 to 2022) from the Department of Primary Industries and Regional Development (DPIRD) South Perth weather station. This is slightly lower than the estimate of 2,080 mm from Luke *et al.* (1987).

4.2 Topography

The topography of the Study Area generally grades from the north-east boundary at 47.60 mAHD to southwest boundary at 46.00 mAHD, Figure 3.

4.3 Geology and Soils

Surface geology mapping by Jordan (1986) is shown on Figure 4.

Surface soils across the Study Area are classified by Jordan (1986) as Mgs1 Pebbly Silt across the Study Area. The soils are strong brown silt with common, fine to occasionally coarse-grained, sub-rounded laterite quartz, heavily weathered granite pebble, some fine to medium-grained quartz sand, of alluvial origin.

This is the same mapping classification for the adjacent Hales Estate Stages 2 to 9. Therefore, the geotechnical investigation performed for the adjacent Hales Estate Stages 2 to 9 is also considered representative of the Study Area as described further below.

Geotechnical investigation conducted by CMW Geosciences in May 2015, and Golder Associates in January and February 2016 incorporated excavation of 99 test pits across the Hales Estate Stages 2 to 9. The surface geology results from the geotechnical investigation are generally consistent with the mapping by Jordan (1986).

The subsurface profile was summarised by Golder Associates (2016) as follows:

> *Topsoil: SAND/Silty Sand – fine to medium grained, grey-brown, with approximately 10% to 15% low plasticity silt, trace roots and vegetation, loose to medium dense, extending to depths of between about 0.1 m to 0.3 m, overlying.*
>
> *Non-Reactive Soils: Sand, Silty/Clayey Sand, Sandy Gravel – fine to coarse grained, yellow to yellow-brown, with approximately 10% to 20% low plasticity fines, fine to medium grained, sub rounded to sub-angular gravel, loose to dense, extending to depths of between about 0.3 m and the maximum depth investigated of 2.5 m where present, overlying.*

> *Reactive Soils: Clayey Sand, Sandy Clayey Gravel, Sandy Clay – fine to coarse grained, yellow to yellow-brown, approximately 20% to 60% low plasticity clay, fine to medium grained, sub rounded to sub-angular gravel, occasionally weakly cemented, loose to very dense/very stiff to hard, extending to the maximum depth investigated of 3.0 m where present.*

The geotechnical investigation report concludes that due to the relatively low permeability of the sand and the relatively shallow depth to clayey soil across the site, soakwells are not suitable for the site and lot connection pits are required.

4.4 Acid Sulphate Soils

The Swan Coastal Plain Acid Sulphate Soils (A.S.S) risk mapping (DWER, 2018) indicates that within the Study Area there is no known risk of A.S.S at up to 3 m depth, Figure 4.

4.5 Groundwater

4.5.1 Groundwater Levels

There is no regional groundwater mapping for the Study Area with groundwater contours shown in Perth Groundwater Atlas (DoE, 2004) terminating west of the site near Roe Hwy. Regional groundwater contours (JDA, 2016) for the Hales Estate indicates groundwater is generally 20 m below the natural surface.

There are no monitoring bores installed within the Study Area. A monitoring bore MB4 installed by Strategen (2016) for the Hales Estate is located near the southern corner of the Study Area. The water level recorded (Table 4) indicates a perched water table on clayey sand. For design of the stormwater management system, a design groundwater level (DGL) is set to be at the interface of the clayey soils, which is around 2.5 m below natural surface at approximately 44.5 mAHD.

TABLE 4: DETAILS OF GROUNDWATER MONITORING BORE, MB4

Bore ID	GDA 1994 Coordinates		Natural Surface (mAHD)	Total Depth	Installation Date	Water Level Recorded	
	Easting	Northing				15/12/15	31/10/16 (Maximum)
MB4	406587	6462278	46.27	3.75	17/11/15	Dry	43.68

4.5.2 Groundwater Quality

There is no groundwater quality data available within the Study Area as the regional groundwater is generally 20 m below the natural surface.

4.5.3 Groundwater Resources for Irrigation

The Department of Water and Environmental Regulation manages the groundwater of the State under the Rights in Water and Irrigation Act 1914 (RIWI Act). The Study Area is located within the Shire of Kalamunda Groundwater Sub-Area of the Perth Groundwater Management Area.

The Superficial Aquifer is generally considered the most feasible irrigation water supply source for the Study Area.

The DWER groundwater allocation limit and water allocations from the Superficial Aquifer are shown in Table 5 and are based on a Resource Allocation Report from DWER as at 01 November 2023.

TABLE 5: DWER GROUNDWATER RESOURCE ALLOCATION AND LIMIT, 01 NOVEMBER 2023

GW Sub-Area	Aquifer	Allocation Limit (kL/yr)	Allocated Volume (kL/yr)	% Allocated & Committed
Shire of Kalamunda	Perth - Superficial Swan	3,000,000	2,618,865	87.3

As of 01 November 2023, the Resource Allocation Report indicates the superficial aquifer was allocated (87.3%) with 2,618,865 kL/year allocated.

The superficial aquifer may be a potential water source for the temporary irrigation of vegetated swales and any tree pits during the establishment phase of the development.

4.6 Surface Water Hydrology

The Study Area is located within the Swan Avon Lower Swan Catchment (DoW, 2013) of the Swan River and Tributaries system.

There are no existing watercourses within the Study Area. Crumpet Creek is located near the southern edge of the Study Area and flows west into Water Corporation's Main Drain at the boundary of the Perth Airport. The Crumpet Creek Catchment upstream of the Study Area is approximately 420 ha, extending east into the Darling Scarp.

Crumpet Creek flows between August to October annually. Estimated 1% AEP flow rate in Crumpet Creek at Berkshire Rd is 7.1 m^3/s and the 10% AEP flow rate is 4.8 m^3/s as reported by Water Corporation (1998).

4.7 Wetlands

Geomorphic Wetland mapping of the Swan Coastal Plain (DBCA, 2018) shows no wetland mapped within the Study Area. There are no Bush Forever sites located within the Study Area.

4.8 Contaminated Sites

A search of DWER's publicly available Contaminated Site Database (accessed 1 November 2023) indicated no contaminated sites within the Study Area.

5. STORMWATER MANAGEMENT

5.1 Design Overview

Local stormwater management is proposed to be consistent with water sensitive design practices and to meet key objectives and criteria as summarised in Table 1.

The stormwater drainage system has been designed based on management of the 'small', minor and major events.

'Small' event management concentrates on the first 15 mm of rainfall (approximately the 1 EY 1 hour event). The first 15 mm of stormwater runoff from impervious surfaces within a Lot discharges into the road drainage network, via a Lot connection pit due to the inability to infiltrate on-site. Stormwater runoff from road reserve areas are retained and infiltrated in vegetated roadside swales, which also provide water quality treatment. Swales are underlain with a Ø150 subsoil drainage pipe to prevent prolonged ponding and waterlogging and discharge into the road drainage network.

The minor drainage system is designed as a system of drains, pipes, culverts, kerbs, gutters, etc. and has the capacity to convey stormwater runoff generated by low frequency storms, typically less than the 20% AEP for residential areas.

The major drainage system is defined as the overland flow path arrangement of roads and attenuation areas planned to provide safe passage of stormwater runoff from extreme rainfall events (up to the 1% AEP).

Stormwater runoff from the Study Area (and adjacent Lot 13) discharge directly into the adjacent Hales Estate Stage 1 Detention Storage area, as outlined in the Hales Estate Stage 1 UWMP (JDA, 2016).

Stormwater runoff from Lots adjacent to Sultana Rd East discharge into the local pipe drainage system.

The stormwater management plan for the Study Area is shown on Figure 5 with engineering details presented in Appendix B.

5.2 The Hales Estate Stormwater Management Design

Previous water management design and reporting has been performed for the adjacent Hales Estate to support local structure planning and detailed subdivision design. These include:

- *Local Structure Plan – The Hales, Lots 14 ,15, 515, 3000 and 9502 Hawtin Road, Forrestfield WA: Local Water Management Strategy*. (JDA, 2016b)
- *The Hales Estate, Lot 9502 Lovett Drive, Forrestfield – Stage 1 Urban Water Management Plan*. (JDA, 2016)
- *The Hales: Stages 2-9, Lots 14 ,15 & 515 Hawtin Road and 9002 Lovett Drive, Forrestfield, Urban Water Management Plan (JDA, 2017)*
- *The Hales: Stages 2-9 – Addendum 1 (JDA, 2021)*

Lot 12 (Study Area) and Lot 13 were identified in these reports as an External Catchment contributing to the Hales Estate Stage 1 Detention Storage (JDA, 2016).

In 2021, the design of the stormwater management system was refined in the area adjacent to and within Crumpet Creek in consultation with the City of Kalamunda. It included two online detention storage areas designed as a widening of Crumpet Creek that are offset and above the low flow channel of the creek. Details of the hydraulic modelling performed is summarised in *The Hales: Stages 2-9 Addendum 1* (JDA, 2021) which is presented in Appendix C.

5.3 Crumpet Creek Design Discharge Criteria

Lot 12 (Study Area) and Lot 13 are shown as a 1.29 ha External Catchment in the approved Hales Estate Stage 1 UWMP (JDA, 2016). This external catchment discharges into the Hales Estate Stage 1 detention storage abutting Crumpet Creek. Peak 1% AEP allowable discharge from this catchment is based on the pre-development flow rate of 14.5 L/s/ha (JDA, 2016). With Lot 12 and Lot 13 both comprising 0.645 ha catchment area each, total allowable discharge from this External Catchment to the Hales Estate is calculated as 19 L/s for the 1% AEP.

5.4 Stormwater Model Parameters

The stormwater management system was modelled using the hydraulic XP-Storm to determine peak flow rates, volumes and levels based on the methodology in *Australian Rainfall and Runoff* (Ball et al., 2019). The rainfall temporal pattern was assumed spatially uniform across the catchment with storms modelled ranging from 30 minutes to 72 hours. Catchment slopes were calculated from road earthwork levels.

The hydraulic XP-Storm model used in *The Hales Stages 2-9 Addendum 1* (JDA, 2021) is the latest model version for the Hales Estate. It has been updated to include Study Area subdivision design as outlined in the following sections.

5.4.1 Post Development Drainage Catchments

There are three post-development stormwater catchments for the Study Area as shown in Figure 5.

- *Catchment A: Northern portion of the Study Area that drains to the Sultana Road East stormwater system through lot connection pits.*
- *Catchment B: Portion of the Study Area that drains to the Hales Estate Stage 1 detention storage.*
- *Catchment C: Portion of Lot 13 that drains to the Hales Estate Stage 1 detention storage through Catchment B.*

Land use areas for each catchment are presented in Table 6.

TABLE 6: CATCHMENT AREAS

Catchment	Road Reserve (ha)	Residential Lots (ha)	Total (ha)
Catchment A	-	0.156	0.156
Catchment B	0.230	0.613	0.843
Catchment C	0.086	0.559	0.645
Total	0.316	1.328	1.664

5.4.2 Loss Model

Rainfall-runoff loss model parameters adopted for each land use is presented in Table 7. This loss model is the same as that adopted in the Hales Stage 1 and Stages 2-9 UWMP's (JDA, 2016 & 2017) for consistency.

TABLE 7: CATCHMENT RAINFALL-RUNOFF LOSS MODEL

Land Use	Initial Loss (mm)	Proportional Loss (%)
Residential Lots (R20)	0	30
Residential Lots (R30 & R40)	0	20
Group Housing (R30)	0	20
Road Reserve	1.5	20

5.5 Small Event Drainage

The following design is adopted for management of the first 15 mm of rainfall ('small' event) for all catchments:

- Residential Lots & Group Housing: All Lots connect directly into the local drainage network through standard lot connection pits to convey the first 15 mm of rainfall.
- Roads: Stormwater runoff from roads is captured and infiltrated in roadside swales in the road reserve.
- Roadside swales (bio-retention area) are underlain with amended soils and planted with suitable plant species, consistent with the *Vegetation Guidelines for Biofilters in South-West Western Australia* (Monash University, 2014). Swales are underlain with subsoil drainage to control groundwater levels and prevent waterlogging.

Table 8 shows the runoff volume from the Study Area that is required to be treated. The vegetated treatment base area provided of 88 m^2 meets the FAWB (2009) criterion for a minimum treatment area of 2% of the connected impervious area (39 m^2). The total provided storage treatment volume of 29 m^3 also meets the 15 mm runoff volume of 29 m^3.

TABLE 8: SMALL EVENT MANAGEMENT

Small Event (15 mm)	Catchment Details	
Impervious Road Catchment Area (m^2)	1,836	
2% of Impervious Catchment Area (m^2)	36.7	
Rainfall (mm)	15	
Runoff Volume (m^3)	27.5	
Roadside Swale Details	Swale 1	Swale 2
Base Area (m^2)	38	50
Top Area (m^2)	48	60
Maximum Allowable Water Depth (m)	0.30	0.30
Side Slope (v:h)	1:4	1:4
Storage Volume (m^3)	12.9	16.1

Lot 13 will need to provide sufficient roadside swale storage for management of the first 15 mm runoff generated from within the Lot 13 road areas.

The 'Small' Flood Event Plan including location of roadside swales is shown on Figure 6.

5.6 Minor Drainage System

The following design is adopted for management of the minor event (for events up to the 20% AEP event):

<u>Catchment A:</u>

- All Lots connect directly into the Sultana Road drainage network through standard lot connection pits.

<u>Catchments B & C:</u>

- Runoff generated in Lots connect directly into the local drainage network through a standard lot connection pit.
- Stormwater runoff from roads flow into roadside swales. When the capacity of the roadside swales is exceeded, stormwater overflows into the underground pipe road drainage network that discharges to the Hales Estate

detention storage downstream of the Study Area. The pit and pipe road drainage network will be sized to manage events up to the 20% AEP.

Modelling results of the Hales Stage 1 detention storage for the minor event including storage volumes and peak water levels are summarised in Table 9. Results for three development stages are presented which include:

- Existing: Current Hales Estate Storage Detention design (JDA, 2017).
- Interim: Existing design with the addition of discharge from the Study Area (Lot 12).
- Ultimate: Existing design with the addition of discharge from the Study Area (Lot 12) and Lot 13.

The Minor (20% AEP) Flood Event Plan is shown on Figure 7 for the Ultimate development stage.

5.7 Major Drainage System

The major drainage system is designed to manage rainfall events greater than the 20% AEP event up to the 1% AEP event. Key points of the major drainage system design adopted are as follows:

Catchment A:

- When the minor drainage system on Lots through the lot connection pit is full, excess stormwater will flow overland into the Sultana Road drainage network.

Catchment B & C:

- When the minor drainage system on Lots through the lot connection pit is full, excess stormwater will flow overland into the local drainage network.
- When the minor drainage pit and pipe system for road runoff is full, excess stormwater will bypass minor drainage structures and flow overland within the road carriageway towards the Hales Stage 1 detention storage.
- Minimum habitable building floor levels will have a 500 mm (0.5 m) clearance from the 1% AEP top water level of the detention storage and 300 mm (0.3 m) from the adjacent road flood level.

Modelling results of the Hales Stage 1 detention storage for the major event including storage volumes and peak water levels under the 3 different development stages are summarised in Table 9. Peak outflow is within the allowable criteria of 19 L/s. The Major (1% AEP) Flood Event Plan is shown on Figure 7 for the Ultimate development stage.

The results demonstrate the Hales Estate detention storage can adequately manage the stormwater runoff from the Study Area up to the 1% AEP event with minimal impact on the existing Hales Estate stormwater design.

TABLE 9: STORMWATER MODELLING RESULTS - MINOR AND MAJOR EVENTS

The Hales Estate Detention Storage Details	Parameter	Existing Development	Interim Development	Ultimate Development
Catchment Areas	Residential Lots (ha)	2.52	3.13	3.69
	Road Reserve (ha)	1.36	1.59	1.68
	Public Open Space (ha)	0.57	0.57	0.57
Detention Storage Details	Invert Level (mAHD)	44.32	44.32	44.32
	Side Slope (v in h)	1 in 6	1 in 6	1 in 6
	Creek Invert (mAHD)	44	44	44
	Basin Outlet Invert (mAHD)	44.32	44.32	44.32
	Base Area (m^2)	3,110	3,110	3,110
Minor Event (20% AEP)	Critical Storm Duration (hrs)	6	6	6
	Storm Rainfall (mm)	49	49	49
	Peak Water Level (mAHD)	44.91	44.91	44.91
	Maximum Depth (m)	0.59	0.59	0.59
	Peak Water Level Area (m^2)	4,300	4,340	4,390
	Peak Water Storage Volume (m^3)	2,200	2,200	2,210
Major Event (1% AEP)	Critical Storm Duration (hrs)	6	3	3
	Storm Rainfall (mm)	83	67	67
	Peak Water Level (mAHD)	45.31	45.31	45.32
	Maximum Depth (m)	0.99	0.99	1
	Peak Water Level Area (m^2)	5,300	5,330	5,400
	Peak Water Storage Volume (m^3)	4,100	4,160	4,224

5.8 Lot Finished Levels Relative to Stormwater

The drainage management criteria for determination of building floor levels shall be a minimum 500 mm above the 1% AEP top water level of the downstream Hales Estate detention storage as per the recommendations in DWER (2017a).

Finished lot levels in the Study Area range from 46.56 mAHD to 48.17 mAHD (Appendix A). Lots adjacent to the Hales Estate Detention Storage range from 46.56 mAHD to 46.76 mAHD, satisfying the minimum 500 mm separation required to the detention storage 1% AEP top water level of 45.32 m AHD (for Scenario 3).

5.9 Water Quality Management

5.9.1 Non-Structural Controls

Non-structural source controls to reduce nutrient export from the site focus on reducing the need for nutrient inputs into the landscape. The following strategies are adopted:

- Local native plants make up a minimum 50% of the planted areas and streetscape treatments. Any non-local species will be selected for drought tolerance and low fertiliser requirements;
- Maintenance practices such as street sweeping to remove sediment build-up, particularly during the development and construction phase (to be coordinated with the City of Kalamunda).

5.9.2 Structural Controls

Structural source controls are proposed to complement the non-structural source controls and provide a complete stormwater treatment train.

The *Stormwater Management Manual for Western Australia* (DWER, 2022b) outlines expected pollutant removal efficiencies for detention/retention systems. While DWER (2022b) does not provide expected pollutant removal efficiencies for all BMPs, application of a treatment train approach such as in this UWMP by using a combination of non-structural and structural measures will achieve BMP outcomes for water quality (Table 10).

TABLE 10: BMP WATER QUALITY PERFORMANCE

Parameter	Structural Controls Nutrient Output Reduction[1]	
	Roadside Swale[2]	Detention/Retention Measures
Total Suspended Solids	80%	65-99%
Total Phosphorus	60%	40-80%
Total Nitrogen	50%	50-70%
Gross Pollutants	-	> 90%

1. Typical Performance Efficiencies via DWER (2022b)
2. Mean % Removal via DWER (2022b)

The following structural control is therefore considered appropriate for the Study Area:

- Roadside swales (bio-retention area) planted with suitable plant species to assist in water quality improvement. Planting will be consistent with *Vegetation Guidelines for Stormwater Biofilters in the south-west of Western Australia* (Monash University, 2014).
- The use of amended soils beneath the roadside swales to treat infiltrated stormwater runoff.

5.9.3 Water Quality Treatment Areas

Guidance for design of the roadside swales is provided in the following guidelines:

- DWER (2017a) *Decision Process for Stormwater Management in Western Australia* – the criteria to capture and treat the first 15 mm of rainfall;
- Payne et al. (2015) *The Adoption Guidelines for Stormwater Biofiltration Systems*;
- *FAWB (2009) Stormwater Biofiltration Systems – Adoption Guidelines;*
- *DoW (2011) Water Sensitive Urban Design – Biofilters; and*
- *Monash University (2014) Vegetation Guidelines for Stormwater Biofilters in the South-West of Western Australia* – for plant selection, density and distribution as appropriate.

Guidelines typically indicate a minimum 300 mm of amended soil media is required in all treatment areas, to support vegetation and treat nutrients. Treatment area should also be minimum of 2% of the connected impervious areas to provide sufficient treatment capacity. The proposed treatment area for the Study Area meets this minimum treatment area requirement.

The minimum specifications for the roadside swales are presented in Table 11.

TABLE 11: MINIMUM SPECIFICATIONS FOR TREATMENT AREA

Item	Specification
Amended soil media	• Minimum 300 mm thick. • Minimum hydraulic conductivity of 5 m/day. • PRI >10. • Light compaction only. • Total clay and silt fraction <3% in total (w/w). • Organic matter content <5% (w/w). • Phosphorus content <80 mg/kg.
Maintenance	• 12 months following initial planting.

5.9.4 Disease Vector and Nuisance Insect Management

Structural stormwater management systems are designed to minimise the risk of chironomid midge and mosquito breeding. Infiltration, evapotranspiration and drawing down of water via subsoil drainage underlying the roadside swale to prevent pooling for longer than three days (72 hours) in late spring to early autumn will prevent completion of the larval stages of the mosquito life cycle (DWER, 2022b), as per requirement of the Department of Health and City of Kalamunda.

6. GROUNDWATER MANAGEMENT

6.1 Groundwater Levels and Management

Groundwater management for the Study Area has been prepared in line with the design criteria presented in the Stormwater Management Manual for Western Australia (DWER, 2022b).

Groundwater management is generally required to ensure minimum separation of 1.5 m between finished lot level and a controlled groundwater level (CGL). This is generally achieved through the use of a combination of imported fill and/or subsoil drainage to limit perched water table rise.

For the Study Area, clean free-draining sand fill, where required, will be used to provide sufficient separation between finished lot levels and CGL. JDA recommends the sand fill is to have a minimum hydraulic conductivity of 5 m/day to achieve the required separation to groundwater. If lower hydraulic conductivity fill is used, there is risk of saturation of soil profile.

Subsoil drainage is proposed within road reserves and beneath roadside swales pits to promote infiltration and prevent waterlogging, and is also a contingency measure to protect infrastructure in the event of any perched water table rise. Figure 8 shows an indicative subsoil drainage layout that discharges to the neighbouring Hales Estate Detention storage.

6.2 Lot Finished Levels Relative to Groundwater

Lot finished levels should be a minimum 1.5 m above the design groundwater level (DGL) which is around 2.5 m below the pre-development surface. Finished lot levels in the Study Area range from 46.56 mAHD to 48.17 mAHD, Appendix A, and indicate all lots have in excess of 1.5 m separation between finished lot levels and DGL.

6.3 Groundwater Quality Management

Small event runoff from roads will discharge into the tree pit treatment areas and be treated within planted vegetation (Nitrogen removal) and amended soils (Phosphorus removal).

No groundwater quality management practices are proposed as Hales Estate indicates that groundwater levels are generally 20 m below the natural surface.

7. WATER EFFICIENCY MEASURES

7.1 Residential Lots

To achieve water efficiency targets, households are to be built consistent with current National Construction Code water efficiency standards.

The State Planning Policy 2.9 regarding water resources (WAPC, 2006) requires new developments to employ a total water cycle approach to the consideration of water resources. This section addresses water conservation measures, fit for purpose non-potable supply, and refers to the potable supply strategy and wastewater strategy. JDA notes that a draft State Planning Policy (SPP) 2.9 was released for public comment in September 2021 which amalgamates and synthesises various SPPs into a single planning document including SPP 2.9. The revised SPP 2.9, once published as final, should be used to further inform appropriate water management measures.

Water Conservation initiatives are vital in reducing water demand and can reduce strain or delay timing of potable water supply infrastructure.

The Water Conservation Strategy for the development includes:

- Residential zoning with smaller lots to reduce garden (ex-house) use of water;
- Use of water-wise practices at the lot scale, including water efficient fixtures and fittings (WELD rated taps, showerheads, toilets, appliances, rainwater tanks) and water-wise landscaping including native plant species; and
- All dwellings are to be built to 6-star building standards as per the current National Construction Code [NCC]. Note the NCC 2022 was published on 01 October 2022 and incorporates a minimum 7-star energy efficient rating for new dwellings. NCC 2022 will be adopted on 01 May 2023 by the WA Government but there will be transitional period in implementation of the new code with the residential energy efficiency provisions mandatory from 01 May 2025 after which all new dwellings are to be 7-star rated.

Conservation measures aim to reduce scheme water consumption using water efficient appliances and utilising 6-star building and appliance rating schemes towards minimising potable water consumption in the development area within the constraints of the site.

7.2 Roadside Swales

Temporary irrigation of vegetated areas within roadside swales and any tree pits is required during establishment phase. Use of mobile water carts is the most feasible water source for the temporary irrigation.

8. UWMP IMPLEMENTATION PLAN

8.1 Construction Management

8.1.1 Dewatering

Dewatering is required for some elements of subdivision construction including sewer installation. Given the depth of construction, dewatering will only be in the Superficial Aquifer.

Prior to commencement of any dewatering, the construction contractor will need to apply for and obtain from DWER a "Licence to Take Water". A licence is not required for dewatering if the pump rate does not exceed 10 L/s over a period of less than 30 days and the volume of water taken over the period does not exceed 25,000 kL. At the time of this reporting, an application has been submitted to DWER and is being processed.

Dewatering will be carried out in accordance with any licence conditions. Where possible, construction will be timed to minimise impacts on groundwater and dewatering requirement.

It is envisioned that residential lots will be connected to sewerage at the earliest opportunity. Canopy Circuit sewer network to the south west of the Study Area can be extended to and supply sewer to the internal properties of the site, while Sultana Rd East sewer network to the north west of the site can be extended to and supply sewer to the properties of the site facing Sultana Rd East.

8.1.2 Acid Sulphate Soils

Figure 4 generally shows there is no known risk of A.S.S at up to 3 m depth within the Study Area.

If A.S.S is encountered it will be investigated and managed in accordance with the applicable DWER Acid Sulphate Guidelines for Identification and Investigation and Treatment and Management of Disturbed Acid Sulphate Soils (DER, 2015). Specific methods for treatment and holding times for A.S.S are specified in these guidelines.

8.1.3 Sediment Control and Dust Suppression

Construction will occur in a manner consistent with an Erosion and Sediment Management Plan to be prepared by the Civil Contractor.

A Licence to Take Water for dust suppression activities may be required. These types of licences are considered temporary, generally up to 2 years in duration, and may be approved by DWER if the groundwater aquifer is over-allocated.

Alternatively, scheme water or water tanking may be required to facilitate dust suppression should an application for a licence to construct a bore not be approved prior to commencement of earthworks or there is insufficient yield due to the clayey nature of the aquifer.

8.1.4 Lot 13 Drainage Connection

A stormwater drainage connection stub has been provided in the road reserve for Lot 13 to connect their stormwater drainage system into at a future date. Lot 13 need to provide sufficient onsite storage and treatment for the small event (15 mm) prior to discharge into the stormwater system.

8.2 Maintenance

Construction and initial maintenance of the drainage system will initially be the responsibility of the developer but will ultimately by the City of Kalamunda at the end of the 12-month defects liability period. Table 12 presents the proposed maintenance schedule. During the builder's construction phase, the developer will conduct more frequent maintenance of the street drainage, with quarterly street sweeping, inspection of pits, eduction of sediment and rubbish in manholes and removal of debris to prevent blockages.

TABLE 12: MAINTENANCE SCHEDULE FOR DRAINAGE INFRASTRUCTURE

Item	Maintenance Interval		
	Quarterly	Bi-annually	As required
Street Drainage			
Street sweeping to reduce particulate build-up	✓		✓
Removal of debris to prevent blockages	✓		
Eduction of sediment and rubbish in manholes/GPTs	✓		
Roadside Swales			
Inspect for erosion + sediment accumulation		✓	
Assess health of vegetation. Remove dead plants and replace where necessary.		✓	
Inspect for standing water 1 day after rainfall events			✓
Removal of sediment and leaf litter layer build up.			✓

8.3 Monitoring Program

A groundwater and surface water monitoring program is not required given that the presence of shallow clays and no surface water feature.

8.4 Responsibilities and Funding

The key roles and responsibilities for the implementation of this UWMP are presented in Table 13 below, with details on the maintenance of the surface water treatment structures previously outlined in Section 8.2.

TABLE 13: ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION OF UWMP

Management Issue	Responsibility and Funding		
	Developer	City of Kalamunda	Lot Owner
Street Drainage			
Construction	✓		
Maintenance			
• Street sweeping and drainage cleaning (eduction of sediment) to be undertaken quarterly and as required until the end of the 12 month defect liability period inspection.	✓		
• Ongoing (from notification of City acceptance).		✓	
Vegetated Treatment Area			
Construction	✓		
Maintenance			
• Two years, including two winters (period between a successful Practical Completion Inspection and a defects inspection with a written confirmation of City acceptance).	✓		
• Ongoing (from notification of City acceptance).		✓	

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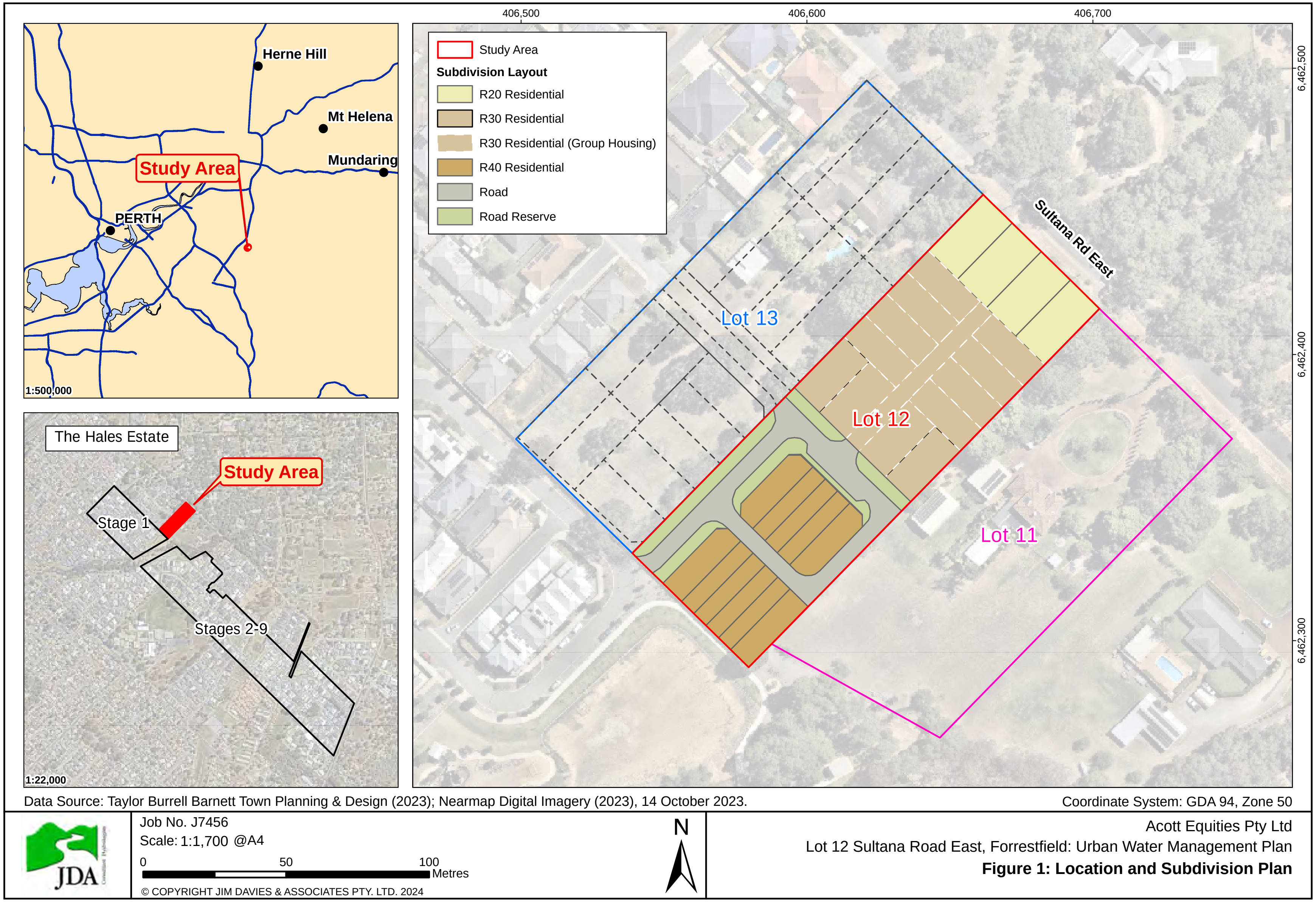
FIGURES


Herne Hill
Mt Helena
Mundaring
Study Area
PERTH
1:500,000
The Hales Estate
Study Area
Stage 1
Stages 2-9
1:22,000
406,500
406,600
406,700
6,462,500
6,462,400
6,462,300
Study Area
Subdivision Layout
R20 Residential
R30 Residential
R30 Residential (Group Housing)
R40 Residential
Road
Road Reserve
Sultana Rd East
Lot 13
Lot 12
Lot 11
Data Source: Taylor Burrell Barnett Town Planning & Design (2023); Nearmap Digital Imagery (2023), 14 October 2023.
Coordinate System: GDA 94, Zone 50
JDA
Job No. J7456
Scale: 1:1,700 @A4
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50
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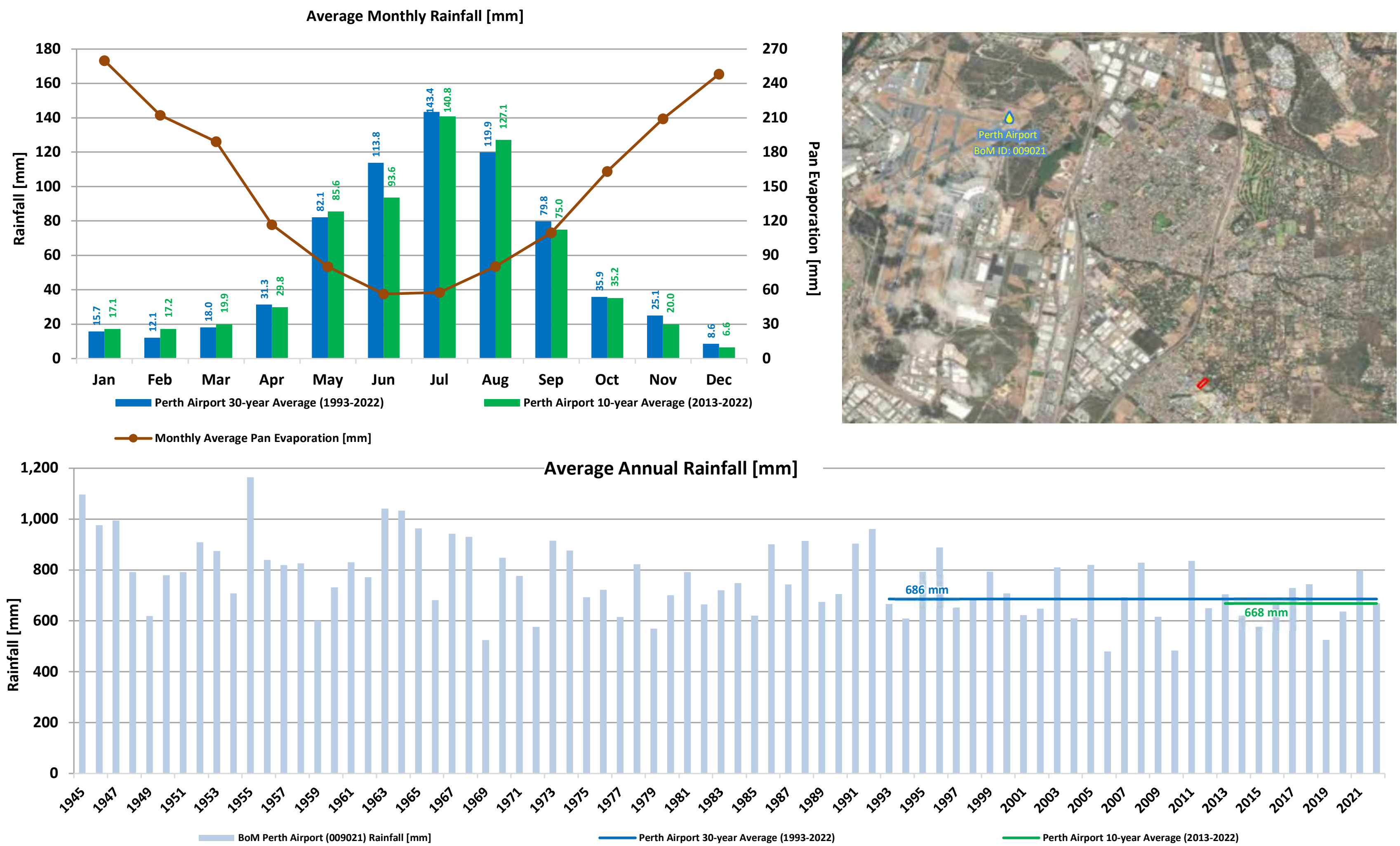
Metres
N
© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2024
Acott Equities Pty Ltd
Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan
Figure 1: Location and Subdivision Plan

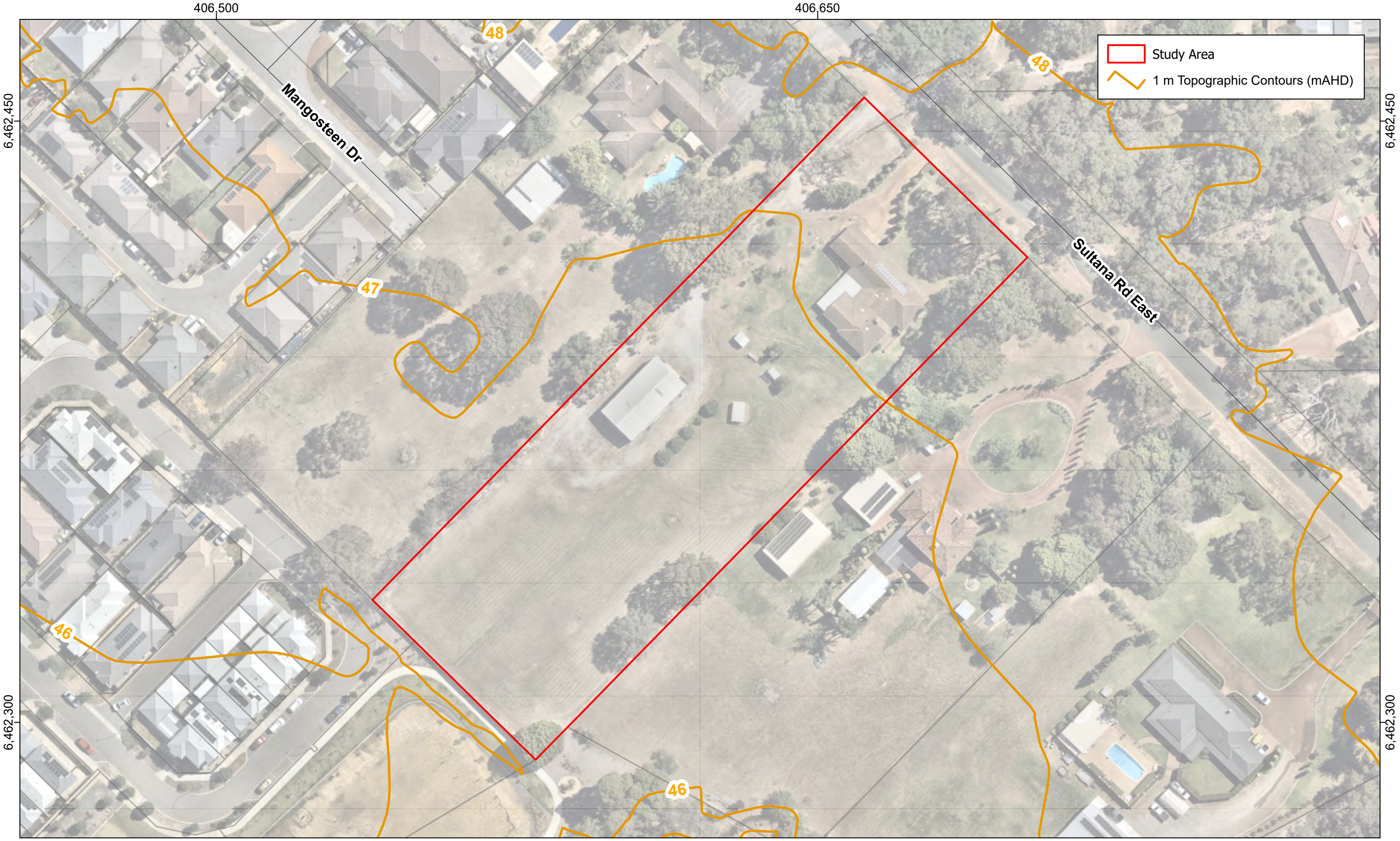


Data Source: Bureau of Meteorology (2023) Perth Airport *(009021)* ; DPIRD (2023) *South Perth Weather Station - Pan Evaporation*

JDA

Job No. J7456

Acott Equities Pty Ltd
Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan
Figure 2: Rainfall and Evapoation



Data Source: DoW (2008); Nearmap (2023)

Coordinate System: GDA 94, Zone 50

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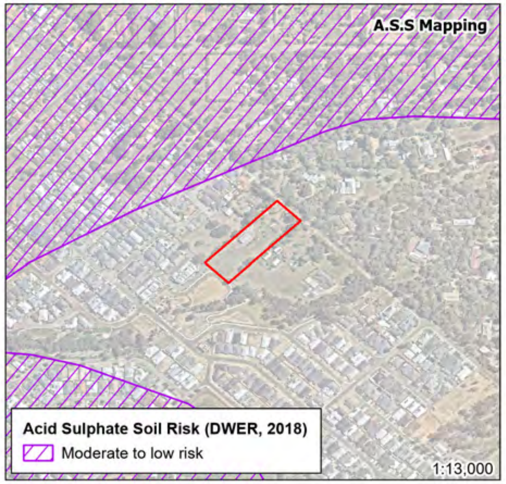
Acott Equities Pty Ltd

Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan

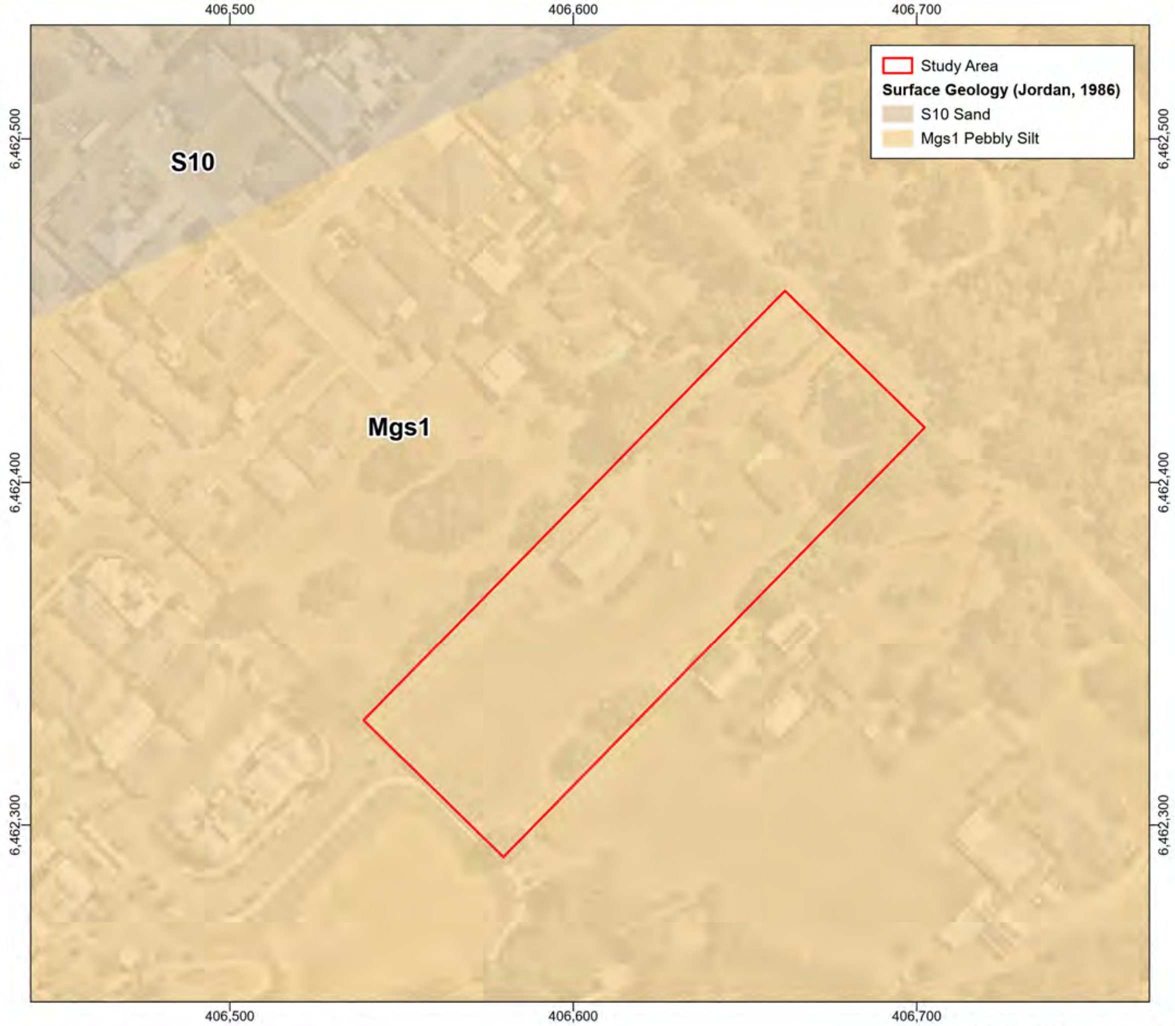
Figure 3: Topography



Lithological Classification

S10 - sand, as S8 over sandy clay to clayey sand of the Guildford Formation, of eolian origin.

Mgs1 - pebbly silt, strong brown silt with common, fine to occasionally coarse-grained, sub-rounded laterite quartz, heavily weathered granite pebble, some fine to medium-grained quartz sand, of alluvial origin.



Data Source: Jordan (1986) Environmental Geology Series *Perth*; A.S.S Risk Mapping (DWER, 2018); Nearmap (2023).

Coordinate System: GDA 94, Zone 50

JDA

Job No. J7456
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Acott Equities Pty Ltd
Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan
Figure 4: Surface Geology, Geotechnical and A.S.S. Mapping

Data Source: Taylor Burrell Barnett Town Planning & Design (2023); Nearmap (2023); C&W (2024)

Coordinate System: GDA 94, Zone 50

JDA Consultant Hydrologists

Job No. J7456

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0 50 100 Meters

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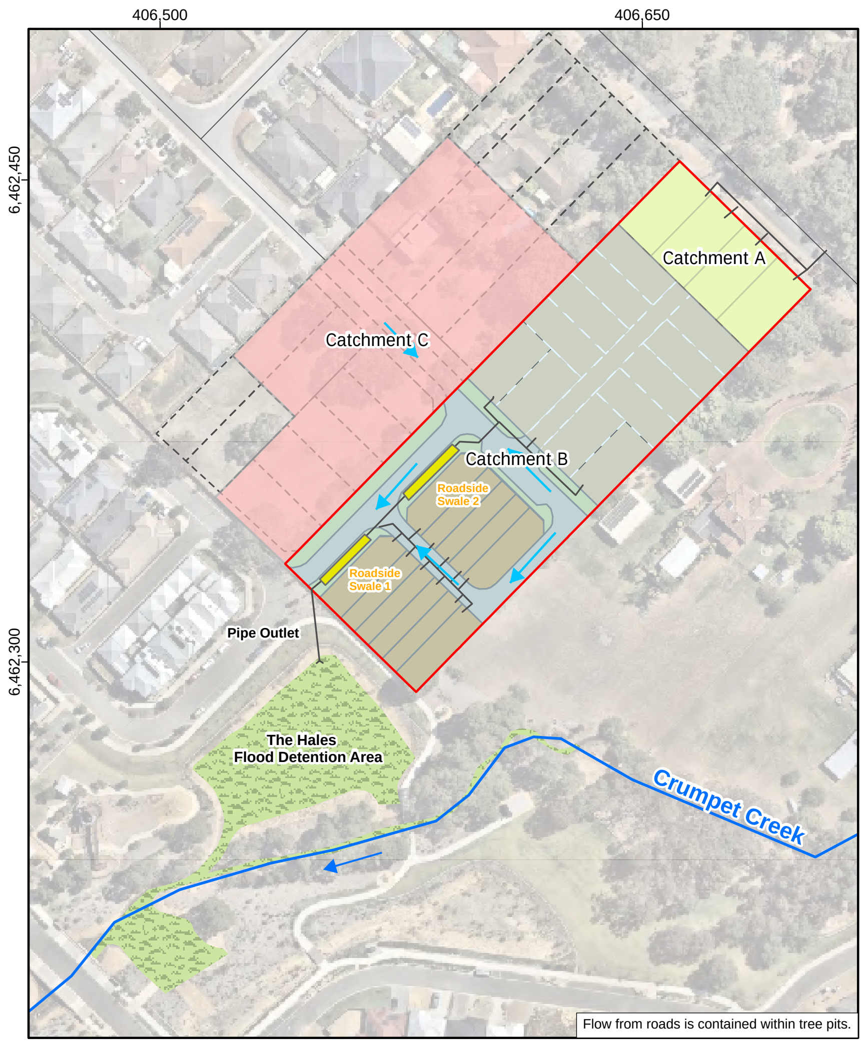
Acott Equities Pty Ltd

Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan

Figure 5: Stormwater Management Plan



Small Event (15 mm)	Catchment Details	
Impervious Road Catchment Area (m^2)	1,836	
2% of Impervious Catchment Area (m^2)	36.7	
Rainfall (mm)	15	
Runoff Volume (m^3)	27.5	
Roadside Swale Details	**Swale 1**	**Swale 2**
Base Area (m^2)	38	50
Top Area (m^2)	48	60
Maximum Allowable Water Depth (m)	0.3	0.3
Side Slope (v:h)	1:04	1:04
Storage Volume (m^3)	12.9	16.1

Item	Specification
Amended soil media	• Minimum 300 mm thick. • Hydraulic conductivity between 5 and 7.2 m/day. • PRI >10 • Light compaction only. • Total clay and silt fraction <3% in total (w/w). • Organic matter content <5% (w/w). • Phosphorus content <80 mg/kg.
Plant selection, planting density and distribution.	• Tolerant of periodic inundation and extended dry periods. • Preferential selection of endemic and local native species (Monash, 2014). • As per Vegetation Guidelines for Stormwater Biofilters in the South-west of Western Australia (Monash, 2014).
Maintenance	• 24 months following initial planting.

Data Source: Taylor Burrell Barnett Town Planning & Design (2023); Nearmap (2023); C&W (2024)

Coordinate System: GDA 94, Zone 50

JDA

Job No. J7456
Scale: 1:2,000 @A4
0 50 100 Metres

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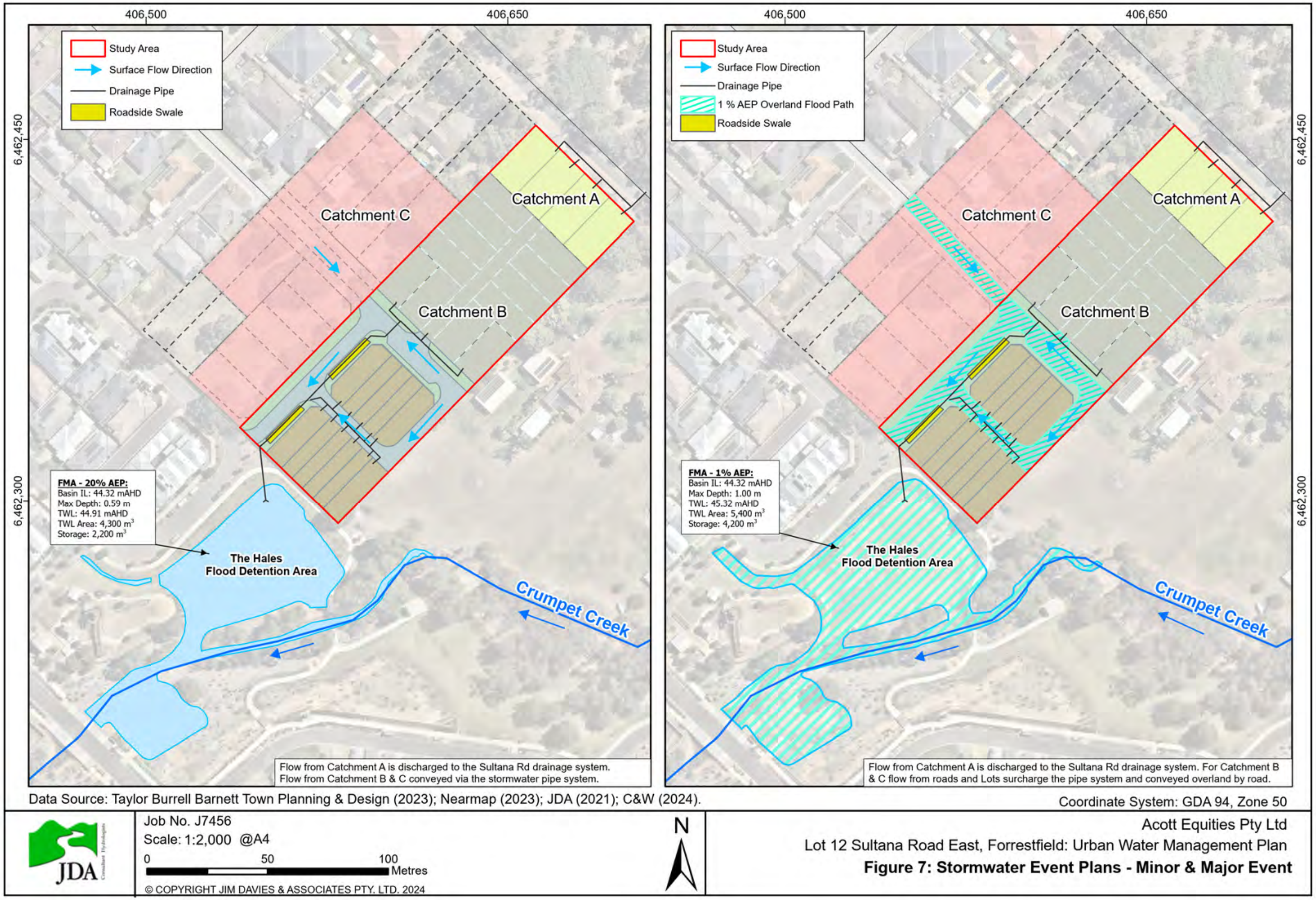
Acott Equities Pty Ltd
Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan
Figure 6: Stormwater Event Plan - Small Event


406,500
406,650
6,462,450
6,462,300
Study Area
Surface Flow Direction
Drainage Pipe
Roadside Swale
Catchment C
Catchment A
Catchment B
FMA - 20% AEP:
Basin IL: 44.32 mAHD
Max Depth: 0.59 m
TWL: 44.91 mAHD
TWL Area: 4,300 m³
Storage: 2,200 m³
The Hales
Flood Detention Area
Crumpet Creek
Flow from Catchment A is discharged to the Sultana Rd drainage system.
Flow from Catchment B & C conveyed via the stormwater pipe system.
1 % AEP Overland Flood Path
FMA - 1% AEP:
Basin IL: 44.32 mAHD
Max Depth: 1.00 m
TWL: 45.32 mAHD
TWL Area: 5,400 m³
Storage: 4,200 m³
Flow from Catchment A is discharged to the Sultana Rd drainage system. For Catchment B & C flow from roads and Lots surcharge the pipe system and conveyed overland by road.
Data Source: Taylor Burrell Barnett Town Planning & Design (2023); Nearmap (2023); JDA (2021); C&W (2024).
Coordinate System: GDA 94, Zone 50
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Job No. J7456
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Acott Equities Pty Ltd
Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan
Figure 7: Stormwater Event Plans - Minor & Major Event

Data Source: Taylor Burrell Barnett Town Planning & Design (2023); Nearmap (2023); C&W (2024).

Coordinate System: GDA 94, Zone 50

Job No. J7456

Scale: 1:1,800 @A4

0 50 100 Meters

Acott Equities Pty Ltd

Lot 12 Sultana Road East, Forrestfield: Urban Water Management Plan

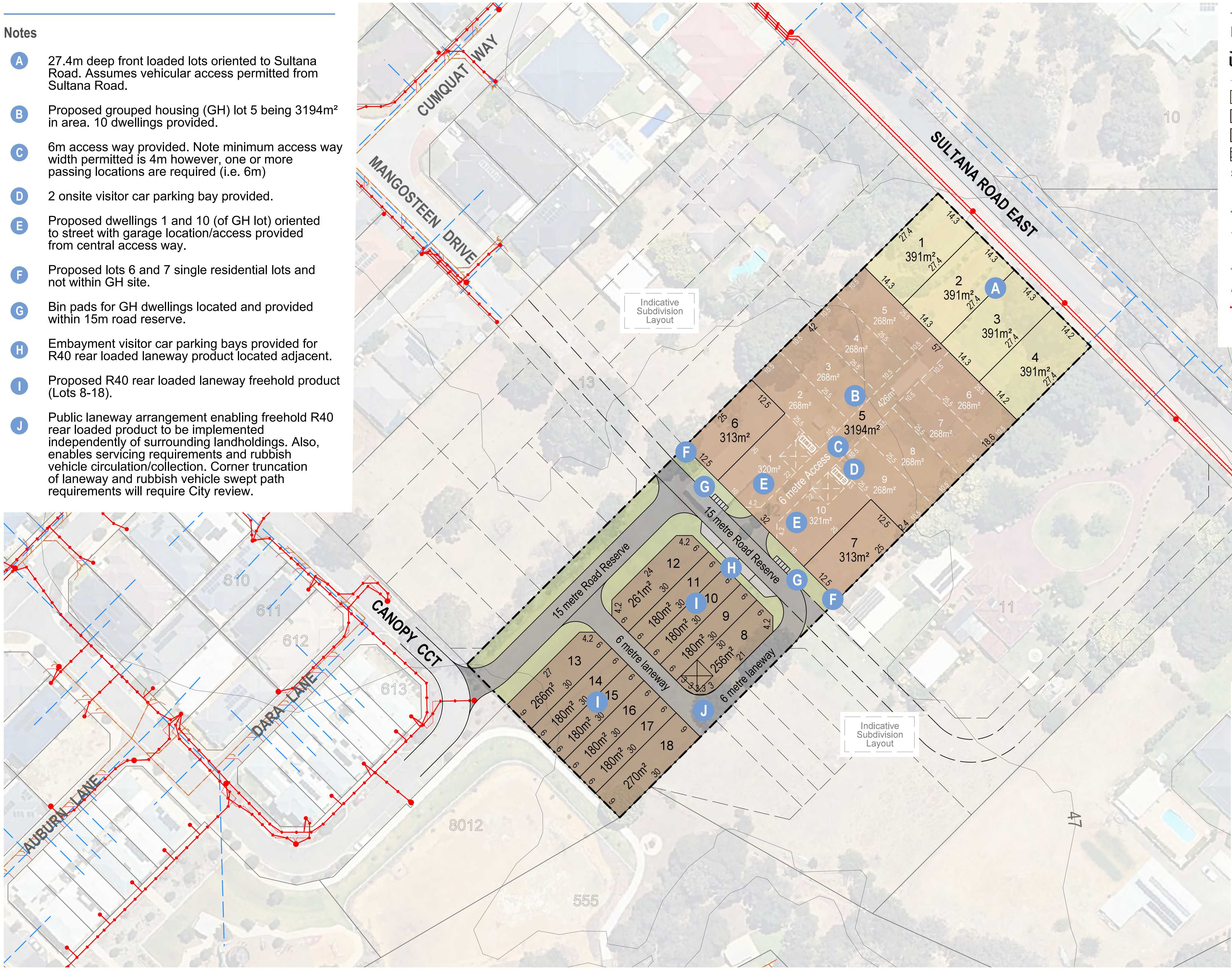
Figure 8: Groundwater Management

APPENDIX A

Subdivision Concept Plan – Lot 12 Sultana Rd, Forrestfield (Taylor Burrell Barnett, 2024)

Notes

- **A** 27.4m deep front loaded lots oriented to Sultana Road. Assumes vehicular access permitted from Sultana Road.
- **B** Proposed grouped housing (GH) lot 5 being 3194m² in area. 10 dwellings provided.
- **C** 6m access way provided. Note minimum access way width permitted is 4m however, one or more passing locations are required (i.e. 6m)
- **D** 2 onsite visitor car parking bay provided.
- **E** Proposed dwellings 1 and 10 (of GH lot) oriented to street with garage location/access provided from central access way.
- **F** Proposed lots 6 and 7 single residential lots and not within GH site.
- **G** Bin pads for GH dwellings located and provided within 15m road reserve.
- **H** Embayment visitor car parking bays provided for R40 rear loaded laneway product located adjacent.
- **I** Proposed R40 rear loaded laneway freehold product (Lots 8-18).
- **J** Public laneway arrangement enabling freehold R40 rear loaded product to be implemented independently of surrounding landholdings. Also, enables servicing requirements and rubbish vehicle circulation/collection. Corner truncation of laneway and rubbish vehicle swept path requirements will require City review.



Legend

Subject Land		(1.0001ha)
1 metre contours		
R25 Residential		0.1563ha
R30 Residential		0.3819ha
R40 Residential		0.2313ha
Road Reserve		0.2306ha

SERVICES

WATER
- PIPE

SEWER
- CONNECTION
- GRAVITY PIPE

ELECTRICAL
- UNDERGROUND DISTRIBUTION LINE
- DISTRIBUTION POLE/LIGHT POLE/PILLAR (Indicative locations only)

Lot Yield

LOT YIELD			LOT AREA	
Size	No. Lots	% Total Lots	Average Size	% of Total Area
179m² - 234m²	7	38.89%	180m²	16.37%
235m² - 319m²	6	33.33%	279m²	21.81%
320m² - 499m²	4	22.22%	391m²	20.32%
2000m² - 2999m² (GH)	1	5.56%	3194m²	41.50%
Total Number of Lots	**18**			
Minimum Lot Size 180m² Maximum Lot Size 3194m²			Average Lot Size 427m² Total Lot Area 7697m²	

GH LOT YIELD (Lot 5)			LOT AREA	
Size	No. Lots	% Total Lots	Average Size	% of Total Area
235m² - 319m²	8	80.00%	268m²	76.98%
320m² - 499m²	2	20.00%	320m²	23.02%
Total Number of Lots	**10**			
Minimum Lot Size 268m² Maximum Lot Size 321m²			Average Lot Size 278m² Total Lot Area 2785m²	

Subdivision Concept Plan

LOT 12 SULTANA ROAD EAST, FORRESTFIELD

DRAFT

scale: 1:1000@A3 | 1:500@A1

0 10 20m

plan: 23/070/018B

date: 23/08/2024

aerial: Feb 2023

Taylor Burrell Barnett Town Planning & Design
Level 7, 160 St Georges Terrace, Perth WA 6000
e: admin@tbbplanning.com.au
p: (08) 9226 4276

APPENDIX B

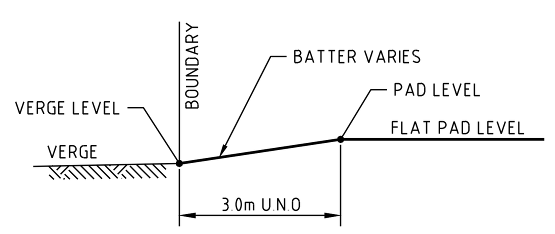
Engineering Drawings
(Cossill & Webley, 2024)

LEGEND

DESCRIPTION	SYMBOL
LIMIT OF WORKS BOUNDARY	— — — —
FINISHED SURFACE CONTOUR MAJOR	25.0
FINISHED SURFACE CONTOUR MINOR	24.5
EXISTING SURFACE CONTOUR	- - 25.0 - -
FINISHED LOT PAD LEVEL	(25.00)
VERGE SPOT LEVEL	25.00

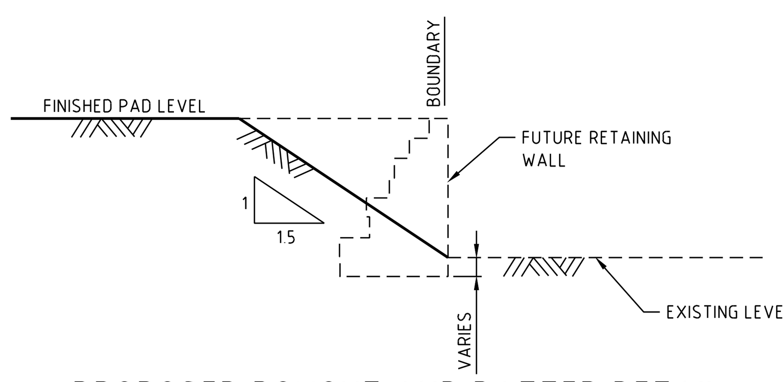
NOTES

1. ALL LEVELS IN METRES TO AHD. SURVEY BY MNG.
2. BATTERS TO EXISTING SURFACE AT 1:3 (CUT) 1:4 (FILL) UNLESS NOTED OTHERWISE.
3. BATTER POSITION FOR FUTURE WALLS TO ENSURE CUT TO FILL EARTHWORKS BALANCE.
4. ALL UNSUITABLE MATERIAL TO BE REMOVED BY THE CONTRACTOR TO APPROVED TIPPING SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION. ALL FEES TO BE PAID BY CONTRACTOR.
5. EXTENT OF CLEARING AND EARTHWORKS TO BE LIMITED TO THE STAGE CLEARING BOUNDARY UNLESS AGREED WITH THE SUPERINTENDENT.
6. ALL CLEARED MATERIAL TO BE MULCHED AND STOCKPILED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
7. CONTRACTOR TO LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS ON SITE.
8. CONTRACTOR TO GRADE EVENLY BETWEEN DESIGN CONTOURS AND MATCH INTO EXISTING SURFACE AT LIMIT OF EARTHWORKS BOUNDARY WHERE APPROPRIATE.
9. EXCESS CUT FROM EARTHWORKS SHALL BE PLACED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
10. DESIGN LEVELS SHOWN SHALL BE ON THE FINISHED SURFACE INCLUDING TOPSOIL WHERE SPECIFIED.
11. THE CONTRACTOR SHALL LIMIT THE MOVEMENT OF EQUIPMENT AND MANPOWER TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION AND EXISTING SERVICES ON SITE.
12. ADJACENT RESIDENTS TO BE NOTIFIED OF THE WORKS AT LEAST TWO WEEKS IN ADVANCE. CONTRACTOR TO PROVIDE MOBILE NUMBER FOR SUPERVISOR AS PART OF NOTIFICATION.



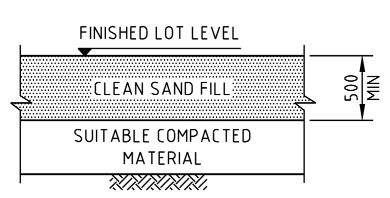
TYPICAL BATTER TO FRONT OF TRADITIONAL LOTS

SCALE: N.T.S



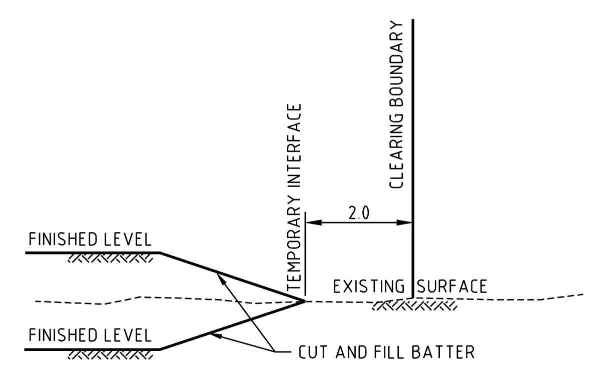
PROPOSED BOXOUT AND BATTER DETAIL FOR FUTURE RETAINING WALLS

SCALE: N.T.S



TYPICAL FILL SECTION FOR LOTS IN SAND AREAS

SCALE: N.T.S



TEMPORARY EARTHWORKS INTERFACE

SCALE: N.T.S

NOTICE TO CONTRACTOR

IT IS THE CONTRACTOR'S RESPONSIBILITY TO INVESTIGATE THE NATURE AND LOCATION OF ALL SERVICES WHICH MAY BE ENCOUNTERED AND TO CONSULT WITH THE RELEVANT SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF EXCAVATIONS. FAILURE TO DO SO OR TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTOR'S LIABILITY FOR REPAIR OF ALL SERVICES DAMAGED BY HIM DURING CONSTRUCTION WORKS THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY FOR THE PROTECTION OF ALL EXISTING SERVICES.

REV	DATE	DRN	CKD	APP	AMENDMENT
B	18.09.24	BVS	NB	(signature)	RE-ISSUED FOR APPROVAL
A	02.05.24	RJW	NB	N. BUTSON	ISSUED FOR APPROVAL

N

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0m 10 20 30
1:500

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Mailing Address: PO Box 680, Subiaco WA 6904
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T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: ACOTT EQUITIES PTY LTD

APPROVED: NATHAN BUTSON 02.05.24

DESIGNED: RJW

SCALE: 1:500

PROJECT: LOT 12 SULTANA RD FORRESTFIELD

TITLE: EARTHWORKS PLAN CONCEPT

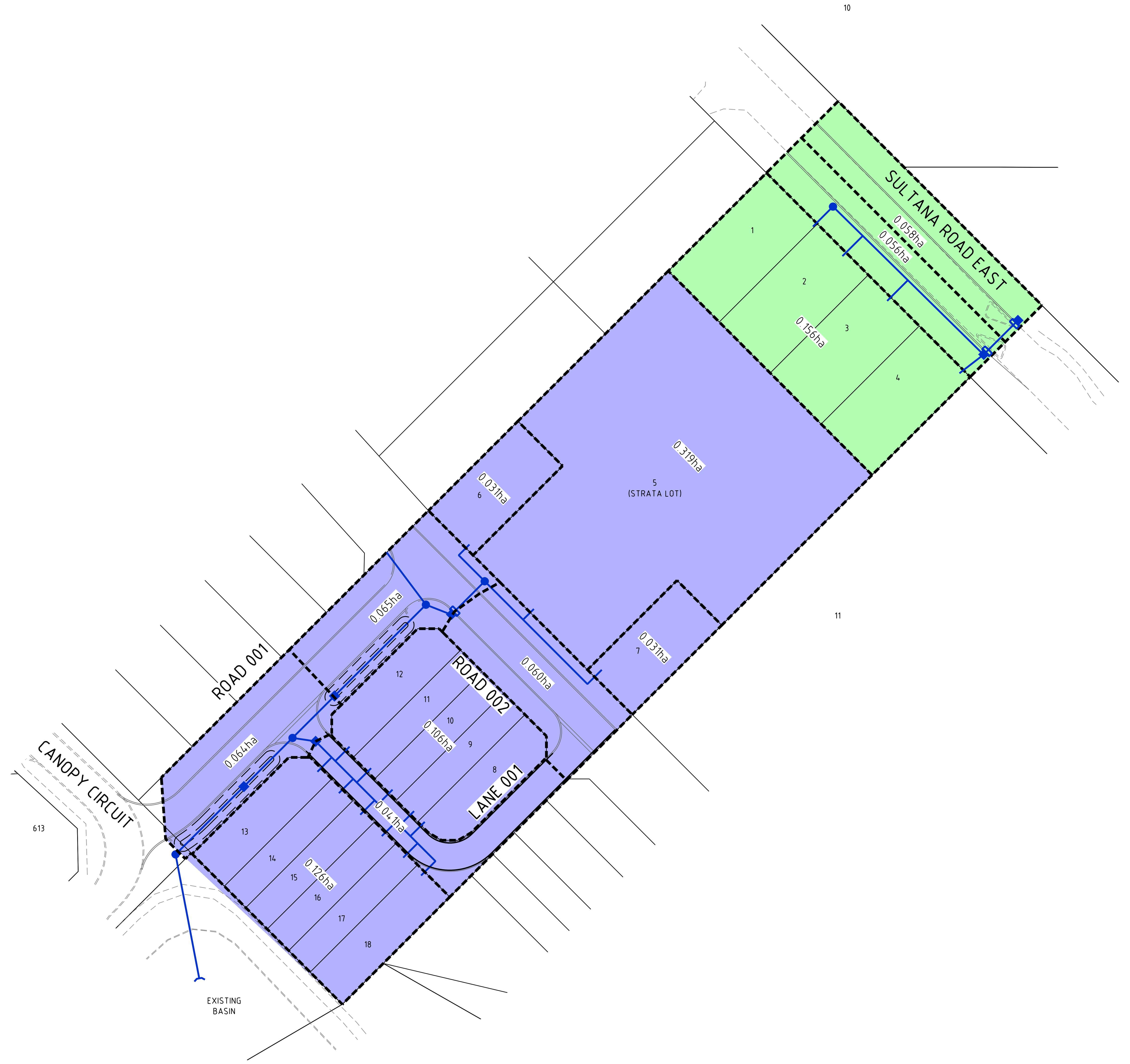
WAPC No.: ×××WAPC NUMBER×××

DRAWING No.: 6518-00-202

REVISION: B

ORIGINAL SIZE: A1

\\FS02\Projects\6518 Lot 12 Sultana Rd Forrestfield\6518-00\Acad\6518-00-202.dwg, 18/09/2024 8:50:37 AM, ben.s, Digital Signing PDF.pc3, 1:1, - CW Reference



LEGEND

DESCRIPTION	SYMBOL
PROPOSED DRAINAGE PIPE	
EXISTING DRAINAGE PIPE	
PROPOSED DRAINAGE PIPE WITH JUNCTION PIT (JP), SIDE ENTRY PIT (SEP), GRATED PIT (GP) AND CIRCULAR GRATED PIT (CGP)	
PROPOSED ROAD	
EXISTING ROAD	
CATCHMENT AREA (Ha)	0.100
DRAINAGE CATCHMENT BOUNDARY	
CATCHMENT A	
CATCHMENT B	

NOTICE TO CONTRACTOR

IT IS THE CONTRACTOR'S RESPONSIBILITY TO INVESTIGATE THE NATURE AND LOCATION OF ALL SERVICES WHICH MAY BE ENCOUNTERED AND TO CONSULT WITH THE RELEVANT SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF EXCAVATIONS. FAILURE TO DO SO OR TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTOR'S LIABILITY FOR REPAIR OF ALL SERVICES DAMAGED BY HIM DURING CONSTRUCTION WORKS THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY FOR THE PROTECTION OF ALL EXISTING SERVICES.

REV	DATE	DRN	CKD	APP	AMENDMENT
B	18.09.24	BVS	NJB		RE-ISSUED FOR APPROVAL
A	02.05.24	RJW	NB	N. BUTSON	ISSUED FOR APPROVAL

N

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1:500 0m 10 20 30

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CLIENT: ACOTT EQUITIES PTY LTD

APPROVED: NATHAN BUTSON 02.05.24

DESIGNED: RJW

SCALE: 1:500

PROJECT: LOT 12 SULTANA RD FORRESTFIELD

TITLE: STORMWATER DRAINAGE CATCHMENT PLAN CONCEPT

WAPC No.: ×××WAPC NUMBER×××

DRAWING No.: 6518-00-702

REVISION: B

ORIGINAL SIZE: A1

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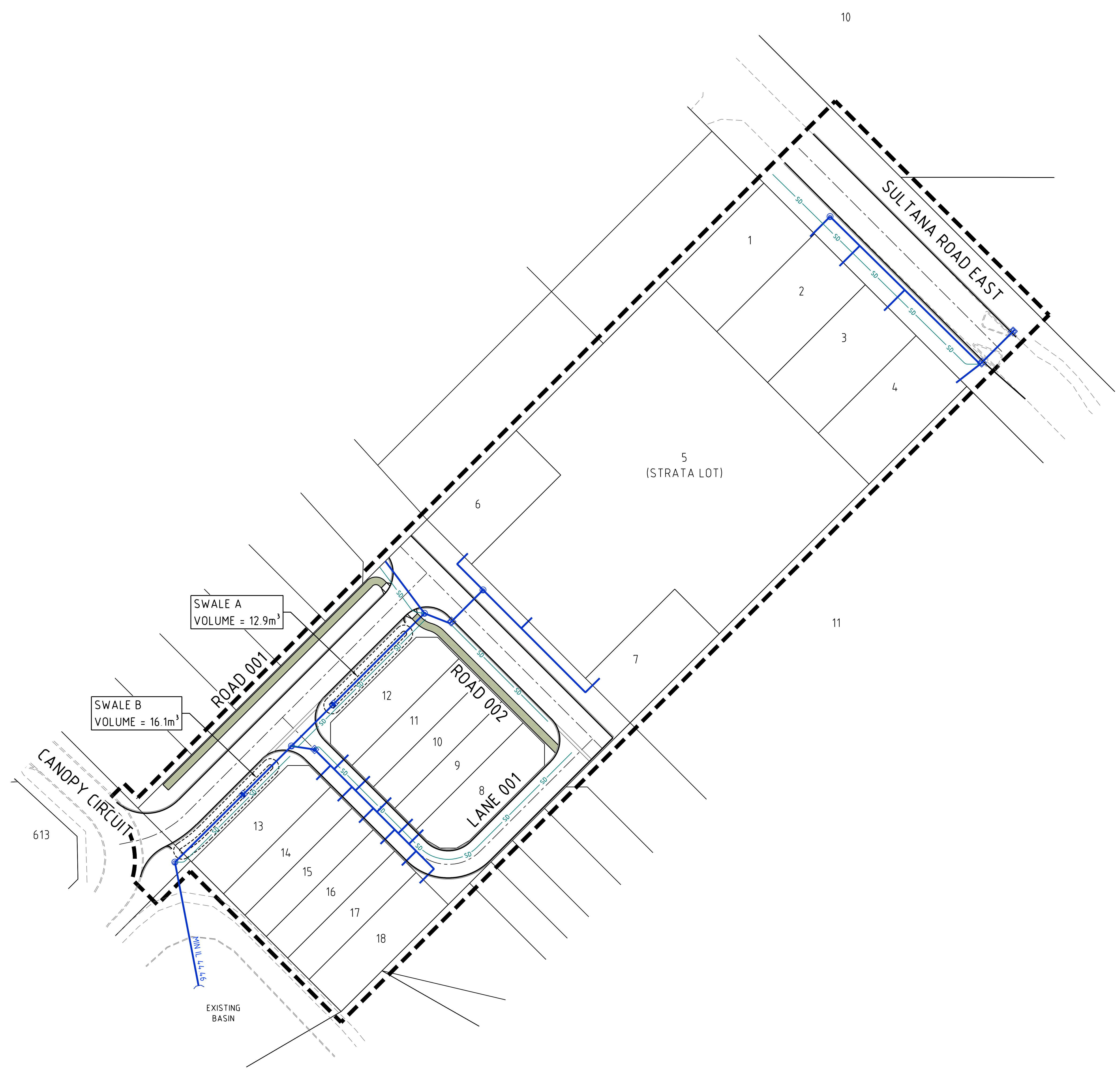

LEGEND

DESCRIPTION	SYMBOL
LIMIT OF WORKS BOUNDARY	
PROPOSED ROAD	
EXISTING ROAD	
PROPOSED CONCRETE PATH AND PRAM RAMP	
PROPOSED DRAINAGE PIPE	
EXISTING DRAINAGE PIPE	
PROPOSED DRAINAGE PIPE WITH JUNCTION PIT (JP), SIDE ENTRY PIT (SEP), GRATED PIT (GP) AND CIRCULAR GRATED PIT (CGP)	
PROPOSED SUBSOIL DRAINAGE PIPE	

NOTICE TO CONTRACTOR

IT IS THE CONTRACTOR'S RESPONSIBILITY TO INVESTIGATE THE NATURE AND LOCATION OF ALL SERVICES WHICH MAY BE ENCOUNTERED AND TO CONSULT WITH THE RELEVANT SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF EXCAVATIONS. FAILURE TO DO SO OR TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTOR'S LIABILITY FOR REPAIR OF ALL SERVICES DAMAGED BY HIM DURING CONSTRUCTION WORKS THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY FOR THE PROTECTION OF ALL EXISTING SERVICES.

REV	DATE	DRN	CKD	APP	AMENDMENT
C	18.09.24	BVS	NJB	[signature]	RE-ISSUED FOR APPROVAL
B	22.05.24	RJW	NB	N. BUTSON	DRAINAGE ALIGNMENT AMENDED
A	02.05.24	RJW	NB	N. BUTSON	ISSUED FOR APPROVAL

N

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0m 10 20 30
1:500

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CLIENT	ACOTT EQUITIES PTY LTD
APPROVED	NATHAN BUTSON 02.05.24
DESIGNED	RJW
SCALE	1:500
PROJECT	LOT 12 SULTANA RD FORRESTFIELD
TITLE	ROADWORKS AND STORMWATER DRAINAGE CONCEPT
WAPC No.	×××WAPC NUMBER×××
DRAWING No.	6518-00-602
REVISION	C
ORIGINAL SIZE	A1

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APPENDIX C

The Hales: Stages 2-9 UWMP – Addendum 1
(JDA, 2021)

THE HALES: STAGES 2 TO 9

"Lots 14, 15 & 515 Hawtin Road and 9002 Lovett Drive, Forrestfield: URBAN WATER MANAGEMENT PLAN – WAPC NO.154808 & 155243"

(Report for Satterley Property Group, report reference J6159ab, dated 20/11/2017)

ADDENDUM 1

Date: 3 March 2021
Reference: J6159af

This Addendum has been prepared to provide an update to the stormwater management for Catchment 1 of the *"LOTS 14, 15 & 515 HAWTIN ROAD AND 9002 LOVETT DRIVE, FORRESTFIELD: URBAN WATER MANAGEMENT PLAN – WAPC NO.154808 & 155243" (UWMP) (J6159AF DATED 20/11/2017).*

Since approval of the UWMP, design of the stormwater management area adjacent to and within Crumpet Creek has been refined in consultation with the City of Kalamunda. Whilst the main principles and objectives and general design guidelines outlined in the UWMP still apply, the detention storage details for Crumpet Creek have been updated.

In summary, the 1 year ARI detention storage (bio-retention) area is now designed to provide stormwater quality treatment and improvement for the road catchment area. Runoff from lots will still be managed in this detention storage with overflow to Crumpet Creek when the storage capacity is exceeded.

Design of the flood storage in Crumpet Creek now maintains the existing creek bed and low flow channel, with storage in two widened areas offset and above the low flow channel. The proposed design is shown in the attached drawing "Crumpet Creek Design" (Cossill & Webley dwg no. 6211-08-203 RevA).

Presented below is additional information to supplement the UWMP for Catchment 1 only.

1) Section 5.5 Minor Drainage System

Additional key points of the design of the minor drainage system for Catchment 1 are as follows:

- All lots connect directly into the road drainage network, via standard lot connection pit.
- 1 Year ARI bio-retention storage has capacity to manage and treat 15 mm of rainfall from road and lot catchment. Discharge to Crumpet Creek occurs via subsoil drainage and overflow spillway.
- 5 Year ARI storage in Crumpet Creek occurs in two areas above and adjacent to the low flow channel. The storage also includes runoff volume from Stage 1B (west of Crumpet Creek).
- Downstream discharge, and upstream levels of Crumpet Creek maintained at pre-development condition.

Tables 8A and 9A and Figure 7A attached present revised details of the bio-retention and detention storage designs.

TABLE 1A: BIO-RETENTION STORAGE DETAILS IN POS

	Catchment 1		
Storage Details			
Catchment Area (ha)	10.23[1]		
Impervious Catchment Area (ha)	7.18[1]		
Basin Invert (mAHD)	44.62		
Base Area (m^2)	677		
Side Slopes	1 in 6		
Spillway Invert (mAHD)	45.12		
Subsoil U/S Invert (mAHD)	44.3		
Subsoil D/S Invert (mAHD)	44.2		
Basin Results	***1 yr 1 hr ARI***	***5 yr ARI***	***100 yr ARI***
Critical Duration (hrs)	1	6	6
Storm Rainfall (mm)	15	49	83
Runoff Volume into Basin (m^3)	1,077	3,518	5,959
Basin Water Level Rise (m)	0.5	0.54	0.68
Basin Top Water Level, TWL (mAHD)	45.12	45.16	45.30
Basin Area at TWL (m^2)	1,340	1,410	1,640
Basin Stored Volume (m^3)	501	550	770
% Stored/Runoff Volume	47	16	13
Spillway Outflow (m^3/s)	0.067	0.21	1.8
Subsoil Outflow (m^3/s)	0.029	0.029	0.029
Emptying Time (days)	0.5	0.5	0.5

1. Includes external catchments contributing to basins.

TABLE 2A: DETENTION STORAGE DETAILS FOR 5 YR ARI IN CRUMPET CREEK

	Catchment 1
Storage Details	
Catchment Area (ha)	10.23[1]
Impervious Catchment Area (ha)	7.18[1]
Basin Invert (mAHD)	44.32
Base Area (m^2)	3,110
Side Slopes	1 in 6
Crumpet Creek Invert	44.00
Basin Outlet Invert (mAHD)	44.32
Basin Results[2]	***5 yr ARI***
Critical Duration (hrs)	6
Storm Rainfall (mm)	49
Runoff Volume into Basin (m^3)	3,518
Basin Water Level Rise (m)	0.59
Basin Top Water Level, TWL (mAHD)	44.91
Basin Area at TWL (m^2)	4,300
Basin Stored Volume (m^3)	2,200
% Stored/Runoff Volume	63
Peak Outflow[3] (m^3/s)	3.71
Emptying Time (days)	0.5

1. Includes external catchments contributing to basins.
2. Includes runoff from Stage 1B catchment west of Crumpet Creek.
3. Outflow includes Crumpet Creek flow from upstream catchments.

2) Section 5.6 Major Drainage System

Additional key points of the design of the major drainage system for Catchment 1 are as follows:

- Design of the flood storage in Crumpet Creek now maintains the existing creek bed and low flow channel, with storage in two widened areas offset and above the low flow channel.
- Downstream discharge and upstream levels maintained at pre-development condition.

Table 10A and Figure 7A attached presents revised details of the detention storage design. Long section of Crumpet Creek through the Study Area is presented in Figure 9A.

TABLE 3A: DETENTION STORAGE DETAILS FOR 100 YR ARI IN CRUMPET CREEK

	Catchment 1
Storage Details	
Catchment Area (ha)	10.23[1]
Impervious Catchment Area (ha)	7.18[1]
Basin Invert (mAHD)	44.32
Base Area (m^2)	3,110
Side Slopes	1 in 6
Crumpet Creek Invert	44.00
Basin Outlet Invert (mAHD)	44.32
Basin Results[2]	***100 yr ARI***
Critical Duration (hrs)	6
Storm Rainfall (mm)	83
Runoff Volume into Basin (m^3)	5,959
Basin Water Level Rise (m)	0.99
Basin Top Water Level, TWL (mAHD)	45.31
Basin Area at TWL (m^2)	5,300
Basin Stored Volume (m^3)	4,100
% Stored/Runoff Volume	69
Peak Outflow[3] (m^3/s)	6.72
Emptying Time (days)	0.5

1. Includes external catchments contributing to basins
2. Includes runoff from Stage 1B catchment west of Crumpet Creek.
3. Outflow includes Crumpet Creek flow from upstream catchments.

3) Section 5.9.2 Structural Controls

Additional key points of the structural source controls for Catchment 1 are as follows:

- The 1 Year ARI detention storage is designed to provide stormwater quality treatment and improvement for the road catchment area.
- Detention storage base area satisfies being at least 2% of the total connected impervious area (660 m^2 for 3.03 ha contributing road catchment).

Further detail on the detention storage will be presented to the City as part of the separate engineering design approvals process. If you have any queries, please do not hesitate to contact Matthew Yan on 9388 2436 or at matt@jdahydro.com.au.

Yours sincerely,

Matthew

JDA Consultant Hydrologists

Encl.
Cossill & Webley dwg no. 6211-08-203 Rev A dated 2/3/2021 "Crumpet Creek Design"
Figure 7A – Stormwater Event Plans
Figure 9A – Crumpet Creek Long Section

J6159af

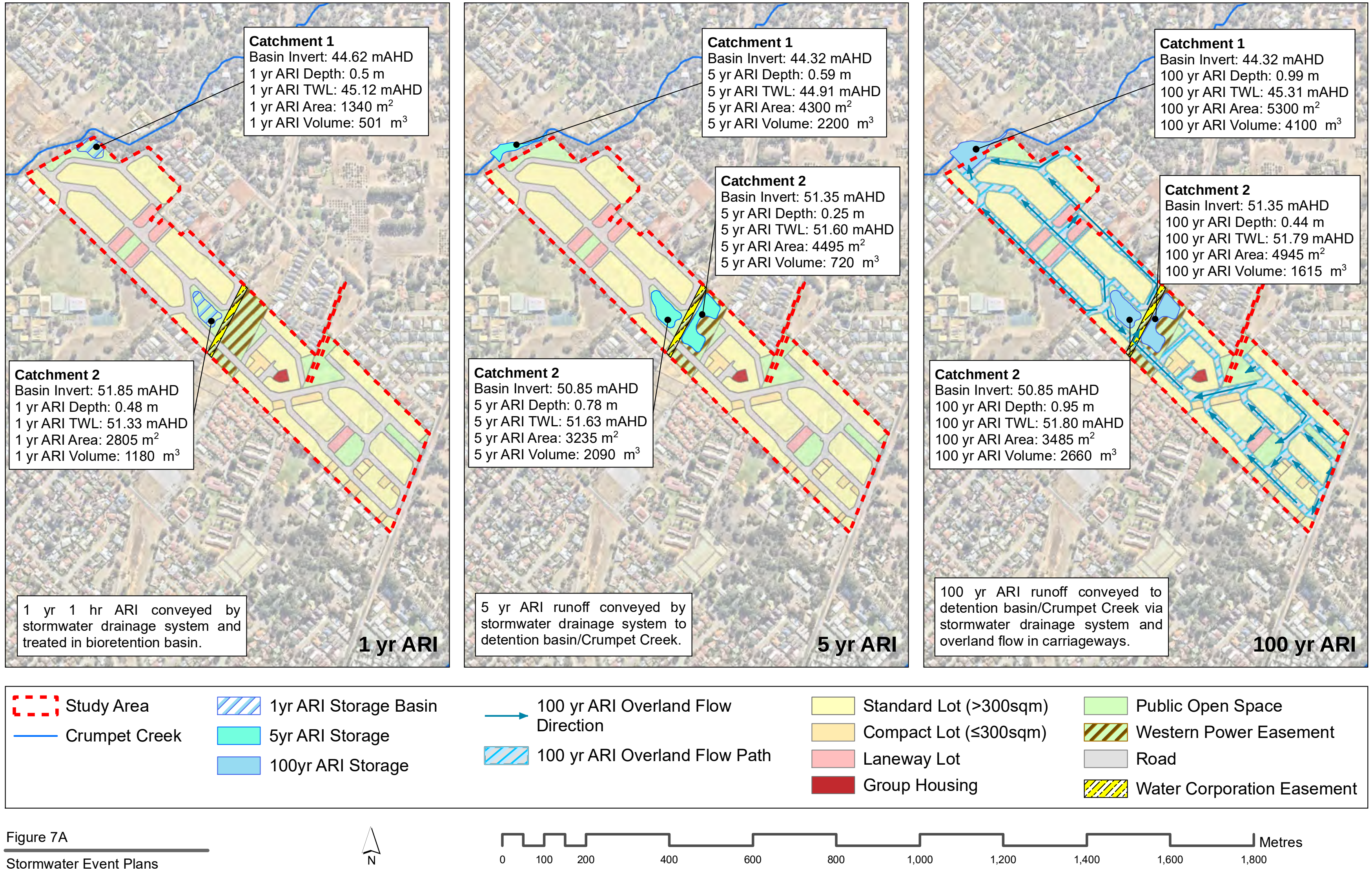


Figure 7A

Stormwater Event Plans

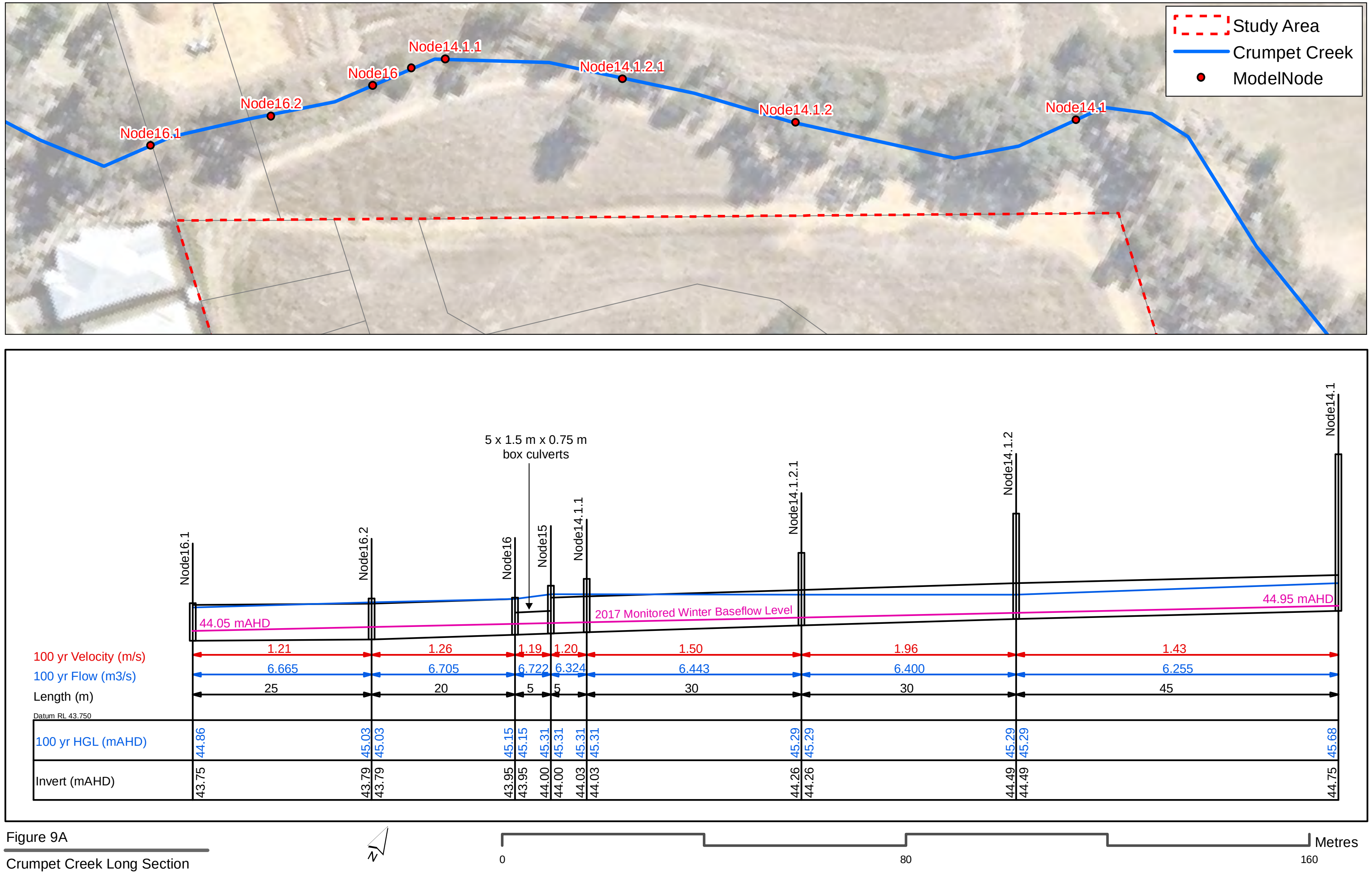
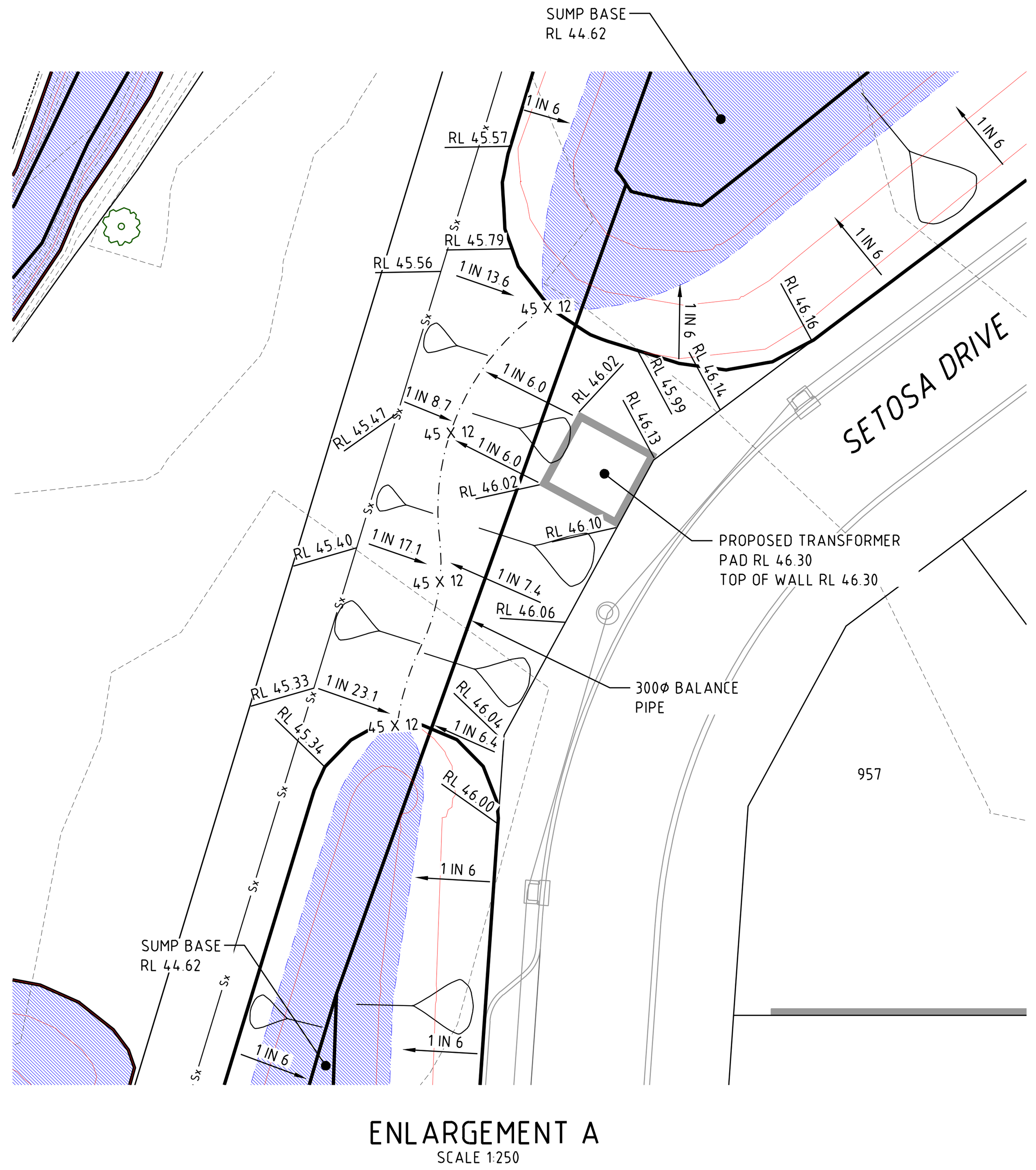


Figure 9A

Crumpet Creek Long Section



	DESIGN STORM EVENT	TWL (m AHD)	VOLUME (m3)	WETTED AREA (m2)
SWALE A	1:1	45.12	374	944
SWALE B	1:1	45.12	127	399
SWALE C	1:100	45.30	4,114	5,323

TRANSFORMER PAD RL 46.30

1:100 TWL 45.30

FREEBOARD = 1000mm

REV	DATE	DRN	CKD	APP	AMENDMENT
A	02.03.21	WBR	-	-	ISSUED FOR APPROVAL

1:250 0m 5 10 15

1:500 0m 10 20 30

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CLIENT: SATTERLEY PROPERTY GROUP

APPROVED: CHECK PRINT

DESIGNED: WBR

SCALE: 1:250 1:500

PROJECT: THE HALES ESTATE, FORRESTFIELD - STAGE 08

TITLE: CRUMPET CREEK DESIGN

WAPC No. 155243

DRAWING No. 6211-08-203

REVISION A

ORIGINAL SIZE A1

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