

Lots 302 Mandurah Road and 309 Kerosene Lane, Baldivis

Addendum for the LWMS

Prepared for Infield Holdings Pty Ltd

By Urbaqua

March 2018

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INTRODUCTION

Urbaqua has been commissioned by Infield Holdings Pty Ltd to prepare this addendum to the Local Water Management Strategy (LWMS) in support of the Local Structure Plan for Lots 302 Mandurah Road and 309 Kerosene Lane in Baldivis. It is understood that the LWMS was previously prepared by 360 Environmental and submitted to the City of Rockingham and Department of Water for assessment in June 2017.

There are a number of outstanding items that need to be addressed. This addendum provides the changes to the LWMS as requested by both agencies and includes updated sections and further information as requested. The outstanding items are provided prior the updated sections.

Please note that this addendum has been prepared to accompany the LWMS and should be read in conjunction with the latest version of the submitted LWMS (Lots 302 and 309 Kerosene Lane, Baldivis Local Water Management Strategy Version AD, June 2017).

3.3 Climate

Outstanding Item 1

CoR	The design rainfall IFDs in Table 2 appear to differ from those specific to the site and the Baldivis area. For example, the 1% AEP 24-hour duration is shown to be 104mm but the City's assessment has determined that this should in fact be 142mm which is a significant difference.
DoW	-
Response	Noted. The site specific IFDs from AR&R 2016 are provided in Table 2 and have been incorporated in the hydrology modelling.

The key rainfall characteristic for hydrological analysis is the Intensity-Frequency- Duration (IFD), a statistic derived from frequency analysis to provide estimates of rainfall intensity for a given duration and return period. Analysis of rainfall and hydrology in the current modelling is based on the latest BoM IFD published in AR&R 2016 and are summarised in Table 2.

Table 2: Rainfall IFDs for the site (mm) (ARR, 2016)

Duration	AEP				
	63.2%	20%	5%	2%	1%
30 min	14.2	20.1	26.5	30.9	34.3
1 hour	18.4	25.8	33.9	39.5	43.9
2 hours	23.7	32.9	43.5	51	57.1
3 hours	27.3	38.1	50.6	59.8	67.4
6 hours	34.6	48.7	65.9	78.8	89.8
12 hours	42.9	61.5	84.2	102	116
24 hours	52	75.2	103	124	141
48 hours	62.2	89	119	140	157
72 hours	69.8	98.2	129	149	165

3.5 Geotechnical

Outstanding Item 2

CoR	Geotechnical Investigation sighted. Section 6.8 of the report states that a design infiltration rate of 5 m/day be adopted for drainage infiltration design. The City notes that the geotechnical investigation did not measure permeability at the proposed location of the POS.
DoW	-
Response	Based on the Geotechnical Investigation a design infiltration rate of 5 m/day has been adopted. This rate has been used in the drainage modelling.

A geotechnical investigation of the site was conducted by Galt Geotechnics in support of the proposed development and is provided as Appendix C in the LWMS. Infiltration testing was performed as part of this investigation.

Given the sandy soils encountered and the permeability measured, the site is considered suitable for disposal of stormwater on site, with a design permeability (k) of no greater than 5 m/day. This permeability rate has been used in the hydraulic modelling.

3.5 Groundwater

Outstanding Item 3

CoR	Response noted and site-specific groundwater monitoring data sighted. Was this bore installed in the future location of the POS? The LWMS must be updated to show the groundwater bore location on a figure and include the lithological bore log as Appendix. The conversion to TDS (mg/L) is unclear. The ANZECC (Section 9.2.10.2) recommended conversion factor of EC to TDS is (EC x 670 = TDS (mg/L)). This would equate to a site-specific TDS of 1541 mg/L.
DoW	-
Response	The Sampling bore was installed in the future location of the POS. The bore location is provided in this addendum. The TDS conversion has also been revised and provided.

Following installation of a groundwater monitoring bore in January 2017 a single sampling was conducted to determine the existing groundwater condition. Samples were taken from the bore and analysed for physical parameters (pH, EC), nutrients (Nitrogen & Phosphorous) and dissolved metals with results assessed against the guidelines provided in Table 4 of LWMS.

The specific electrical conductivity recorded at the site was 2.3 mS/cm, which converts to a calculated total dissolved solid value of approximately 1541 mg/L ((Section 9.2.10.2, ANZECC). The groundwater at the site is considered to be brackish (within the range 1001-3000 mg/L).

The location of the bore is provided in Attachment 1 of this addendum.

3.7 Water Resources

Outstanding Item 4

CoR	Appendix D has not been updated since the previous version of the LWMS. As such the city's comment remains unresolved. Amendments to Section 4.1. Confirmation is required from the DoW that this allocation has been set aside to support the proposed development.
DoW	-
Response	The correspondence with DoW regarding the groundwater licence application has been provided in this addendum.

An application for a 5C Licence to take water and an application for a license under section 26D of the Rights to Take Water and Irrigation Act 1914 was submitted to DoW in September 2014.

The licence applications are currently waiting for the LWMS to be approved. DoW has confirmed that sufficient water is available and has been set aside. The related correspondence with DoW has been provided in Attachment 2 to this addendum.

3.8.6 Contaminated Sites

Information received from BHP Nickel West (via the City of Rockingham) in February 2018 outlines that the facility on Lot 2209 Millar Road Baldivis has been registered as contaminated site with remediation required. Remediation activities have been undertaken at the site since 1994, owing to the impact on ammonium sulphate on groundwater. The information was provided to ensure the developer of the Study Area is aware of this issue.

5.2 Stormwater Management System

Outstanding Item 5

CoR	Table 7 does not provide any information in relation to the 1EY. Please update.
DoW	The revised LWMS is proposing to direct a portion of the 1 EY runoff into underground storage cells in the POS. this design offers limited water quality treatment. 1 EY runoff should be treated at source as high in the catchment as possible through tree pits, raingardens or swales. End of pipe 1EY runoff should undergo quality treatment through biofiltration. Section should explain why the underground approach has been chosen and detail any support for this design from the City of Rockingham.

Response	<p>The first 15 mm of rainfall in lots will be retained at source and infiltrated using soakwells. The runoff from the road reserve will be infiltrated partly at source within the soakage pits and then through amended soils at the base of the underground storage located at the outlets of the road drainage network. This approach has been recommended by the City of Rockingham and is consistent with the recently approved LWMS for the neighbouring LSP of Lots 5 to 8 Kerosene Lane. The details of the 1 EY stormwater system have been added to Table 7.</p> <p>Further Details on the water quality treatment and any other at source treatment systems (if possible) will be discussed and provided in the UWMP.</p>
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Outstanding Item 6

CoR	<p>Figure 9 has not been updated since the previous version of the LWMS and as such the information presented differs to that shown in Table 7. Figure 10 refers to an infiltration basin and area of inundation for the 1, 5 and 100 yr ARI. This should refer 1 EY, 20% and 1% AEP.</p> <p>Table 7 shows that the underground storage invert is the same as the storage basin invert of 9.0 mAHD. A conceptual cross section of the updated stormwater management configuration (underground storage and drainage basin) must be provided to demonstrate the intended design.</p> <p>A landscape concept is required to show how the stormwater management system will interact the POS design including existing vegetation/trees to be retained. The request for a Landscape Plan is outlined in Appendix A of the LWMS as a Better Urban Water Management (WAPC, 2008) requirement.</p>
DoW	<p>Diagrams indicated that the "1 yr ARI event" will be directed to surface bioretention area. All figures should be updated to reflect any revised stormwater runoff strategy.</p> <p>Please include a cross section of the proposed infiltration basin and include conceptual top water levels for all rainfall events, location and depth of amended soil, depth to groundwater and slope gradients. The cross section should indicate how the underground storage cells are integrated into the POS/stormwater runoff treatment system and detail preliminary dimensions, pipe connections and use of amended soils.</p>
Response	<p>Noted. Figures 9 and 10 had not been updated since the previous version of the LWMS.</p> <p>Hydrology and hydraulic modelling of the site has been undertaken with the latest IFDs and the infiltration rate of 5 m/day. Table 7 has been updated accordingly.</p> <p>Updated Figures 9 and 10 with a cross section as requested are provided in this addendum. A landscape concept is also provided in Attachment 3.</p>

Outstanding Item 7

CoR	<p>The LWMS does not identify whether this POS is located within or outside of the Parmelia Gas Pipeline Easement. The neighbouring development of Lots 5 to 8 Kerosene Lane to the north has a similar linear POS abutting the easement with a drainage basin. It is therefore recommended that this be investigated further.</p>
DoW	-

Response

This easement will be considered through further detailed engineering design and presented in the UWMP. Use of this easement and at source infiltration (raingardens) will be considered to further reduce drainage requirements within the larger POS.

A major and minor approach to the design of stormwater management systems has been adopted for the site. The minor system consists of underground pipes and pits, kerbs and gutters designed to convey runoff up to the 20% AEP event to the underground storage within the POS and ensure serviceability of the road network. The major system consists of road and POS drainage basin and provides protection of the community from extreme flooding events (up to the 1% AEP event) that exceed the capacity of the minor system.

5.2.2 Major System (Extreme Events)

The major drainage system will consist of the roads and the drainage basin. Events larger than the 20% AEP event will be conveyed to the drainage basin within the POS (Figure 10).

In order to determine the requirements for the underground storage and drainage basin hydrologic and hydraulic modelling of the site has been undertaken with the model XP-Storm. The following parameters have been used to determine post development runoff using the XP-Storm model:

- The catchment (7.09 ha) for the site has been defined;
- Rainfall for the site is based on 2016 IFD Data (Section 3.3);
- Depth to groundwater of more than 5 m;
- Basin and underground storage inverts of 9.0 and 8.0 mAHD respectively;
- Infiltration rate of 5 m/day (Section 3.5); and
- A slope value of 0.014 was used.

The post development scenario for the site was modelled to determine the basin configuration.

Table 6 outlines the runoff coefficients used in the post development model. It should be noted that these values are conservative estimates and that the breakdown of lot densities are estimates only and will be confirmed in the UWMP.

Table 6: Post development Runoff Coefficients

Landuse	Area (ha)	Runoff Coefficient	Comment
Lots	4.34	30%	15 mm of initial loss was considered on for lots to account for lot connections to the soakwells.
Road Reserve	1.85	80%	Includes road, footpaths and verges.
POS	0.90	10%	The POS was assumed to retain the runoff within its boundary.
Total Area			7.09 ha
Equivalent Impervious Area			1.48 ha
2% of Equivalent Imp. Area			296 m ²

The stormwater was designed to contain the 20% AEP event within the underground storage and 1% AEP event within the storage basin in the POS areas. The proposed stormwater management system is presented in Table 7 and Figure 9.

Flow paths for the frequent events, 20% and 1% AEP events are shown in Figure 10 and demonstrate areas that are inundated during each event. The system allows for minimum habitable floor levels to be at least 0.5 m above the proposed top water level in the basin. Figure 10 presents a conceptual cross section of the POS with the storage basin, underground storage and design water levels. Landscaping concept of the POS is provided in Attachment 3 to this addendum.

The proposed underground storage and basin design is conceptual only. The UWMP will provide the final configuration that may be modified following a review of additional earthwork and road design levels.

Table 7: Stormwater Management System

STORMWATER MANAGEMENT SYSTEM	
Catchment Area (ha)	7.09
Frequent Events (first 15mm of rainfall)	
System	Infiltration through Amended Soil
Location	Base of the Underground Storage
Infiltration Rate (m/day)	5
Minimum Area Required (m ²)	300
Underground Storage (for up to 20% AEP event)	
Location	POS
Base Area (m ²)	600
Invert (mAHD)	8.00
Depth to Groundwater (m)	> 5.0
Maximum Depth (m)	0.75
Flood Storage (m ³)	450
Storage Basin (for events greater than 20% AEP and up to 1% AEP)	
Location	POS
Base Area (m ²)	300
Invert (mAHD)	9.00
Maximum Basin Depth (m)	0.80
Depth to Groundwater (m)	> 5.0
Side Slopes	1:6
Maximum Basin Top Area (m ²)	725
Maximum Flood Depth (m)	0.70
Top Water Level (mAHD)	9.70
Top Water Level Area (m ²)	662
Flood Storage (m ³)	330
Critical Duration (hours)	24
Maximum time to empty (hours)	10

6.2 Construction Phase

Outstanding Item 8

CoR	The LWMS must also refer to the requirement to provide an amalgamated stormwater management configuration with Lots 5 to 8 Kerosene Lane. The detailed design of the ultimate configuration can be documented in the UWMP, but the LWMS must demonstrate that this is achievable. The Implementation Strategy should outline the commitment to work with the developer of Lots 5 to 8 Kerosene Lane to provide a centralised stormwater management system to be documented at detailed design (UWMP) stage.
DoW	-
Response	Noted. The implementation strategy has been updated accordingly.

6.1.1 Urban Water Management Plan

The UWMP will document the final water management plans for this site. It will include a summary of the site conditions in a number of plans; environmental, geotechnical, surface water, groundwater and site condition plans.

A key focus of the UWMP will be to provide detail of the final stormwater system design, including engineering drawings of infrastructure, details of control point inverts, and the locations and clearance to groundwater. Further information that is obtained from additional monitoring and details on the final lot density will allow for an analysis of the conceptual designs provided in the LWMS.

The following information will also be provided in the UWMP:

- Details on the piped road drainage network provided in engineering drawings;
- Any at source infiltration opportunities (including raingardens, use of easement POS);
- Further detail of the landscaping design, including POS area and water requirements and water use sustainability initiatives;
- Final configuration of the POS, including integration of designs with Lot 5 to 8 to ensure a centralised, cohesive stormwater management system;
- Design of non-structural controls; and
- Measures to mitigate mosquito populations

Figure 9 - Conceptual Stormwater System

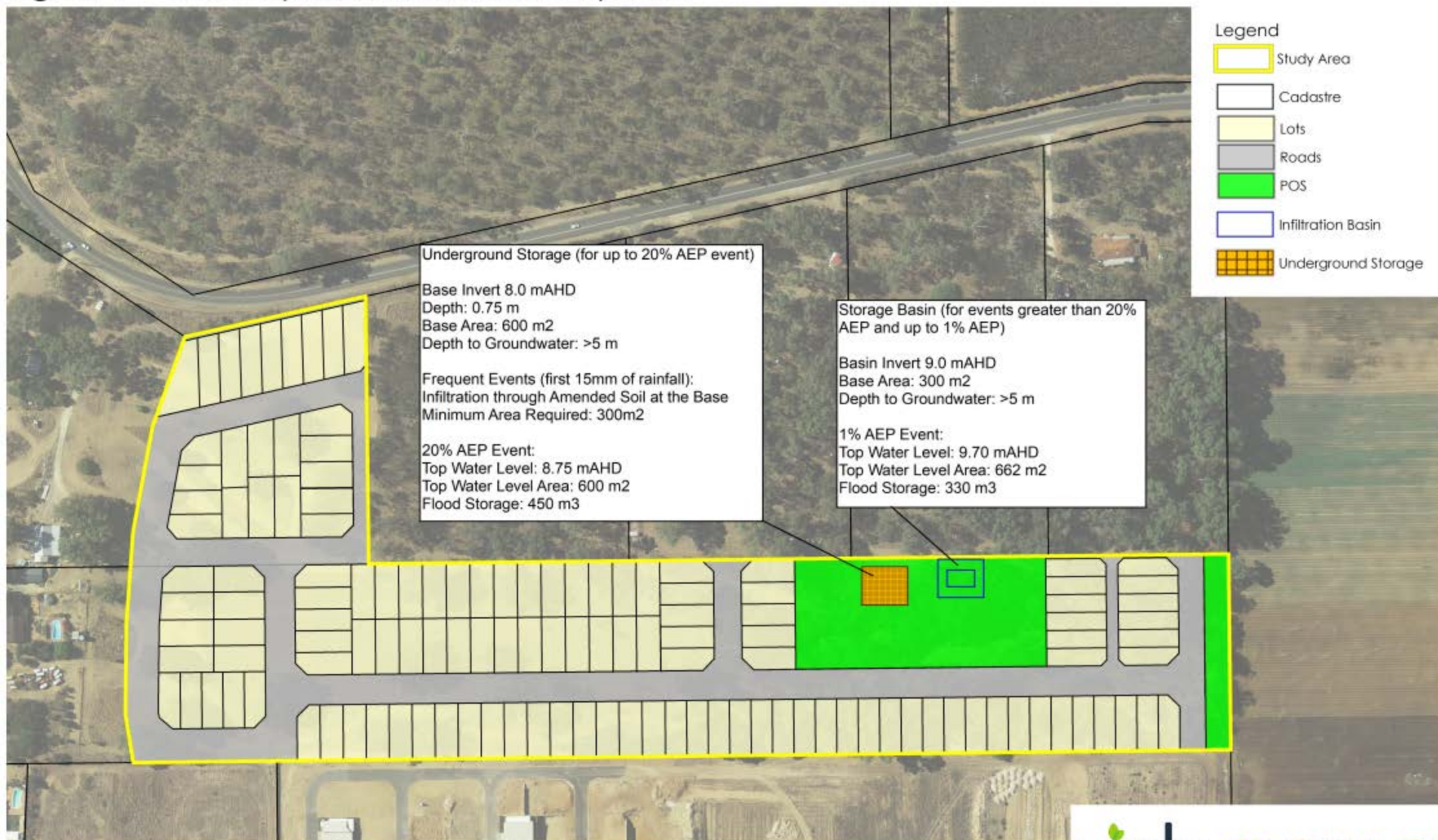
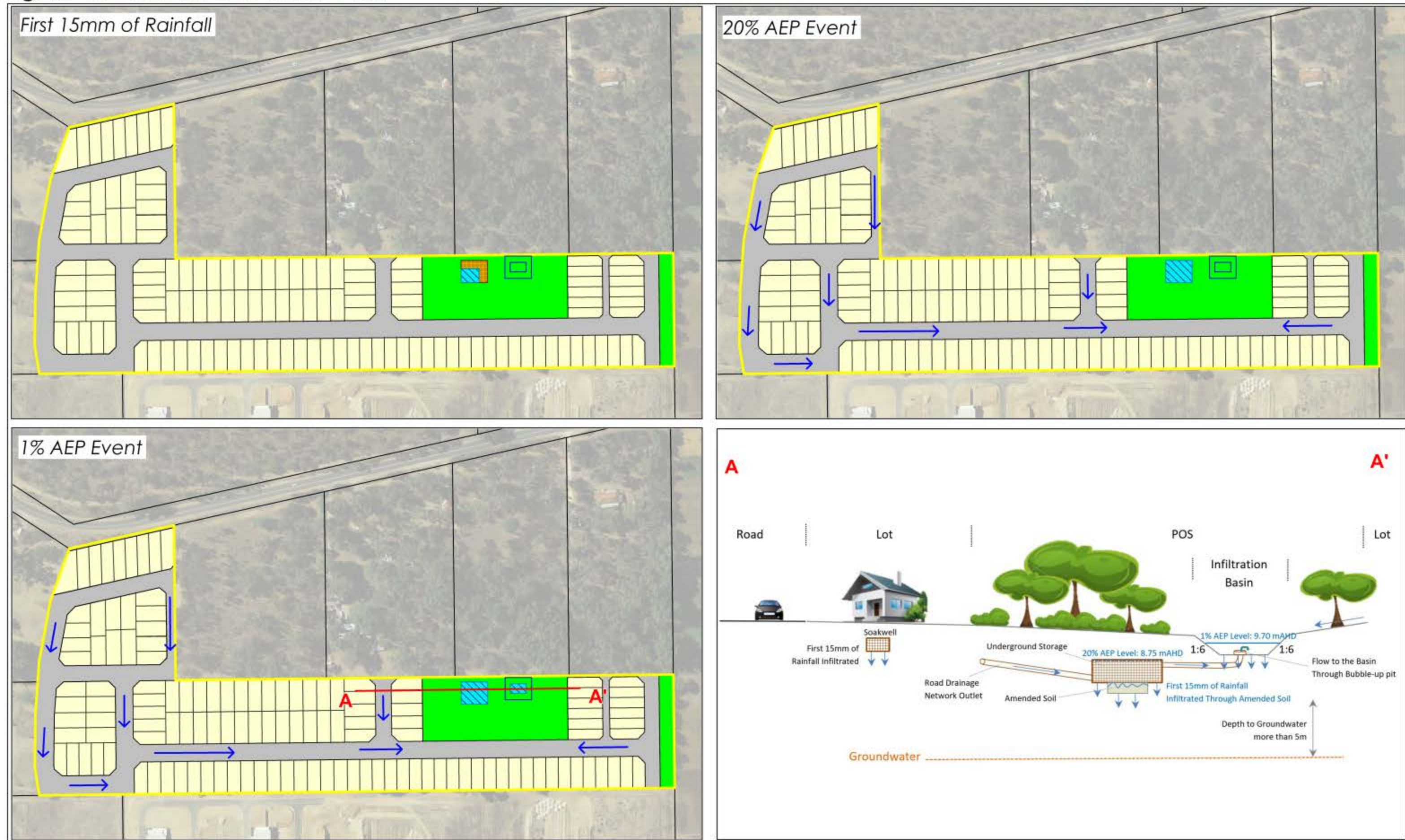


Figure 10 - Stormwater Event Plan



Legend

	Study Area		Lots		Inundated Area
	Cadastre		Road		Infiltration Basin
	Flow Direction		POS		Underground Storage

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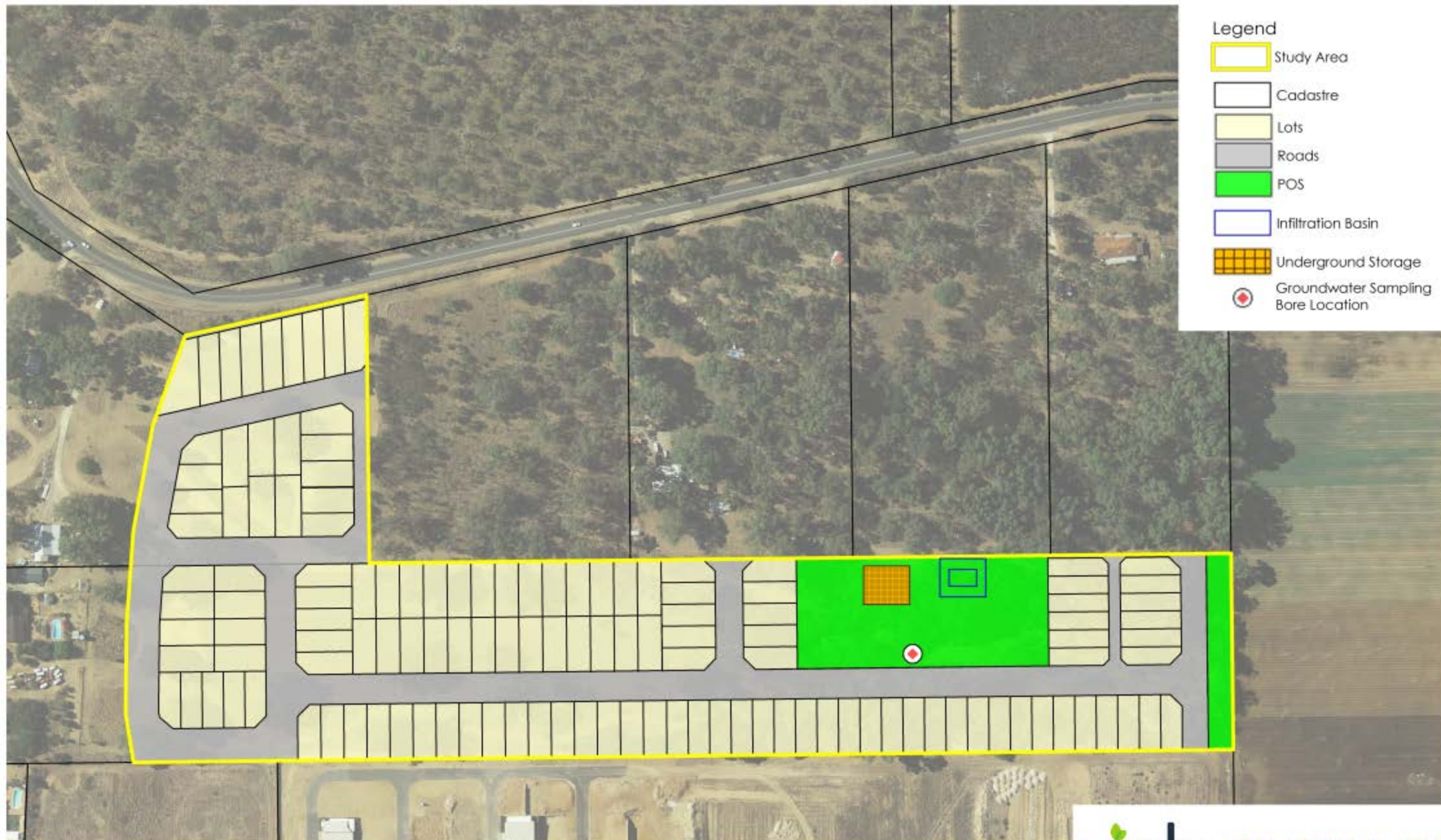
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ATTACHMENT 1: Groundwater Sampling Bore Location

Infield Holdings Pty Ltd: Kerosene Lane, Baldivis - Addendum for the LWMS Groundwater Sampling Bore Location



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Scale 1: 2,500 @ A4

0 50 m



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ATTACHMENT 2: 5C Licence Application - DoW Correspondence

Ross Perrigo

From: Carmel Sullivan <carmel.sullivan@dwer.wa.gov.au>
Sent: Friday, August 25, 2017 12:35 PM
To: Ross Perrigo
Subject: FW: HPRM: Authorisation Letter

Hi Ross

The City of Rockingham are aware of our assessment process and acknowledge that if the resource was fully allocated prior to the submission of an LWMS, then this information would have been communicated to them by DoW. The submission of an application captures the requested volume of water in the licensing system, it does not however guarantee that a licence will be issued. This decision is subject to the assessment process under Section 7.2 of the RIWI Act. We would not proceed through all the planning and subdivisional stages before advising there was insufficient water available. We find this is not a good use of time or resources and a bit late in the process.

Kind regards

Carmel Sullivan

A/Program Manager - Water Licensing
Peel Region

Department of Water and Environmental Regulation

107 Breakwater Parade, MANDURAH WA 6210
PO Box 332, MANDURAH WA 6210
T: (08) 9550 4210 | F: (08) 9581 4560
E: carmel.sullivan@dwer.wa.gov.au www.dwer.wa.gov.au

From: Ross Perrigo [<mailto:ross@urbaqua.org.au>]
Sent: Thursday, 24 August 2017 10:37 AM
To: Sandy WOOD <Sandy.WOOD@dwer.wa.gov.au>
Subject: RE: HPRM: Authorisation Letter

Thanks Sandy.

That was my understanding of the CAW and GWL applications. Could you confirm that there is allocation available for these applications when the LWMS is approved? Both the LWMS approval and GWL applications rely on confirmation of the other.

City of Rockingham has requested the following in the LWMS:

Amendments to Section 4.1. Confirmation is required from the DoW that this allocation has been set aside to support the proposed development.

Don't hesitate to give me a call should you have any questions.

Regards,

Ross Perrigo
Senior Engineer
m: 0403 315 926 | p: 9328 4663 | f: 6316 1431

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From: Sandy WOOD [<mailto:Sandy.WOOD@dwer.wa.gov.au>]
Sent: Thursday, August 24, 2017 10:32 AM
To: Ross Perrigo
Subject: RE: HPRM: Authorisation Letter

Morning Ross

Further to you email and the attached letter of authority to act on behalf of your client. I can confirm we are in receipt of the CAW & GWL applications, the applications still need to be assessed. It is my understanding that the LWMS needs to be approved as part of the assessment process.

I hope this helps.

Regards

Sandy Wood
Natural Resource Management Officer
Kwinana Peel Region

Department of Water and Environmental Regulation
Marine Operations Centre, 107 Breakwater Pde, MANDURAH WA 6210
PO Box 332 MANDURAH, WA 6210
T: (08) 9550 4207 | F: (08) 9581 4560
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Twitter: [@DWER_WA](https://twitter.com/DWER_WA)

From: Ross Perrigo [<mailto:ross@urbaqua.org.au>]
Sent: Friday, 18 August 2017 4:00 PM
To: Sandy WOOD <Sandy.WOOD@dwer.wa.gov.au>
Subject: HPRM: Authorisation Letter

Hi Sandy,

Earlier we discussed an existing application for Lot 302 Mandurah Road and Lot 309 Kerosene Lane in Baldivis.

Please find attached a letter from our client regarding authorisation to act on his behalf with regards to this application.

Should you require anything further, please do not hesitate to give me a call.

Regards,

Ross Perrigo
Senior Engineer
m: 0403 315 926 | p: 9328 4663 | f: 6316 1431

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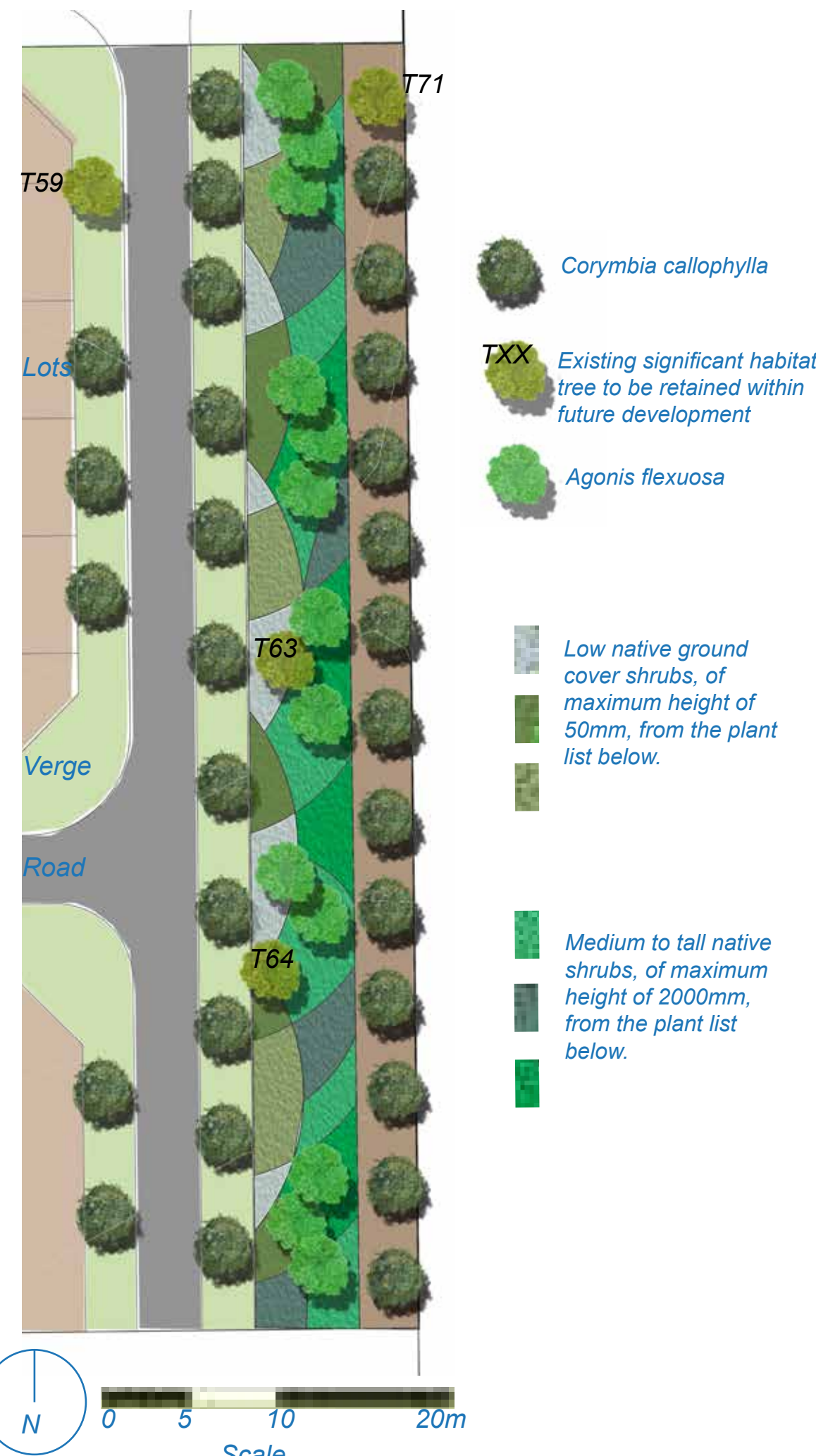
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ATTACHMENT 3: Landscaping Plans

LANDSCAPE CONCEPT POS AREA 1



LANDSCAPE CONCEPT POS AREA 2



Key

- Existing trees and vegetation retained where possible and further supplemented with local and fire safe species (see list)
- Drainage basin planted with native reeds and sedges. (By others)
- Paved picnic area and seating
- Decorative concrete paving
- Stairs down to POS from pathway above
- Grassed drainage swale with max batters of 1:6
- Drainage outlet from underground storage tanks
- Limestone retaining walls, with planted garden
- Parallel parking car bays (7)
- Disabled access parking bay
- Underground storage tanks

- TXX Existing significant habitat tree to be retained within future development
- Corymbia calophylla
- Agonis flexuosa
- Melaleuca raphiophylla

Plant list

Trees

- Agonis flexuosa
Allocasuarina fraseriana
Banksia menziesii
Brachychiton populensis
Brachychiton X rosea
Corymbia calophylla
Eucalyptus decipiens
Eucalyptus marginata
Eucalyptus rudis
Eucalyptus spathulata
Eucalyptus tottiana
Melaleuca raphiophylla

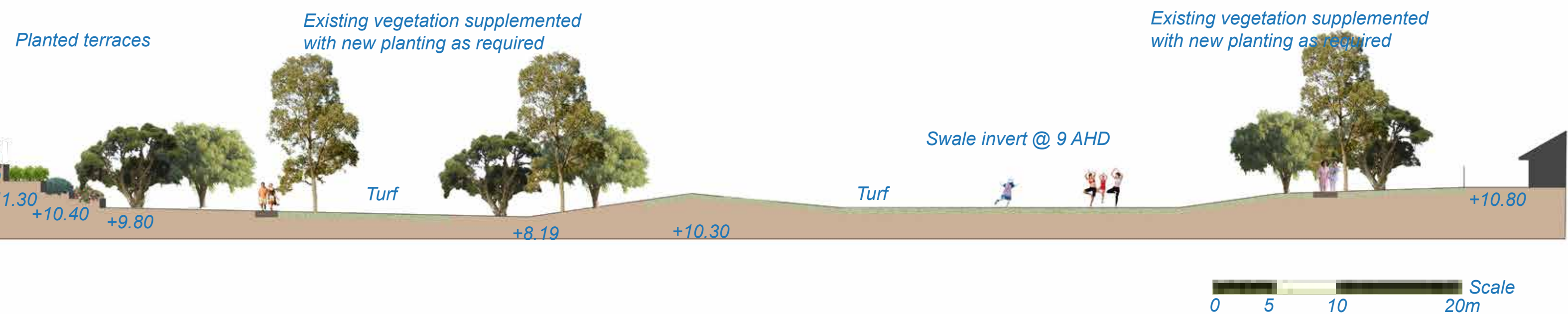
Shrubs and groundcovers

- Anigozanthos manglesii
Atriplex cinerea
Banksia blechnifolia
Bossiaea ornata
Callitris preisii
Calothamnus villosus
Carobrotus virescens
Conostylis candidans
Correa alba
Correa pulchella
Corymbia maculata
Damperia linearis
Dianella revoluta
Dichondra repens
Eremaea pauciflora
Eremophila glabra
Festuca glauca
Ficinia nodosa
- Gastrolobium capitatum
Gompholobium scabrum
Grevillea crithmifolia
Hardenbergia comptoniana
Hardenbergia comptoniana
Hemiandra pungens
Hypocalymma robustum
Kennedia prostrata
Kennedia prostrata
Leucophyta brownii
Melaleuca lanceolata
Melaleuca lateritia
Melaleuca seriata
Melaleuca trichophylla
Myoporum parvifolium
Olearia axillaris
Pericalymma ellipticum
- Philotheca spicata
Pimelea ferruginea
Scaevola alba
Scaevola crassifolia
Templetonia retusa
Verticordia acerosa
Verticordia plumosa
Zygophyllum billardieri

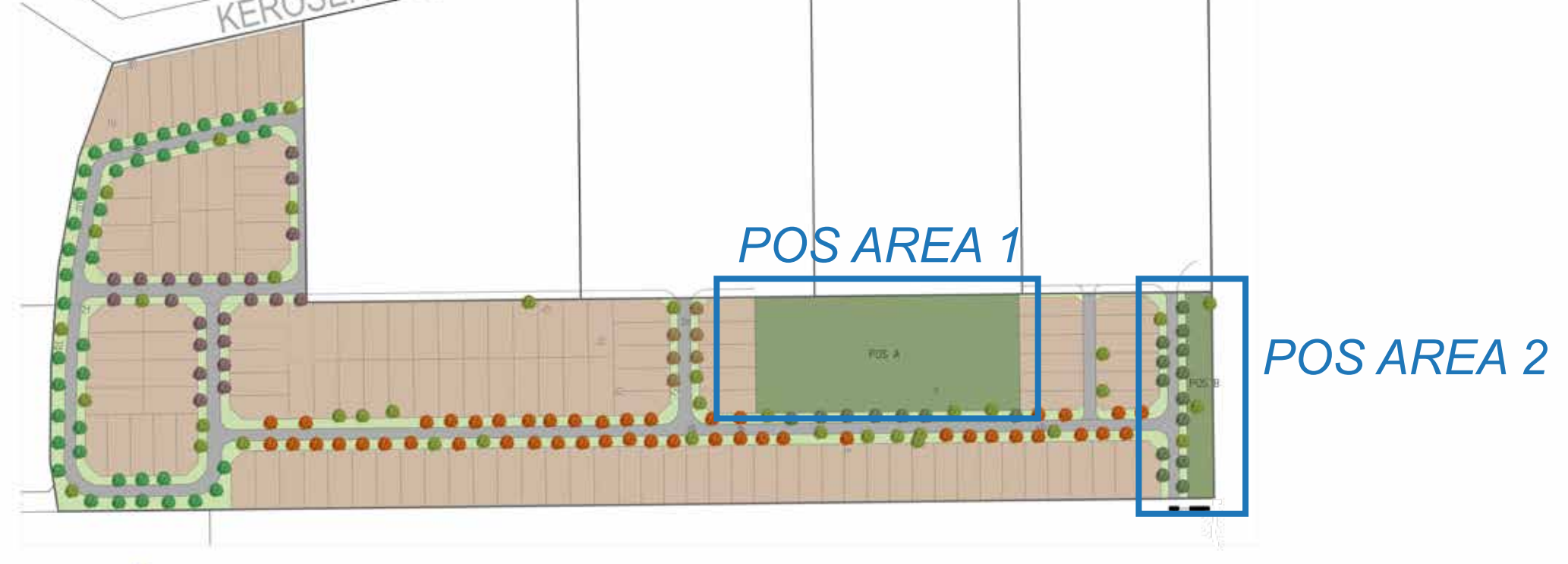
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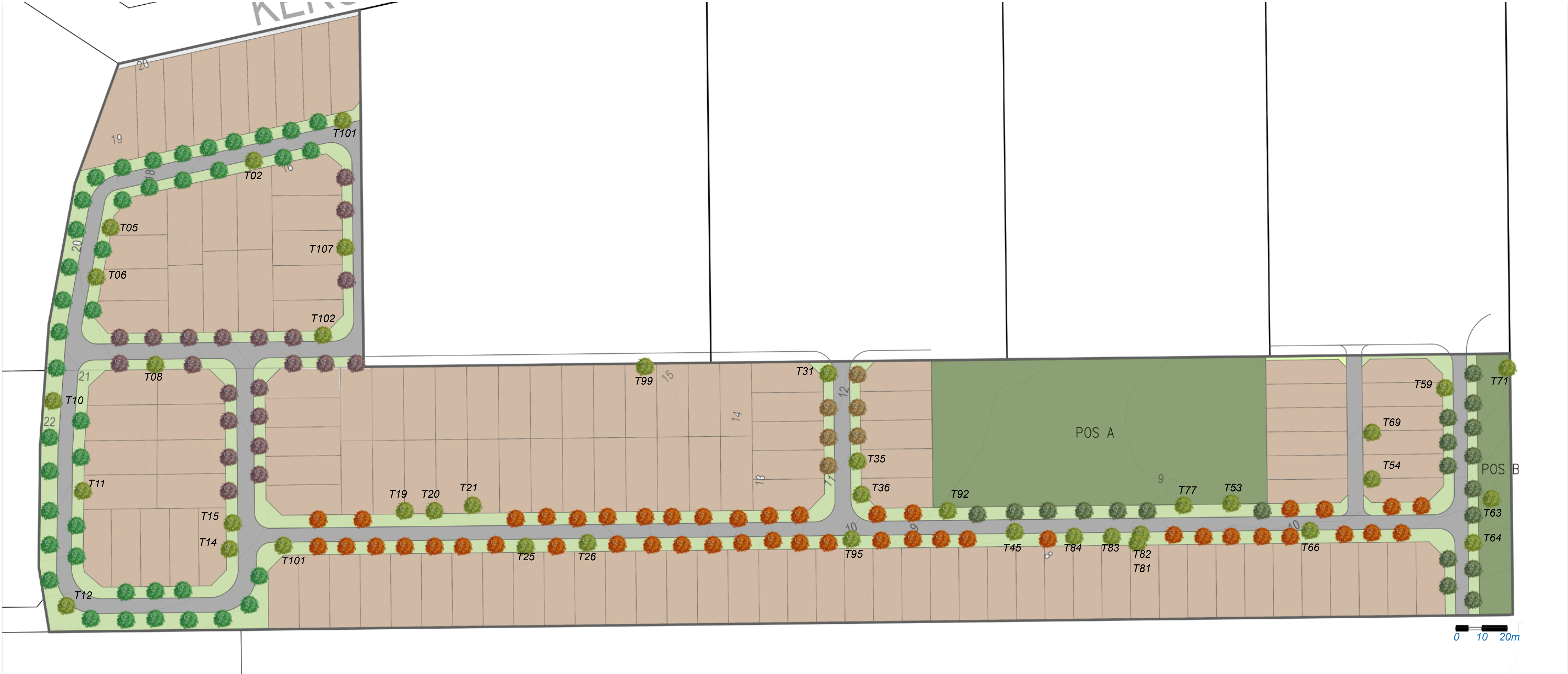
- Final plant selections for POS areas and street trees to be done in accordance with the City of Rockingham's preferred species list.
- Garden beds and turf areas prepared to the City of Rockingham's specification.
- Park furniture and concrete paving installed to the City of Rockingham's specification.
- Low fuel load plantings in accordance with Bush fire management Plan
- All garden and turf areas to be irrigated by bore.

Section A-A



Location Plan





Key

TXX Existing significant habitat tree to be retained within future verge development

Eucalyptus sideroxylon

Agonis flexuosa

Callistemon "Kings Park Special "

Eucalyptus Leucoxylon "rosea"

Corymbia ficifolia

- Notes
- Final plant selections for POS areas and street trees to be done in accordance with the City of Rockingham's preferred species list.
 - Garden beds and turf areas prepared to the City of Rockingham's specification.
 - Existing significant trees retained where possible.
 - Low fuel load plantings in accordance with Bush fire management Plan



Client: Town of Victoria Park

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
For Project Team	V1	AN	RP	Electronic	21 August 2017
Final	V2	AN	RP	Electronic	20 March 2018

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