



ROWE
GROUP
DESIGN

WANDI NORTH STRUCTURE PLAN

LYON ROAD, WANDI
SPN-0004M-4

RECORD OF ENDORSEMENT

IT IS CERTIFIED THAT AMENDMENT NO. 9 TO THE WANDI NORTH LOCAL
STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN
AUSTRALIAN PLANNING COMMISSION ON:

19 FEBRUARY 2026

Signed for and on behalf of the Western Australian Planning Commission:


.....

an officer of the Commission duly authorised by the Commission pursuant to
section 24 of the *Planning and Development Act 2005* for that purpose.

TABLE OF AMENDMENTS

AMENDMENT NO.	SUMMARY OF THE AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC
1	- Correction of the boundary between the Wandi North and Wandi South Structure Plan areas.	Minor	22 February 2012
2	- Alterations to the road layout (Stage 4) to address Kwinana Freeway noise and removal of road link (Stage 1).	Minor	11 July 2012
3	- Alterations to road layout, POS areas and the removal of a small part of the Investigation Area at the Primary School on Lot 677 Lyon Road.	Minor	27 February 2013
4	- Alterations to the road layout and lot configurations at Lot 683 Lyon Road (Stages 5 and 6).	Minor	10 April 2013
5	- The incorporation of an additional area of land to the north of the Structure Plan within Lot 683 Lyon Road and its integration into the Structure Plan area.	Minor	4 August 2014
6	- Classification of an area of land for 'Public Purposes' for the Wandi Primary School; - The increases in an area of 'Residential Area – R40' over an area currently zoned 'Residential Area – R30' at Lot 13; - Designation of an area of Parks Recreation and Drainage to the south of the land designated for 'Public Purposes'; and - Removal of Investigation Area 1.	Major	21 February 2017
7	- Removal of the 'Investigation area' from the Structure Plan Map; and - Reallocation of Land within Lot 9020 from R30 to R60.	Minor	AMENDMENT CANCELLED
8	- Removal of the 'Investigation area' from the Structure Plan Map; and - Designate approximately 2523m² of land at Lot 120 (No.1) Hartz Way as 'Commercial'.	Minor	27 May 2022
9	- Inclusion of approximately 5.07 hectares of balance land bound by Morwell Entrance, Windjana Rise, Wirra Corner and Lyon Road, comprising Lots 132, 9008 and 9035, within the Structure Plan boundary.	Minor	19 February 2026

DOCUMENT CONTROL

Printed 09 February 2026 4582_20250925_R_LSP Amdt mods_are V2

VERSION	FILE NAME	PREPARED BY	APPROVED BY	DATE
13	4582C_21Aug01R_rt	R. Thompson	R. Dixon	17/08/2021
14	4582_21sept01R_rt	R. Thompson	R. Dixon	28/09/2021
15	4582_21sept02R_rt	R. Thompson	R. Dixon	16/05/2022
16	4582_231018_LSPAmdt_R_rt	R. Hitchin	R. Thompson	20/11/2023
17	4582_20250925_R_LSP Amdt mods_are	A. Read.	R. Thompson	25/09/2025
18	4582_20250925_R_LSP Amdt mods_are V2	A. Read.	R. Thompson	09/02/2026

This report has been authorised by;



Rebecca Thompson
Manager Urban Design



Robyn Hitchin
Senior Urban Planner



Jamie Baxter
Quality Control

CONTACT PERTH OFFICE

p 9221 1991 **e** info@rowegroup.com.au **w** rowegroup.com.au
a 3/369 Newcastle Street, Northbridge 6003

Although all care has been taken on the compilation of this document Greg Rowe Pty Ltd and all parties associated with its preparation disclaim any responsibility for any errors or omissions. The right is reserved to change this document at any time. This document does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Liability is expressly disclaimed by Greg Rowe Pty Ltd for any loss or damage which may be sustained by any person acting on this document.

© 2026 Greg Rowe Pty Ltd All Rights Reserved. Copyright in the whole and every part of this document belongs to Greg Rowe Pty Ltd and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Greg Rowe Pty Ltd.



EXECUTIVE SUMMARY

This Structure Plan incorporates the following amendment to the existing approved Wandí North Structure Plan:

- ▲ Inclusion of approximately 5.07 hectares of balance Urban land bound by Morwell Entrance, Windjana Rise, Wirra Corner and Lyon Road, comprising Lots 132, 9008 and 9035, within the Structure Plan boundary. The additional land is to be allocated a Residential (R30) zoning under the Structure Plan.

The proposed amendment to the Structure Plan will complete the residential development of the Wandí Urban cell. The planning, environmental, traffic and servicing considerations for the Amendment area have been historically considered in the planning for the existing Structure Plan area, which will facilitate the seamless inclusion of the additional land. This land was not previously included within the Structure Plan boundary because of the underlying MRS zoning, however this has now been resolved and as such, the land is ready and capable of development for residential purposes.



STRUCTURE PLAN SUMMARY

ITEM	STRUCTURE PLAN	SECTION NUMBER REFERENCED IN REPORT
Wandi North Structure Plan Area	102.6 hectares	1.2
Area of each land use proposed:		3.1
Zones		
- Residential	- 44.4 hectares	
- Commercial	- 0.25 hectares	
Reserves		
- Parks, Recreation and Drainage	- 33.1 hectares	
- Public Purposes – Primary School	- 3.5 hectares	
Estimated Lot Yield	1,092 lots	3.3
Estimated Number of Dwellings	1,092 dwellings	3.3
Estimated Residential Density:		3.3
- dwellings per gross urban hectare as per Directions 2031	- 10.6 dwellings per gross urban hectare	
- dwellings per site hectare as per Liveable Neighbourhoods	- 24.5 dwellings per residential site hectare	
Estimated population	3057 people @2.8 people per household	3.3
Number of Secondary Schools	nil	3.8
Number of Primary Schools	1 primary school	3.8
Amount of Unrestricted Public Open Space as per Liveable Neighbourhoods (credited within LSP boundary)	6.48 hectares, 8.07%	3.2
Amount of Restricted Public Open Space as per Liveable Neighbourhoods (credited within LSP boundary)	6.6 hectares, 8.21%	3.2
Composition of total Public Open Space provided (including additional not credited parkland)		3.2
- Neighbourhood Parks	- 30.2 hectares, 91%	
- Local Parks	- 2.9 hectares, 9%	

Note: All information and areas are approximate only and are subject to survey and detailed design.

CONTENTS

DOCUMENT CONTROL	I
RECORD OF ENDORSEMENT	I
TABLE OF AMENDMENTS	II
EXECUTIVE SUMMARY	III
STRUCTURE PLAN SUMMARY	IV
CONTENTS	I
FIGURES	II
TECHNICAL APPENDICES	III
1. STRUCTURE PLAN AREA	2
2. OPERATION	2
3. STAGING	2
4. SUBDIVISION & DEVELOPMENT REQUIREMENTS	2
5. LOCAL DEVELOPMENT PLANS	3
6. DEVELOPER CONTRIBUTION ARRANGEMENTS	4
1. PLANNING BACKGROUND	7
1.1 INTRODUCTION AND PURPOSE	7
1.2 LAND DESCRIPTION	7
1.2.1 LOCATION	7
1.2.2 AREA AND LAND USE	8
1.2.3 LEGAL DESCRIPTION AND OWNERSHIP	8
1.3 PLANNING FRAMEWORK	12
1.3.1 ZONING AND RESERVATIONS	12
1.3.2 REGIONAL AND SUB-REGIONAL STRUCTURE PLAN	13
2. SITE CONDITIONS AND CONSTRAINTS	17
2.1 BIODIVERSITY AND NATURAL AREA ASSETS	17
2.2 SOILS AND TOPOGRAPHY	17
2.3 ACID SULPHATE SOILS	18

2.4	CONTAMINATION	18
2.5	HYDROLOGY AND GROUNDWATER.....	18
2.6	BUSHFIRE MANAGEMENT	18
2.7	HERITAGE	19
2.7.1	ABORIGINAL CULTURAL HERITAGE	19
2.7.2	EUROPEAN HERITAGE.....	19
3.	LAND USE AND SUBDIVISION REQUIREMENTS	20
3.1	LAND USE	20
3.2	RESIDENTIAL	20
3.3	PUBLIC OPEN SPACE	22
3.4	MOVEMENT NETWORKS	22
3.5	WATER MANAGEMENT	23
3.6	SERVICING	25
3.7	DEVELOPER CONTRIBUTION ARRANGEMENTS.....	25

FIGURES

PLAN 1. LOCAL STRUCTURE PLAN	4
1. REGIONAL LOCATION.....	9
2. LOCAL LOCATION	10
3. SITE PLAN	11
4. METROPOLITAN REGION SCHEME ZONING.....	15
5. CITY OF KWINANA LOCAL PLANNING SCHEME NO. 2 ZONING.....	16
6. INDICATIVE SUBDIVISION CONCEPT (AMENDMENT AREA).....	21
7. PUBLIC OPEN SPACE DISTRIBUTION PLAN	26
8. PUBLIC OPEN SPACE SCHEDULE	27

▲ TECHNICAL APPENDICES

APPENDIX NUMBER	DOCUMENT TITLE	NATURE OF DOCUMENT	REFERRAL/APPROVAL AGENCY	APPROVAL STATUS AND MODIFICATIONS
1	Certificates of Title	Supporting	-	-
2	Bushfire Management Plan	Requires Approval	DFES and City of Kwinana	
3	Local Water Management Strategy	Requires Approval	City of Kwinana	Approved by DWER 23/01/2025



PART ONE

IMPLEMENTATION



ROWE
GROUP
DESIGN

1. STRUCTURE PLAN AREA

This Structure Plan applies to the land contained within the inner edge of the line denoting the structure plan boundary on the Structure Plan Map (Plan 1).

2. OPERATION

In accordance with Schedule 2, Part 4 of the Planning and Development (Local Planning Schemes) Regulations 2015, this Structure Plan shall come into operation when it is approved by the Western Australian Planning Commission (WAPC).

3. STAGING

The Structure Plan has been delivered over approximately 15 development stages, comprising the Honeywood and Whistling Grove estates. The current Structure Plan amendment represents the final development stages for both estates.

The Amendment area comprises Urban Residential Development with anticipated yield of approximately 88 lots (subject to detailed design), anticipated to be delivered in a single stage by each of the respective landowners.

4. SUBDIVISION & DEVELOPMENT REQUIREMENTS

4.1 DENSITY

Residential densities for the Structure Plan area are the residential densities shown on the Structure Plan Map (Plan 1).

4.2 PUBLIC OPEN SPACE

Public open space is to be provided in accordance with the Structure Plan Map (Plan 1).

4.3 LAND USE PERMISSIBILITY

Land use permissibility within the Structure Plan area shall accord with the corresponding land use classification in the City of Kwinana Local Planning Scheme No.2.

4.4 BUSHFIRE MANAGEMENT PLAN

This Structure Plan is supported by a Bushfire Management Plan (BMP). Any land falling within 100 metres of a bushfire hazard identified in the BMP is designated as a Bushfire Prone Area for the purpose of the Building Code of Australia.

4.5 NOTIFICATIONS ON TITLE

The Council shall recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval for a notification to be placed on the Certificate of Title to suitably respond to the following:

- a) That a lot(s) with a bushfire attack level (BAL) rating of 12.5 or higher is within a designated bushfire prone area and subject to a *Bushfire Management Plan*.



4.6 MOSQUITO AND MIDGE MANAGEMENT PLAN

The Council shall recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval for the preparation, approval and implementation of a Mosquito and Midge Management Plan.

4.7 LYON ROAD INTERFACE

The Lyon Road interface is to be managed with retention of existing trees and revegetation, and road widening being provided at subdivision stage.

Vehicle access is only permitted from Lyon Road where shown on the Subdivision Concept Plan and is to be guided by a Local Development Plan. A s150 (*Planning and Development Act*) access restriction may be required at subdivision stage.

4.8 TREE RETENTION AND REVEGETATION PLAN

Vegetation for retention and revegetation areas along the Lyon Road verge are identified on the Subdivision Concept Plan.

Tree retention is to be identified through the preparation of a Tree Retention and *Revegetation Management Plan* prior to subdivision works.

4.9 ADDITIONAL REQUIREMENTS

ADDITIONAL REQUIREMENTS	APPROVAL STAGE
Contamination investigation and, where required, site remediation.	Condition of subdivision.
A <i>Tree Retention and Revegetation Management Plan</i> .	Condition of subdivision.
Three (3) metre widening of the Lyon Road reserve.	Condition of subdivision.

5. LOCAL DEVELOPMENT PLANS

Local Development Plans (LDP) are required to be prepared and implemented pursuant to Part 6 of Schedule 2 of the *Planning and Development Act (Local Planning Schemes) Regulations 2015* for lots comprising one or more of the following attributes:

- Lots abutting Lyon Road; and
- Lots directly abutting the proposed cul-de-sac head and tree retention area.

Local Development Plans are required to address the following:

- Where required, uniform fencing is to be provided along the Lyon Road interface;
- The Lyon Road interface is intended to provide for a 'soft' transition to the adjacent Rural zone; and



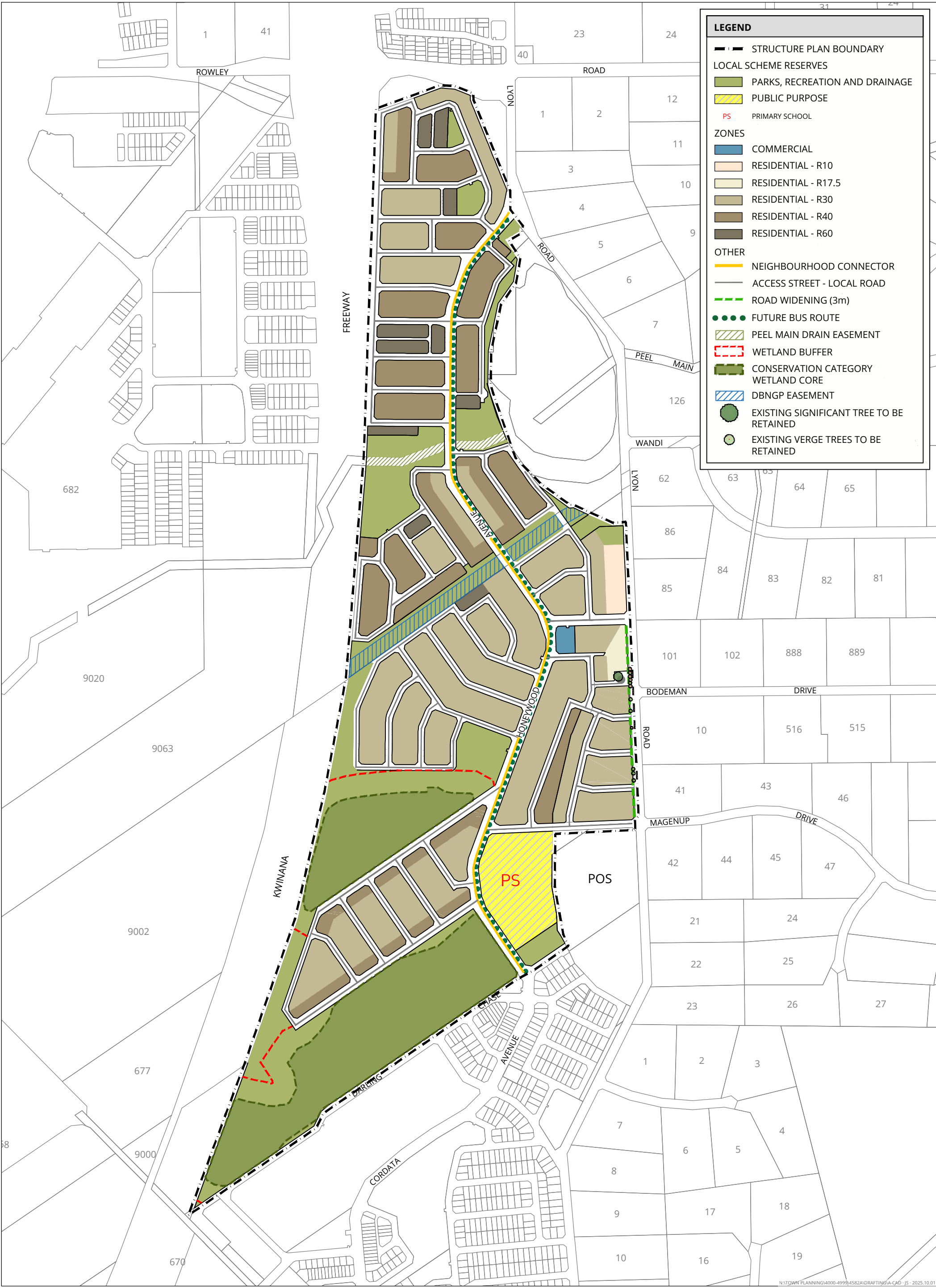
- c) The coordination and management of vehicle access on to Lyon Road.

6. DEVELOPER CONTRIBUTION ARRANGEMENTS

Under the City of Kwinana Local Planning Scheme No. 2, the following development contribution arrangements apply and/or are contemplated:

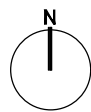
- a) Development Contribution Area 5 for the funding of traditional infrastructure; and
- b) Development Contribution Area 9 for the funding of community infrastructure.





WANDI NORTH LOCAL STRUCTURE PLAN (AS AMENDED)

PLAN 1
WANDI NORTH



0 180 m
SCALE @ A3: 1:7500
4582C-STR-01-T

DRAWN:
DATE CREATED:
PROJECTION:
CADASTRE:

JS
2025.10.01
MGAS0 GDA94
LANDGATE

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.



ROWE
GROUP
DESIGN



PART TWO

EXPLANATORY SECTION



ROWE
GROUP
DESIGN

1. PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSE

This Structure Plan comprises an amendment to the existing approved Wandí North Structure Plan.

The proposed amendment to the Structure Plan seeks to:

- ▲ Include approximately 5.07 hectares of balance Urban land bound by Morwell Entrance, Windjana Rise, Wirra Corner and Lyon Road, comprising Lots 132, 9008 and 9035, within the Structure Plan boundary. The additional land is to be allocated a Residential (R30) zoning under the Structure Plan.

The amendment area was previously not included within the Urban zone under the Metropolitan Region Scheme, and as such was previously excluded from the Structure Plan boundary. This land has now been appropriately zoned, and therefore the purpose of the Amendment is to modify the Structure boundary to include this land. This land will comprise the final development stages of the Honeywood and Whistling Grove estates. Notwithstanding its previous exclusion from the approved Structure Plan, previous technical studies and design considerations for this land have been included in the context of the wider Structure Plan.

We confirm no other modifications are proposed to the balance of the Structure Plan as part of this request.

For the purposes of the following 'Part Two – Explanatory Section' of the Structure Plan, this report primarily focuses on the area pertaining to the current amendment request, providing contextual information in relation to the wider Structure Plan area where required.

1.2 LAND DESCRIPTION

1.2.1 LOCATION

The Structure Plan is located within the metropolitan south-west corridor, within the municipality of the City of Kwinana. The site is situated approximately 24 kilometres south of the Perth Central Area and is accessible via the Kwinana Freeway. The Kwinana Town Centre is located approximately 8 kilometres south and the Spectacle Regional Reserve approximately 1 kilometre from the site.

The Structure Plan area is generally bound by Rowley Road to the north, Lyon Road to the east, Darling Chase to the south, and the Kwinana Freeway to the west.

The area pertaining to this amendment comprises Lot 132 (No.23) Wirra Corner, Lot 9008 Lyon Road and Lot 9035 Windjana Rise, Wandí, being an area of approximately 5.07 hectares bound by Morwell Entrance to the north, Wirra Corner and Hartz Way to the west, Windjana Rise to the south, and Lyon Road to the east.

Refer **Figure 1** – Regional Location.

Refer **Figure 2** – Local Location.



1.2.2 AREA AND LAND USE

The development of the Structure Plan area has generally been completed, comprising the Honeywood and Whistling Grove estates. The proposed amendment area represents the final development stages for those estates.

The land subject to amendment has been predominantly cleared of vegetation under previous approvals. There is a small area of vegetation remaining within Lot 132, which will be cleared to facilitate the development of the land for residential purposes.

There is an existing market garden operation on Lot 9004, which is intended to cease to facilitate the development of the land for residential purposes.

Refer **Figure 3** – Site Plan.

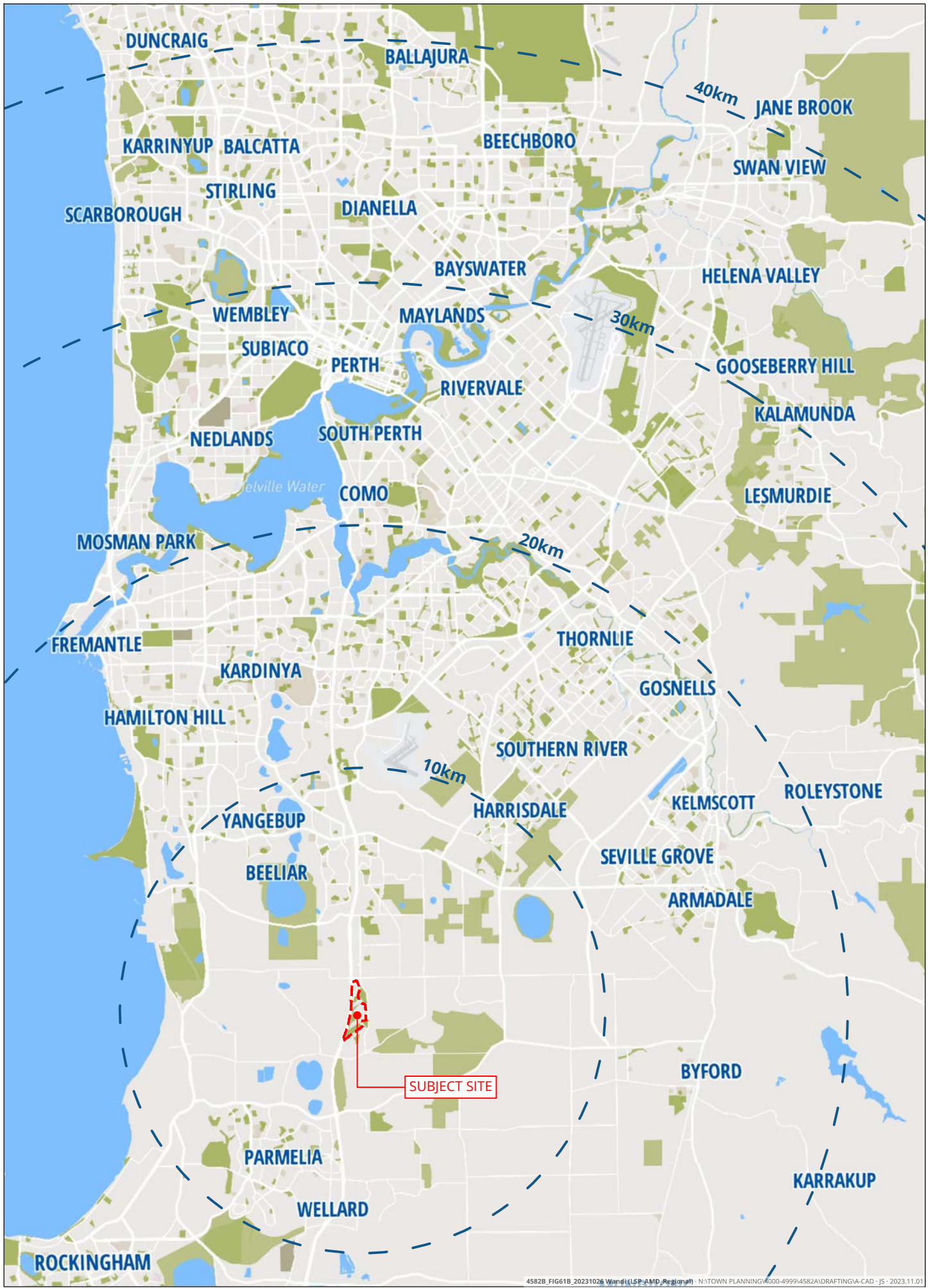
1.2.3 LEGAL DESCRIPTION AND OWNERSHIP

The Amendment Area comprises three (3) landholdings with an area of approximately 5.07 hectares, The lots subject to the Amendment are legally described as follows:

ADDRESS	DEPOSITED PLAN	VOLUME / FOLIO	PROPRIETOR
Lot 132 (No. 23) Wirra Corner	421718	4010 / 132	Wandi Anketell Holdings Pty Ltd
Lot 9008 (No. 520) Lyon Road	427658	4058 / 175	Galati Rando
Lot 9035	408837	2910 / 182	Wandi Anketell Holdings Pty Ltd

Refer **Appendix 1** – Certificate of Title.





4582B_FIG1B_20231026_Ward1(LSP-AMP_Regional) - N:\TOWN PLANNING\4000-4999\4582A\DRAWING\A-CAD - JS - 2023.11.01



0 5000m
SCALE @ A4: 1:200,000



FIGURE 1
REGIONAL LOCATION

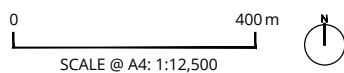
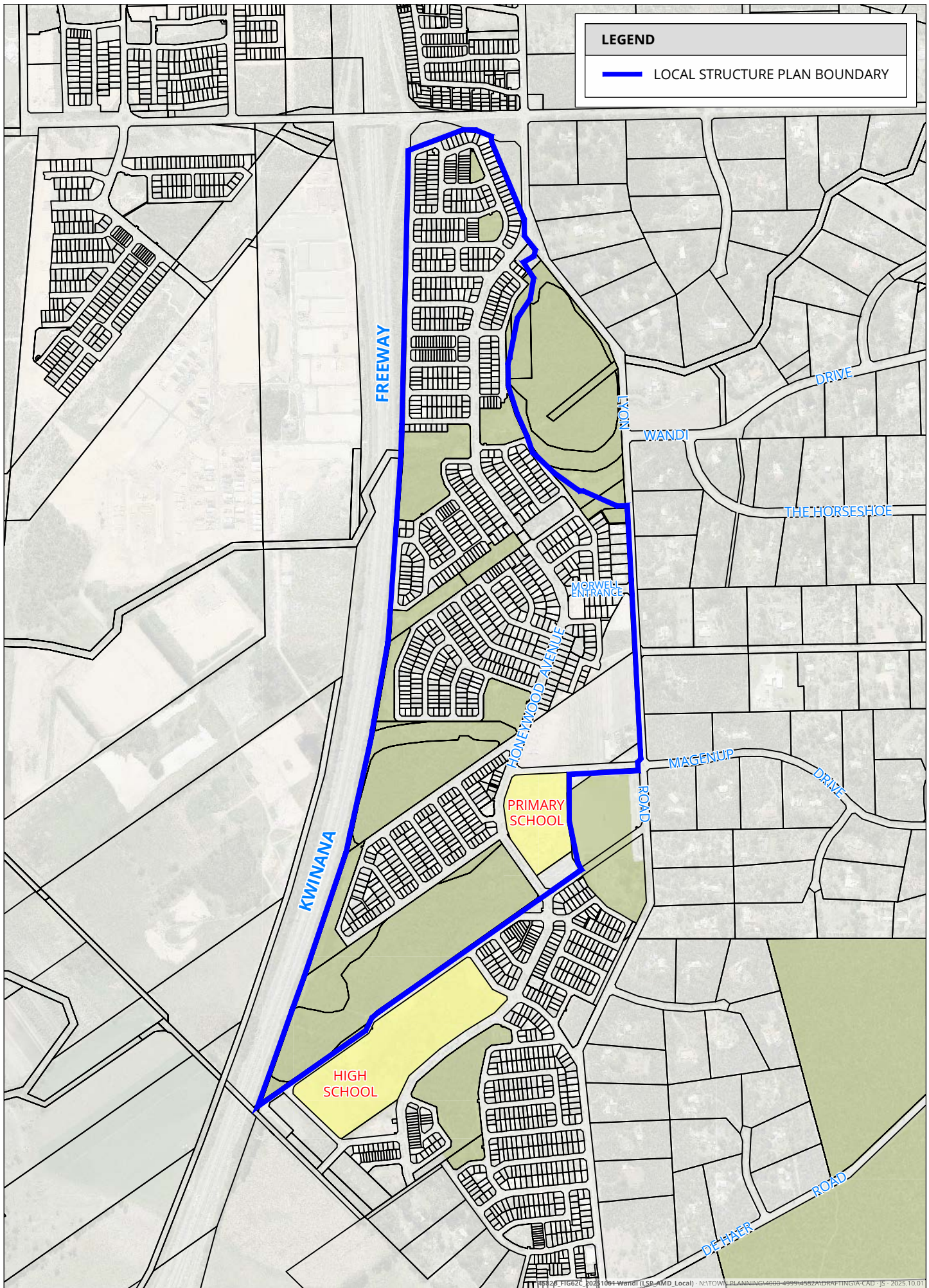


FIGURE 2
LOCAL LOCATION



1.3 PLANNING FRAMEWORK

1.3.1 ZONING AND RESERVATIONS

The Structure Plan area is currently zoned 'Urban' under the provisions of the Metropolitan Region Scheme.

In accordance with the *Planning and Development Act 2005*, the Minister for Planning resolved to approve Amendment 164 to the City of Kwinana Town Planning Scheme No. 2 (subject to modifications) in August 2025. Upon Gazettal, Amendment 164 rezones the land from 'Rural Water Resource' and 'Special Rural' to 'Development', bringing it in to conformance with the Metropolitan Region Scheme.

Refer **Figure 4** – Metropolitan Region Scheme Zoning.

Refer **Figure 5** – City of Kwinana Town Planning Scheme No. 2 Zoning.

1.3.1.1 PUBLIC DRINKING WATER SOURCE PROTECTION AREA

The amendment area is located within the Jandakot Underground Water Pollution Catchment Area (UWPCA), classified as P3*. Accordingly, the provisions of *Water Quality Protection Note No. 38: Priority 3* (P3*) Areas* and *Water Quality Protection Note No. 25: Land Use Compatibility Tables for Public Drinking Water Source Areas* apply to the land.

In this regard, Amendment No. 164 to the City of Kwinana Town Planning Scheme No. 2 introduced a Special Control Area: *Public Drinking Water Source Protection Area*, and introduced the following provisions in to the Scheme:

Clause 5.15.5 Public Drinking Water Source Protection Area

5.15.5.1 Except for the development (including use of land, the removal of vegetation and earthworks) noted below, all development within a Public Drinking Water Resource Protection Area shall be subject to a requirement for development approval and shall be subject to the discretion of the local government, notwithstanding that the use may be designated a 'P' use under the Scheme.

For land identified as a Priority 3 Drinking Water Source Protection Area, requirements for development approval and land use permissibility are as per cl. 61 of the deemed provisions and the zoning table in the Scheme for the following uses:*

- a) *Ancillary accommodation;*
- b) *Grouped dwelling;*
- c) *Home Business;*
- d) *Home Occupation);*
- e) *Home office;*
- f) *Home store;*
- g) *Multiple dwelling;*

- h) *Residential building;*
- i) *Single house;*
- j) *Single bedroom dwelling; and*
- k) *Bed and Breakfast*

5.15.5.2 In its determination of any application for development approval and its advice in relation to land subdivision in a P3 area, the local government is to have particular regard to:*

- a) *State Planning Policy 2.9 Water and associated guidelines.*
- b) *Advice received from the Department of Water and Environmental Regulation (including comments in relation to its Water Quality Protection Note 25: Land Use Compatibility in Public Drinking Water Source Areas).*
- c) *Recommendations of the relevant drinking water source protection report or land use and water management strategy.*
- d) *The potential risk of contamination to the public drinking water source area resulting from a proposed land use and/or development.*
- e) *The retention of native vegetation and protection of wetlands and waterways.*
- f) *The drainage characteristics of the land, including surface and groundwater flow, and the adequacy of proposed measures to meet water quality targets and manage run-off and drainage.*

1.3.2 REGIONAL AND SUB-REGIONAL STRUCTURE PLAN

1.3.2.1 PERTH AND PEEL @ 3.5 MILLION AND SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

Perth and Peel @ 3.5 Million seeks to meet the targets identified under *Directions 2031 and Beyond* ('Directions 2031') and the *State Planning Strategy 2050*. The suite of documents also includes four sub-regional planning frameworks for the Central, North-West, North-East and South Metropolitan Peel sub-regions. The four sub-regional planning frameworks detail where future homes and employment should be located, and where important environmental assets should be avoided and protected.

The subject site is located within the *South Metropolitan Peel Sub-Regional Planning Framework* (the Framework). The Framework represents a whole of State Government approach to managing the future urban form within the sub-region and identifies sufficient land to meet the increased demand for residential dwellings.

Both *Perth and Peel @ 3.5 Million* and the *South Metropolitan Peel Sub-Regional Framework* identify the subject site as 'Urban', consistent with the zoning of the site under the MRS.

Whilst not operational at the time of approval of the original Structure Plan, the proposed amendment is consistent with objectives of the Sub-Regional Planning Framework.



1.3.2.2 JANDAKOT STRUCTURE PLAN

The Wandí North Structure Plan is situated within the Jandakot Structure Plan area.

Further to the review of the Jandakot Underground Water Pollution Control Area (Jandakot UWPCA), the Jandakot Structure Plan was prepared to provide a planning framework for the land previously affected by the underground water pollution control area.

The district level requirements of the Jandakot Structure Plan, such as the identification and preservation of natural areas, the allocation of public open space and public purpose areas, road network and hierarchy, the allocation of school sites and the allocation of commercial activity have therefore been further refined through the preparation of the Wandí North Structure Plan and subsequent amendments.

Historically, the major constraint to urban development within this corridor was in relation to groundwater and stormwater management. However, with the preparation of the Jandakot District Water Management Plan, these issues were subsequently resolved and have been accommodated in the current planning and development of the Wandí Urban Cell.

The proposed amendment to the Structure Plan is consistent with the intent and requirements of the Jandakot Structure Plan.

1.3.2.3 EASTERN RESIDENTIAL INTENSIFICATION CONCEPT

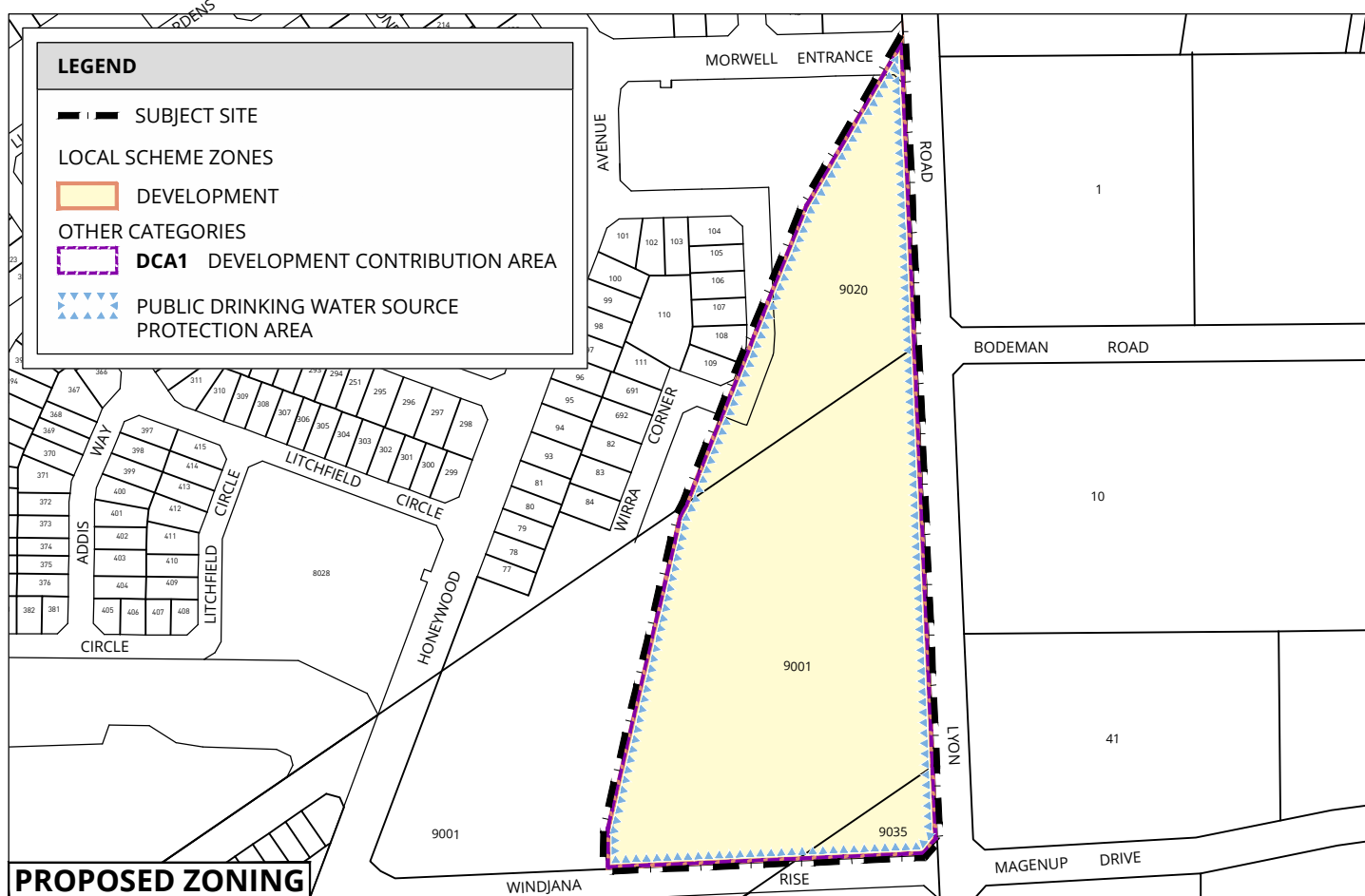
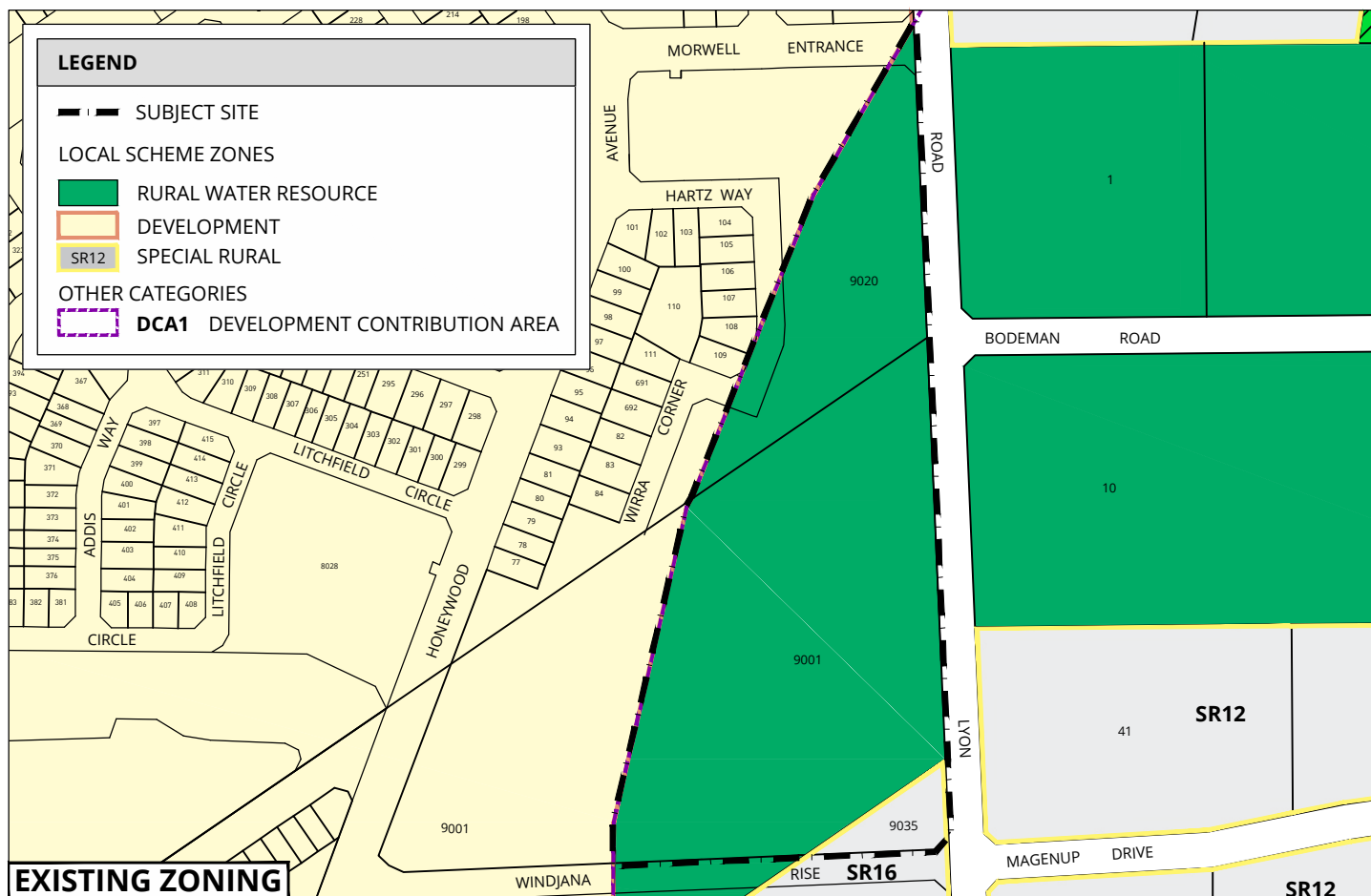
The City of Kwinana's draft District Structure Plan, referred to as the 'Eastern Residential Intensification Concept' (ERIC) was prepared by the City of Kwinana in 2005 to provide strategic direction and refinement of the future urban areas identified under the Jandakot Structure Plan. Whilst ERIC was never finally adopted by Council, it was used as an informal guide in the preparation of the original Structure Plan.

The proposed Structure Plan amendment is considered to be consistent with the general intent and requirements of ERIC.





FIGURE 4
METROPOLITAN REGION SCHEME ZONING



4582B_FIG68D_20250924_Honeywood_(TPS Rezoning) - N:\TOWN PLANNING\4000-4999\4582A\DRAWING\A-CAD - JS - 2025.10.01



0 100 m
SCALE @ A4: 1:4000



FIGURE 5
CITY OF KWINANA TOWN PLANNING SCHEME No.2 REZONING

2. SITE CONDITIONS AND CONSTRAINTS

2.1 BIODIVERSITY AND NATURAL AREA ASSETS

The Amendment area has predominantly been cleared of vegetation and therefore holds little to no value for native fauna.

There is a small area of vegetation remaining within Lot 132 (approximately 3,000 sqm), however this is not considered to be of substantial size or quality to be worthy of retention, noting the *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* classify areas of 1 hectare or less as being of very low viability with very high management costs. The retention and management of a small area of vegetation within an urban setting is considered to be unviable in the long-term.

Notwithstanding, the clearing of this vegetation was included in a previous EPBC Act referral and approval (EPBC 2010/5476) for the existing Wandi North Structure Plan / Honeywood estate in July 2010, with revised conditions approved in October 2015.

Conditions of the EPBC approval (for the wider Structure Plan area) include the on-site retention of fauna habitat within public open space and associated wetland areas within the existing development. Funds have also previously been contributed to the Department of Environment and Conservation (now DBCA) for the offset of Black Cockatoo habitat lost because of vegetation clearing throughout the Structure Plan area. The offset and associated management conditions have therefore already been satisfied for the subject site, and no additional requirements under the EPBC Act are necessary.

A site assessment undertaken in 2019 in support of the MRS rezoning for the land, confirmed the vegetation type and condition within Lot 132 is generally consistent with what was previously mapped by RPS (2007) to inform the original local structure planning work, and can be described as *Banksia attenuata* and *Banksia menziesii* low woodland with *Eucalyptus marginata* and *Allocasuarina fraseriana* scattered trees covering *Acacia pulchella* shrubland over *Hibbertia hypericoides* low shrubland.

The subject site does not comprise any area of Bush Forever, nor is it within an Environmentally Sensitive Area. There are no threatened or priority flora species recorded on the site.

It is also noted the Wandi North Structure Plan area has already achieved considerable conservation outcomes by retaining approximately 24 hectares of mapped 'Bassendean Complex – Central and South' in areas of retained wetland and upland vegetation, as well as prioritising the retention of larger, more viable, areas of intact native vegetation (mostly around 5 to 10 hectares).

2.2 SOILS AND TOPOGRAPHY

The subject site is situated within the Bassendean Sands dune system near the interface of the Bassendean and Spearwood Dune systems. This system consists of deep Bassendean Sands, which are characterised as "very light at surface, yellow at depth, fine to medium grained, sub-rounded quartz moderately well sorted of Aeolian origin".



The Amendment area has gently sloping topography, with ground levels generally grading northwest to southeast from approximately 32 metres AHD to 29 metres AHD.

2.3 ACID SULPHATE SOILS

The Department of Water and Environmental Regulation (DWER) Acid Sulphate Soil Risk Mapping identifies the site as having a moderate to low risk of Acid Sulphate Soils (ASS) occurring within 3 metres of natural soil surface.

Notwithstanding the DWER mapping, the site is situated in an upland area, with depths from ground level to the water table averaging more than 9 metres. Further, the site does not exhibit the landform characteristics typical of ASS. The site is therefore considered to have a low risk of disturbing potential or actual ASS during ground intrusive earthworks.

2.4 CONTAMINATION

The subject site is not listed on the Department of Water and Environmental Regulation Contaminated Sites Database as being a registered contaminated site (known or suspected).

The site comprises an existing market garden on Lot 9004. Any remediation required following the ceasing of that operation will be detailed and undertaken at subdivision and/or development stage.

2.5 HYDROLOGY AND GROUNDWATER

There are no mapped wetlands or other surface water bodies within or adjacent to the proposed Amendment area.

The site is generally hydrologically unconstrained, with free draining sandy soils, clearance to groundwater and no regional surface water features.

2.6 BUSHFIRE MANAGEMENT

The Amendment area is partially situated within a mapped 'Bushfire Prone Area', as designated by the Department of Fire and Emergency Services. Therefore, in accordance with SPP 3.7, a Bushfire Management Plan has been prepared for the site. A copy of the Bushfire Management Plan is contained at **Appendix 2**.

The subject site and immediate surrounds have been predominantly cleared to facilitate the development of the land for urban residential purposes, with the land either already developed or otherwise planned to be developed for such purposes in the near future.

Therefore, given the relatively cleared nature of the site and immediate surrounds, the only risk of bushfire for the proposed development will be from existing vegetation within the rural-residential lots to the east of Lyon Road, and from a small portion of the existing public open space /vegetation conservation area to the west. The balance of land within the hazard assessment area, following planned clearing and development, presents only a moderate (or lower) risk of bushfire.

An assessment undertaken against the SPP 3.7 compliance criteria indicates the future residential development of the site is capable of achieving the relevant acceptable compliance solutions, with



majority of the site comprising a Bushfire Attack Level (BAL) rating of 12.5 and BAL 'Low'. A small portion of the site along the eastern boundary is impacted by the BAL19 contour, and to a lesser extent BAL 29. These ratings are not an impediment to the development of the land for residential purposes.

Refer **Appendix 2** – Bushfire Management Plan.

2.7 HERITAGE

2.7.1 ABORIGINAL CULTURAL HERITAGE

A review of the Department of Planning, Lands and Heritage Aboriginal Cultural Heritage Inquiry System indicates there are no known sites of Aboriginal cultural heritage affecting the subject site.

2.7.2 EUROPEAN HERITAGE

A review of the Heritage Council's inherit online database indicates there are no sites of European heritage value affecting the subject site.



3. LAND USE AND SUBDIVISION REQUIREMENTS

3.1 LAND USE

The Structure Plan sets out the land use, residential densities, public open space, public and private transport provision, environmental considerations and servicing requirements for the development of the land.

The Structure Plan comprises primarily Residential development with density codes ranging from R10 to R60. The Structure Plan also comprises a range of local and neighbourhood public open space and conservation areas, as well as a primary school, local playing fields, and an area zoned for a local commercial centre.

The Amendment seeks to include approximately 5.07 hectares of land proposed for Residential (R30) development within the Structure Plan boundary. The inclusion of this land will facilitate the development of the balance of the Honeywood and Whistling Grove estates.

3.2 RESIDENTIAL

Whilst subject to detailed design at subdivision stage, indicative concept planning undertaken for the Amendment area suggests a residential yield of approximately 88 lots, with an average lot size of approximately 439m². The indicative concept proposes a range of lots sizes, with larger lots fronting Lyon Road, or otherwise siding on, to provide for a transitional interface for the rural residential allotments to the east.

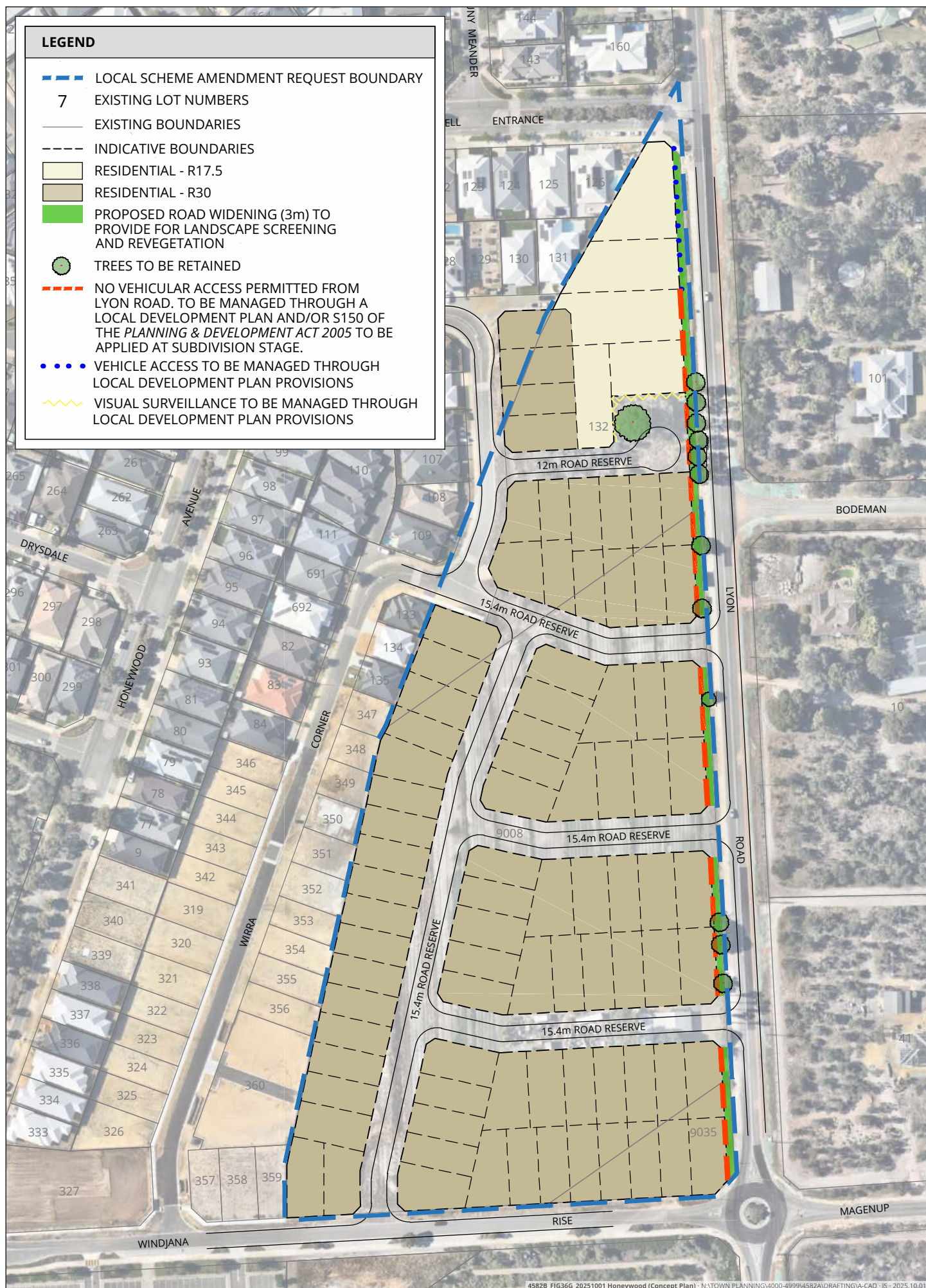
The proposed indicative lot typologies, configuration and densities are generally consistent with and complementary to the existing surrounding residential development within the Honeywood and Whistling Grove estates.

Consistent with the existing surrounding residential development, the proposed Structure Plan allocates a residential density code of R30 to the Amendment area.

Based on a yield of 88 lots, the Amendment area achieves a density of approximately 22.8 dwellings per residential site hectare and 17 dwellings per gross urban hectare.

The wider Structure Plan achieves an overall density of approximately 24.5 dwellings per residential site hectare and 10.6 dwellings per gross urban hectare, noting the large areas of conservation have contributed to a lower gross density than would typically be expected for greenfield residential development.

Refer **Figure 6** – Indicative Subdivision Concept (Amendment Area).



0 50 m
SCALE @ A4: 1:2000



FIGURE 6
INDICATIVE SUBDIVISION CONCEPT (AMENDMENT AREA)

3.3 PUBLIC OPEN SPACE

Public open space has been delivered for the locality in accordance with the existing approved Wandri North Structure Plan. In accordance with the existing approved Structure Plan, no public open space is required within the Amendment area.

The Wandri North Structure Plan (as amended) comprises a total of approximately 30.78 hectares of public open space, comprising a mix of active and passive recreation, as well as wetland and vegetation conservation. Of the 30.78 hectares, 13.52% is provided as unrestricted open space and 17.26% comprises restricted open space. In addition to the 30.78 hectares of reserved public open space, the Structure Plan area is also traversed by the Peel Main Drain and the Dampier to Bunbury Natural Gas Pipeline Corridor, both of which have been landscaped and reserved to provide additional passive and active recreation opportunities for the community.

The total open space calculations include areas of public open space adjoining, but outside the Structure Plan boundary. This was a negotiated outcome as part of the original approved Structure Plan.

Notwithstanding, standard Liveable Neighbourhoods requirements provide for a minimum 10% of the gross subdivisible area being provided as credited public open space, providing for a minimum 8% unrestricted open space and a maximum of 2% restricted open space. Restricted open space in excess of the credited 2% may be deducted from the gross subdivisible area.

Within the Structure Plan boundary (as amended), the Structure Plan provides for 13.08 hectares of public open space, comprising 8.07% unrestricted and 8.21% restricted, of which 2% is credited under Liveable Neighbourhoods.

All lots within the Structure Plan area, including the amendment area, are situated within 200 metres of an area of public open space.

The Structure Plan (as amended) therefore satisfies the public open space requirements stipulated under Liveable Neighbourhoods, with regard to provision, distribution and function.

Refer **Figure 7** – Public Open Space Distribution Plan.

Refer **Figure 8** – Public Open Space Schedule.

3.4 MOVEMENT NETWORKS

The Amendment area is bound by Morwell Entrance to the north, Wirra Corner and Hartz Way to the west, Lyon Road to the east and Windjana Rise to the south. Honeywood Avenue is situated further to the west of the site.

Honeywood Avenue is designed as a Neighbourhood Connector, distributing traffic through the Structure Plan area from Rowley Road in the north to Anketell Road in the south, providing connection to the wider metropolitan region via the Kwinana Freeway. Honeywood Avenue is designed to a 25.2 metre cross-section, with a central vegetated drainage swale.

The proposed movement network for the Amendment areas is generally dictated by the existing surrounding local access roads, of which there is sufficient capacity to accommodate the anticipated future development.

Access Roads within the Amendment area are proposed to comprise reserve widths of 15.4 metres, consistent with the existing adjoining road network and Liveable Neighbourhoods cross-section for an Access Street C. Road design will be confirmed at detailed subdivision stage.

Given existing traffic volumes along Lyon Road and a proposed vegetated buffer, no direct lot access (for vehicles) is permitted from Lyon Road. Limited access can be considered where no internal access road is provided. Where vehicle access is required from Lyon Road, this is to be coordinated through Local Development Plan provisions.

3.5 WATER MANAGEMENT

A Local Water Management Strategy (including various addenda) has been approved for the existing Wandri North Structure Plan, with Urban Water Management Plans prepared, approved and implemented at each stage of subdivision.

The Amendment area is proposed to be incorporated within the existing water management system for the Structure Plan area. A Local Water Management Strategy has therefore been prepared for the amendment area, providing the framework for the application of total water cycle management for the proposed residential development, including how it relates to the existing surrounding drainage system. The proposed Local Water Management Strategy is consistent with the District Water Management Strategy approved for the site as part of the recent rezoning of the land.

Refer **Appendix 6** – Local Water Management Strategy.

The key guiding principles of the Local Water Management Strategy are as follows:

- ▲ Facilitate implementation of sustainable best practice urban water management.
- ▲ 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.
- ▲ Encourage environmentally responsible development.

The below table provides a summary of the Local Water Management Strategy design principles and criteria.

CATEGORY	DWMS OBJECTIVES	LWMS CRITERIA
Water Conservation and Sustainability	- Ensure non-potable water systems are considered as part of an integrated water supply.	- Consider alternative fit for purpose water sources where appropriate and cost-effective.

CATEGORY	DWMS OBJECTIVES	LWMS CRITERIA
	- Household target water use of 100kL/person/year. - Scheme water target use of 40 to 60kL/person/year. - Use of waterwise landscaping practices both at development and lot scale.	- Aim to achieve the State Water Plan target for water use of 100kL/person/year. - Buildings to comply with water efficiency standards introduced in to the building code.
Stormwater Management	- Safe conveyance and management of stormwater runoff in accordance with ARR 2019 (Ball et al., 2019) - At-source retention of small storm events (15 mm). - Maintenance of pre-development hydrological regime by on site infiltration of all stormwater runoff up to 1% AEP. - Water quality treatment systems and water sensitive urban design structures designed in accordance with the Stormwater Management Manual for Western Australia (DWER, 2022) Chapter 9 (Structural Controls) and Australian Runoff Quality (EA, 2006).	- Manage surface water flows from major events in road carriageways and POS to protect infrastructure from flooding and inundation. - Runoff for events up to the 1% AEP to be retained and infiltrated within underground storage units within the road reserve.
Groundwater Management	- Ensure adequate separation (1.5 m) between building floor level and groundwater. - No management of groundwater levels is proposed (subsoil drainage). - Finished levels to provide sufficient separation to groundwater to allow infiltration of stormwater onsite to enhance recharge to the Jandakot Mound. - No groundwater abstraction for irrigation within the Jandakot Water Pollution Control Area (UWPCA). - Management of fertiliser and pesticide application in streetscapes using soil amendments, appropriate plant selection, limiting turf areas and maintenance management systems.	- All lots to have minimum 1.2 m clearance to pre-development AAMGL. - No subsoil drainage is required due to significant depth to groundwater. - No public open space will be established within the Study Area and no groundwater abstraction for irrigation is proposed.
Water Quality	- Adopt nutrient load reduction design objectives for stormwater runoff. - Use of amended soils and selective planting to treat stormwater.	- Non-structural controls to reduce applied nutrient loads. - Maintain groundwater quality at pre-development levels (median winter concentrations) and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems.

CATEGORY	DWMS OBJECTIVES	LWMS CRITERIA
Monitoring	- Commit to a post-development monitoring program in future planning.	- Due to significant depth to groundwater, no post-development groundwater monitoring is proposed.

Refer **Appendix 6** – Local Water Management Strategy.

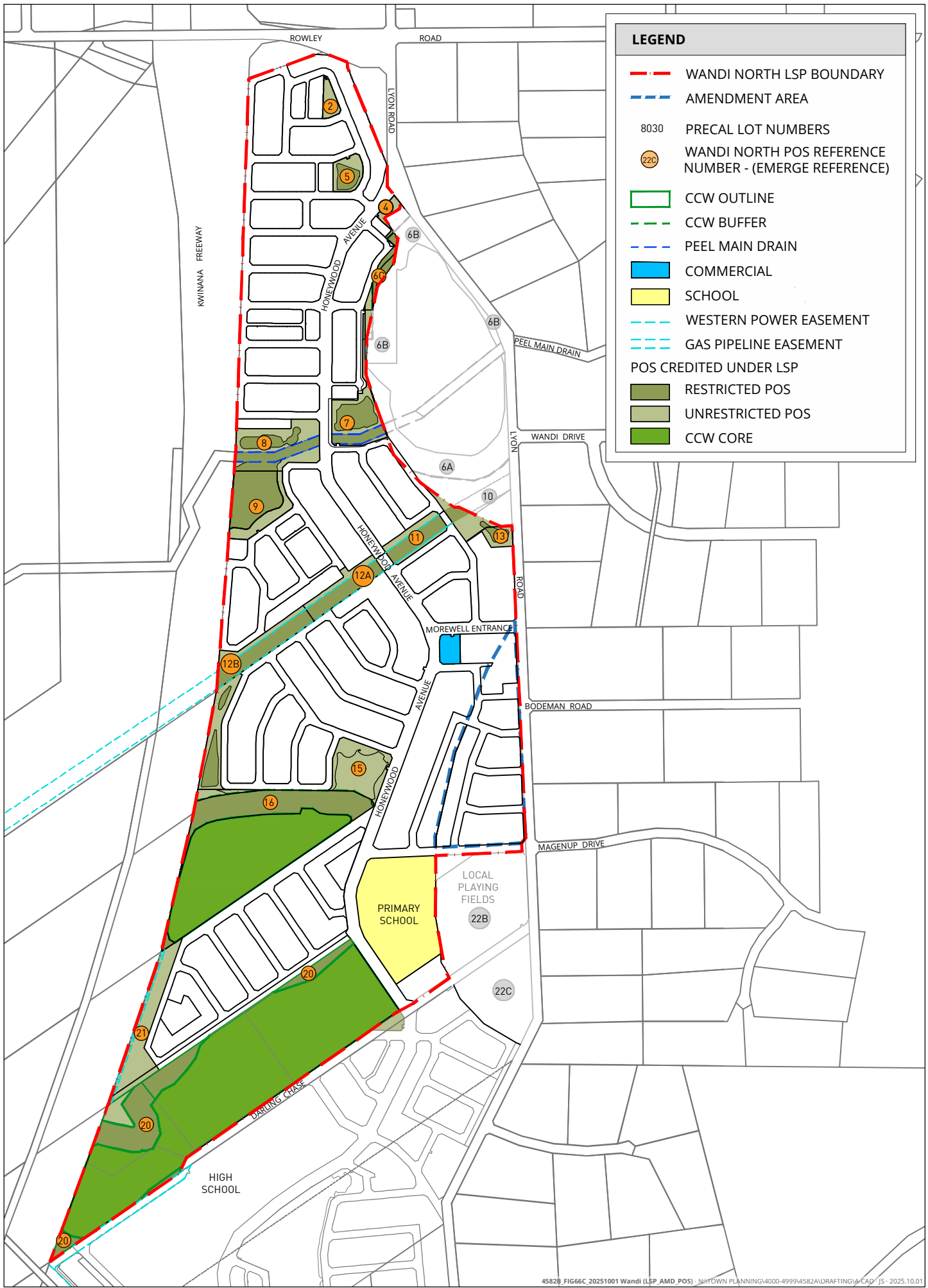
3.6 SERVICING

Reticulated water, sewer, electricity, gas and telecommunication services are readily available to the Amendment area from existing surrounding development. No substantial upgrades are expected to facilitate the proposed development.

3.7 DEVELOPER CONTRIBUTION ARRANGEMENTS

Upon Gazettal of Amendment No. 164 to TPS 2, the subject land will be included within the boundaries of Development Contribution Areas 5 (traditional infrastructure) and 9 (community infrastructure). Contribution payments will therefore be applicable to the land in accordance with the requirements of Development Contribution Plans 5 and 9.





45828 FIG66C_20251001 Wandli (LSP_AMD_POS) - NANTOWN PLANNING\4000-4999\4582A\DRAWING\CAD - JS - 2025.10.01

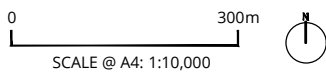


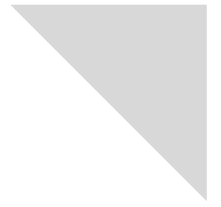
FIGURE 7
PUBLIC OPEN SPACE DISTRIBUTION PLAN

Wandi North Local Structure Plan (as amended) – Public Open Space Schedule

25.10.2023				
Site Area (Local Structure Plan Boundary)			102.65	
Less				
CCW 16		4.68		
CCW 20		11.42		
Total			16.10	
Net Site Area				86.55
Deductions				
Primary School		3.50		
Peel Main Drain (within LSP boundary)		0.58		
Gas Pipeline (within LSP boundary)		1.84		
Commercial		0.25		
Dedicated Drainage (1:1yr ARI / First 15mm)		0.00		
Total			6.18	
Gross Subdivisible Area				80.38
POS @10%				8.04
Public Open Space Contribution				
May comprise:				
Min 80% unrestricted POS			6.43	
Min 20% restricted use POS			1.61	
Total Required POS				8.04
POS Reference Number (area within LSP boundary only)	1:1yr / First 15mm Drainage (m ²)	Deduction from Net Area	Unrestricted POS area (m ²)	Credited Restricted POS area (m ²)
2	2040	0	2040	0
4	1396	0	1396	0
5	4013	0	2111	1902
6B	2269	0	0	2269
6C	2161	0	2161	0
7	7592	0	3350	4242
8 and 9	25088	0	10910	14177
10	3289	0	3124	165
11	2430	0	2430	0
12A	1935	0	1935	0
12B	2437	0	2437	0
13	2210	0	1213	997
14	7672	0	4716	2956
15	11258	0	11258	0
16	20071	0	1341	18730
20	22359	0	2379	19980
21	12593	0	12045	549
	0	0	0	0
	0	0	0	0
Total	130813	0	64846	65967
	13.08	0.00	6.48	6.60
Percentage of gross subdivisible area		0.00%	8.07%	8.21%
Additional POS for Noting (Outside LSP Boundary)			Unrestricted POS area (m ²)	Restricted POS area (m ²)
22 (Local Playing fields)	59271		59271	0
CCW 6 (Minus Peel Main Drain)	73327		0	73327
6A	23702		6183	17519
6B	15824		0	15824
10	3504		3504	0
4	1393		1393	0
Total for Noting	177021		70351	106670
Total Combined POS Provision	307834		135197	172637
	30.78		13.52	17.26

Notes:

1. This Public Open Space Schedule is based on the Public Open Space Plan prepared by Rowe Group (Plan ID: 7926-Fig-23-F_20181205).
2. 1 Yr/ 15mm drainage considerations not included in calculations, as per current Local Structure Plan



APPENDIX 1

CERTIFICATES OF TITLE (AMENDMENT AREA)



ROWE
GROUP
DESIGN

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

4035

258

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES

**LAND DESCRIPTION:**

LOT 9004 ON DEPOSITED PLAN 425068

**REGISTERED PROPRIETOR:
(FIRST SCHEDULE)**

SANTO GALATI RANDO
ANNUNZIATA GALATI RANDO
BOTH OF 72 THE HORSESHOE, WANDI WA 6167
AS JOINT TENANTS

(AF P461771) REGISTERED 9/5/2023

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. P321960 MORTGAGE TO KEITH ROBERT MULLINS, LINDA CRISTINE MULLINS, AS JOINT TENANTS IN 10/200 SHARE, DEL FRANCIS WILLMOTT, JENNIFER EVE WILLMOTT, AS JOINT TENANTS IN 10/200 SHARE, LOUIS VELLIOS, IN 15/200 SHARE, ANTHONY KUR, IN 10/200 SHARE, PANGA PTY LTD, IN 30/200 SHARE, RED HORSE PTY LTD, IN 10/200 SHARE, PAULINE FAY WEBB, IN 5/200 SHARE, JOSEF ECSERI, JOHANNA ECSERI, AS JOINT TENANTS IN 40/200 SHARE, TVT SUPER FUND PTY LTD, IN 10/200 SHARE, ALLAN ROBERT MACPHERSON, IN 10/200 SHARE, FRANMAR NOMINEES PTY LTD, IN 15/200 SHARE, LYNETTE KATHERINE CHRISP, IN 10/200 SHARE, CAROL ANNE ROYSTON, IN 10/200 SHARE, AARON DEBONO, IN 5/200 SHARE, LEONARD JAMES AYLMOORE, IN 10/200 SHARE, ALL OF PO BOX 46 MOUNT LAWLEY WA 6929, AS TENANTS IN COMMON REGISTERED 17/10/2022.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP425068
PREVIOUS TITLE: 4029-503
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.

END OF PAGE 1 - CONTINUED OVER

RECORD OF CERTIFICATE OF TITLE

REGISTER NUMBER: 9004/DP425068

VOLUME/FOLIO: 4035-258

PAGE 2

LOCAL GOVERNMENT AUTHORITY:

CITY OF KWINANA

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

4010**164**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 132 ON DEPOSITED PLAN 421718

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

WANDI ANKETELL HOLDINGS PTY LTD OF CARE OF SATTERLEY PROPERTY GROUP LEVEL 3 27-31 TROODE STREET WEST PERTH WA 6005

(AF O818780) REGISTERED 18/10/2021

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

1. L537548 MORTGAGE TO AUSTRALIA & NEW ZEALAND BANKING GROUP LTD REGISTERED 24/1/2011.
2. L537549 MORTGAGE TO WANDI ANKETELL LAND FINANCE COMPANY PTY LTD REGISTERED 24/1/2011.
- L537550 TRANSFER OF MORTGAGE L537549, MORTGAGEE NOW AUSTRALIA AND NEW ZEALAND BANKING GROUP LTD REGISTERED 24/1/2011.
3. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR SEWERAGE PURPOSES TO WATER CORPORATION - SEE DEPOSITED PLAN 421718 AS CREATED ON DEPOSITED PLAN 70124
4. O818781 EASEMENT TO CITY OF KWINANA FOR EMERGENCY ACCESS PURPOSES - SEE DEPOSITED PLAN 421718 REGISTERED 18/10/2021.
5. O818786 NOTIFICATION SECTION 165 PLANNING & DEVELOPMENT ACT 2005 LODGED 18/10/2021.
6. O818787 NOTIFICATION SECTION 165 PLANNING & DEVELOPMENT ACT 2005 LODGED 18/10/2021.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP421718
PREVIOUS TITLE: 2838-777
PROPERTY STREET ADDRESS: 23 WIRRA CNR, WANDI.

END OF PAGE 1 - CONTINUED OVER

RECORD OF CERTIFICATE OF TITLE

REGISTER NUMBER: 132/DP421718

VOLUME/FOLIO: 4010-164

PAGE 2

LOCAL GOVERNMENT AUTHORITY:

CITY OF KWINANA

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

2910**182**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BG Roberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 9035 ON DEPOSITED PLAN 408837

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

WANDI ANKETELL HOLDINGS PTY LTD OF LEVEL 2, 18 BOWMAN STREET SOUTH PERTH
(AF N417529) REGISTERED 8/9/2016

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

1. L537548 MORTGAGE TO AUSTRALIA & NEW ZEALAND BANKING GROUP LTD REGISTERED 24/1/2011.
2. L537549 MORTGAGE TO WANDI ANKETELL LAND FINANCE COMPANY PTY LTD REGISTERED 24/1/2011.
- L537550 TRANSFER OF MORTGAGE L537549, MORTGAGEE NOW AUSTRALIA AND NEW ZEALAND BANKING GROUP LTD REGISTERED 24/1/2011.
3. N403356 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 8/8/2016.
4. N403357 CAVEAT BY CITY OF KWINANA LODGED 2/9/2016.
5. N417533 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 8/9/2016.

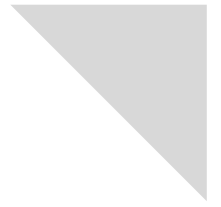
Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP408837
PREVIOUS TITLE: 2909-494
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF KWINANA



APPENDIX 2

BUSHFIRE MANAGEMENT PLAN



ROWE
GROUP
DESIGN

Bushfire Management Plan Addendum

**Lot 132 Wirra Corner, Part Lot 9004 and Lot 9035
Lyon Road, Wandi**

City of Kwinana

Date: 6 February 2026

Bushfire Logic
ABN: 926 121 79165

LIMITATIONS STATEMENT

This report has been prepared in accordance with the Agreement between Bushfire Logic and the Client. This Bushfire Management Plan has been prepared for the sole purpose of supporting a structure plan application at Lot 132 Wirra Corner, Part Lot 9004 and Lot 9035 Lyon Road, Wandí (the Site).

In undertaking this work the author(s) have made every effort to ensure the accuracy of the information used. Unless otherwise stated in the report, Bushfire Logic has not independently verified such information and cannot guarantee its accuracy or completeness. Within the limitations imposed by the scope of work, preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable bushfire consultants under similar circumstances. No other warranty, expressed or implied, is made.

The measures contained in this Bushfire Management Plan, are considered to be minimum requirements and they do not guarantee that a building will not be damaged in a bushfire, persons injured, or fatalities occur either on the subject site or off the site while evacuating. This is substantially due to the unpredictable nature and behaviour of fire and fire weather conditions. Additionally, the correct implementation of the required bushfire protection measures will depend upon, among other things, the ongoing actions of the landowners and/or operators over which Bushfire Logic has no control. The growth, planting or removal of vegetation, poor maintenance of any fire prevention/mitigation measures, addition of structures not included in this report, or other activity can and will change the bushfire threat to all properties detailed in this report.

Should changes be made to the Site, a new Bushfire Management Plan will be required. All surveys, forecasts, projections and recommendations made in this report associated with the proposed development are made in good faith based on information available to Bushfire Logic at the time. All maps included herein are indicative in nature and are not to be used for accurate calculations. Notwithstanding anything contained therein, Bushfire Logic accepts no Liability, including Liability for Loss in connection with:

- ☐ A Claim, damage, or injury to property, or persons caused by fire;
- ☐ Further growth, planting or removal of vegetation on the Site;
- ☐ Poor maintenance of any fire protection measures;
- ☐ Additional structures not included in this assessment; or
- ☐ Any other activity that may change the bushfire threat level.

The Client and owner of the site acknowledge that they have been made aware of the exclusions above and that such exclusion of Liability is reasonable in all the circumstances.

This report is valid for a period of two years only from the date of its issue. All BAL ratings identified within this report are indicative only and are required to be verified at the time of construction of individual buildings to ensure appropriate setbacks have been achieved.

Document Control: Report Details		
Report version	Report Date	Version Details
V1.1	6 February 2026	Original
BPAD Practitioner	Jemma Douglas (Level 2)	BPAD-38400

1. INTRODUCTION

Bushfire Logic has been engaged to prepare an addendum to the Bushfire Management Plan (BMP) prepared by Smith Bushfire Consultants dated 9 June 2023 to support a structure plan application and an indicative subdivision layout at Lot 132 Wirra Corner, Part Lot 9004 and Lot 9035 Lyon Road, Wandí (Attachment 1: Concept Subdivision Plan).

As shown in Figure 2 below, the subject land is partially within a declared Bush Fire Prone Area 2 (BFP2). This addendum has been prepared in accordance with State Planning Policy 3.7 – Bushfire (SPP 3.7) and the bushfire protection criteria contained within the Planning for Bushfire Guidelines (September 2024) (the Guidelines). The purpose of this addendum is to address comments raised by the Department of Fire and Emergency Services (DFES) in correspondence dated 5 September 2024 in respect of the proposal (Attachment 2: DFES Referral Comments 5 September 2024).

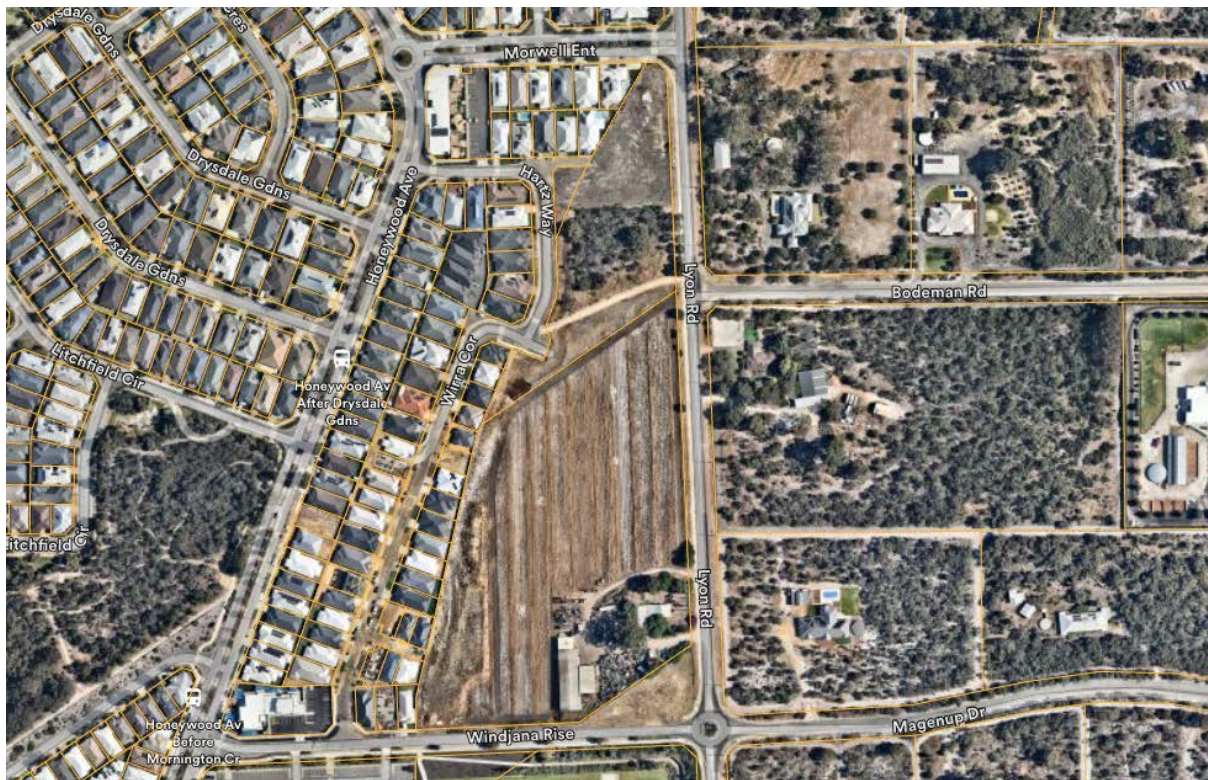


Figure 1: Location Plan

3. BUSHFIRE ASSESSMENT RESULTS

The bushfire assessment for this site has followed the methodology provided for within AS3959:2018 and the requirements of State Planning Policy 3.7: Bushfire and the Planning for Bushfire Guidelines (2024).

3.1 ASSESSMENT INPUTS

Bushfire Assessment inputs for the proposed development have been calculated using the Method 1 BAL Assessment procedures as outlined in AS3959:2018. This incorporates the following factors:

- ☐ WA adopted Fire Danger Index (FDI), being FDI 80;
- ☐ Vegetation Classes;
- ☐ Effective Slope under classified vegetation; and
- ☐ Distance between proposed development site and classified vegetation

3.1.1 Relevant Fire Danger Index (FDI)

The fire danger index for this site has been determined in accordance with Table 2.1 or otherwise determined in accordance with a jurisdictional variation applicable to the site.

Fire Danger Index

FDI 40 ☐ FDI 50 ☐ FDI 80 ☒ FDI 100 ☐
Table 2.7 *Table 2.6* *Table 2.5* *Table 2.4*

3.1.2 Vegetation Classification

A site assessment was undertaken on 28 October 2025. All vegetation within 150m of the Structure Plan area and within the bushfire prone area mapping has been classified in accordance with Clause 2.2.3 of AS 3959-2018. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified in the following pages and shown on Figure 3: Pre-Development Vegetation Assessment and Photo Points Map on the following page.

A summary of the plot data assessed as per Clause 2.2.3 of AS 3959-2018 is provided below in Table 2 below, detailed plot data is provided in Appendix 2.

Table 1: Vegetation Classification Table (as per AS3959:2018)

Plot	Vegetation Classification	Effective Slope
1	Class G Grassland	All upslopes and flat land (0 degrees)
2	Class D Scrub	All upslopes and flat land (0 degrees)
3	Class D Scrub	Downslope 1-2 degrees
4	Class B Woodland	Downslope 2 degrees

5	Class A Forest	All upslopes and flat land (0 degrees)
6	Excluded 2.2.3.2 (e) Non-vegetated areas and (f) Low-threat vegetation	N/A

3.2 ASSESSMENT OUTPUT

3.2.1 Bushfire Attack Level Results

In accordance with SPP 3.7 and the Guidelines, Figure 4: Post-Development Vegetation Assessment and Figure 5: Bushfire Attack Level Contour Map has been prepared to illustrate the radiant heat impacts for the proposed development. The vegetation assessment and BAL contour map have been completed in accordance with the Method 1 methodology of AS3959-2018.

Figures 4 and 5 demonstrate that the Structure Plan area and each of the indicative lots are unencumbered by BAL-40 and BAL-FZ.

Vegetation Classification

All vegetation within 150m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2018. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified below.

Vegetation Plot 1				
Classification	Class G Grassland			
Exclusion Clause (if applicable)	N/A			
Effective Slope	Measured	Upslope	Applied Range (Method 1)	All upslopes and flat land (0 degrees)
Description/Justification:	Clear grassy areas used as paddocks with occasional trees. Less than 30% foliage cover.			
Post Development Assumptions:	Nil.			

S 150 180 210 240 270 300 330 360 390 SW W NW 239°SW (T) 32°11'31"S, 115°51'50"E ±26ft ▲ 106ft  Bushfire Logic 28 Oct 2025, 08:39:39	SW 240 270 300 330 360 390 0 30 60 W NW N 306°NW (T) 32°11'33"S, 115°51'50"E ±9ft ▲ 110ft  Bushfire Logic 28 Oct 2025, 08:49:32
---	---

Photo ID: P1	Photo ID: P2
--------------	--------------



Vegetation Plot 2				
Classification	Class D Scrub			
Exclusion Clause (if applicable)	N/A			
Effective Slope	Measured	Upslope	Applied Range (Method 1)	All upslopes and flat land (0 degrees)
Description/Justification:	Predominantly Melaleuca scrub and Banksia trees to 5m with unmanaged grasses and shrubs.			
Post Development Assumptions:	Nil.			
 Photo ID: P7		 Photo ID: P8		
 Photo ID: P9		 Photo ID: P10		

Vegetation Plot 3				
Classification	Class D Scrub			
Exclusion Clause (if applicable)	N/A			
Effective Slope	Measured	Downslope 1-2 degrees	Applied Range (Method 1)	Downslope >0-5 degrees
Description/Justification :	Predominantly Melaleuca scrub and Banksia trees to 5m with unmanaged grasses and shrubs.			
Post Development Assumptions:	Nil.			

ESESSW

6090120150180210240

147°SE (T) 32°11'35"S, 115°51'54"E ±6ft▲ 98ft



Bushfire Logic28 Oct 2025, 08:54:02

Photo ID: P11

ESESSW

90120150180210240

174°S (T) 32°11'35"S, 115°51'53"E ±6ft▲ 103ft



Bushfire Logic28 Oct 2025, 08:53:39

Photo ID: P12

NNEESE

3300306090120150

58°NE (T) 32°11'38"S, 115°51'51"E ±6ft▲ 98ft



Bushfire Logic28 Oct 2025, 08:56:44

Photo ID: P13

NNEESE

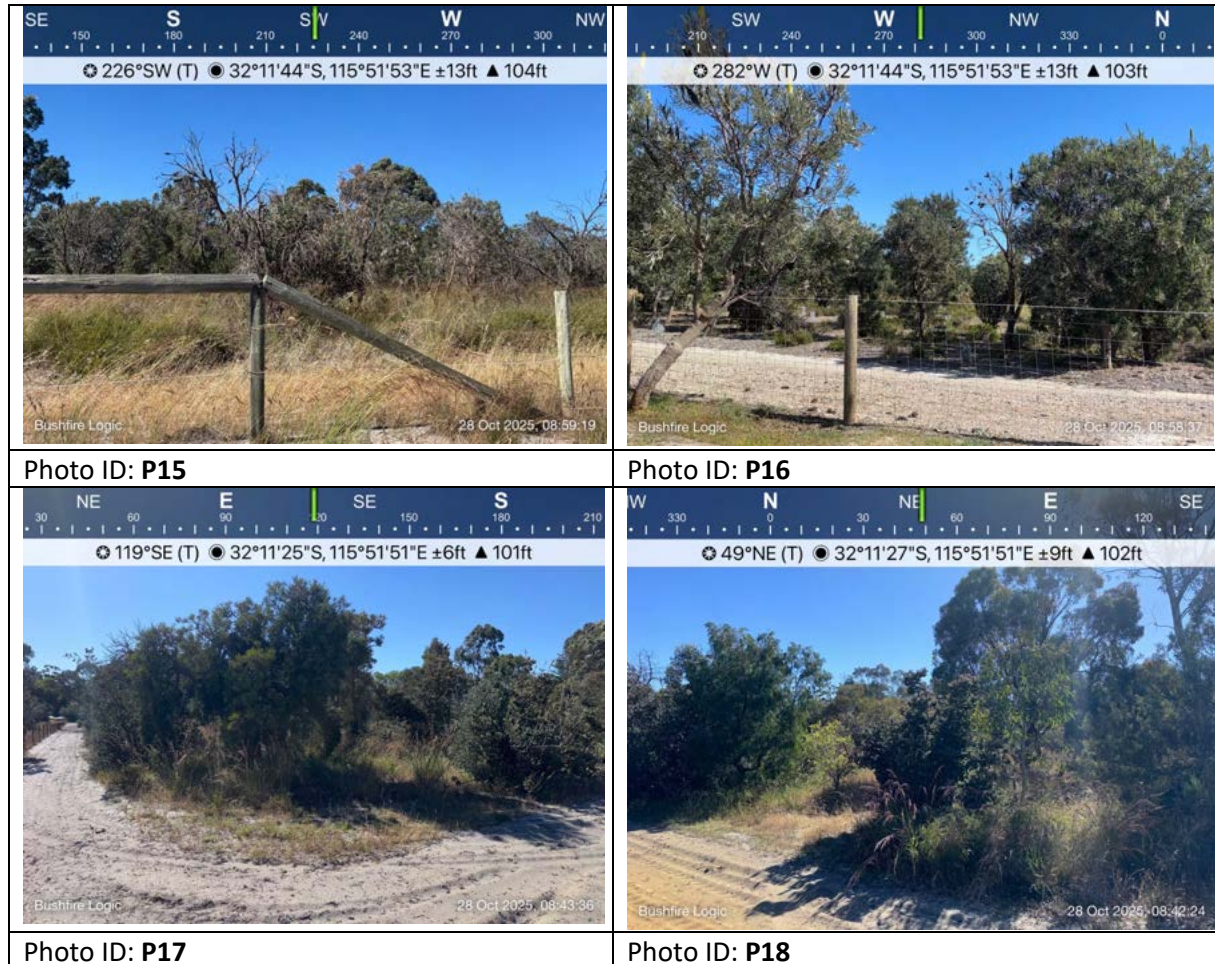
300306090120150

64°NE (T) 32°11'40"S, 115°51'51"E ±13ft▲ 100ft



Bushfire Logic28 Oct 2025, 08:57:52

Photo ID: P14



Vegetation Plot 4				
Classification	Class B Woodland			
Exclusion Clause (if applicable)	N/A			
Effective Slope	Measured	Downslope 2 degrees	Applied Range (Method 1)	Downslope >0-5 degrees
Description/Justification:	Areas of eucalypt trees with a prominent understory of grasses. Occasional shrubs also present.			
Post Development Assumptions:	N/A			

Vegetation Plot 5				
Classification	Class A Forest			
Exclusion Clause (if applicable)	N/A			
Effective Slope	Measured	Upslope	Applied Range (Method 1)	All upslopes and flat land (0 degrees)
Description/Justification:	Plot 4 is characterised by areas of eucalypts, banksia and peppermint trees and understory of juvenile trees, shrubs and tall grasses forming a tiered vegetation structure.			
Post Development Assumptions:	N/A			
				
Photo ID: P21		Photo ID: P22		

Vegetation Plot 6				
Classification	N/A			
Exclusion Clause (if applicable)	2.2.3.2 (e) Non-vegetated areas 2.2.3.2 (f) Low threat vegetation – minimal fuel condition.			
Effective Slope	Measured	N/A	Applied Range (Method 1)	N/A
Description/Justification:	Plot 6 includes areas of public open space managed to a low threat state, existing private cultivated gardens, maintained verges and ploughed firebreaks. Plot 6 also includes areas permanently cleared of vegetation such as existing houses, driveways, public road reserves and footpaths.			
Post Development Assumptions:	Nil.			
				
Photo ID: P23		Photo ID: P24		
				
Photo ID: P25		Photo ID: P26		



Photo ID: **P27**



Photo ID: **P28**

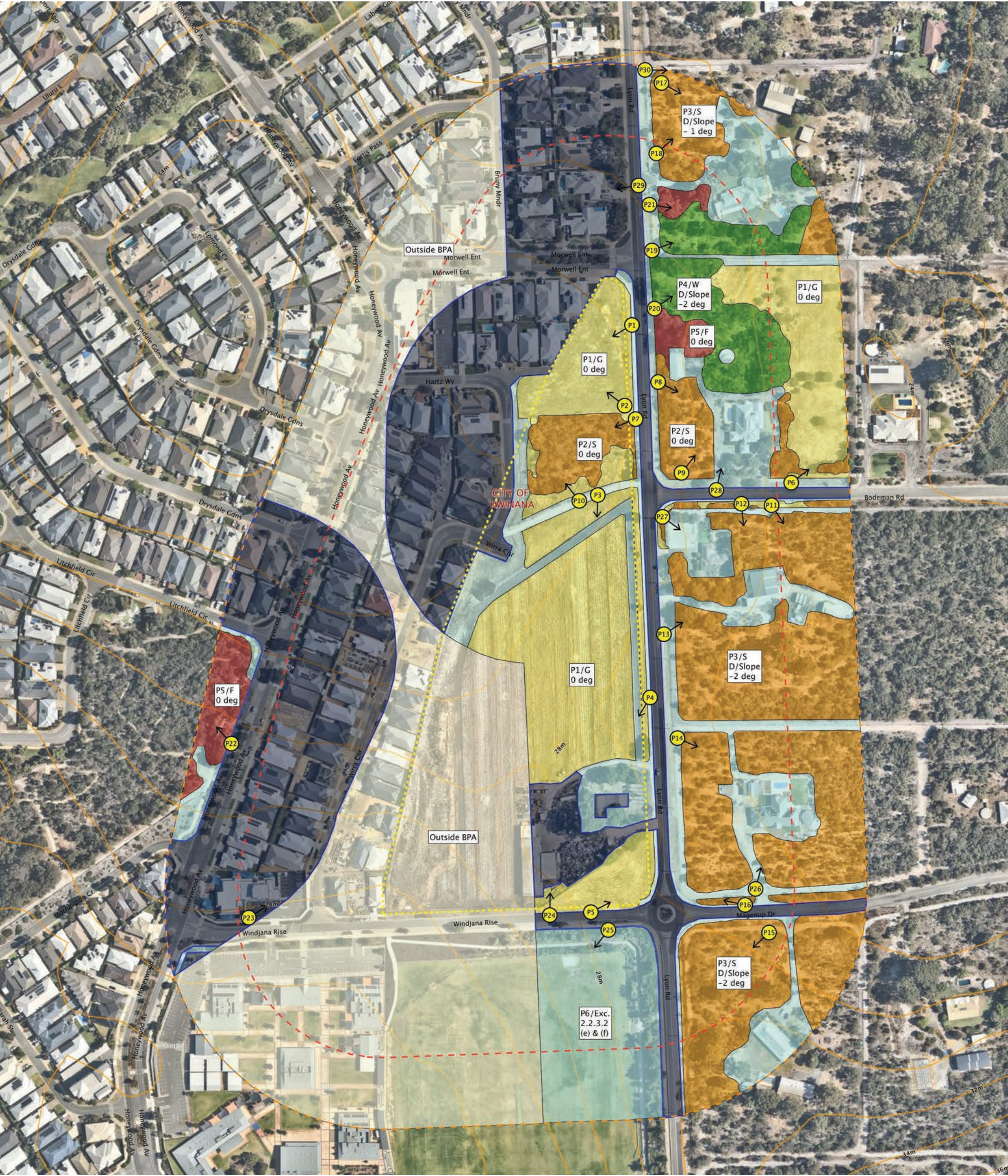


Photo ID: **P29**



Photo ID: **P30**

FIGURE 3: PRE-DEVELOPMENT VEGETATION ASSESSMENT AND PHOTOPOINTS MAP
LOT 132 WIRRA CORNER, PART LOT 9004 AND LOT 9035 LYON ROAD, WANDI



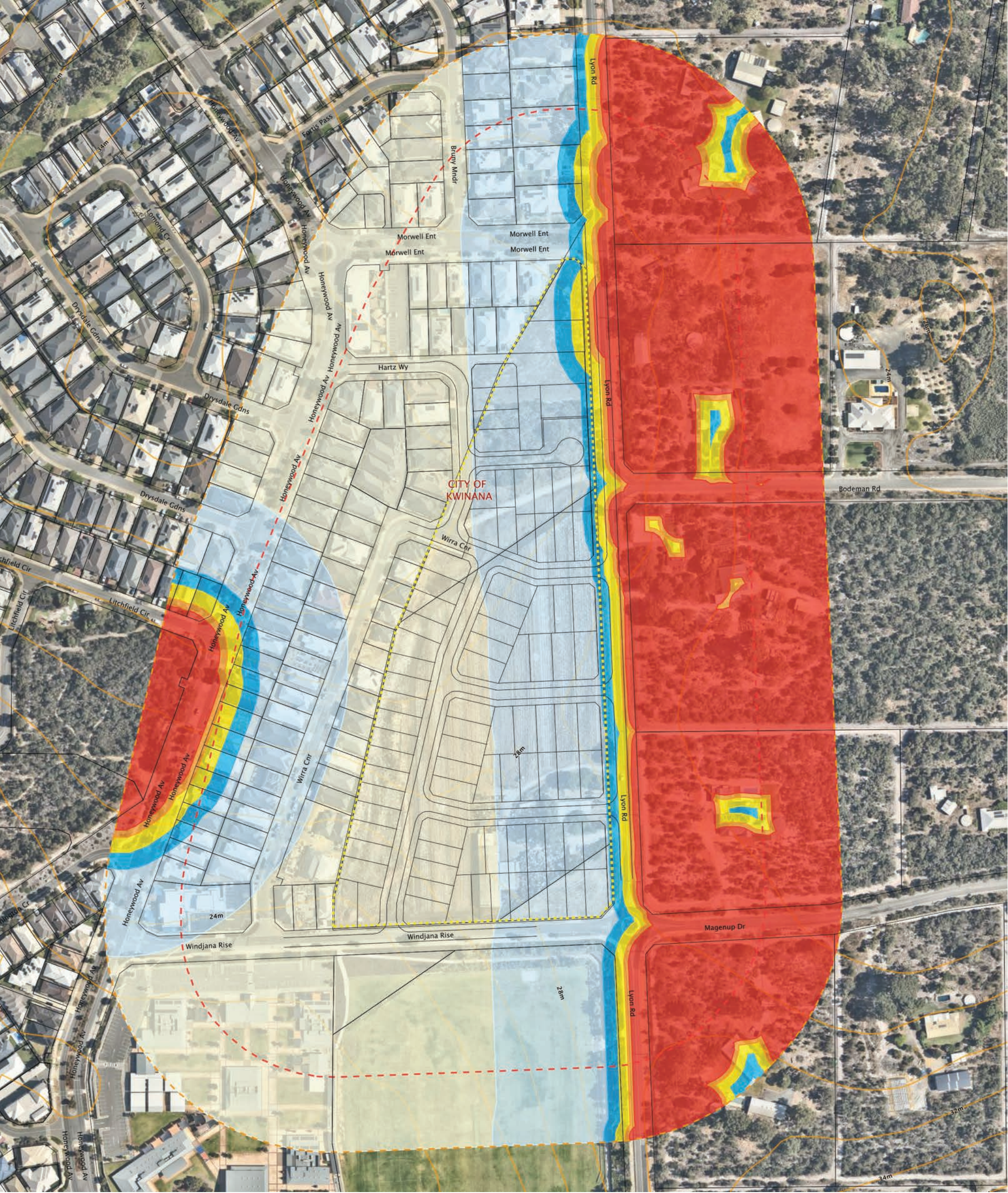
Legend

- Photopoint
- Structure Plan Area
- 100m Assessment Boundary
- 150m Assessment Boundary

Vegetation Classification

Excluded 2.2.3.2 (e)	Class G Grassland
Excluded 2.2.3.2 (f)	Class B Woodland
Class A Forest	
Class D Scrub	

FIGURE 5: BUSHFIRE ATTACK LEVEL CONTOUR MAP
LOT 132 WIRRA CORNER, PART LOT 9004 AND LOT 9035 LYON ROAD, WANDI



Legend

- Photopoint
- Structure Plan Area
- 100m Assessment Boundary
- 150m Assessment Boundary

Bushfire Attack Level Contour

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5



LEGEND

SUBJECT SITE

7

EXISTING LOT NUMBERS

EXISTING BOUNDARIES

PROPOSED BOUNDARIES

PROPOSED ROAD WIDENING (3m) TO PROVIDE FOR LANDSCAPE SCREENING AND REVEGETATION

TREES TO BE RETAINED

NO VEHICULAR ACCESS PERMITTED FROM LYON ROAD, TO BE MANAGED THROUGH A LOCAL DEVELOPMENT PLAN AND/OR S150 OF THE PLANNING & DEVELOPMENT ACT 2005 TO BE APPLIED AT SUBDIVISION STAGE.

VEHICLE ACCESS TO BE MANAGED THROUGH LOCAL DEVELOPMENT PLAN PROVISIONS

VISUAL SURVEILLANCE TO BE MANAGED THROUGH LOCAL DEVELOPMENT PLAN PROVISIONS

LOT SUMMARY

ORIGINAL AREAS:	3
LOT 132	1.17ha
LOT 9008	3.60ha
LOT 9035	1804m ²
TOTAL AREA	4.94ha
PROPOSED LOTS:	88
MINIMUM LOT AREA	313m ²
AVERAGE LOT AREA	439m ²
MAXIMUM LOT AREA	1002m ²
TOTAL AREA	3.86ha



Our Ref: D34686
Your Ref: PLAN 203

Gary Williams
City of Kwinana
Gary.Williams@kwinana.wa.gov.au

Dear Mr Williams

RE: LOTS 132 WIRRA CORNER, PART LOT 9004 AND LOT 9035 LYON ROAD, WANDI – AMENDMENT NO.164 TO LOCAL PLANNING SCHEME NO. 2 AND AMENDMENT NO. 9 TO WANDI NORTH LOCAL STRUCTURE PLAN

I refer to your email dated 25 July 2024 regarding the submission of a Bushfire Management Plan (BMP) (Version 1.1), prepared by Smith Consulting and dated 9 June 2023, for the above Local Planning Scheme and Structure Plan amendments.

This advice relates only to *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7) and the *Guidelines for Planning in Bushfire Prone Areas* (Guidelines). It is the responsibility of the proponent to ensure the proposal complies with relevant planning and building requirements. This advice does not exempt the applicant/proponent from obtaining approvals that apply to the proposal including planning, building, health or any other approvals required by a relevant authority under written laws.

Assessment

1. Policy Measure 6.5 a) (ii) Preparation of a BAL contour map

Issue	Assessment	Action
Vegetation classification	Evidence to support the exclusion of Plot 1 in its entirety as managed to low threat in accordance with AS3959 is required. In particular, the lots to the east of Lyon Road (corner of Bodeman Road) have large areas excluded which do not appear to be managed to an APZ standard. Foliage cover is in excess of 15%. An enforceable mechanism is required to provide certainty that the proposed management measures can be achieved in perpetuity and that they are enforceable. If unsubstantiated, the vegetation should be classified as per AS3959, or the resultant BAL ratings may be inaccurate.	Modification to the BMP is required.
Vegetation classification	Vegetation Plot 3 cannot be substantiated as Class B Woodland with the limited information and photographic evidence available. Photo ID's 6 and 7 do not represent	Modification to the BMP is required.

	Class B Woodland. The foliage cover exceeds 30% and a shrub understorey is present. The BMP should detail specifically how the Class B Woodland classification was derived as opposed to Class A Forest. If unsubstantiated, the vegetation classification should be revised to consider the vegetation as per AS3959, or the resultant BAL ratings may be inaccurate.	
--	---	--

2. Policy Measure 6.5 c) Compliance with the Bushfire Protection Criteria

Element	Assessment	Action
Location, and Siting & Design	A1.1 & A2.1 – not demonstrated The BAL ratings cannot be validated for the reason(s) outlined in the above table.	Modification to the BMP required.

Recommendation – compliance with acceptable solutions not demonstrated – modifications required

It is critical the bushfire management measures within the BMP are refined to ensure they are accurate and can be implemented to reduce the vulnerability of the development to bushfire. The planning proposals have not demonstrated compliance to the following:

1. Element 1: Location, and
2. Element 2: Siting and Design.

If you require further information, please contact me on telephone number 9395 9703.

Yours sincerely



Sasha De Brito
SENIOR LAND USE PLANNING OFFICER

5 September 2024



Smith Bushfire Consultants Pty Ltd

BUSHFIRE MANAGEMENT PLAN

Lots 132, 9001 & 9035 Lyon Road, Wandi

City of Kwinana



Prepared by Ralph Smith
SMITH BUSHFIRE CONSULTANTS Pty Ltd
BPAD 27541
smith.consulting@bigpond.com
0458 292 280

Site visited 9 May & 24 May 2023; Report completed 9 June 2023

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lot 132, 9001 & 9035 Lyon Road, Wandri

Site visit: Yes ☒ No ☐

Date of site visit (if applicable): Day 9 and 24 Month May Year 2023

Report author: Ralph Smith

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☒ Level 3 practitioner ☐

If accredited please provide the following.

BPAD accreditation number: 27541 Accreditation expiry: Month August Year 2023

Bushfire management plan version number: 1.1

Bushfire management plan date: Day 7 Month June Year 2023

Client/business name: Terranovis Pty Ltd

	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	☐	☒
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the bushfire protection criteria elements)?	☐	☒

Is the proposal any of the following (see [SPP 3.7 for definitions](#))?

	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)	☐	☒
Strategic planning proposal (including rezoning applications)	☐	☒
Minor development (in BAL-40 or BAL-FZ)	☐	☒
High risk land-use	☐	☒
Vulnerable land-use	☐	☒

None of the above ☐

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author

Ralph Smith

Date 9/6/2023

Table of Contents

	Page
Number	
1: Proposal Details	5
2: Environmental Considerations	7
2.1: Native Vegetation – modification and clearing	7
2.2: Re-vegetation / Landscape Plans	7
3: Bushfire Assessment Results	7
3.1: Assessment Inputs	7
3.2: Assessment Outputs	17
4: Identification of Bushfire Hazard Issues	17
5. Assessment against the Bushfire Protection Criteria	18
5.1: Compliance Table	18
6: Responsibilities for Implementation and Management of the Bushfire Measures	20
List of Figures	
Figure 1. The copy of the Indicative Concept Plan	5
Figure 2. Map of Bushfire Prone Areas for the subject site	6
Figure 3. Pre-development Vegetation Classification Map	8
Figure 4. Post-development Vegetation Classification Map	9
Figure 5. BAL Contour Map	15
Figure 6. Contour map and slope	16
Figure 7. Spatial representation of the bushfire management strategies	19
List of Appendices	
Appendix 1. Map of native vegetation extent	21
Appendix 2. Map of the Carnaby Cockatoo roost site buffered by 6 km	22
Appendix 3. Map of the Black Cockatoo confirmed roost site buffered by 1 km	23
Appendix 4. Map of the environmentally sensitive areas	24
Appendix 5. Map of the location of the current hydrants	25
Appendix 6. City of Kwinana Fire Control Order extract	26
References	27

Full Content Detail

Document control

Report Version	Purpose	Author/reviewer and accreditation details	Date Submitted
1	Support the subdivision application	Ralph Smith	31 May 2023
1.1	Revised text	Ralph Smith	9 June 2023

DISCLAIMER

This Bushfire Management Plan has been prepared in good faith. It is derived from sources believed to be reliable and accurate at the time of publication. Nevertheless, this plan is distributed on the terms and understanding that the author is not responsible for results of any actions taken based on information in this publication or for any error or omission from this publication.

Smith Bushfire Consultants Pty Ltd has exercised due and customary care in the preparation of this Bushfire Management Plan and has not, unless specifically stated, independently verified information provided by others.

Any recommendations, opinions or findings stated in this report are based on circumstances and facts as they existed at the time Smith Bushfire Consultants Pty Ltd performed the work. Any changes in such circumstances and facts upon which this document is based may adversely affect any recommendations, opinions or findings contained in this plan.

© SMITH BUSHFIRE CONSULTANTS Pty Ltd – June 2023

Section 1: Proposal Details

The proposal is to continue the transition into multiple smaller lots for future dwellings.

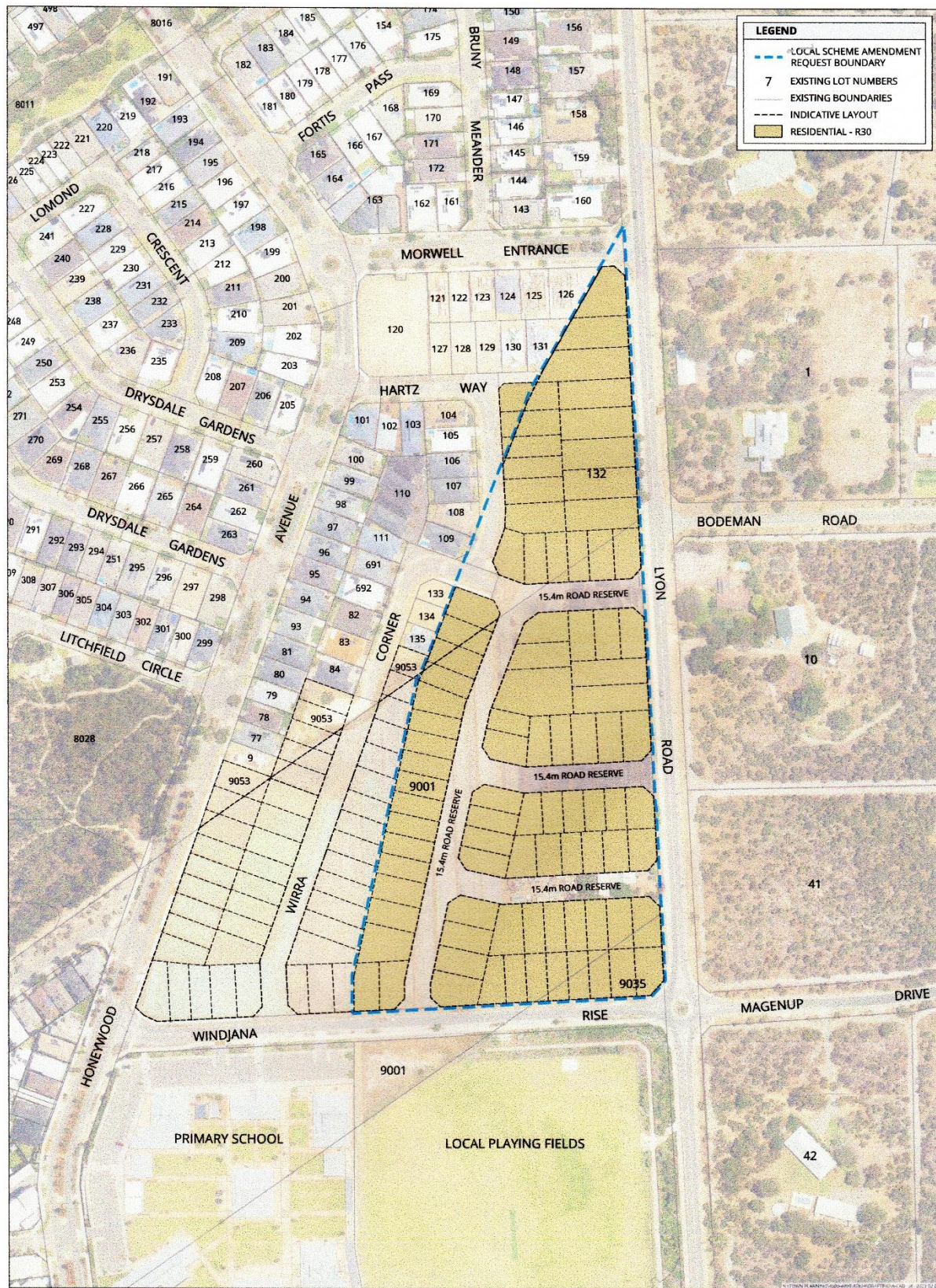


Figure 1. A copy of the Indicative Concept Plan.



Figure 2. Screen shot of map of bushfire prone areas for the subject site.

The current lot is not entirely declared as bushfire prone. The declaration of bushfire prone is required for the Building Code of Australia to trigger AS 3959, and the construction standard requirements. The partial declaration of the bushfire prone area triggers the planning requirements.

Section 2: Environmental Considerations

The State Planning Policy 3.7 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values. A desktop search has identified that the following are not registered for the development site or immediately surrounding area:

- Threatened and priority flora;
- Threatened and priority fauna;
- Contaminated site registration;
- Clearing Regulation – Environmental Sensitive Areas;
- Threatened ecological community;
- Ringtail possum habitat;
- Black Cockatoo breeding sites; and
- Carnaby Cockatoo confirmed roost sites.

The following two avifauna are within the buffered area:

- Black Cockatoo roosting site buffered 1 km;
- Carnaby Cockatoo confirmed roost sites buffered 6 km.

Subsection 2.1: Native Vegetation – modification and clearing

There will be a need to clear a small area of native scrub vegetation as a component of this subdivision. The development site is virtually entirely cleared, except around the current working market garden and the associated dwelling where there is some vegetation.

Subsection 2.2: Re-vegetation/Landscape Plans

There is no revegetation plan for the new lots. It is anticipated that any new dwelling will have a level of garden within the building envelope that is compliant with the City of Kwinana firebreak notice.

Section 3: Bushfire Assessment Results

Any dwellings located on the new lots have all been assessed as being with BAL rating of BAL-29 or less. The woodland vegetation to the west and scrub to the east are the primary vegetation threat that are influencing the BAL rating for these lots.

Subsection 3.1: Assessment Inputs

The assessment inputs are shown in the forthcoming pages and are supported by a vegetation assessment, photographic evidence and text to support the vegetation assessment and a BHL assessment map.

Site Assessment

The assessment of the proposed subdivision was undertaken on 9 May & 24 May 2023 for the purpose of determining the Bushfire Attack Level in accordance with AS 3959 (Method 1).



Figure 3. Pre-development Vegetation Classification Map.



Figure 4. Post-development Vegetation Classification Map.

Vegetation Classification

All vegetation within 150 metres of the proposed subdivision as indicated on the site assessment plan was classified in accordance with the Western Australian Government criteria and Clause 2.2.3 of AS 3959 was applied. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified below. AS 3959 only requires consideration of 100 metres between vegetation and the building and 50 metres between vegetation and the building for grassland.

Plot 1

Exclusion – Low threat vegetation and non-vegetated areas.
Clause 2.2.3.2 (e) and (f).



Photo ID: Photo 1 Looking west along Windjana Rise.



Photo ID: Photo 2 Looking east towards the oval south of the subdivision site.



Photo ID: Photo 3 Looking at the oval south of the development site.



Photo ID: Photo 4 Looking at the neighbouring dwelling and APZ.



Photo ID: Photo 5 Looking at the reticulated horse paddock with little grassland vegetation.



Photo ID: Photo 6 Looking at the neighbouring dwelling and APZ.

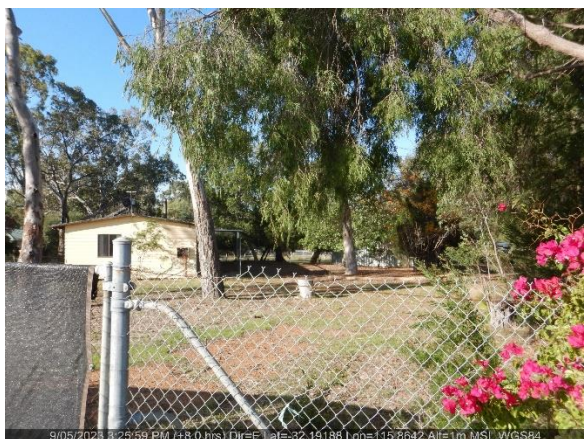


Photo ID: Photo 7 Looking at the neighbouring lot with a dwelling and APZ.



Photo ID: Photo 8 Looking across the northern end of the subdivision site and Lyon Road.



Photo ID: Photo 9 Looking at the cleared land west of the subdivision site.



Photo ID: Photo 10 Looking at the active market garden.



Photo ID: Photo 11 Looking at the neighbouring land ready for dwellings to be built.

Plot 2

Class D – Scrub (AS 3959 classification – D–13)



Photo ID: Photo 12 Looking at the scrub vegetation on the neighbouring lot to the east.



Photo ID: Photo 13 Looking at the scrub on the neighbouring lots to the east.



Photo ID: Photo 14 Looking east at the scrub on the neighbouring land.



Photo ID: Photo 15 Looking at the firebreaks on the neighbouring land to the east and the scrub.



Photo ID: Photo 16 Looking at scrub on the neighbouring land to the east.



Photo ID: Photo 17 Looking at the scrub that will be removed that is within the subdivision site.

Plot 3

Class B – Woodland (AS 3959 classification – B – 05).



Photo ID: Photo 18 Looking at the woodland that is north of the subdivision site.



Photo ID: Photo 19 Looking at the woodland that is west of the subdivision site.



Photo ID: Photo 20 Looking at the woodland that is west of the subdivision site.

Notes to Accompany Vegetation Classification

1. Plot 1

Exclusion – Low threat vegetation and non-vegetated areas

Clause 2.2.3.2 (e) & (f) includes the areas modified to 'low threat vegetation'.

This plot comprises the lots which have been cleared and the area of vegetation that needs to be cleared as a component this development. It also includes the land to the west that has already been cleared and is being developed as a subdivision with new dwellings and infrastructure.

This plot also includes the managed to low threat active market garden.

This plot also includes the school, road infrastructure, and the neighbouring dwellings, gardens and driveways.

2. Plot 2

Class D – Scrub (AS 3959 classification – D-13)

This plot comprises the scrub that is east of the subdivision site. The scrub is principally Banksia species and separated from the subdivision site by Lyon Road.

3. Plot 3

Class B – Woodland (AS 3959 classification – B-05)

This plot comprises the woodland that is west of the subdivision site on the neighbouring reserve. The woodland is a mixture of overstorey species, some of which are introduced species and others are native species. The edge of the vegetation plot has the majority of trees, which appear to diminish in number the further into the area.

This plot also has an area that is north of the subdivision site and east of Lyon Road. This plot comprises introduced overstorey species and some native species that do not exceed 30% crown cover. The precautionary principle has been applied to this vegetation plot as it appears that many of the species are cultivated and reticulated, but the bushfire threat appears to be consistent with native woodland vegetation.

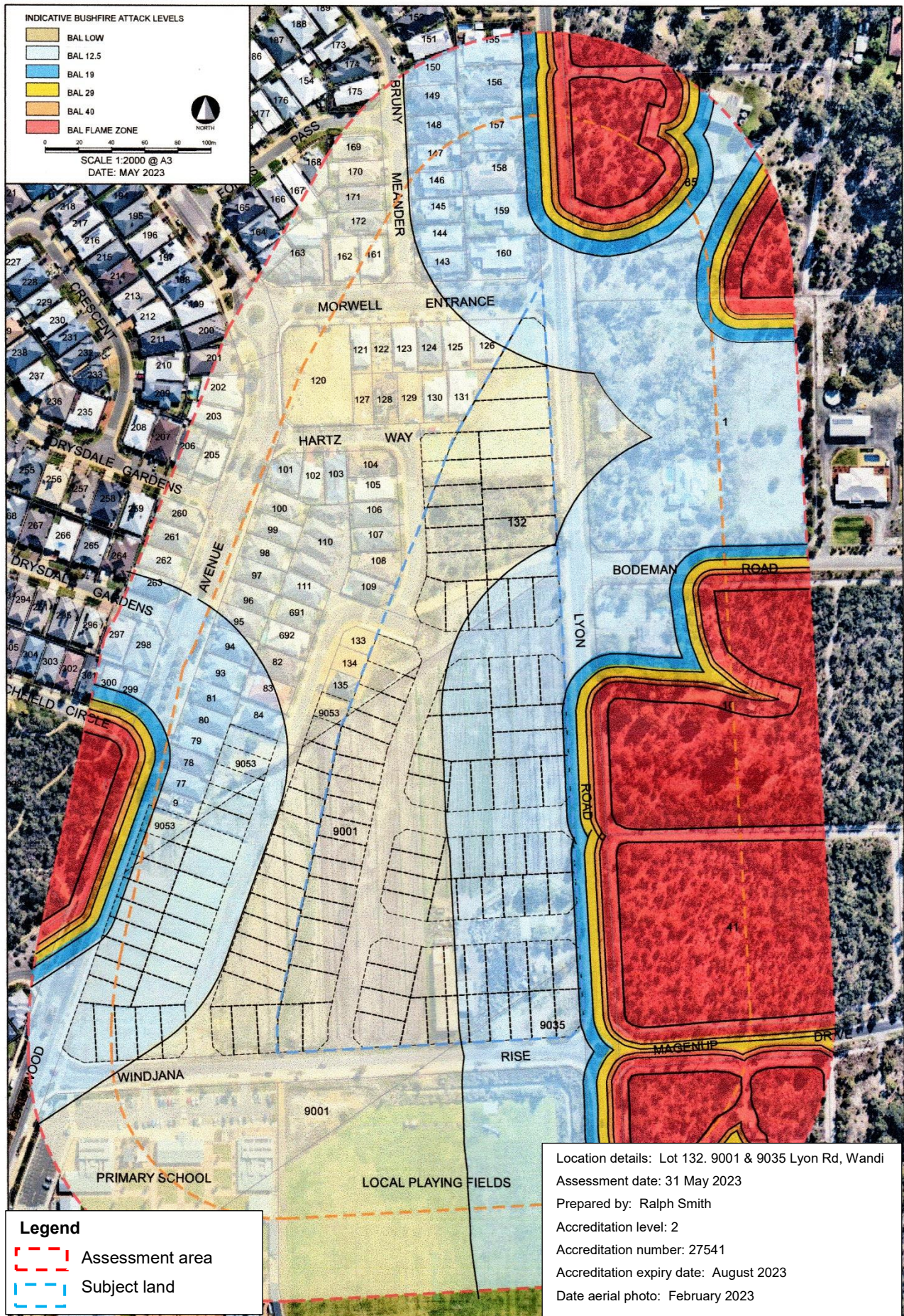


Figure 5. BAL contour map.

Slope



Figure 6. Two-metre contour lines.

The slope is effectively negated on any potential bushfire run as the area to the west is clear of vegetation adjacent to the subdivision site and level or upslope within the banksia woodland.

Subsection 3.2: Assessment outputs

Plot	Applied Vegetation Classification	Effective Slope Under the Classified Vegetation (degrees)	Separation Distance to the Classified Vegetation (metres)	BAL Contour
1	Exclusion – Low threat vegetation and non-vegetated areas Clause 2.2.3.2 (e) & (f)	Not applicable	Not applicable	LOW
2	Class D – Scrub (AS 3959 classification – D-13)	Level	25	19
3	Class B – Woodland (AS 3959 classification – B-05)	Level	25	19

Note: The separation distance is to the lot boundary. The actual BAL rating for future dwellings on some lots will need to be confirmed at a later date.

Section 4: Identification of bushfire hazard issues

The most significant bushfire hazard is the woodland and scrub vegetation on the neighbouring lots adjacent to the subdivision lot. The scrub vegetation is separated from the subdivision by a major arterial road. The protection to the dwellings will be enhanced by constructing to the appropriate standard (AS 3959).

Section 5: Assessment against the Bushfire Protection Criteria

Subsection 5.1: Compliance Table

Bushfire protection criteria	Method of Compliance	Proposed bushfire management strategies
	Acceptable solutions	
Element 1: Location	A1.1 Development location	This development will be developed in such a manner that on completion the BAL rating of BAL-29 or less is possible for all lots.
Element 2: Siting and design	A2.1 Asset Protection Zone (APZ)	There will be no APZs required with the development for the future dwellings.
Element 3: Vehicular access	A3.1 Public road	All public roads will be constructed to the appropriate standards as required in the Guidelines.
	A3.2a Multiple access routes	There are multiple access options that facilitate movement to a range of alternative locations and directions of travel.
	A3.2b Emergency access way	Not applicable
	A3.3 Through roads	The road network will provide the through roads and link to Lyon Road, Windjana Rise and Honeywood Road which are all constructed.
	A3.4a Perimeter roads	A perimeter road is not planned for the subdivision and the roads will link to the subdivision to the west.
	A3.4b Fire service access routes	Not applicable.
	A3.5 Battle-axe access legs	Not applicable.
	A3.6 Private driveways	The private driveways will all be less than 50 metres in length.
Element 4: Water	A4.1 Identification of future water supply	The site will be serviced by reticulated scheme water in accordance with the State Government requirements.
	A4.2 Provision of water for firefighting purposes	Hydrants will be developed in accordance with the State's Guidelines.



LEGEND

Subject land



Sealed roads



REQUIREMENTS

1. The site will be serviced by a reticulated scheme water system and hydrants will be established.
2. This is the woodland bushfire threat vegetation.
3. This is the scrub bushfire threat vegetation.
4. Principal access roads for access and egress that links to the established road network.
5. This vegetation will be cleared as a component of this subdivision.

Location details: Lot 132. 9001 & 9035 Lyon Rd, Wandl

Assessment date: 31 May 2023

Prepared by: Ralph Smith

Accreditation level: 2

Accreditation number: 27541

Accreditation expiry date: August 2023

Date aerial photo: January 2023

Version No: 1

Figure 7. Spatial representation of bushfire management strategies.

Section 6: Responsibilities for Implementation and Management of the Bushfire Measures

This section is to set out the responsibilities of the developer/s, landowner/s and local government with regards to the initial implementation and ongoing maintenance of the required actions.

No.	Implementation Action
1	A notification pursuant to Section 165 of the <i>Planning and Development Act 2005</i>, is to be placed on the certificate(s) of title of the proposed lot(s) with a Bushfire Attack Level (BAL) rating of 12.5 or above, advising the existence of a hazard or other factor. Notice of this notification is to be included in the diagram or plan of survey (deposited plan). The notification is to state as follows: <i>"This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and is subject to a Bushfire Management Plan. Additional planning and building requirements may apply to development on this land"</i> (Western Australian Planning Commission).
2	Comply with the relevant local government annual firebreak notice issued under s33 of the Bush Fires Act 1954.
3	Construct the new scheme water fire hydrants to comply with the State's requirements and in accordance with the Water Corporation standards as recorded in Design Standard No 63.
4	Construct the roads to the required standards as specified in the Guidelines.

LANDOWNER/OCCUPIER – ONGOING

No.	Management Action
1	Comply with the relevant local government annual firebreak notice issued under s33 of the Bush Fires Act 1954.
2	Maintain the dwelling to the appropriate construction standard.

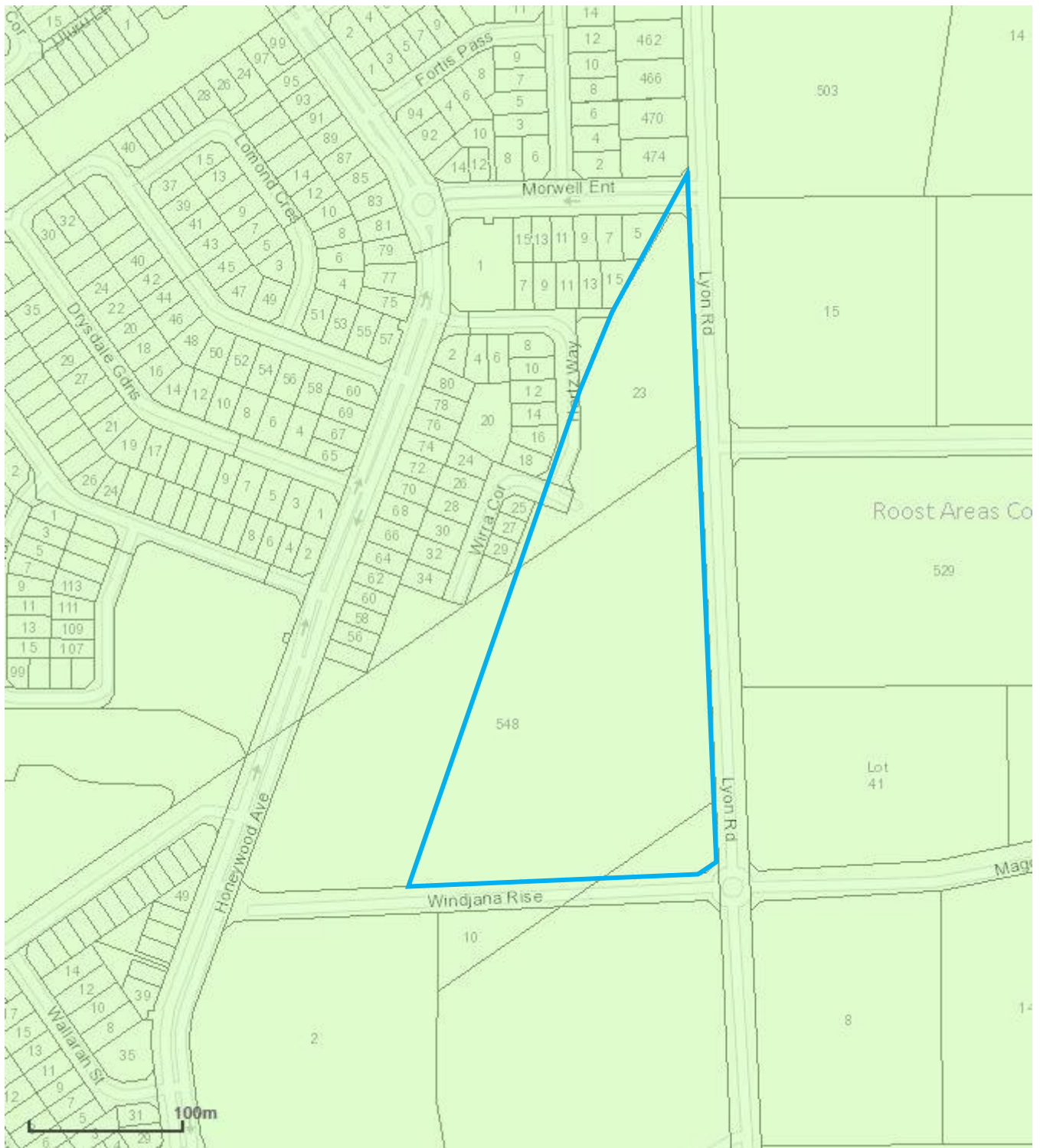
Appendix 1

Location of the native vegetation extent (from the State Government data) in the general area of the development. It is noted that this map is out of date as some areas shown as native vegetation on the development site and adjacent land to the north-west are now cleared.



Appendix 2

Copy of the Carnaby Cockatoo confirmed roost site buffered by 6 km for the general area and the subdivision lot.



Appendix 3

Copy of the Black Cockatoo confirmed roost site buffered by 1 km for the general area and the subdivision lot.



Appendix 4

Copy of the environmentally sensitive areas. The environmentally sensitive areas are not within the subdivision site.



Appendix 5

Map of the location of the current hydrants.



Appendix 6

Copy of a section of the Fire-Break and Hazard Compliance Notice for the City of Kwinana.

Important information for all land owners with the City of Kwinana

This Fire-Break/Hazard Compliance Notice is issued by the City of Kwinana pursuant to section 33 and 24G (2) of the Bush Fires Act 1954 to assist with the prevention, control and extinguishment of bush fires or to prevent the spread or extension of a bush fire to any adjoining land.

All property owners and/or occupiers of land within the City of Kwinana are hereby served with a first and final Fire-Break/Hazard Compliance Notice (the Notice) and are required to comply with the requirements in full.

Fire-breaks

The fire-breaks outlined below must be completed before the dates in the Notice and must be maintained throughout the period as required by this Notice.

Land with a total area of 3,501m² or greater

Note: As owner and/or occupier the land, you must ensure that your property complies with the requirements of this Notice from **1 December** each year and must be maintained throughout the year until **31 May** the following year.

Owners and/or occupiers of land that is 3,501m² or greater are required to construct fire-breaks and maintain fire-breaks:

- ☐ inside and along all land boundaries in a continuous form or within 10 metres of property boundaries;
- ☐ around all sides of all buildings on the land;
- ☐ as a minimum, all driveways and access ways to houses, sheds and buildings on the land must be constructed and maintained to the specification of a fire-break;
- ☐ on any land surrounding any place where, wood or timber piles, hay stacks, tyres, flammable liquids, chemicals and gas products or other flammable material are kept on the land;
- ☐ in a manner so that they are trafficable, contain no dead ends and are wide enough for a heavy-duty fire vehicle or other emergency service vehicles to be able to turn corners and carry out other manoeuvres without the vehicles being obstructed in any way;
- ☐ that maintains an asset protection zone around all buildings, infrastructure and fixed assets on the land; and
- ☐ that ensures that all flammable materials are removed from all rooftops and gutters of buildings.

Land with a total area of 1,500m² to 3,500m²

The works outlined in this category **must be maintained all year round** and owners and/or occupiers of land are required to maintain an asset protection zone around all buildings, infrastructure and fixed assets on the property by:

- ☐ ensuring that all long grass, weeds, etc. are slashed, mowed or trimmed down by other means to a height no greater than 50mm across your entire property; and
- ☐ removing all flammable materials from all rooftops and gutters of buildings.

Land with a total area of up to 1,499m²

The works outlined in this category must be maintained all year round and owners and/or occupiers are required to:

- ☐ ensure all long grass, weeds, etc. are slashed, mowed or trimmed down by other means to a height no greater than 50mm across the entire property; and
- ☐ remove all flammable materials from all rooftops and gutters of buildings.

References

Australian Building Codes Board, (2019). *Building Code of Australia*. Australian Building Codes Board, Sydney

City of Kwinana, (2023). *Fire Control Order*. Retrieved 31 May 2023 from <https://www.kwinana.wa.gov.au/CityOfKwinana/files/b3/b35b26c0-90d1-47ad-bf02-1b3da5067cb0.pdf>

City of Kwinana, (2023). Intramaps from <https://www.Kwinana.wa.gov.au/develop/mapping-services/interactive-property-maps.aspx>

Environmental and conservation values from <https://espatial.dplh.wa.gov.au/PlanWA/Index.html?viewer=PlanWA>

Landgate (SLIP), (2023). *Map of Bushfire Prone Areas*. Retrieved 14 March 2023 from <https://maps.slip.wa.gov.au/landgate/bushfireprone/>

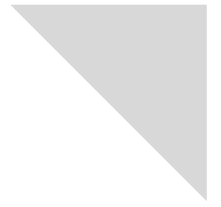
Near map from <http://maps.au.nearmap.com/>

Slope percentage to degrees conversion from <https://www.calcunation.com/calculator/slope-percent-conversion.php>

Standards Australia. (2018). *Australian Standard 3959 – Construction of buildings in bushfire-prone areas*. Standards Australia, Sydney, NSW.

Western Australian Planning Commission. (2015). *State Planning Policy 3.7 – Planning in Bushfire Prone Areas*. Western Australian Planning Commission, Perth, WA.

Western Australian Planning Commission. (2021). *Guidelines for Planning in Bushfire Prone Areas*. Western Australian Planning Commission, Perth, WA. December 2021



APPENDIX 3

LOCAL WATER MANAGEMENT STRATEGY



ROWE
GROUP
DESIGN



Government of **Western Australia**
Department of **Water and Environmental Regulation**

Your ref: J7370c
Our ref: DWERT5845 & PA 069099
Enquiries: Jane Sturgess, Ph 9550 4228

JDA Consultant Hydrologists
PO Box 117
SUBIACO WA 6904

Attention: Matthew Yan

Dear Matthew

***REVISED LOT 132, 9035 & PART LOT 9001 LYON ROAD, WANDI – LOCAL
WATER MANAGEMENT STRATEGY – WANDI NORTH LOCAL
STRUCTURE PLAN AMENDMENT***

Thank you for providing the revised Local Water Management Strategy (LWMS) received 17 December 2024 for the Department of Water and Environmental Regulation (Department) to assess.

Revision C of the *Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandu - Local Water Management Strategy* (dated 17/12/2024) meets the requirements of the Department.

A history of the Department's comments and corresponding actions is provided in Attachment 1 for your records. It should also be confirmed that the LWMS meets the requirements of the City of Kwinana.

The Department's acceptance of the LWMS does not provide exemption from the need to gain any applicable statutory local government or other agency approvals, nor approvals that may be required under legislation administered by the Department.

In the event there are modifications to the proposal that may have implications on aspects of water management, the Department should be notified to enable the implications to be assessed.

Should you require any further information on the comments, please contact the undersigned at the Mandurah office on 9550 4228.

Yours sincerely

A handwritten signature in black ink, appearing to be 'J. Sturgess', with a long horizontal stroke extending to the right.

Jane Sturgess
A/Program Manager – Planning Advice
Kwinana Peel Region

23 / 01 / 2025

Cc Ruban Ganesha
 City of Kwinana

Attachment 1 - Department of Water and Environmental Regulation comments on the revised Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandí - Local Water Management Strategy

Contact for further information:

	Date received	Comments Sent
Rev 1	9 June 2023	29 June 2023
Rev 2	17 December 2024	23 January 2025
Rev 3		

No.	Page	Section	Rev a - DWER Comments	Rev a – Author's Actions
1	19	4.6.3.1 Regional Groundwater quality Table 5	The Department's comments on the DWMS included the requirement to include ANZECC guideline values in the water quality tables. Please include the trigger values outlined in Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMICANZ, 2000) within Tables 5 – 7 (where applicable).	Tables 5-7 already refer to values from the Australian Drinking Water Guidelines (2011), which is considered more relevant to the Study Area, then compared to Lowland Rivers from ANZECC & AMRCANZ, 2000. Action: No action.
			Bore MW6 is noted within the text and Table 4 as representing pre-development baseline conditions of the Study Area. Please include the water quality results from Bore MW6 within Table 5 Pre-development Groundwater Quality.	Bore MW6 construction is only suitable for groundwater level monitoring, and not water quality monitoring. Hence it is only included in Section 4.6.2 Groundwater Levels, and not in Section 4.6.3 Groundwater Quality. Action: No action.
2	21	4.6.3.1 Regional Groundwater quality Table 7	JDA's comments on the revised DWMS (Ref: J7126d, 11 March 2022) commit to undertaking one additional winter (2022) monitoring event for water levels and quality. Please confirm this sampling has been undertaken and include the results within Table 7 Pre-development Groundwater Quality – WS01D.	Additional water level and quality monitoring from WS01d was performed for end of winter 2024 on 19 November 2024. Action: Groundwater quality results from 19/11/2024 is now included in Table 7.
			Pesticides and hydrocarbons are briefly discussed in s4.6.3.2. Please include the detections within Table 7.	Noted. Action: Text and Table 7 updated to include Mecoprop concentration.

No.	Page	Section	Rev a - DWER Comments	Rev a – Author's Actions
			The monitoring results in Appendix B indicate that Mecoprop was detected in Bore WS01D at a concentration of 0.2mg/L. The guideline value for Mecoprop is 0.01mg/L within the Guidelines for Drinking Water Quality (World Health Organisation, 2017). Further information is required, noting that the bore is indicative of water quality from Lots 9035 and part Lot 9001, which are located within the Jandakot Underground Water Pollution Control Area (UWPCA).	This elevated herbicide reading on 22 Nov 2021 was also highlighted during the contamination audit. Western Environmental Pty Ltd performed additional water quality monitoring on 20 Jan 2022 and Mecoprop concentration was <1 ug/L. Results from the laboratory analysis are included in revised LWMS as Appendix D. The Mandatory Auditors Report and clearance of the contamination condition indicate the elevated 2021 Mecoprop concentration has now been resolved. Action: Additional text as above is included and laboratory results included as new Appendix D.
3	21	4.6.4 Public Drinking Water Source Areas	The wellhead protection zone (WHPZ) of Bore J520 covers approximately 6,000m² of Part Lot 9001 and Lot 9035 in the south eastern corner of the Study Area. Please remove the reference to the WHPZ within the statement “There are no Water Corporation wells and associated WHPZ located within the Study Area”.	Noted. Action: Sentence removed.
			At the time of receipt of the LWMS, the priority classification of Lots 132, 9035 and part Lot 9001 Lyon Road within the Jandakot UWPCA was in the process of being amended from Priority 2 to Priority 3* by the Department, therefore the inclusion of additional information is recommended to clarify the current position. Please include the following additional background information before Paragraph 3: “The Study Area was originally classified as a Priority 2 area, however following Metropolitan Regional Scheme Minor Amendment 1381/57 in December 2022, the area will be changed to a	Noted. Action: Additional text included.

No.	Page	Section	Rev a - DWER Comments	Rev a – Author's Actions
			Priority 3* Public Drinking Water Source Area (PDWSA)."	
4	25	5.3 Water Efficiency Measures Lot Scale	Please make an adjustment to the 4 th dot point. Non potable water supply options are encouraged, however, please remove the reference to greywater recycling. As detailed in Water Quality Protection Note 38 – Priority 3* Areas (WQPN 38), the use of recycled water is generally not supported in P3* areas.	Noted. Action: Reference to greywater recycling removed.
5	26	6. Stormwater Management	The DWMS modelled individual onsite infiltration areas within the northern and southern catchments. The LWMS proposes to capture the small, minor and major stormwater events within underground storage cells. Please include some notes around what was originally proposed within the DWMS and why there has been a change in drainage infrastructure and management within the LWMS, including water quality improvement measures.	Noted. Action: Additional text included.
6	26	6.1.1 Small Event Management	As outlined within the endorsed DWMS, please confirm if rain gardens and/or tree pits within road reserves are proposed to manage small storm events for water quality improvement. Please capture any proposed rain gardens and tree pits within Figure 8 Stormwater Management Plan.	Rain gardens and/or tree pits are proposed in road reserves, where suitable. Possible locations are included on Figure 8. It is difficult to determine exact locations and dimensions of these structures without detail design on location of services and crossovers etc., which can be confirmed in a UWMP. Action: Figure 8 updated to include possible rain garden locations.
7	27	6.2 Stormwater Modelling	<i>External catchments</i> (as per Figure 8) It is noted that the proposed off-site drainage within the northern catchment has significantly increased, compared to offsite drainage identified within the endorsed DWMS.	The northern external catchment increased due to a revised subdivision layout. This layout has again been further refined and is now comparable to the DWMS.

No.	Page	Section	Rev a - DWER Comments	Rev a – Author's Actions
			Please include runoff volumes discharging to external catchments as well as confirmation that the receiving infrastructure has the capacity to manage the additional flows.	Noted. Additional information is provided in the revised LWMS. Action: Additional text included.
			Table 3 Land Use Breakdown states the Study Area includes 4.15ha of residential lots and 0.92ha of road reserve. However, stormwater modelling results (Table 9) state 2.58ha of residential lots. Please confirm within the text if the lots identified as external catchment (Figure 9) were excluded within the modelling calculations for the residential area to help understand the discrepancy in area (ha).	Noted. Table 9 presents stormwater modelling results for the Underground Storage. It therefore does not include parts of the Study Area that discharge as an external catchment. Action: Additional text included to clarify catchment areas.
			The storage volume for the 1% AEP has been calculated as 663m ³ . The modelling has determined that this volume can be accommodated within a storage area of 1304.73m ² with a base length of 686.7m. Can you please advise if this measurement relates to the total length required for the underground cells and if the road reserve can accommodate this given the proposed north-south length of Study Area is less than 300m.	The 686.7 base length was used for modelling purposes, and provides indication of length of underground infiltration units required. As outlined on Figure 8, it is proposed to install the underground units in duplicate rows, thereby reducing the length in half. Notwithstanding the above, catchment areas have now changed with the revised subdivision layout. Action: Storage volume and size is now updated with revised infiltration modelling from change in subdivision layout.
8	29	7.2 Change in Groundwater Levels	The Jandakot Drainage and Water Management Plan (Department of Water, 2009) includes information on the effects of urbanisation.	Noted. Action: Additional text included.
9		7.4 Groundwater Quality	Please include water quality management measures that will be utilised on-site and remove reference to measures that are not proposed such as: • the use of clean sand fill • biorention areas and swales • post development water quality monitoring program	Noted. Action: These 3 items removed from this section.

No.	Page	Section	Rev a - DWER Comments	Rev a – Author's Actions
			The following additional recommendations, as outlined within WQPN 38, should be adopted within the LWMS to protect the Jandakot UWPCA: • PDWSA awareness-raising strategies to potential property purchasers and the local community. • Any private bores need to be appropriately located and constructed to prevent contamination of the public drinking water source. • Private bores should not be located within the WHPZ.	Noted. Action: Additional text included.
10	30	8 Water Quality Management	It is recommended that the use of herbicides is minimised, particularly within the Jandakot UWPCA. Please reference and recommend the adoption of the best practice guidance provided within PSC 88 Use of Herbicides in Water Catchment Areas (Department of Health, 2006).	Noted. Action: Additional text included.
11	32	9.1 Roles and Responsibilities Table 10	Please advise who will be responsible for ensuring on-going community education to inform correct landscaping including fertiliser and herbicide application rates, in accordance with s8.1. Please include groundwater monitoring requirements.	The developer will provide new home owners with welcome packs that contain pamphlets and brochures on correct landscaping practices. Action: No action.
12	32	9.2 Urban Water Management Plan	The 2nd dot point relates to the refinement of the final configuration of flood storage areas including side slopes. However, the LWMS proposes only underground cells. As above, will roadside rain gardens be utilised?	Noted. Action: Text revised.

No.	Page	Section	Rev a - DWER Comments	Rev a – Author's Actions
13	33	9.4 Stormwater System Operation and Maintenance Table 11	Tree pits and rain gardens were previously proposed in the endorsed DWMS. Please include the inspection and maintenance of the health of tree pits and rain gardens within Table 11. Please advise if the geofabric on the base of the underground cells will require inspection and routine sediment removal to ensure on-going water quality functionality and include in Table 11.	Noted. Action: Additional text included and Table 11 updated. The underground storage units are likely to require routine inspection and sediment removal as required. Frequency will be specified by the underground storage manufacturer. Action: Additional text included and Table 11 updated.
14	33	9.5 Monitoring	The DWMS committed to developing a post development monitoring program within the LWMS and “The monitoring program will be designed to allow a quantitative assessment of the hydrological impacts of the proposed development within the Study Area. Post-development monitoring program will include measurement of groundwater levels and quality for comparison to pre-development levels.” In addition, Table 1 within the LWMS includes the water quality objective: “Maintain groundwater quality at pre-development levels (median winter concentrations) and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems.” Please capture the abovementioned requirements within an updated LWMS to enable the water quality objective to be verified.	Noted. Action: Text revised.
15	45	Figures 8 & 9 Stormwater Management Plan / Stormwater Event Plans	WQPN 38 Priority 3* areas states that “end of conveyance stormwater infrastructure and subsoil drains should not outlet within WHPZs.”	No underground storage units are proposed within the WHPZ. Action: No action.

OFFICIAL

No.	Page	Section	Rev a - OWER Comments	Rev a- Author's Actions
			The south eastern side of the Study Area is within a WHPZ. Please confirm underground stormwater storage cells are not proposed within the WHPZ.	

Prepared for:
S & A GALATI-RANDO

Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandí

Local Water Management Strategy



DECEMBER 2024

Report ref. J7370c

Suite 1/27 York St, Subiaco WA 6008 | PO Box 117, Subiaco WA 6904
T +61 (08) 9388 2436 W jdahydro.com.au



DISCLAIMER

This document is published in accordance with and subject to an agreement between JDA Consultant Hydrologists ("JDA") and the client for whom it has been prepared ("Client"), and is restricted to those issues that have been raised by the Client in its engagement of JDA. It has been prepared using the skill and care ordinarily exercised by Consultant Hydrologists in the preparation of such documents.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by JDA and the Client without first obtaining a prior written consent of JDA, does so entirely at their own risk and JDA denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

QUALITY ASSURANCE

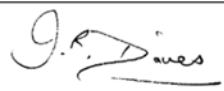
The JDA quality control system has been in place since 1997 and meets the requirements of AS/NZS ISO 9001:2008. JDA is committed to maintaining and improving the quality management system

CONTACT DETAILS

JDA Consultant Hydrologists
PO Box 117
Subiaco, WA, 6904 Australia

Phone: +61 (0) 8 9388 2436
Email: info@jdahydro.com.au
Website: www.jdahydro.com.au

Document Version No.	Issue Date
J7370a	25 May 2023
J7370c	17 December 2024

	Name	Signature	Date
Author	Michael Ioannidis		17 December 2024
Checked by	Matthew Yan		17 December 2024
Approved by	Jim Davies		17 December 2024

CONTENTS

1. EXECUTIVE SUMMARY	1
2. INTRODUCTION	4
2.1 BACKGROUND	4
2.2 STATUTORY FRAMEWORK	4
2.2.1 <i>Regional Planning</i>	4
2.2.2 <i>District Planning</i>	4
2.2.3 <i>Local Planning</i>	5
2.3 KEY DESIGN PRINCIPLES AND OBJECTIVES	5
2.3.1 <i>Stormwater Management Manual for Western Australia (DWER, 2022)</i>	5
2.3.2 <i>Better Urban Water Management (WAPC, 2008)</i>	6
2.3.3 <i>Guidelines for Subdivision Development (City of Kwinana, 2010)</i>	6
2.3.4 <i>Peel Harvey WSUD Local Planning Policy (EPA, 2006)</i>	7
2.3.5 <i>Lot 132, Lot 9035 and Part Lot 9001 Lyon Rd, Wandi District Water Management Strategy (JDA, 2022)</i>	7
3. PROPOSED DEVELOPMENT	9
4. PRE-DEVELOPMENT ENVIRONMENT	10
4.1 EXISTING LAND USE	10
4.2 TOPOGRAPHY	10
4.3 CLIMATE	10
4.4 GEOLOGY AND SOILS	10
4.5 ACID SULPHATE SOILS	10
4.6 GROUNDWATER	11
4.6.1 <i>Regional Hydrogeology</i>	11
4.6.2 <i>Groundwater Levels</i>	11
4.6.3 <i>Groundwater Quality</i>	12
4.6.4 <i>Public Drinking Water Source Area</i>	16
4.7 SURFACE WATER HYDROLOGY	17
4.8 WETLANDS	17
4.9 CONTAMINATED SITES	17
4.10 ABORIGINAL HERITAGE	18
5. WATER SUPPLY AND EFFICIENCY	19
5.1 WATER SUPPLY	19
5.1.1 <i>Potable Water</i>	19
5.1.2 <i>Non-Potable Water</i>	19
5.2 WASTEWATER MANAGEMENT	19
5.3 WATER EFFICIENCY MEASURES	19
6. STORMWATER MANAGEMENT	21

6.1	STORMWATER SYSTEM OVERVIEW	21
6.1.1	<i>Small Event Management</i>	21
6.1.2	<i>Minor Drainage</i>	21
6.1.3	<i>Major Drainage</i>	22
6.2	STORMWATER MODELLING	22
6.2.1	<i>Catchment Runoff Parameters</i>	22
6.2.2	<i>Modelling Results</i>	22
7.	GROUNDWATER MANAGEMENT	24
7.1	DESIGN CRITERIA	24
7.2	CHANGE IN GROUNDWATER LEVELS	24
7.3	MANAGING GROUNDWATER LEVELS	24
7.4	GROUNDWATER QUALITY	24
8.	WATER QUALITY MANAGEMENT	25
8.1	NUTRIENT SOURCE CONTROLS	25
8.2	LAND USE CHANGE NUTRIENT IMPACTS	25
8.3	DISEASE VECTOR AND NUISANCE INSECT MANAGEMENT	26
9.	IMPLEMENTATION	27
9.1	ROLES AND RESPONSIBILITIES	27
9.2	URBAN WATER MANAGEMENT PLAN (SUBDIVISION)	27
9.3	CONSTRUCTION MANAGEMENT	27
9.3.1	<i>Dewatering</i>	27
9.3.2	<i>Acid Sulphate Soils</i>	28
9.4	STORMWATER SYSTEM OPERATION AND MAINTENANCE	28
9.5	MONITORING	28
10.	REFERENCES	30

LIST OF TABLES

1. Summary of LWMS Design Principles and Criteria
2. Key Hydrological Parameter Values Used in this Report
3. Land Use Breakdown
4. Details of Groundwater Monitoring Bores
5. Pre-Development Groundwater Quality Summary, Physicochemical and Nutrients
6. Pre-Development Groundwater Quality Summary, Dissolved Metals Concentrations
7. Pre-Development Groundwater Quality – WS01d
8. Catchment Rainfall-Runoff Loss Model
9. Stormwater Modelling Results
10. Implementation Responsibilities
11. Maintenance Schedule for Drainage Infrastructure

LIST OF FIGURES

1. Location Plan
2. Proposed Land Use
3. Topography
4. Rainfall and Evaporation
5. Surface Geology, A.S.S and Geomorphic Wetland Mapping
6. Monitoring Bore Locations and Pre-Development AAMGL
7. Groundwater Level Time Series
8. Stormwater Management Plan
9. Storm Event Plans

APPENDICES

- A. Local Water Management Strategy Checklist for Developers
- B. Groundwater Monitoring Laboratory Results from 22 November 2021 (Eurofins)
- C. Groundwater Monitoring Laboratory Results from 19 November 2024 (MPL)
- D. Preliminary & Detailed Site Investigation Report – Laboratory Results Summary (WEPL)
- E. Stormwater Modelling Results

1. EXECUTIVE SUMMARY

JDA has been appointed by S & A Galati-Rando to prepare a Local Water Management Strategy (LWMS) for Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandí, herein referred to as the Study Area (Figure 1).

This Local Water Management Strategy (LWMS) has been prepared to support a minor amendment to the Wandí North Local Structure Plan [LSP], which is to include the Study Area within the existing LSP, Figure 1.

This LWMS provides the framework for the application of total water cycle management to the proposed residential structure within the LSP amendment area, consistent with the District Water Management Strategy (JDA, 2022), Department of Water and Environmental Regulation's principles of Water Sensitive Urban Design as described in the Stormwater Management Manual (DWER, 2022), and Better Urban Water Management (WAPC, 2008).

A summary of the LWMS design principles and objectives is presented in Table 1.

TABLE 1: SUMMARY OF LWMS DESIGN PRINCIPLES AND CRITERIA

Key Guiding Principles		
- Facilitate implementation of sustainable best practice urban water management. - 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. - Encourage environmentally responsible development.		
Category	DWMS Objectives (JDA, 2022)	LWMS Criteria
Water Conservation and Sustainability	- Ensure non-potable water supply systems are considered as part of an integrated water supply. - Household target water use of 100 kL/person/year. - Scheme water target use of 40 to 60 kL/person/year. - Use of waterwise landscaping practices both at development and lot scale.	- 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. - Buildings are to comply with water efficiency standards introduced into the building code.
Stormwater Management	- Safe conveyance and management of stormwater runoff in accordance with ARR 2019 (Ball et al., 2019) - At-source retention of small storm events (15 mm). - Maintenance of pre-development hydrological regime by on site infiltration of all stormwater runoff up to 1% AEP. - Water quality treatment systems and water sensitive urban design structures designed in accordance with the Stormwater Management Manual for Western Australia (DWER, 2022) Chapter 9 (Structural Controls) and Australian Runoff Quality (EA, 2006).	- Manage surface water flows from major events in road carriageways and POS to protect infrastructure from flooding and inundation. - Runoff for events up to the 1% AEP to be retained and infiltrated within underground storage units within the road reserve.
Groundwater Management	- Ensure adequate separation (1.5 m) between building floor level and groundwater. - No management of groundwater levels is proposed (subsoil drainage). - Finished levels to provide sufficient separation to groundwater to allow infiltration of stormwater onsite to enhance recharge to the Jandakot Mound. - No groundwater abstraction for irrigation within the Jandakot Water Pollution Control Area (UWPCA). - Management of fertiliser and pesticide application in streetscapes using soil amendments, appropriate plant selection, limiting turf areas and maintenance management systems.	- All lots to have minimum 1.2 m clearance to pre-development AAMGL. - No subsoil drainage is required due to significant depth to groundwater. - No POS will be established within the Study Area and no groundwater abstraction for irrigation is proposed.
Water Quality	- Adopt nutrient load reduction design objectives for stormwater runoff. - Use of amended soils and selective planting to treat stormwater.	- Non-structural controls to reduce applied nutrient loads. - Maintain groundwater quality at pre-development levels (median winter concentrations) and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems.
Monitoring	Commit to a post-development monitoring program in future planning.	Post-development groundwater monitoring program proposed for 2 years.

A number of assumptions have been made in the preparation of this report. Table 2 highlights a few key assumptions. 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	6.2	Bureau of Meteorology (2016)
Rainfall temporal patterns	6.2	Australian Rainfall & Runoff (Ball et al., 2019)
Hydraulic conductivity of in-situ soil	6.2	Minimum 5 m/day

The new edition of Australian Rainfall and Runoff (ARR) Ball et al (2019) adopts different probability terminology from that used in ARR 1987 (IEAust., 1987). In line with ARR 2019, this report adopts new terminology Exceedances Per Year (EY) and Annual Exceedance Probability (AEP) instead of previous terminology, Average Recurrence Interval (ARI) used in ARR 1987, see conversions below.

- 1 EY is equivalent to 1 Year ARI
- 20% AEP equates to 4.48 Year ARI
(For simplicity, this report adopts 20% AEP as equivalent to 5 Year ARI)
- 1% AEP is equivalent to 100 Year ARI

2. INTRODUCTION

2.1 Background

This Local Water Management Strategy (LWMS) has been prepared by JDA Consultant Hydrologists on behalf of S & A Galati-Rando to support incorporation of the Study Area as a minor amendment to the Wandi North Local Structure Plan (LSP).

The LSP amendment area covers a total area of 5.07 ha, of which 1.47 ha (Lot 132) is owned by Wandi Anketell Holdings Pty Ltd and managed by Satterley Property Group, and 3.6 ha (Part Lot 9001 and Lot 9035) is owned by S & A Galati-Rando and managed by Terranovis Pty Ltd. The Study Area is located within the City of Kwinana, approximately 25km south of the Perth CBD and is bound by Honeywood Stage 1C to the northwest, a future subdivision to the southwest, Wandi Playing Fields to the south and Lyon Road to the east, Figure 1.

A portion of the site has been cleared in accordance with Subdivision Approval 159175 for Lot 9001, whilst the remainder of the site is currently being used for intensive horticulture (market garden).

Proposed development of the Study Area will comprise of residential lots and form the final stages of the Honeywood and Whistling Grove development areas up to Lyon Road.

The LWMS provides the framework for the application of total water cycle management to the proposed residential development, consistent with the District Water Management Strategy (DWMS) (JDA, 2022) and Department of Water and Environmental Regulation (DWER) principles of Water Sensitive Urban Design (WSUD) described in the Stormwater Management Manual (DWER, 2022). This document details stormwater, groundwater and water quality management, at a level of detail suitable for the purpose of the local planning scheme.

2.2 Statutory Framework

2.2.1 Regional Planning

The Western Australian Planning Commission (WAPC), in conjunction with the City of Kwinana prepared and adopted the Jandakot District Structure Plan (DSP) to provide a broad framework for land use, conservation and development of land within rezoning cells of Mandogalup, Wandi, Anketell, Casuarina and Wellard (East).

In support of the DSP, the Department of Water prepared the *Jandakot Structure Plan Area Drainage & Water Management Plan (DWMP)* in 2009. It presented a district scale hydrological strategy to guide urban development which included regional groundwater and surface water modelling for both pre-development and post development conditions. Peak runoff compensation volumes for district sub-catchments discharging into the Peel Main Drain and guidelines for controlled groundwater levels are provided.

The Study Area is currently zoned 'Urban' in the Metropolitan Region Scheme and 'Development' in the City of Kwinana Local Planning Scheme No. 2.

2.2.2 District Planning

The Study Area is located in the Jandakot Underground Water Pollution Control Area (Jandakot UWPCA) and was reclassified as a P3* source protection area from a P2 source protection area, allowing the re-zoning from "Rural – Water Protection" to "Urban". DWER (2018) *Water Quality Protection Note No. 38: Priority 3* (P3*) areas* describes additional recommendations beyond those specified in *Better Urban Water Management* (WAPC, 2008) for land development within P3* water protection areas to protect public drinking water quality and public health.

A District Water Management Strategy (DWMS) was prepared by JDA for the Study Area in 2022. The DWMS (JDA, 2022) provides guidance on water and wastewater management, groundwater and stormwater management and structural and non-structural controls for stormwater and groundwater treatment for the future development.

2.2.3 Local Planning

This LWMS is presented in support of the Wandí North LSP amendment as part of the Better Urban Water Management Framework (WAPC, 2008). This LWMS develops surface water and groundwater management strategies at a local scale and is in accordance with the requirements of the DWMS (JDA, 2022).

A copy of the LWMS checklist from the *Interim: Developing a local water management strategy* (2008) guidelines is attached as Appendix A.

2.3 Key Design Principles and Objectives

The LWMS employs the following documents to define its content, key principles and objectives:

- Peel-Harvey WSUD Local Planning Policy (EPA, 2006);
- Better Urban Water Management (WAPC, 2008);
- Jandakot Drainage and Water Management Plan – Peel Main Drain Catchment (DoW, 2009);
- Guidelines for Subdivision Development (City of Kwinana, 2010);
- Local Governmental Guidelines for Subdivision Development (IPWEA, 2017);
- Decision Process for Stormwater Management in Western Australia (DWER, 2017a); and
- Wandí, Lyon Rd Precinct District Water Management Strategy (JDA, 2018);
- Stormwater Management Manual for Western Australia (DWER, 2022); and
- Lot 132, Lot 9035 and Part Lot 9001 Lyon Rd, Wandí District Water Management Strategy (JDA, 2022).

A summary of the key design principles and objectives is provided in Table 1 and summarised below.

2.3.1 Stormwater Management Manual for Western Australia (DWER, 2022)

The Water and Rivers Commission (Department of Water, DoW, 2006-2017; Department of Water and Environmental Regulation, DWER, 2017-present) released *A Manual for Managing Urban Stormwater Quality in Western Australia* in 1998 to define and practically describe Best Management Practices (BMP's) to reduce pollutant and nutrient inputs to stormwater drainage systems. The Manual also aimed to provide guidelines for the incorporation of water sensitive design principles into urban planning and design, which would enable the achievement of improved water quality from urban development.

The document was released to provide a guideline for best planning and management practices and was intended for use by Water and Rivers Commission, but also by other State and Local Government Authorities and sectors of the urban development industry.

In consultation with a working team comprising industry and government representatives a major review of the manual was completed in 2007. The revised manual was officially launched in August 2007.

Principle objectives for managing urban water in WA are stated as:

- Water Quality: To maintain or improve the surface and groundwater quality within development areas relative to pre-development conditions.
- Water Quantity: To maintain the total water cycle balance within development areas relative to the pre-development conditions.
- Water Conservation: To maximise the reuse of stormwater.
- Ecosystem Health: To retain natural drainage systems and protect ecosystem health.

- Economic Viability: To implement stormwater systems that are economically viable in the long term.
- Public Health: To minimise the public risk, including risk of injury or loss of life to the community.
- Protection of Property: To protect the built environment from flooding and waterlogging.
- Social Values: To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater.
- Development: To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles

The manual was reviewed and updated in 2022 from the August 2007 version to ensure all information contained in the document was correct and up-to-date.

2.3.2 Better Urban Water Management (WAPC, 2008)

The guideline document *Better Urban Water Management* (WAPC, 2008), focuses on the process of integration between land use and water planning by specifying the level of investigations and documentation required at various decision points in the planning process. It outlines the requirement for preparation of a Local Water Management Strategy to guide and support water management concepts at the local structure plan level. This LWMS complies with the BUWM process.

2.3.3 Guidelines for Subdivision Development (City of Kwinana, 2010)

The City of Kwinana (CoK) Guidelines for Subdivision Development (CoK, 2010) provides details of the City's requirements regarding stormwater drainage management. The document provides both general guidelines at the strategic conceptual design level and also more specific detailed criteria for design of drainage systems (grades, subsoil drainage).

At the strategic level key design guidelines are cited as follows:

- Australian Rainfall and Runoff (Ball et al. 2019).
- Stormwater Drainage Design in Small Urban Catchments (J Argue, ARRB Special Report No 34).
- Subsurface Drainage of Road Structures (RJ Gerke, ARRB Special Report No 35).
- Water Sensitive Urban (Residential) Design Guidelines for Perth Metropolitan Region (Whelans et al, 1993).
- Stormwater Quality Management Manual (Water and Rivers Commission, 1998).

Specific criteria in relation to stormwater/groundwater are detailed as:

- Examine the total drainage catchment area and ensure that any upstream drainage is able to pass through the subdivision.
- Drainage network is designed to 10yr ARI except for arterial drainage and compensating storages to be designed to a 20yr ARI.
- Floor levels minimum 500 mm above 100yr ARI flood level in storages, main drains and watercourses.
- The pre-development AAMGL generally be maintained following development. Where AAMGL is within 1.2m of the design surface level, subsoils will be installed at AAMGL and fill imported. Subsoils are generally provided as a separate system.
- Water Sensitive Urban Design principles incorporated into the design.
- Open Drainage facilities have 1:6 side slopes.
- Nutrient filtration to occur prior to drainage water being released to a Water Corporation Main Drain.

2.3.4 Peel Harvey WSUD Local Planning Policy (EPA, 2006)

The Peel Harvey WSUD Local Planning Policy (Peel Development Commission, 2006) was developed through the Federal Governments Coastal Catchments Initiative and endorsed by the Environmental Protection Authority (EPA). It aims to assist local government to help integrate catchment management objectives with land and resource planning in urban landscapes.

The policy identifies broad policy objectives against which strategic and statutory proposals can be assessed. WSUD principles, in order of priority, are outlined below:

- Provide protection to life and property from flooding that would occur in a 100-year Average Recurrence Interval (ARI) flood event.
- Manage rainfall events to minimise runoff as high in the catchment as possible. Use multiple low cost 'in-system' management measures to reduce runoff volumes and peak flows (for example, maximise infiltration from leaky pipes and stormwater pits installed above pollutant retentive material)
- Retain and restore existing elements of the natural drainage system, including waterway, wetland and groundwater features and processes, and integrate these elements into the urban landscape, possibly through a multiple use corridor.
- Minimise pollutant inputs through implementation of appropriate non-structural source controls (such as town planning controls, strategic planning controls, pollution prevention procedures, education and participation programs and regulatory controls) and structural controls (that manage the quantity and quality of stormwater runoff and prevent or treat stormwater pollution)
- Maximise water use efficiency, reduce potable water demand, and maximise the re-use of water harvested from impermeable surfaces.

Water quantity management principles and objectives are provided based on post-development discharges being maintained relative to predevelopment levels. Criteria are provided for both ecological protection (1 in 1 year events), and flood protection (1 in 100 year events). Water quality management principles and objectives are based on maintaining or improving water quality relative to existing conditions.

Specific water quality guidelines are provided in the document including limitations on developments where average input rates of nutrients exceed 15 kg/phosphorus/ha per annum or 150 kg/nitrogen/ha per annum.

This policy is stated as holding no legal standing and envisages each local government in the Peel Harvey catchment will customise the model policy to suite its own specific requirements.

2.3.5 Lot 132, Lot 9035 and Part Lot 9001 Lyon Rd, Wandl District Water Management Strategy (JDA, 2022)

The *Lot 132, Lot 9035 and Part Lot 9001 Lyon Rd District Water Management Strategy* was prepared on behalf of Satterley Property Group & Rando Galati for the MRS rezoning of Lot 132, Lot 9035 and Part Lot 9001 Lyon Rd. The DWMS demonstrated that the area was capable of supporting the proposed urban rezoning. The aims of the DWMS were to:

1. Define land area requirements for conveyance of flood flows and protection of future development from peak flood events.
2. Propose a drainage design strategy appropriate for local conditions in the strategy area that incorporates best practice water sensitive urban design measures. The strategy identifies Water Sensitive Urban Design practices to be implemented within both private allotments and the public domain, and the legal mechanisms by which all identified practices will be implemented.
3. Prescribe the design criteria for water quantity and water quality for each catchment.

4. Outline the hydrologic and hydraulic framework parameters and subsequently develop the overall drainage network concept.
5. Define an implementation framework for the drainage design objectives.
6. Recommend monitoring programs for water quantity and quality pre- and post-development as well as for ensuring hydraulic performance over the lifetime of the drainage structure.

3. PROPOSED DEVELOPMENT

The Study Area, 5.07 ha, is situated within the City of Kwinana and is bound by Honeywood Stage 1C to the northwest, a future subdivision to the southwest, Wandí Playing Fields to the south and Lyon Road to the east.

The proposed land use for the Study Area is shown on Figure 2.

Key elements of the LSP amendment related to urban water management include:

- Retention and infiltration of frequently occurring rainfall events ('small' event) at-source within residential lots or from road reserves within underground storage.
- Retention and infiltration of stormwater for the minor and major rainfall events within underground storage.
- Use of local native species in streetscapes to reduce nutrient input and conserve water resources with irrigation only for establishment.

A breakdown of the land use within the Study Area is presented in Table 3 below.

TABLE 3: LAND USE BREAKDOWN

Land Use Description	Study Area
Residential Lots	4.15
Road Reserve	0.92
Total	5.07

4. PRE-DEVELOPMENT ENVIRONMENT

4.1 Existing Land Use

The Study Area comprises of intensive horticulture as a market garden with a section of remnant bushland in the north which has recently been cleared for future residential development, Figure 1. The market garden has been in operation since the early-1980s.

4.2 Topography

The topography across Study Area generally grades northwest to southeast from 32 mAHD to 29 mAHD, Figure 3, except in the southwest corner which grades northeast to southwest from 29 mAHD to 25 mAHD, Figure 3.

4.3 Climate

The Study Area is characterised by a Mediterranean climate with warm dry summers and cool wet winters.

Rainfall data has been obtained from the Bureau of Meteorology for the nearby *Jandakot Aero* gauge (Site ID. 009172) 10.4 km northeast of the Study Area (Figure 4).

The average annual rainfall, 1973 to 2022, for Jandakot Aero was 810 mm, with 30-year and 10-year averages of 765 mm and 768 mm, respectively. This represents a 5.6% (30-year average) and 5.2% (10-year average) decrease from the average annual rainfall for Jandakot Aero. The general decline in rainfall observed across the Jandakot Aero 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 1,700 mm for the Study Area from gridded BoM (2017) 1975-2005 average pan evaporation data, similar to 2021/2022 annual evaporation recorded at the Department of Primary Industries and Regional Development (DPIRD) Wattleup weather station of 1,652 mm (2021) and 1,677 mm (2022), lower than the estimate of 1,900 mm from Luke *et al.* (1987).

4.4 Geology and Soils

Surface geology mapping by Gozzard (1986) is shown on Figure 5.

The Study Area is generally mapped as 'S8' *Bassendean Sand*. These sands are very light grey at surface, yellow at depth, fine to medium-grained, moderately sorted, sub-angular to sub-rounded and of aeolian origin (Gozzard, 1986). These sands are freely draining and have low phosphorus retention capacity.

A detailed geotechnical investigation of the Study Area will be required at the UWMP/subdivision stage of development.

4.5 Acid Sulphate Soils

The Study Area is classified as Class 2, Figure 5, having moderate to low risk of Acid Sulphate Soils (A.S.S) occurring within 3 m of natural soil surface but high to moderate risk of A.S.S beyond 3 m of natural soil surface (DWER, 2017b).

A preliminary A.S.S. analysis was undertaken as part of the geotechnical investigation (Golder, 2008) for the adjacent Honeywood development area. A total of 40 test pits were assessed including limited SPOCAS testing on one or two selected samples per test location. One test pit was located within the Study Area and did not result in confirmation of A.A.S.S/P.A.S.S.

4.6 Groundwater

4.6.1 Regional Hydrogeology

The geological formations have been grouped into two distinct aquifers, each being assigned the name of the major geological unit contributing to it. In descending order of depth from natural surface they are:

- Superficial Aquifer (unconfined)
- Leederville Aquifer (confined)

Superficial Aquifer

The superficial aquifer in Wandí is part of the Jandakot Mound with flow in a south-westerly direction and has an extent of approximately 552 km². The saturated thickness of the aquifer is approximately 35 – 40 m, with the top of the superficial at approximately 20 mAHD and the base of the unit at -18 mAHD. The estimated transmissivity is in the order of 600 - 800 m²/day (Davidson, 1995). The salinity of the aquifer is generally low, between 0 and 500mg/L.

Below the superficial aquifer is the Kardinya Shale Member of the Osborne Formation which separates the superficial from the underlying Leederville aquifer at approximately -60 to -80 mAHD.

Vertical fluctuations in the groundwater table may be several metres and occur seasonally, consistent with Perth's winter-dominated Mediterranean rainfall pattern. Rainfall recharge to the superficial aquifer is 15 to 25% of total annual rainfall (Davidson, 1995).

Leederville Aquifer

The Leederville Aquifer is approximately 250 - 300 m thick. The Osborne Formation overlies the Leederville Formation and includes the Kardinya Shale (confining bed) and Henley Sandstone formations. The Henley Sandstone formation is included in the Leederville Aquifer (Davidson & Yu, 2008).

The Pinjar, Wanneroo and Mariginiup members are present in the Leederville Formation with a base at approximately -350 mAHD. Water level records of the Leederville Aquifer over recent years show a falling potentiometric head, signs of greater abstraction than recharge.

The Leederville Aquifer is a major drinking water resource with groundwater salinity beneath the Jandakot Mound typically < 500 mg/L ('fresh').

4.6.2 Groundwater Levels

Pre-development groundwater level monitoring was conducted by JDA for the Wandí Local Structure Plan area in 21 bores, labelled 1 to 21 on Figure 6, of which Bore 8 was within the Study Area.

Groundwater levels were measured on 22 March 2007 to determine the design groundwater levels across the LSP area for the Wandí LWMS (JDA, 2009). Bore 8 within the Study Area was dry on 22 March 2007. An Average Annual Maximum Groundwater Level (AAMGL) was calculated at 5 long-term DWER bores and groundwater levels measured on 22 March 2007 across the LSP area. An average correction of +1.15 m was applied to groundwater levels measured in the LSP area on 22 March 2007 to estimate the AAMGL at each bore (JDA, 2009). AAMGL contours were produced in JDA (2009) and are shown on Figure 6. The estimated AAMGL across the Study Area ranges from 23 mAHD in the north to 21 mAHD in the south-west corner and is approximately 1 m lower than estimated maximum groundwater level contours in WRC (1997). Depth to AAMGL from natural surface ranges from 5 to 9 m.

Post-development groundwater level monitoring for the adjacent Honeywood Estate and Honeywood Rise has also been performed at bores MW6, WAM1, WAM2 and DWER bore JM42 from February 2012 to October 2017 (Figure 7). Monitoring of Bore WAM4 occurred between November 2016 to August 2021 (Figure 7). This monitoring data is considered representative of the pre-development baseline condition of the Study Area.

Bore details are presented in Table 4 and locations shown in Figure 6.

TABLE 4: DETAILS OF GROUNDWATER MONITORING BORES

Bore ID	GDA 1994 Coordinates		Natural Surface (mAHD)	Total Depth (mbToC)	Top of Casing (mAHD)	Screened Interval (mbNS)	Installation Date
	Easting	Northing					
WAM1d	392674	6438502	23.77	10.0	24.52	8 to 10	19 October 2004
WAM1s	392672	6438501	23.77	6.0	24.48	4 to 6	19 October 2004
WAM2d	392474	6437404	21.96	10.5	22.51	8 to 10	19 October 2004
WAM2s	392474	6437404	22.05	6.5	22.57	4 to 6	19 October 2004
WAM4d	392203	6436628	15.97	10.95	16.43	8 to 10	19 October 2004
WAM4s	392806	6436298	15.83	3.5	16.54	1.5 to 3.5	19 October 2004
MW6	392753	6438041	24.04	3.48	26.20	-	-
WS01d	392769	6437319	-	10.73	-	6 to 10	8 November 2021
JM42	393314	6438041	25.92	16.7	25.87	4.7 to 16.7	06 June 1975

Notes: m BNS = metres below natural surface; m AHD = metres Australian Height Datum.

Groundwater monitoring bore WS01d, located at the southwest corner of the Study Area, was installed by DPP on 08 November 2021 using the hollow stem auger method and drilled to a total depth of 10 m below surface; screened in the lowest 4 m; and constructed of 50mm PVC. The bore was installed for the DWMS (JDA, 2022) to verify the pre-development groundwater levels of the Study Area. A groundwater level of approximately 21.5 mAHD was measured at WS01d on 18 November 2021, approximately 0.5 m higher than the estimated AAMGL. This increase was consistent with the surrounding post-development monitoring bores and DWER bore JM42 and likely reflects the approximately 12% higher rainfall recorded to end of November 2021 compared to the mid-term average.

4.6.3 Groundwater Quality

4.6.3.1 Regional

Post-development groundwater quality monitoring conducted in the adjacent Honeywood Estate and Honeywood Rise developments and is considered representative for the regional pre-development groundwater quality. Physicochemical properties, nutrients and dissolved metals were monitored quarterly in bores WAM1 (shallow and deep) and WAM2 (shallow and deep) from September 2014 to July 2017, and at WAM4 (deep) from November 2016 to August 2021.

A summary of the water quality data collected is presented in Tables 5 and 6 and described as follows:

- The groundwater in all bores was acidic with mean pH ranging from 4.9 to 5.5.
- The groundwater in WAM1s and WAM1d was generally fresh with EC less than 500 $\mu\text{S}/\text{cm}$, whilst the groundwater in WAM2s and WAM2d was marginally brackish. The groundwater in WAM4 was brackish and exceeded the guidance value of 1000 $\mu\text{S}/\text{cm}$.
- Nutrient concentrations were much higher in bores WAM2s and WAM2d than in the other bores. In WAM2s/d, Total nitrogen (TN) concentrations ranged from 0.5 mg/L to 63 mg/L with a mean TN concentration of 15 to 19 mg/L. In the other bores, TN ranged from 1 to 2.7 mg/L with mean of 1.4 to 2.2 mg/L. The high TN concentrations in WAM2s/d were from high concentrations of oxides of nitrogen ($\text{NO}_x\text{-N}$) with mean values of 16 mg/L and 14 mg/L, respectively.
- The mean ammonia ($\text{NH}_3\text{-N}$) concentrations in WAM1s, WAM1d and WAM4 were 0.69 mg/L, 0.46 mg/L and 0.43 mg/L, which have exceeded the Australian Drinking Water Guidelines (ADWG) for health and/or aesthetic guideline values (NHMRC & NRMCC, 2011).

- The maximum dissolved Total Phosphorus (TP) and phosphate ($\text{PO}_4\text{-P}$) concentrations were in bores WAM1s and WAM4.
- All dissolved metal concentrations were less than the ADWG (2011) health and/or aesthetic guideline values.

A summary of the pre-development monitoring results compared to the Nov 2021 monitoring result are as follows:

- pH in November 2021 was within the range of the previous monitoring data.
- EC in WAM1s and WAM4 was slightly higher than previous data although groundwater in WAM1s was still fresh and WAM4 still brackish. EC in bore WAM2d was slightly less than the minimum value and fresh. Groundwater EC in bores WAM1d (321 $\mu\text{S/cm}$) and WAM2s (562 $\mu\text{S/cm}$) was within the range of the previous data, 231 – 440 $\mu\text{S/cm}$ and 508 – 1,000 $\mu\text{S/cm}$, respectively.
- TN concentrations in bores WAM1s, WAM2s and WAM2d were lower than the minimum results of the previous data, while TN concentrations in WAM1d was slightly higher. The TN concentration in bore WAM4 were within the range of the previous data, 1 mg/L to 2.2 mg/L.
- Nitrogen was mostly in the form of $\text{NO}_x\text{-N}$ in bore WAM2s and in the form of $\text{NH}_3\text{-N}$ in bores WAM1s, WAM1d and WAM4. Nitrogen in WAM2d had similar proportions of both $\text{NH}_3\text{-N}$ and $\text{NO}_x\text{-N}$.
- $\text{NH}_3\text{-N}$ concentrations in all bores were consistent with the previous monitoring results with WAM1s, WAM1d and WAM4 $\text{NH}_3\text{-N}$ concentrations higher than ADWG (2011) guideline values.
- The TP and $\text{PO}_4\text{-P}$ concentrations were consistent with the previous data except for the $\text{PO}_4\text{-P}$ concentration in WAM1d which was slightly higher at 0.098 mg/L.
- All metal concentrations were consistent with the previous monitoring data.

TABLE 5: PRE-DEVELOPMENT GROUNDWATER QUALITY SUMMARY, PHYSICOCHEMICAL AND NUTRIENTS

Parameter	Statistics	Guidance Value	WAM1s	WAM1d	WAM2s	WAM2d	WAM4
Physico-chemical							
pH <i>in-situ</i>	Min	6.5-8.5 ¹	4.34	3.68	4.79	4.53	5.26
	Max		6.02	5.73	6.08	5.86	5.92
	Mean		4.9	5.3	5.5	4.9	5.4
	Median		4.695	5.545	5.495	4.765	5.345
	Nov-21		4.23	5.12	5.24	5.04	5.34
EC (μS/cm) <i>in-situ</i>	Min	<1000 ¹	201	231	508	483	850
	Max		427	440	1,000	1,090	1,499
	Mean		310	324	790	848	1,170
	Median		295	315	830	887.5	1,133
	Nov-21		451	321	562	394	1,612
Nutrients (mg/L)							
NH ₃ _N	Min	<0.41 ²	0.23	0.25	<0.005	0.019	0.13
	Max		1	0.66	0.04	0.08	1.3
	Mean		0.69	0.46	0.01	0.037	0.43
	Median		0.765	0.45	0.005	0.032	0.34
	Nov-21		0.42	0.67	<0.005	0.063	0.62
NO _x _N	Min	-	<0.005	<0.005	3	0.32	<0.005
	Max		0.5	<0.05	39	56	<0.05
	Mean		0.054	0.021	16	14	0.0076
	Median		0.005	0.005	8.8	9.1	0.005
	Nov-21		<0.05	<0.05	2.2	0.074	<0.005
TN	Min	-	1.6	1	3.9	0.5	1
	Max		2.7	1.6	62	63	2.2
	Mean		2.2	1.4	19	15	1.4
	Median		2.1	1.45	10.45	9.45	1.3
	Nov-21		1.3	1.9	2.6	0.3	1.4
PO ₄ _P	Min	-	0.011	0.02	<0.005	<0.005	0.085
	Max		0.2	0.041	0.028	<0.005	0.12
	Mean		0.086	0.032	0.0087	0.005	0.099
	Median		0.0855	0.0325	0.005	0.005	0.096
	Nov-21		0.025	0.098	0.007	<0.005	0.081
TP	Min	-	<0.05	<0.05	<0.05	<0.05	0.09
	Max		0.22	0.06	<0.05	<0.05	0.13
	Mean		0.098	0.051	0.05	0.05	0.11
	Median		0.08	0.05	0.05	0.05	0.1
	Nov-21		<0.05	0.11	<0.05	<0.05	0.11

Notes:

PQL = Practical Quantification Limit; defined at the lowest concentration at which an analyte can be detected in a sample with a reasonable degree of accuracy and precision.

- ADWG (2011) *aesthetic* guideline values. Exceedances printed in **brown**.
- ADWG (2011) *health* guideline values. Exceedances printed in **orange**.

TABLE 6: PRE-DEVELOPMENT GROUNDWATER QUALITY SUMMARY, DISSOLVED METALS CONCENTRATIONS

Parameter	Statistics	Guidance Value	WAM1s	WAM1d	WAM2s	WAM2d	WAM4
Arsenic (mg/L)	Mean Nov-21	≤0.01 ²	0.0012 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.0039 <0.001
Cadmium (mg/L)	Mean Nov-21	≤0.002 ²	0.0001 <0.0001	0.0001 <0.0001	0.00081 <0.0001	0.00022 <0.0001	0.00068 <0.0001
Chromium (mg/L)	Mean Nov-21	≤0.05 ²	0.0019 0.002	0.0014 <0.001	0.001 <0.001	0.001 <0.001	0.002 0.001
Lead (mg/L)	Mean Nov-21	≤0.01 ²	0.0018 0.001	0.0011 <0.001	0.0013 <0.001	0.001 <0.001	0.0027 <0.001
Mercury (mg/L)	Mean Nov-21	≤0.001 ²	0.000051 <0.00005	0.00005 <0.00005	0.00005 <0.00005	0.00005 <0.00005	0.00005 <0.00005
Nickel (mg/L)	Mean Nov-21	≤0.02 ²	0.001 <0.001	0.001 <0.001	0.006 <0.001	0.0045 <0.001	0.0021 <0.001

Notes:

PQL = Practical Quantification Limit; defined at the lowest concentration at which an analyte can be detected in a sample with a reasonable degree of accuracy and precision.

1. ADWG (2011) *aesthetic* guideline values. Exceedances printed in **brown**.
2. ADWG (2011) *health* guideline values. Exceedances printed in **orange**.

4.6.3.2 Study Area

Bores WS01d and WS01s were installed at the southwest corner of the Study Area as part of the DWMS (2022) to assess the Study Area groundwater quality. A water sample was collected on 22 November 2021 and on 19 November 2024 from bore WS01d to compare the Study Area groundwater quality with the regional groundwater quality. Note bore WS01s was dry on 22 November 2021.

Water quality results from WS01d are summarised in Table 7 with detailed laboratory results of hydrocarbons, metals and pesticides from 22 November 2021 and 19 November 2024 sampling occasions provided in Appendix B.

A summary of the pre-development monitoring results at WS01d is as follows:

- pH was generally higher than the other regional bores but was still slightly acidic and below the ADWG (2011) guideline value. Groundwater was generally fresh below guideline values.
- Nutrient concentrations in WS01d were within a similar range to the regional bores, except for higher NO_x_N, TP and PO₄_P concentrations and likely attributable to the current intensive horticulture land use up-gradient of the bore. TN has decreased significantly from 13.0 mg/L to 5.2 mg/L between 2021 to 2024 and TP also decreased from 1.9 mg/L to 1.5 mg/L over the same time period.
- TN concentrations were mostly in the soluble form of NO_x_N.
- TP concentrations were higher than the surrounding regional bores.
- All dissolved metal concentrations, except Iron & Aluminium, were less than ADWG (2011) guideline values.
- Pesticide/Herbicide concentrations were less than the PQL of the analysis except for Mecoprop in November 2021 (0.2 mg/L). Western Environmental Pty Ltd resampled the bore on 20 January 2022 and Mecocrop was below the detection limit of <0.001 mg/L. This information was presented in the Mandatory Auditors Report to clear the site contamination condition.
- Hydrocarbons were less than the PQL of the analysis.
- *Escherichia coli* was less than the PQL of the analysis.

TABLE 7: PRE-DEVELOPMENT GROUNDWATER QUALITY – WS01D

Parameter	PQL	Guidance Value	WS01d	
			Nov-21	Nov-24
Physico-chemical/Other				
pH ^{lab}	0.1	6.5-8.5 ¹	6.2	6.0
EC (µS/cm) ^{lab}	10	≤1000 ¹	390	510
TDS (mg/L)	10	≤600 ¹	430	320
Fluoride (mg/L)	0.5	≤1.5 ²	<0.5	0.29
Nutrients (mg/L)				
NH ₃ _N	0.01	≤0.41 ²	0.19	0.11
NO _x _N	0.05	-	12.0	4.2
TKN	0.2	-	1.0	0.96
TN	0.2	-	13.0	5.2
PO ₄ _P	0.01	-	1.5	1.5
TP	0.01	-	1.9	1.4
Ionic Balance (mg/L)				
Calcium, Ca ²⁺	0.5	-	75	30
Chlorine, Cl ⁻	1	≤250 ¹	70	
Magnesium, Mg ²⁺	0.5	-	10	7.9
Potassium, K ⁺	0.5	-	19	17
Sodium, Na ⁺	0.5	≤180 ¹	43	36
Sulphate, SO ₄ ²⁻	5	≤250 ¹	61	53
Alkalinity (mg/L)				
Alkalinity (Bicarbonate)	20	-	22	32
Alkalinity (Carbonate)	10	-	<10	<5.0
Alkalinity (Hydroxide)	20	-	<20	<5.0
Alkalinity (total) as CaCO3	20	-	22	32
Hardness	5	≤200 ¹	230	110
Dissolved Metals (mg/L)				
Aluminium, Al	0.05	≤0.2 ²	0.4	0.21
Arsenic, As	0.001	≤0.01 ²	0.003	0.002
Barium, Ba	0.01	≤2 ²	0.03	0.01
Beryllium, Be	0.0005	≤0.06 ²	<0.001	0.0005
Boron, B	0.05	≤4 ²	0.1	0.071
Cadmium, Cd	0.0001	≤0.002 ²	<0.0002	<0.0001
Chromium, Cr	0.001	≤0.05 ²	0.001	<0.001
Copper, Cu	0.001	≤1 ¹ , ≤2 ²	0.002	0.0014
Iron, Fe	0.01	≤0.3 ²	0.86	0.65
Lead, Pb	0.001	≤0.01 ²	<0.001	<0.001
Manganese, Mn	0.005	≤0.1 ¹ , ≤0.5 ²	0.028	0.014
Mercury, Hg	0.00005	≤0.001 ²	<0.0001	<0.00005
Nickel, Ni	0.001	≤0.02 ²	0.001	<0.001
Selenium, Se	0.001	≤0.01 ²	0.002	<0.001
Zinc, Zn	0.001	<0.02 ¹	<0.005	0.0033
Microbial (CFU/100 mL)				
Escherichia Coli	1	ND	<1	<10
Acid Herbicides				
Mecoprop	0.001	0.01	0.2	<0.001 ³

Notes:

PQL = Practical Quantification Limit; defined at the lowest concentration at which an analyte can be detected in a sample with a reasonable degree of accuracy and precision.

ND = No detection.

1. ADWG (2011) *aesthetic* guideline values. Exceedances printed in **brown**.
2. ADWG (2011) *health* guideline values. Exceedances printed in **orange**.
3. Mecoprop sample from WS01d on 22 January 2022 (see Appendix D).

4.6.4 Public Drinking Water Source Area

The Study Area is located within the Jandakot Underground Water Pollution Control Area (UWPCA) which occupies a total area of 7,400 ha. The Jandakot UWPCA was proclaimed in 1975 under the *Metropolitan Water Supply Sewage Scheme and Drainage Act 1909*. Water from the Jandakot Mound is abstracted by the Water Corporation as part of the Perth Metropolitan Integrated Water Supply System.

DWER is the lead agency in protecting catchments for water supply in Western Australia and supports the Australian Drinking Water Quality Guidelines (NHMRC & NRMCC, 2011) barrier approach to water quality protection, with catchment management the first barrier of protection. Subsequent barriers are water storage, treatment and disinfection.

The Study Area was originally classified as a Priority 2 area, however following Metropolitan Regional Scheme Minor Amendment 1381/57 in December 2022, the area will be changed to a Priority 3* Public Drinking Water Source Area (PDWSA).

The P3* zoning is a variation to Priority 3 to address increased risk to water quality from the approved land use change. Water Quality Protection Note (WQPN) 38 (DWER, 2018) sets out the groundwater catchment priority classification system and provides a guide on compatible land uses to protect groundwater from pollutant risk. The southeast corner of the Study Area intersects the Well Head Protection Zone (WHPZ) of Bore J520.

Priority 3 (P3) source protection areas are defined where it is necessary to manage the risk of pollution to the water source where the land is zoned for urban and commercial or light industrial uses. P3 areas generally have the requirement of using best management practices and connection to deep sewerage. P3 areas are protected in accordance with the objective of risk management.

Any urban development within P3* areas must comply with the compatibility criteria. Other information provided in the WQPN 38 includes:

- DWER's advice on land and water based activities in proclaimed PDWSA.
- Best Management Practices (BMPs) guidance used to protect water quality in PDWSAs
- Overview of legislation, policies and processes used to protect PDWSAs
- The development of multi-agency guideline designed to balance views of community, industry and government, in order to maintain a reliable safe public drinking water supply.

4.7 Surface Water Hydrology

The Study Area is located within the Lower Serpentine catchment of the Serpentine River Catchment (DoW, 2009).

Rainfall runoff from the highly permeable sandy soils within the Study Area is limited and therefore there are no natural surface tributaries.

4.8 Wetlands

Geomorphic wetland mapping of the Swan Coastal Plain (DBCA, 2016), Figure 5, shows no mapped wetlands within the Study Area. Within the vicinity of the Study Area, there is a Resource Enhancement [RE] dampland (UFI 6892) to the northeast of the Study Area; a Resource Enhancement [RE] sumpland (UFI 6664) to the northwest of the Study Area; three Conservation sumplands (UFIs 15585, 15584, 14663), one Multiple Use sumpland (UFI 15583) and one Multiple Use dampland (UFI 6530) to the southwest of the Study Area; and two Conservation sumplands (UFIs 12980, 14064) and one Multiple Use sumpland (UFI 14063) to the south of the Study Area.

4.9 Contaminated Sites

A search of DWER's publicly available Contaminated Site Database (accessed 05 May 2023) indicated no contaminated sites within the 1 km buffer of the Study Area.

JDA notes the publicly available database only identifies 3 of the 7 contaminated sites classifications: *Contaminated – restricted use*; *Contaminated – remediation required*; and *Remediated for restricted use*. The remaining classifications

are *Report not substantiated; Possibly contaminated – investigation required, Not contaminated – unrestricted use; and Decontaminated.*

The existing market garden has been continuously operating since establishment in the early-1980s from which there are potential pre-development risks to groundwater quality including diesel spills from machinery, pesticide residues, excessive nutrients and septic tanks/leach drains.

4.10 Aboriginal Heritage

There are no registered aboriginal sites within the Study Area.

An 'other heritage place' (ID: 3427), 'Mandogalup Swamp/Spectacles', is mapped to the north and south of the Study Area.

The Aboriginal Heritage Enquiry System (DPLH, 2023b) denotes this area as '*Mythological, Hunting Place, Water Source*' but with a status denoted the area as stored data and not a site.

5. WATER SUPPLY AND EFFICIENCY

5.1 Water Supply

5.1.1 Potable Water

Potable water supply to the development will be scheme water with connection to the existing system from Gaebler Road. This system has already been extended to the Honeywood and Whistling Grove development areas adjacent to the Study Area.

5.1.2 Non-Potable Water

Non-potable water supply options that can generally be adopted or investigated further to reduce demand for potable water supply in urban developments, such as greywater and wastewater recycling, are in this instance restricted in a P3* area to minimise risk of water quality contamination. Use of household scale rainwater tanks is encouraged to reduce demand for scheme water within the development.

Whilst there are no POS areas within the Study Area, non-potable water supply from water carting and transport services will be used to meet any streetscape irrigation demand for establishment.

5.2 Wastewater Management

Wastewater will be managed by Water Corporation by extension of the existing adjacent service infrastructure as per the Honeywood and Whistling Grove development areas.

5.3 Water Efficiency Measures

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. 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.

The objective for water conservation is to minimise use of water and maximise water use efficiency where possible. It can be achieved at both the development scale and lot scale and is identified in the State Water Plan (Government of Western Australia, 2007) as a priority item for potable water. The State Water Plan target for household water use is 100 kL/person/year (potable and non-potable water), with a consumption target for scheme water of 40 to 60 kL/person/year (potable water).

Consistent with the State Water Plan, the main objectives for the development are:

- Reduce household water use to not more than 100 kL/person/year.
- Minimise use of potable water where drinking water quality is not essential, particularly ex-house.
- Household consumption targets for in-house potable water use of 40 to 60 kL/person/year.

Development Scale

Development scale water conservation measures appropriate for the Study Area include:

- Strategic planning (orientation, shape, elevation etc.) of road reserves to minimise long-term irrigation demand.

- Within streetscapes, the use of waterwise landscaping practices including native plantings, hydrozoning, mulching, soil amendments and water retention products.

Lot Scale

Lot scale water conservation measures appropriate for the Study Area include:

- Increased residential density, including smaller lots with reduced ex-house irrigation areas.
- Buildings constructed to current 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 was 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.
- Initiatives to encourage waterwise landscaping of residential lots including use of native plant species, hydrozoning, mulching, soil amendments, water retention products and installation of appropriate irrigation fixtures.
- Encourage use of non-potable water supply options for ex-house irrigation uses (ie. Rainwater tanks)

6. STORMWATER MANAGEMENT

6.1 Stormwater System Overview

Local stormwater management is proposed to be consistent with the key objectives and criteria detailed in Table 1 as presented in the DWMS (JDA, 2022) and the adjacent Honeywood Stage 1 C development area to the west.

Whilst the DWMS (JDA, 2022) identified stormwater management in northern and southern drainage basins, this is now been replaced with underground storage (infiltration) units located within the road reserve (e.g. StormTech, ecoAID, Tunnelwell). This allows more efficient infiltration of stormwater and distributes the water across the development area rather than concentrating it in two locations.

Stormwater management is designed according based on small events, minor drainage and major drainage.

Small event management concentrates on the first 15 mm of rainfall (approximately the 1 EY 1 hour event) and will comprise lot retention and retention of stormwater runoff from roads within rain gardens, tree pits and underground storage units.

The minor drainage system is defined as a system of drains, pipes, culverts, kerbs, gutters etc. designed to convey runoff generated by low frequency storms, typically less than the 20% AEP for residential areas to the underground storage units within road reserves. Residential lots fronting Windjana Rise, some fronting Lyon Road and a portion of the residential lots fronting Honeywood Estate in the northern part of the Study Area will drain out of the Study Area to Magenup Drive, Lyon Road and the Honeywood Estate drainage system, respectively.

The major drainage system is defined as the arrangement of roads and attenuation areas planned to provide safe passage of stormwater runoff from extreme rainfall events to the underground storage units.

The drainage system is described in more detail below with the key elements of the drainage system shown on Figure 8.

6.1.1 Small Event Management

The following strategies are proposed to meet the criteria for small event management:

- All residential lots are to retain and infiltrate the first 15 mm of rainfall from connected impervious areas. This can be achieved by means of systems such as soakwells and/or other underground storage units.
- Stormwater runoff from roads for the first 15 mm of rainfall will be discharged to underground storage units within the road reserves. 'Leaky' drainage pits/manholes, raingardens and tree pits adjacent to lots can provide at-source treatment within the internal catchment, if deemed suitable at further detailed design in the UWMP.

6.1.2 Minor Drainage

To meet the design criteria for the minor drainage system (for events up to the 20% AEP event), the following strategies are proposed:

- Stormwater flow from road reserves will be conveyed primarily by the road pipe network sized for 20% AEP event to the underground storage units located within the road reserves, similar to the adjacent Honeywood Stage 1 C development area to the west.
- Runoff generated within residential lots in excess of lot storage units will flow overland via driveways or front of lots into the road drainage network. Where proposed lots are less than 350 m², lot storage units are to be interconnected within the lot.

6.1.3 Major Drainage

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 strategy are as follows:

- Management will include infiltration of stormwater into in-situ sands (as in small and minor events) together with runoff from lots (excess of lot storage units) and road stormwater runoff.
- Road reserves provide flood storage and conveyance. In major storm events, stormwater will flow overland within the road carriageway and be captured by nearby underground storage units within the road reserve.
- Stormwater runoff up to the 1% AEP will be retained and infiltrated within underground storage units located in the road reserve.
- Minimum habitable building floor levels will have a 500 mm (0.5 m) clearance from the top water level of the underground storage units within the road reserve, consistent with DWER (2017a).

6.2 Stormwater Modelling

Stormwater drainage areas for the Study Area were sized and modelled in PCSump Version 6.1 (JDA, 2020) based on the post-development stormwater catchments shown on Figure 8. The Deep Water Table Model has been adopted and a saturated hydraulic conductivity of 5 m/day has been assumed.

The design storms modelled were according to the methodology in Australia Rainfall and Runoff (Ball et al., 2019). The rainfall temporal pattern was assumed to be spatially uniform across the catchment with storm durations from 30 minutes to 168 hours (7 days).

Underground infiltration units were modelled as being 2.5 m wide and 1 m deep within the road reserve. These units would be located on one side of the road reserve only. With a total verge width of 4.5 m, a 2.5 m wide underground infiltration unit leaves a remaining 2 m for other services.

6.2.1 Catchment Runoff Parameters

Figure 8 shows the Study Area contains both internal and external drainage catchments.

The internal catchment contributing to the Study Area drainage system comprise 2.88 ha of Lots and 1.01 ha of road reserve. External catchments drain to existing City of Kwinana stormwater drainage infrastructure, as per existing lots adjacent. A breakdown of the rainfall-runoff loss model parameters for each land use is presented in Table 8 below.

TABLE 8: CATCHMENT RAINFALL-RUNOFF LOSS MODEL

Land Use	Initial Loss (mm)	Continuing Loss (mm/hr)	Proportional Loss (%)
Residential Lots	15	10	-
Road Reserve	1.5	-	10

6.2.2 Modelling Results

Stormwater modelling results for the ‘small’ event (first 15 mm), minor (20% AEP) and major (1% AEP) events are summarised in Table 9. Event Plans are shown on Figure 9 with detailed modelling results attached as Appendix E.

Stormwater modelling results for the first 15 mm in underground infiltration units conservatively assumes no infiltration by rain gardens or tree pits.

Results in Table 9 and presented in Figures 8 and 9 demonstrates that up to the 1% AEP rainfall event can be safely retained and infiltrated in underground storage units located within the road reserve.

Rain garden locations shown on Figure 8 are indicative only and are based on inactive lot side boundaries. Exact size and location of the rain gardens and tree pits are to be determined at detail design and presented in the UWMP.

Underground storage unit locations shown on Figure 8 are indicative only. Exact length and location is to be subject to further refinement and detail design in the UWMP.

TABLE 9: STORMWATER MODELLING RESULTS

	Underground Storage
Catchment Details	
Residential Lots (ha)	2.88
Road Reserve (ha)	1.01
Underground Storage Details	
Maximum Depth (m)	1.0
Width (m)	2.5
Length (m)	372
Chamber Base Area (m ²)	930
1% AEP (Major) Event Management	
Critical Duration (hours)	2
Maximum Water Depth (m)	1.0
Peak Water Storage Volume (m ³)	930
20% AEP (Minor) Event Management	
Critical Duration (hours)	2
Maximum Water Depth (m)	0.24
Peak Water Storage Volume (m ³)	222
First 15 mm (Small Event)	
Duration (hour)	1
Water Depth (m)	0.07
Peak Water Storage Volume (m ³)	62

7. GROUNDWATER MANAGEMENT

7.1 Design Criteria

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

- Manage groundwater levels to protect infrastructure and assets.
- Maintain groundwater regime for the protection of groundwater-dependent ecosystems.
- Managing and minimising changes in groundwater levels and quality following urban development.
- Maintain or improve existing groundwater quality.

7.2 Change in Groundwater Levels

DoW (2009) presents district scale modelling of current climate maximum groundwater levels across the Jandakot Mound. Modelling results of depth to groundwater in very wet and very dry climates shows it is >4 m in the Study Area. It outlines further local scale investigation should be performed to determine whether any groundwater management (subsoil drainage or fill) is required.

An increase in groundwater levels is generally expected to occur following change in land use to urban development. For the Study Area, post-development recharge rate with infiltration of all stormwater on site for residential development will not be dissimilar to the current pre-development recharge rate of the market garden. The cease in groundwater abstraction from the market garden production bore will have minimal impact on the Study Area groundwater levels as the bore intercepts groundwater throughflow from close to the base of the superficial aquifer.

7.3 Managing Groundwater Levels

Groundwater management is generally required to ensure minimum separation of 1.2 m between finished lot level and winter maximum level as per the Jandakot Structure Plan DWMP (DoW, 2009). Given clearance to pre-development AAMGL within the Study Area ranges from approximately 5 m to 9 m and surrounding areas have already been developed, the Study Area is not expected to be impacted by any potential post-development groundwater rise, hence, no imported sand fill and groundwater management will be required.

7.4 Groundwater Quality

Being in a P3* area, water quality management measures are required to ensure proposed development does not impact on existing or future water supply. Measures proposed include:

- All urban lots connected to reticulated sewer
- Exclusion of high-risk land uses (e.g., service stations)
- Use of bio-retention areas/rain gardens and tree pits (if practical) with amended soil and vegetation to remove nutrients and contaminants from stormwater runoff
- Responsive landscaping with endemic plant species that are water wise with low nutrient requirement
- Public drinking Water Supply Area (PDWSA) awareness-raising strategies to potential property purchasers and the local community
- Any private bores need to be appropriately located and constructed to prevent contamination of the public drinking water source.
- Private bores should not be located within the WHPZ.

8. WATER QUALITY MANAGEMENT

8.1 Nutrient Source Controls

The effective implementation of the structural and non-structural controls as part of the residential development will enhance water quality from the Study Area as a result of land use change.

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

- Local native plants make up a minimum 50% of the streetscape treatments. Any non-local species will be selected for drought tolerance and low fertiliser requirements;
- Community education to inform correct landscaping and fertiliser application rates; and
- Maintenance practices such as street sweeping and pit eductions to remove sediment build-up, particularly during the development and construction phase. The UWMP will outline the schedule and cleaning requirements for street sweeping, which will be co-ordinated with the City of Kwinana.

The use of herbicides on streetscapes and residential lots will be minimised where possible, but if used must be in accordance with best practice guidance as outlined in the Department of Health *PSC 88 Use of Herbicides in Water Catchment Areas* (29 August 2006). This information will be provided as part of community education and in welcome packs to new home owners and to local government at handover of streetscapes.

Structural source controls are proposed to compliment the non-structural source controls which may include upstream GPTs and manhole inlets to capture debris, rubbish and sediment. Any fine sediment that enters the underground storage units will settle on the geo-fabric base and can be cleaned.

This development employs stormwater management within underground storage units. This approach is consistent with the adjacent Honeywood Stage 1 C development area to the west.

8.2 Land Use Change Nutrient Impacts

The Study Area pre-development is largely comprised of intensive horticulture. A section of remnant bushland in the north has been recently cleared for future residential development. The UNDO (Urban Nutrient Decision Outcomes) decision support tool (DoW, 2016) and associated fact sheets provide detail of nutrient inputs from various land use types.

Intensive horticulture falls under the category of unrestricted *Rural Living* in the UNDO tool which has a nutrient input rate of 70.1 kg/ha/yr TN and 13.2 kg/ha/yr TP. These values are based on median nutrient inputs on land with horses (DoW, 2016b) and are likely an underestimate of the nutrient inputs associated with intensive horticulture across the Study Area. The *Rural Living* fact sheet (DoW, 2016b) summarises median input rates of various land uses from the literature with *Annual horticulture (vegetables)* having a median nutrient input rate of 143 kg/ha/yr TN, 104% higher than *Rural Living*, and 127 kg/ha/yr TP, 860% higher.

The proposed development of the Study Area incorporates road reserves and R30 residential lots. For R30 zoning, lot sizes typically range from 270 m² to 420 m² with an average of 350 m².

The UNDO tool separates residential lots into various ranges based on area, with a nutrient input rate for lots < 400 m² of 23.4 kg/ha/yr TN and 6.9 kg/ha/yr TP, and lots between 400 m² and 500 m² of 65.5 kg/ha/yr TN and 16.7 kg/ha/yr TP. Assume 55% of the lots are less than 400 m² and the rest are between 400 m² and 500 m², the average nutrient input rate from residential lots within the Study Area is 44.3 kg/ha/yr TN and 11.3 kg/ha/yr TP, a 37% reduction in TN and 14% reduction in TP compared to unrestricted *Rural Living*.

Proposed land use change of the Study Area from intensive horticulture to urban results in significant reductions in nutrient inputs post-development.

8.3 Disease Vector and Nuisance Insect Management

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

9. IMPLEMENTATION

9.1 Roles and Responsibilities

Table 10 details the roles and responsibilities to undertake the implementation plan.

The operation and maintenance of the stormwater management system will initially be the responsibility of the developer but will ultimately be accepted by the Local Authority. Preparation of the UWMP will be the responsibility of the developer.

TABLE 10: IMPLEMENTATION RESPONSIBILITIES

IMPLEMENTATION		RESPONSIBILITY	
LWMS Section	Action	Developer	City of Kwinana
9.2	Preparation of an Urban Water Management Plan to support subdivision	✓	
9.4	Construction of stormwater system	✓	
9.4	Stormwater system operation and maintenance Initially Following handover	✓	✓
9.5	2 Year Post Development Monitoring Program	✓	

9.2 Urban Water Management Plan (Subdivision)

Better Urban Water Management (WAPC, 2008) requires an Urban Water Management Plan (UWMP) at subdivision stage. With an approved LWMS, a UWMP is required as a condition of subdivision and prior to any subdivision activities.

Further work that is identified for inclusion in the UWMP:

- Design of treatment structures and flood storages as outlined in the Stormwater Management Manual (DWER, 2022);
- Refinement of the final configuration (length, width and height) and exact location of rain gardens, tree pits and underground storage units; dependent on final earthworks, drainage, location of services and cross overs and road design levels.

9.3 Construction Management

9.3.1 Dewatering

Given the significant depth to groundwater (5 to 9 m), dewatering will likely not be required.

Should dewatering of the superficial aquifer beneath the Study Area be required, prior to commencement the construction contractor may 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. Dewatering should then be carried out in accordance with the licence conditions and where possible, construction should be timed to minimise impacts on groundwater and any dewatering requirement.

9.3.2 Acid Sulphate Soils

Figure 5 shows a moderate to low risk of A.S.S across the Study Area and there was no confirmation of Actual Acid Sulphate Soils (A.A.S.S) or Potential Acid Sulphate Soils (P.A.S.S.) in a test pit adjacent to the Study Area in the neighbouring Honeywood Estate development (Golder Associates, 2008).

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 (DER, 2015a) and Treatment and Management (DER, 2015b) of Disturbed Acid Sulphate Soils. Specific methods for treatment and holding times for A.S.S are specified in these guidelines.

9.4 Stormwater System Operation and Maintenance

The stormwater drainage system will require maintenance to ensure correct operation. It is considered the following operating and maintenance practices will be required periodically:

- Inspection and removal of debris, litter and sediments surrounding pipe inlets/outlets and in manholes/gross pollutant traps (GPTs) and underground storage units. Manholes or GPTs are recommended upstream of the pipe inlets to the underground storage units.
- Street sweeping to reduce particulate build-up on road surfaces, particularly during the initial construction phase of the development.
- Arrange education campaigns regarding source control practise to minimise pollution runoff into the stormwater drainage system.
- Regular inspection and maintenance of tree and plant health in tree pits and rain gardens.

The operating and maintenance schedule required is presented in Table 11.

TABLE 11: 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/underground storage units	✓	✓	✓
Inspection and maintenance of tree health in tree pits and rain gardens		✓	✓

9.5 Monitoring

Post-development monitoring is required to quantitatively assess the hydrological impacts of the proposed development. The monitoring program will be designed to allow a quantitative assessment of the hydrological impacts of the proposed development within the Study Area.

The post-development monitoring program will operate for a 2 year period following completion of 80% of the lots. With over 5 m depth to groundwater from post development finished surface levels, the focus on monitoring is post development water quality. Monitoring is to occur from bore WS01d with measurements of the following:

- Groundwater levels (annually) – end of winter
- Groundwater quality (annually) – All parameters in Table 7, Hydrocarbons, Pesticides and Herbicides.

All sampling is to be conducted according to Australian Standards and all water quality sample testing will be conducted by a NATA approved laboratory.

Post development monitoring data is to be compared to pre-development data and appropriate ANZECC water quality criteria. Further details of the monitoring program including criteria and contingency action are to be established in the UWMP.

10. REFERENCES

- Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019, *Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia*.
- Bureau of Meteorology [BoM] (2023) *Climate Data Online, Jandakot Aero (009172) Rainfall Data*. Accessed May 2023.
- City of Kwinana (2010) *Residential Subdivision and Development Guidelines*. Issue 1, 20 May 2010.
- Davidson (1995) *Hydrology and Groundwater Resources of the Perth Region Western Australia*. Western Australia Geological Survey, Bulletin 142.
- Davidson, W.A. & Yu, X. (2006) *Perth regional aquifer modelling system (PRAMS) model development: Hydrogeology and groundwater modelling*. Department of Water, Hydrogeological record series HG 20.
- Department of Environmental Regulation [DER] (2015a) *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes*. Version: Final, June 2005.
- DER (2015b) *Treatment and management of soil and water in acid sulfate soil landscapes*. Version: Final, June 2005
- Department of Biodiversity, Conservation and Attractions [DBCA] (2016) *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*. Published 28 January 2016, last updated 18 January 2020.
- Department of Planning, Lands and Heritage [DPLH] (2023a) *Map Sheet 24: Forrestdale. Metropolitan Region Scheme Map, 1:25000 Map Series*. Amended to 24 April 2023. Published by the Department of Planning, Lands and Heritage, Perth WA.
- DPLH (2023b) *Aboriginal Heritage Inquiry System*. Accessed May 2023.
- Department of Primary Industries and Regional Development [DPIRD] (2023) Pan Evaporation data from Wattleup weather station. Accessed May 2023.
- Department of Water [DoW] (2009) *Jandakot drainage and water management plan, Peel main drain catchment*. Department of Water, December 2009.
- DoW (2015) *Selection of future climate projections for Western Australia*. Water Science Technical Series, Report no. WST 72.
- DoW (2016a) *Urban Nutrient Decision Outcomes (UNDO) tool User Guide Version 1.1.0*. Water Science Technical Series Report Number 76, July 2016.
- DoW (2016b) *UNDO Tool Fact Sheet: Rural Living: Nutrient Input Rates*.
- Department of Water and Environmental Regulation [DWER] (2017a) *Decision Process for Stormwater Management in Western Australia*. November 2017.
- DWER (2017b) *Acid Sulphate Soil (A.S.S) Hazard Mapping*.
- DWER (2018) *Priority 3* (P3*) areas*. Water quality protection note no. 38, October 2018.
- DWER (2022) *Stormwater Management Manual for Western Australia*. First published 2004-2007, updated May 2022.
- DWER (2023) *Contaminated Sites Database*. Accessed May 2023.
- Engineers Australia, Institution of [IEAust.] (1987) *Australian Rainfall and Runoff*.
- Engineers Australia [EA] (2006) *Australian Runoff Quality A guide to Water Sensitive Urban Design*.
- EPA (2006) *Peel-Harvey WSUD Local Planning Policy, Final*. October 2006.
- Golder Associates (2008) *Preliminary Geotechnical Investigation and Preliminary Acid Sulfate Soil Assessment, Proposed urban and residential development lots 676, 678, 679, 680 and 683 Lyon Rd Wandí*. Report 077642581R for Satterley Property Group, February 2008.
- Government of Western Australia (2007) *State Water Plan 2007*.
- Gozzard, J.R. (1986) *Environmental Geology Series 1:50,000 Environmental Map – Fremantle, Sheets 2033-I and 2033-IV*. Geological Survey of Western Australia.

IPWEA (2017) *Local Government Guidelines for Subdivisional Development Edition 2.3*, November 2017.

JDA (2009) *Wandí (North) Local Water Management Strategy (LWMS)*. JDA Ref: J4106d. Prepared for Satterley Property Group Pty Ltd, January 2009.

JDA (2018) *Wandí, Lyon Rd Precinct District Water Management Strategy*. JDA Ref: J6608a. Prepared for Satterley Property Group, September 2018.

JDA (2020) *PCSump Version 6.1 – USER GUIDE*. JDA Ref: J6216f, February 2020.

JDA (2022) *Lot 132, Lot 9035 and Part Lot 9001 Lyon Rd, Wandí District Water Management Strategy*. JDA Ref: J7126c. Prepared for Satterley Property Group / Rando Galati, March 2022.

Luke, G.L, Burke, K.L. & O'Brien, T.M. (1987) *Evaporation data for Western Australia – Resource Management Technical Report No. 65*. Perth: W.A. Department of Agriculture, division of Resource Management. October 1987.

NHMRC, NRMCC (2011). *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. Version 3.5*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra

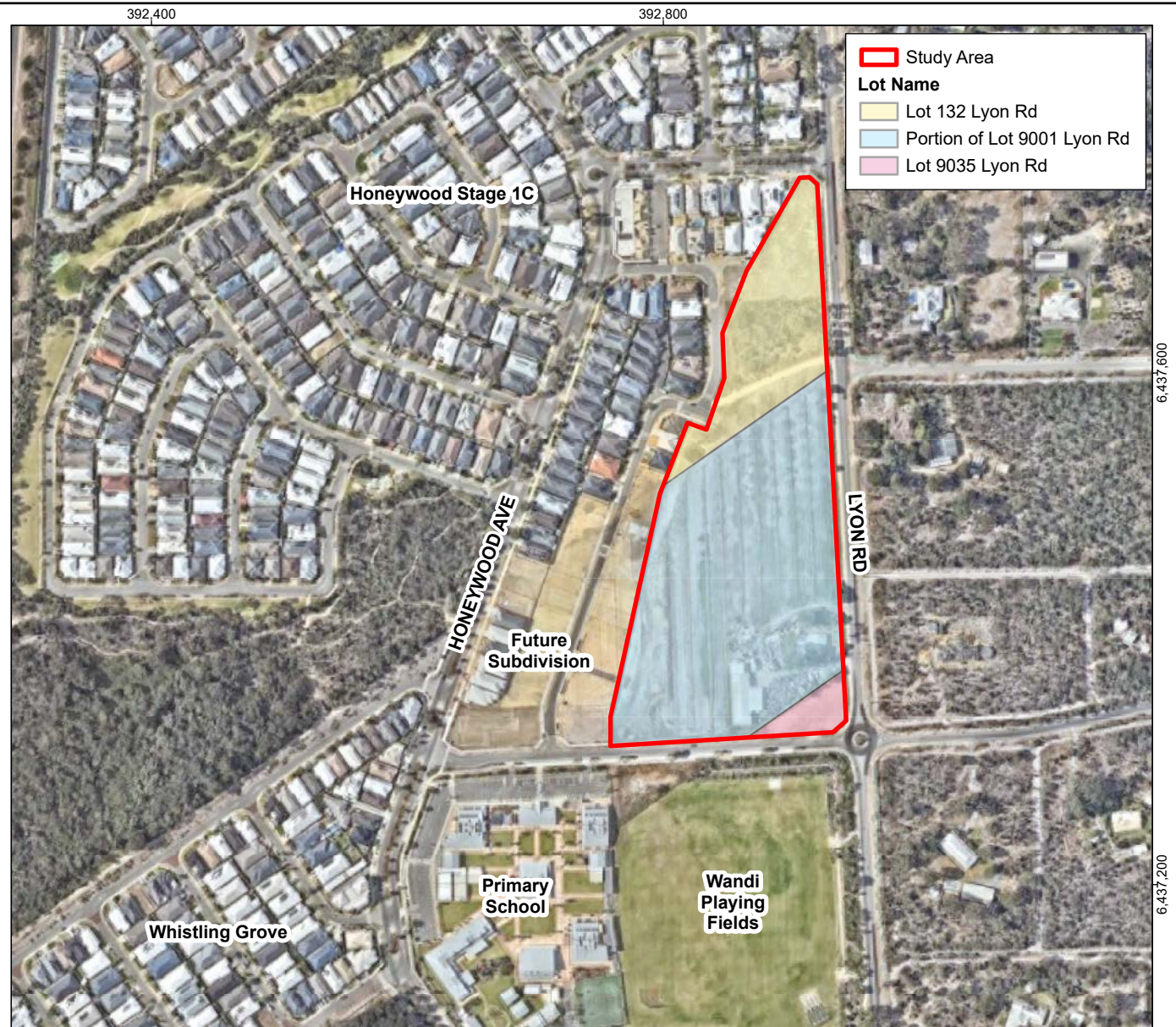
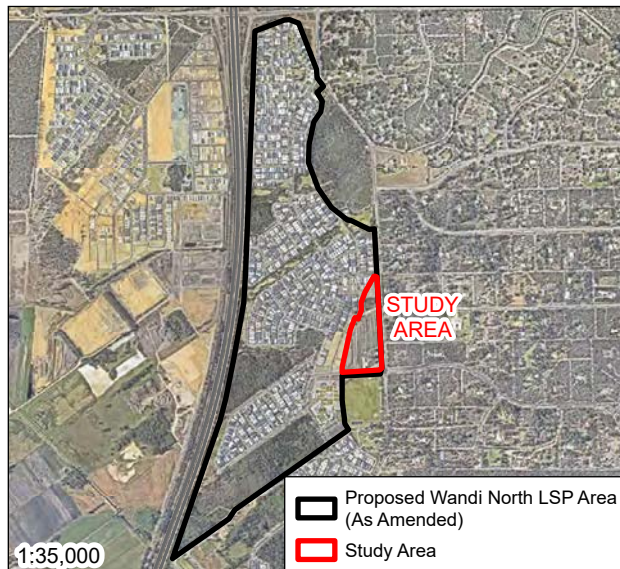
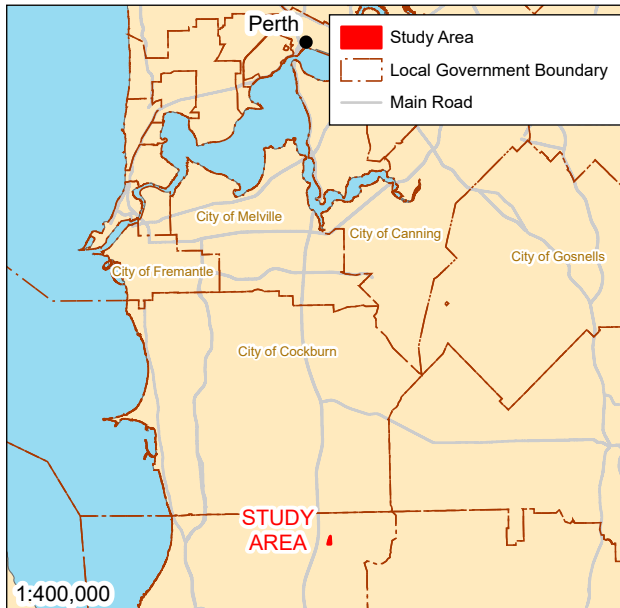
Waters and Rivers Commission [WRC] (1997) *Perth Groundwater Atlas*.

West Australian Planning Commission [WAPC] (2001) *Southern River/Forrestdale/Brookdale/Wungong District Structure Plan*. Published by WAPC, January 2001.

WAPC (2006) *State Planning Policy 2.9 Water Resources*. WA Government Special Gazette 227.

WAPC (2008) *Better Urban Water Management*. Perth, Western Australia. October 2008

FIGURES

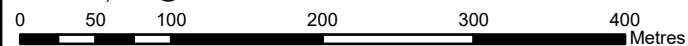


Data Source: Nearmap (2024)

Coordinate System: GDA 94, Zone 50



Job No. J7370
 Scale: 1:5,000 @A4



© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2024



S & A Galati-Rando
 Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandli LWMS
Figure 1: Location Plan



Data Source: Nearmap (2023)

Coordinate System: GDA 94, Zone 50



Job No. J7370
Scale: 1:3,500 @A4

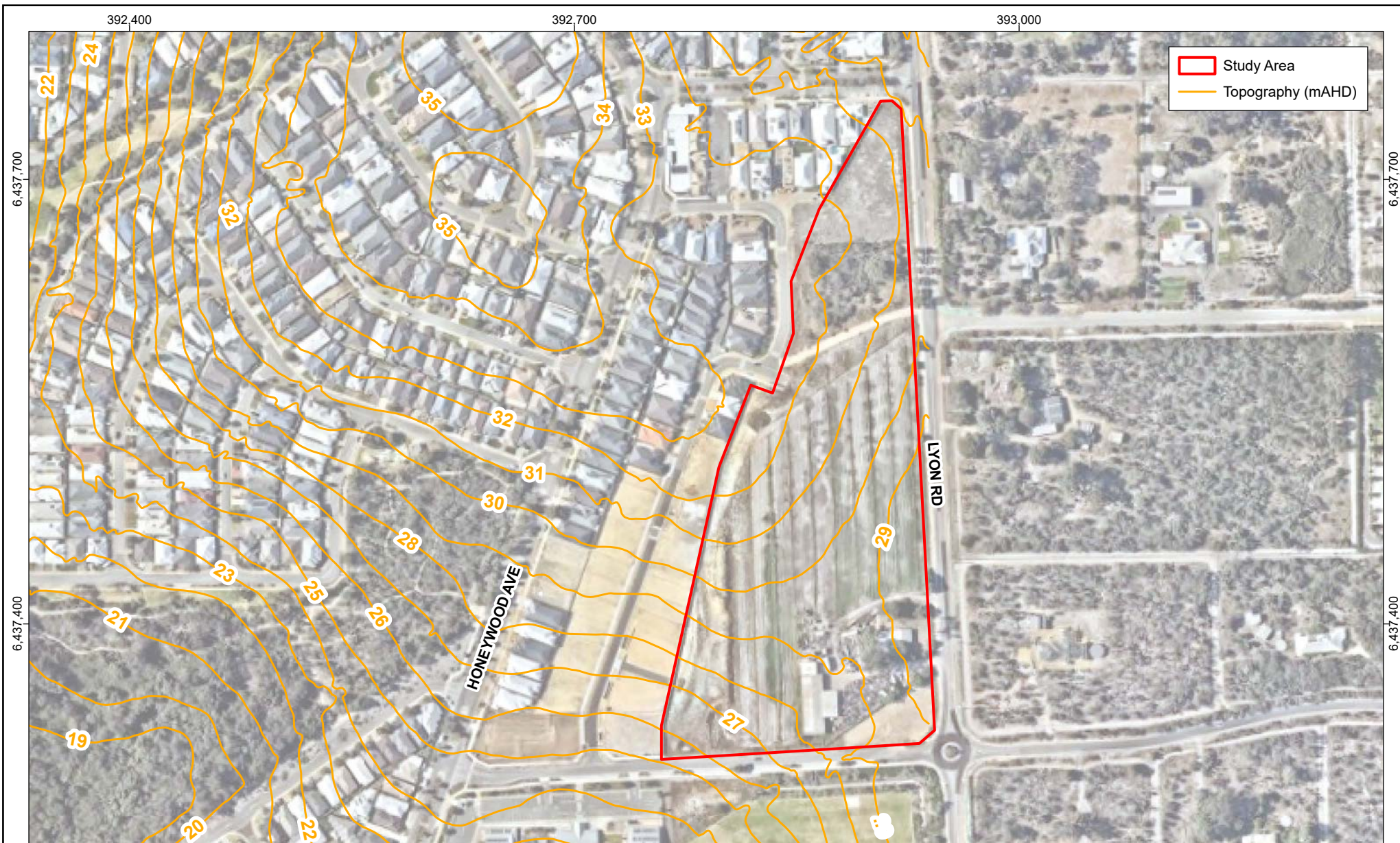
0 100 200 Meters

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2023



S & A Galati-Rando
Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandilong

Figure 2: Proposed Land Use



Data Source: LiDAR 1m (DoW, 2008); Nearthmap (2024)

Coordinate System: GDA 94, Zone 50



Job No. J7370
Scale: 1:3,500 @A4

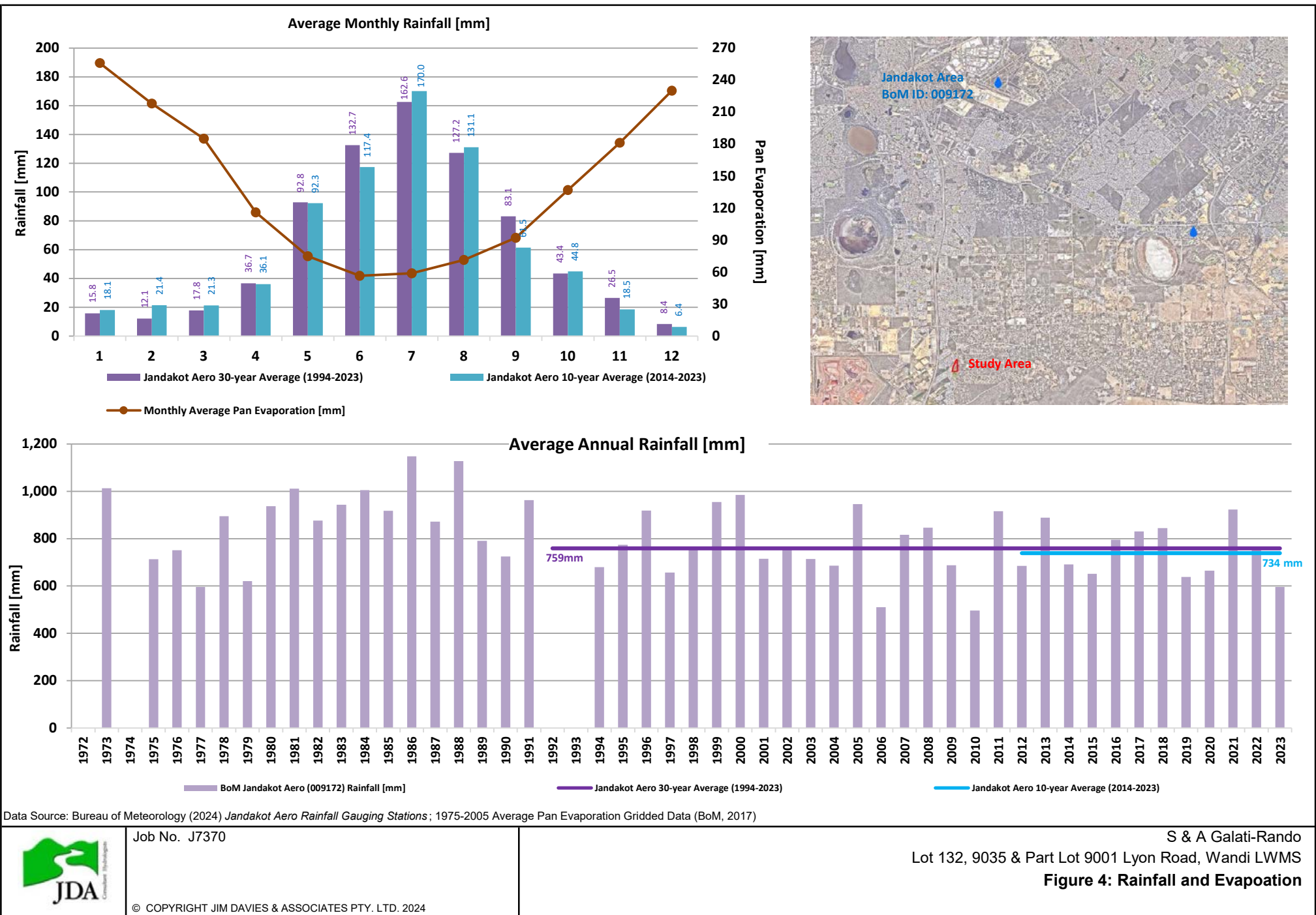
0 100 200 Meters

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2024



S & A Galati-Rando
Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandri LWMS

Figure 3: Topography



Data Source: Bureau of Meteorology (2024) Jandakot Aero Rainfall Gauging Stations; 1975-2005 Average Pan Evaporation Gridded Data (BoM, 2017)

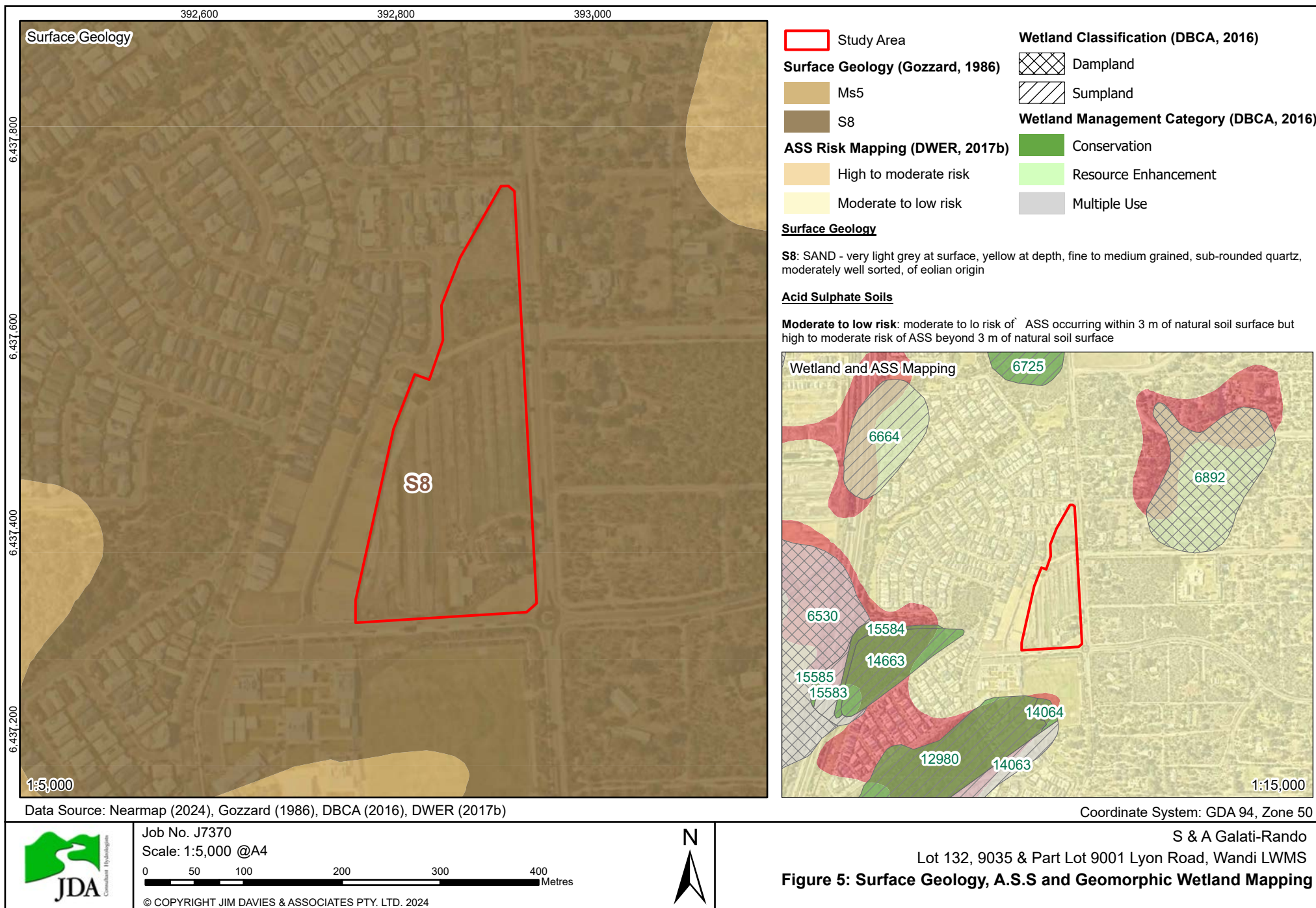


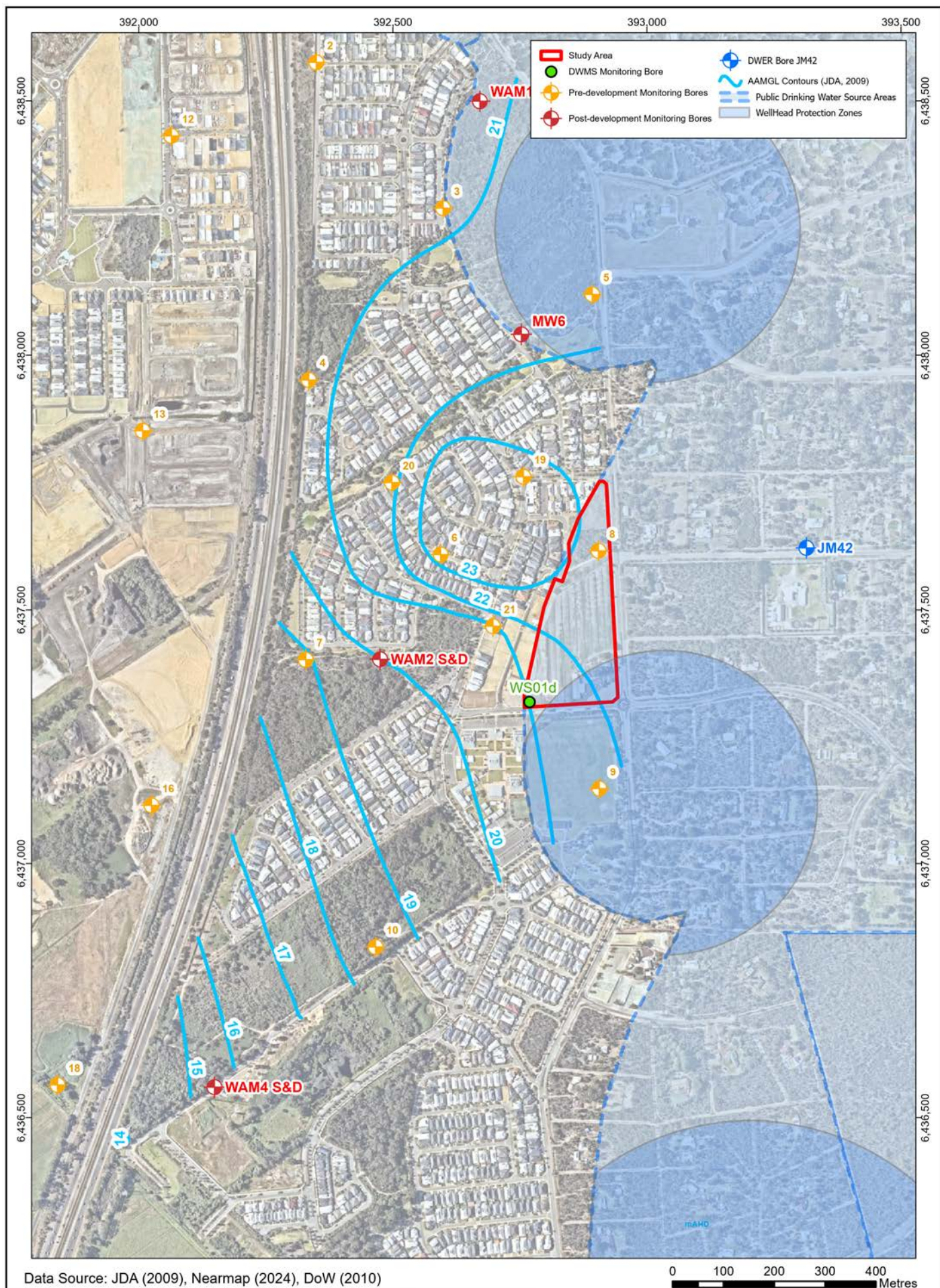
Job No. J7370

S & A Galati-Rando
Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandí LWMS

Figure 4: Rainfall and Evapoation

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2024





Data Source: JDA (2009), Nearmap (2024), DoW (2010)

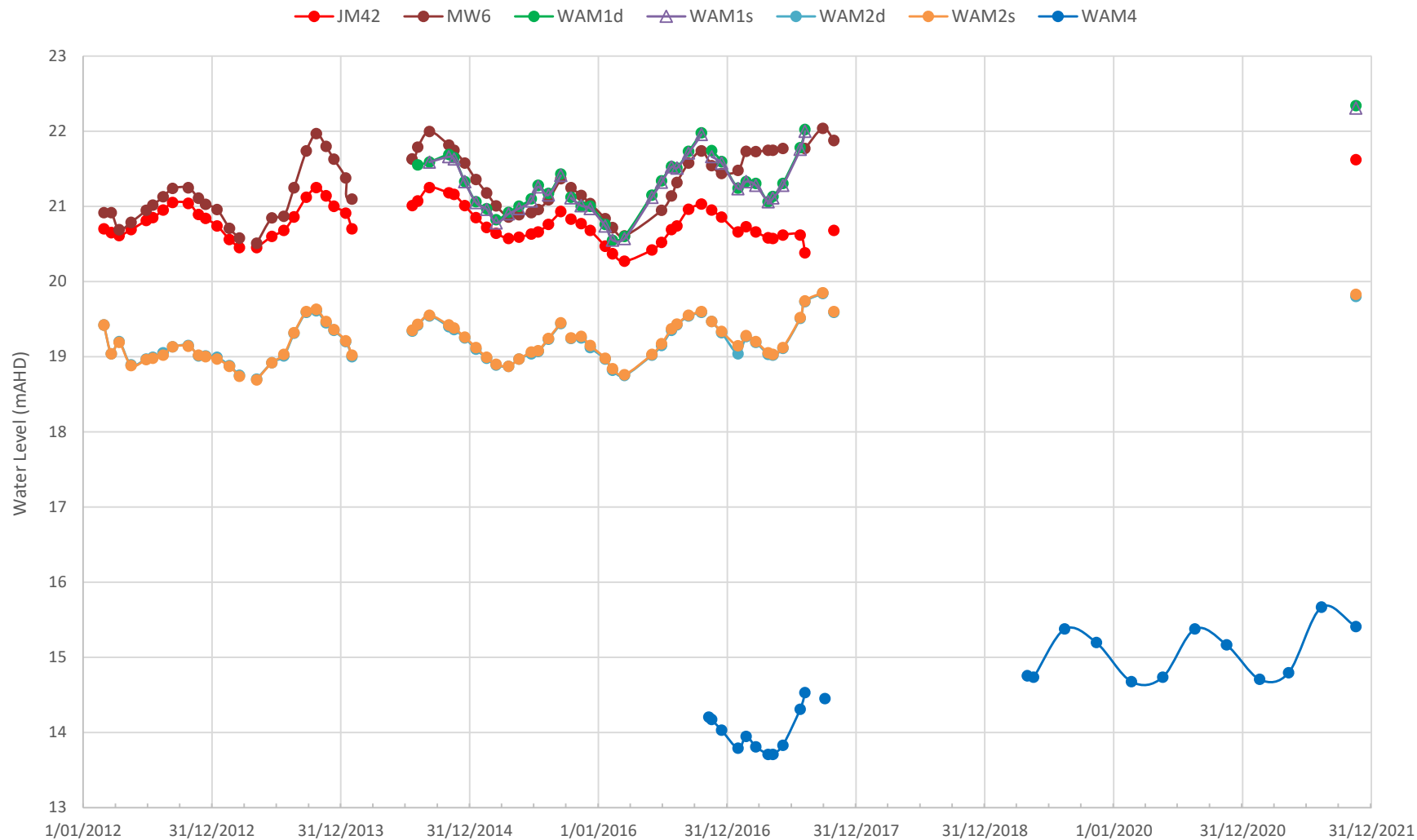
0 100 200 300 400 Metres



Job No. J7370
Scale: 1:10,000 @A4
Coordinate System: GDA 94, Zone 50
© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2024



S & A Galati-Rando
Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandu LWS
Figure 6: Monitoring Bore Locations and Pre-Development AAMGL



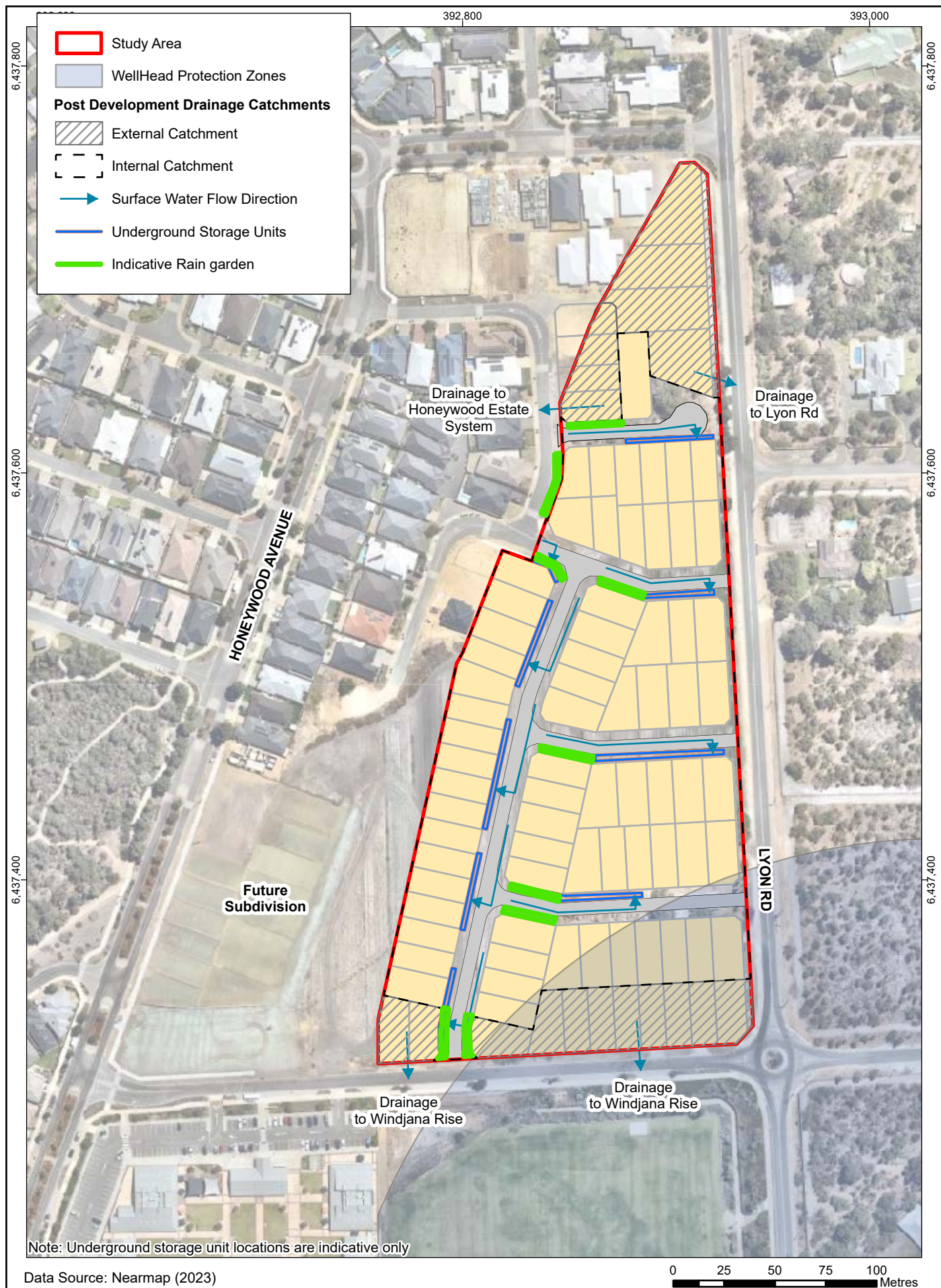
Data Source: JDA EsDAT Database



Job No. J7370

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2024

S & A Galati-Rando
 Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandri LWMS
Figure 7: Groundwater Level Time Series

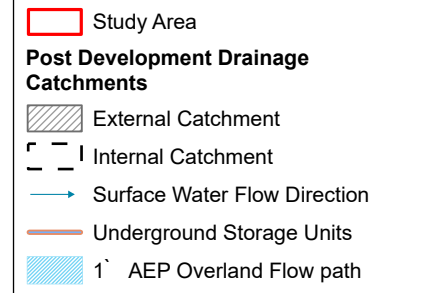
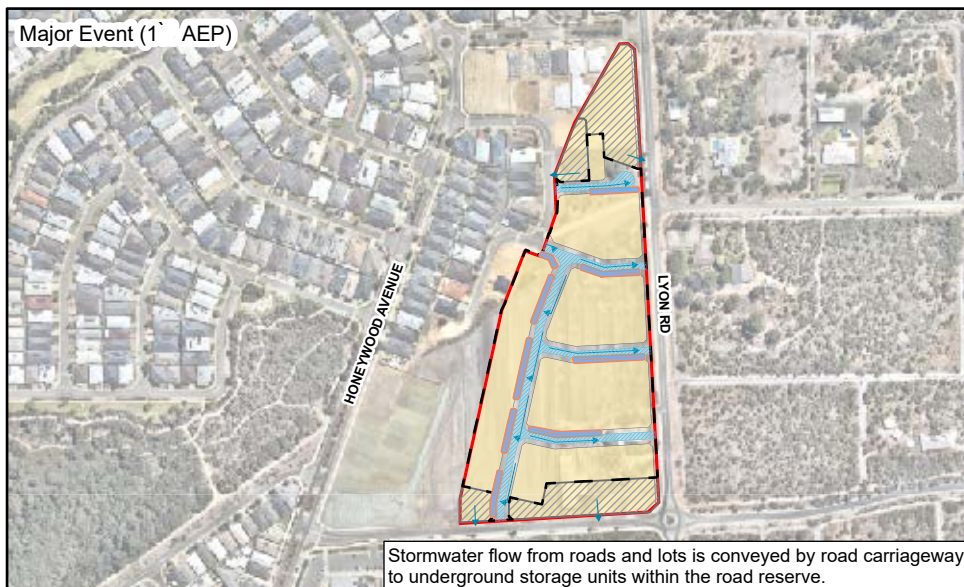
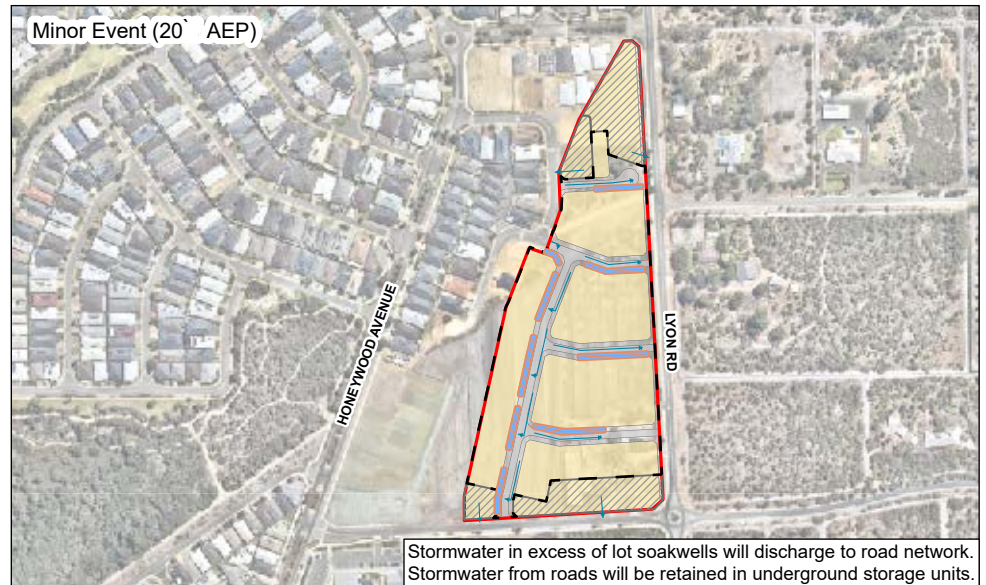
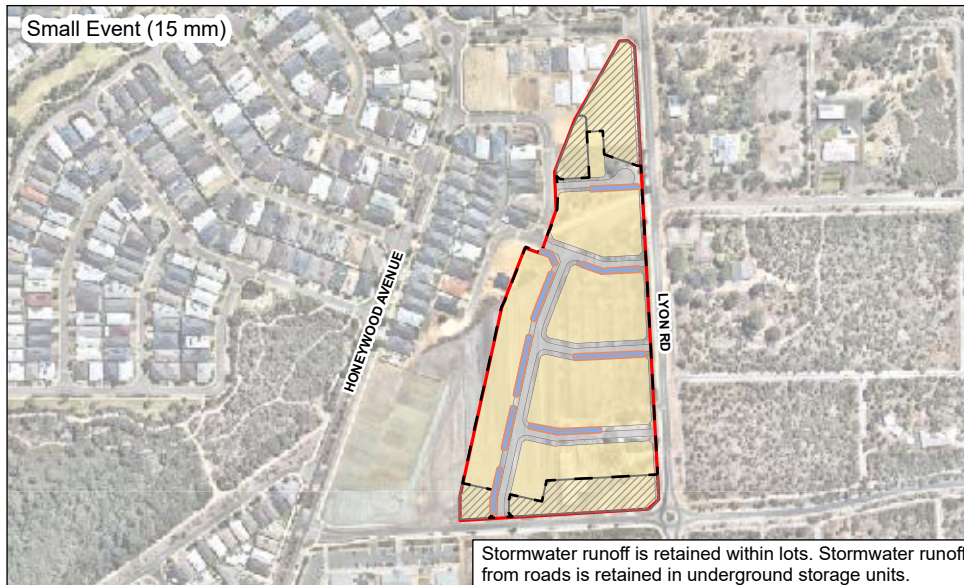


Job No. J7370
 Scale: 1:2,500 @A4
 Coordinate System: GDA 94, Zone 50
 © COPYRIGHT JIM DAVIES &
 ASSOCIATES PTY. LTD. 2023



S & A Galati-Rando
 Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandu LWMS

Figure 8: Stormwater Management Plan



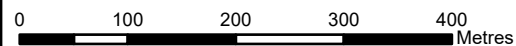
	Underground Storage
1% AEP (Major) Event Management	
Critical Duration (hours)	2
Maximum Water Depth (m)	1
Peak Water Storage Volume (m ³)	930
20% AEP (Minor) Event Management	
Critical Duration (hours)	2
Maximum Water Depth (m)	0.24
Peak Water Storage Volume (m ³)	222
First 15 mm (Small Event)	
Duration (hour)	1
Water Depth (m)	0.07
Peak Water Storage Volume (m ³)	62

Data Source: earmap (0) PCSump (0)

Coordinate System: GDA 94, Zone 50



Job No. J7370
Scale: 1:7,000 @A4



© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2023



S & A Galati-Rando
Lot 132, 9035 & Part Lot 9001 Lyon Road, Wandri LWMS
Figure Stormwater Event Plans

APPENDIX A

Local Water Management Strategy: Checklist for Developers

Local water management strategy item	Deliverable		Notes
Executive summary			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: Design elements and requirements for best management practices and critical control points	✓	Chapter 1, Table 1
Introduction			
Total water-cycle management – principles and objectives Planning background Previous studies		✓ ✓	Section 2
Proposed development			
Structure plan, zoning and land use Key landscape features Previous land use	Site context plan Structure plan	✓ ✓	Sections 2 & 3; Figures 1-3. Section 4.1
Landscape – proposed public open space areas, public open space credits, water source, bore(s), lake details, irrigation areas (if applicable)	Landscape plan	✗	No POS within development
Design criteria			
Agreed design objectives and source of objectives		✓	Table 1
Pre-development environment			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		✓	Section 4
Site conditions – existing topography/contours, aerial photo underlay, major physical features	Site condition plan	✓	Section 4.1, Figures 3 & 4
Geotechnical – topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	✓	Section 4.4, 4.5, Figure 5
Environmental – areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental plan plus supporting data where appropriate	✓	Section 4.8-4.9; Figure 5
Surface water – topography, 100- year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface-water plan	✗	No surface water features (Section 4.7)
Groundwater – topography, pre-development groundwater levels and water quality, test bore locations	Groundwater plan plus site investigations	✓	Section 4.6; Figures 6 & 7

Local water management strategy item	Deliverable		Notes
Water sustainability initiatives			
Water efficiency measures – private and public open spaces including method of enforcement		✓	Section 5.3; No POS.
Water supply (fit-for-purpose) strategy, agreed actions and implementation		✓	Section 5.1
Wastewater management		✓	Section 5.2
Stormwater management strategy			
Flood protection – peak flow rates, volumes and top water levels at control points, 100-year flowpaths and 100-year detention storage areas	100-year-event plan Long section of critical points	✓	Section 6; Figures 8 & 9
Manage serviceability – storage and retention required for the critical 5- year ARI storm events Minor roads should be passable in the 5- year ARI event	5-year-event plan	✓	Section 6; Figures 8 & 9
Protect ecology – detention areas for the 1-year 1-hour ARI event, areas for water quality treatment and types of agreed structural and non-structural best management practices and treatment trains (including indicative locations). Protection of waterways, wetlands (and their buffers), remnant Vegetation and ecological linkages	1-year-event plan Typical cross sections	✓	Section 6; Figures 8 & 9
Groundwater management strategy			
Post-development groundwater levels, existing and likely final surface levels, outlet controls, and subsoil drain areas/exclusion zones	Groundwater/s ubsoil plan	✓	Section 7
Actions to address acid sulfate soils or contamination		✓	Section 9.3.2
The next stage – subdivision and urban water management plans			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required before detailed design.		✓	Section 9.2
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		✓	Section 9.5
Implementation			
Developer commitments		✓	Section 9.1
Roles, responsibilities, funding for implementation		✓	Section 9.1

APPENDIX B

Groundwater Monitoring Laboratory Results
from 22 November 2021 (Eurofins)

Western Environmental Pty Ltd
Level 3, 25 Prowse Street
West Perth
WA 6005



NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: Jackie Cox

Report 843809-W
Project name
Project ID P21.185
Received Date Nov 24, 2021

Client Sample ID			WS01D	DUP01	RB01	FB01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L21-No58205	L21-No58206	L21-No58207	L21-No58208
Date Sampled			Nov 22, 2021	Nov 22, 2021	Nov 22, 2021	Nov 22, 2021
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	99	98	97	99
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH >C10-C16 less Naphthalene (F2) ^{N01}	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Carbamate Pesticides						
Aldicarb	0.01	mg/L	< 0.01	< 0.01	-	-
Bendiocarb	0.01	mg/L	< 0.01	< 0.01	-	-
Carbaryl	0.01	mg/L	< 0.01	< 0.01	-	-
Carbofuran	0.01	mg/L	< 0.01	< 0.01	-	-
Methomyl	0.01	mg/L	< 0.01	< 0.01	-	-
Oxamyl	0.01	mg/L	< 0.01	< 0.01	-	-
Thiobencarb	0.01	mg/L	< 0.01	< 0.01	-	-
Acid Herbicides						
2,4-D	0.001	mg/L	< 0.001	< 0.001	-	-
2,4-DB	0.001	mg/L	< 0.001	< 0.001	-	-
2,4,5-T	0.001	mg/L	< 0.001	< 0.001	-	-
2,4,5-TP	0.001	mg/L	< 0.001	< 0.001	-	-
Actril (loxyneil)	0.001	mg/L	< 0.001	< 0.001	-	-
Dicamba	0.001	mg/L	< 0.001	< 0.001	-	-
Dichlorprop	0.001	mg/L	< 0.001	< 0.001	-	-
Dinitro-o-cresol	0.001	mg/L	< 0.001	< 0.001	-	-

Client Sample ID			WS01D	DUP01	RB01	FB01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L21-No58205	L21-No58206	L21-No58207	L21-No58208
Date Sampled			Nov 22, 2021	Nov 22, 2021	Nov 22, 2021	Nov 22, 2021
Test/Reference	LOR	Unit				
Acid Herbicides						
Dinoseb	0.001	mg/L	< 0.001	< 0.001	-	-
MCPA	0.001	mg/L	< 0.001	< 0.001	-	-
MCPB	0.001	mg/L	< 0.001	< 0.001	-	-
Mecoprop	0.001	mg/L	0.20	0.20	-	-
Warfarin (surr.)	0.001	%	int	int	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benzo(g,h,i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Dibenz(a,h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Indeno(1,2,3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	-	-
2-Fluorobiphenyl (surr.)	1	%	71	73	-	-
p-Terphenyl-d14 (surr.)	1	%	61	59	-	-
Phenols (Halogenated) - Low level						
2-Chlorophenol	0.00005	mg/L	< 0.00005	< 0.00005	-	-
2,4-Dichlorophenol	0.00005	mg/L	< 0.00005	< 0.00005	-	-
2,4,5-Trichlorophenol	0.0001	mg/L	< 0.0001	< 0.0001	-	-
2,4,6-Trichlorophenol	0.0001	mg/L	< 0.0001	< 0.0001	-	-
2,6-Dichlorophenol	0.00005	mg/L	< 0.00005	< 0.00005	-	-
4-Chloro-3-methylphenol	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Pentachlorophenol	0.001	mg/L	< 0.001	< 0.001	-	-
Tetrachlorophenols - Total	0.0005	mg/L	< 0.0005	< 0.0005	-	-
Total Halogenated Phenol*	0.001	mg/L	< 0.001	< 0.001	-	-
Phenols (non-Halogenated) - Low level						
2-Cyclohexyl-4,6-dinitrophenol	0.01	mg/L	< 0.01	< 0.01	-	-
2-Methyl-4,6-dinitrophenol	0.0005	mg/L	< 0.0005	< 0.0005	-	-
2-Methylphenol (o-Cresol)	0.00005	mg/L	< 0.00005	< 0.00005	-	-
2-Nitrophenol	0.0001	mg/L	< 0.0001	< 0.0001	-	-
2,4-Dimethylphenol	0.00005	mg/L	< 0.00005	< 0.00005	-	-
2,4-Dinitrophenol	0.0005	mg/L	< 0.0005	< 0.0005	-	-
3&4-Methylphenol (m&p-Cresol)	0.0001	mg/L	< 0.0001	< 0.0001	-	-
4-Nitrophenol	0.0005	mg/L	< 0.0005	< 0.0005	-	-

Client Sample ID			WS01D	DUP01	RB01	FB01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L21-No58205	L21-No58206	L21-No58207	L21-No58208
Date Sampled			Nov 22, 2021	Nov 22, 2021	Nov 22, 2021	Nov 22, 2021
Test/Reference	LOR	Unit				
Phenols (non-Halogenated) - Low level						
Dinoseb	0.01	mg/L	< 0.01	< 0.01	-	-
Phenol	0.00005	mg/L	< 0.00005	< 0.00005	-	-
Total Non-Halogenated Phenol*	0.01	mg/L	< 0.01	< 0.01	-	-
Phenol-d6 (surr.)	1	%	55	45	-	-
Organophosphorus Pesticides (Trace level)						
Azinphos-methyl	0.001	mg/L	< 0.001	< 0.001	-	-
Bolstar	0.001	mg/L	< 0.001	< 0.001	-	-
Chlorfenvinphos	0.001	mg/L	< 0.001	< 0.001	-	-
Chlorpyrifos	0.01	mg/L	< 0.01	< 0.01	-	-
Chlorpyrifos-methyl	0.001	mg/L	< 0.001	< 0.001	-	-
Coumaphos	0.01	mg/L	< 0.01	< 0.01	-	-
Demeton-O	0.001	mg/L	< 0.001	< 0.001	-	-
Demeton-S	0.01	mg/L	< 0.01	< 0.01	-	-
Diazinon	0.001	mg/L	< 0.001	< 0.001	-	-
Dichlorvos	0.001	mg/L	< 0.001	< 0.001	-	-
Dimethoate	0.001	mg/L	< 0.001	< 0.001	-	-
Disulfoton	0.001	mg/L	< 0.001	< 0.001	-	-
EPN	0.001	mg/L	< 0.001	< 0.001	-	-
Ethion	0.001	mg/L	< 0.001	< 0.001	-	-
Ethoprop	0.001	mg/L	< 0.001	< 0.001	-	-
Ethyl parathion	0.001	mg/L	< 0.001	< 0.001	-	-
Fenitrothion	0.001	mg/L	< 0.001	< 0.001	-	-
Fensulfothion	0.001	mg/L	< 0.001	< 0.001	-	-
Fenthion	0.001	mg/L	< 0.001	< 0.001	-	-
Malathion	0.001	mg/L	< 0.001	< 0.001	-	-
Merphos	0.001	mg/L	< 0.001	< 0.001	-	-
Methyl parathion	0.001	mg/L	< 0.001	< 0.001	-	-
Mevinphos	0.001	mg/L	< 0.001	< 0.001	-	-
Monocrotophos	0.001	mg/L	< 0.001	< 0.001	-	-
Naled	0.001	mg/L	< 0.001	< 0.001	-	-
Omethoate	0.001	mg/L	< 0.001	< 0.001	-	-
Phorate	0.001	mg/L	< 0.001	< 0.001	-	-
Pirimiphos-methyl	0.01	mg/L	< 0.01	< 0.01	-	-
Pyrazophos	0.001	mg/L	< 0.001	< 0.001	-	-
Ronnel	0.001	mg/L	< 0.001	< 0.001	-	-
Terbufos	0.001	mg/L	< 0.001	< 0.001	-	-
Tetrachlorvinphos	0.001	mg/L	< 0.001	< 0.001	-	-
Tokuthion	0.001	mg/L	< 0.001	< 0.001	-	-
Trichloronate	0.001	mg/L	< 0.001	< 0.001	-	-
Triphenylphosphate (surr.)	1	%	66	59	-	-
Organochlorine Pesticides (Trace level)						
4,4'-DDD	0.00001	mg/L	< 0.00001	< 0.00001	-	-
4,4'-DDE	0.00001	mg/L	< 0.00001	< 0.00001	-	-
4,4'-DDT	0.00001	mg/L	< 0.00001	< 0.00001	-	-
α-HCH	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Aldrin	0.00001	mg/L	< 0.00001	< 0.00001	-	-
β-HCH	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Chlordanes - Total	0.00001	mg/L	< 0.00001	< 0.00001	-	-
d-HCH	0.00001	mg/L	< 0.00001	< 0.00001	-	-

Client Sample ID			WS01D	DUP01	RB01	FB01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L21-No58205	L21-No58206	L21-No58207	L21-No58208
Date Sampled			Nov 22, 2021	Nov 22, 2021	Nov 22, 2021	Nov 22, 2021
Test/Reference	LOR	Unit				
Organochlorine Pesticides (Trace level)						
Dieldrin	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Endosulfan I	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Endosulfan II	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Endosulfan sulphate	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Endrin	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Endrin aldehyde	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Endrin ketone	0.00001	mg/L	< 0.00001	< 0.00001	-	-
g-HCH (Lindane)	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Heptachlor	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Heptachlor epoxide	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Hexachlorobenzene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Methoxychlor	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Toxaphene	0.002	mg/L	< 0.002	< 0.002	-	-
DDT + DDE + DDD (Total)*	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Aldrin and Dieldrin (Total)*	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Vic EPA IWRG 621 OCP (Total)*	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Ammonia (as N)	0.01	mg/L	0.19	0.19	-	-
Chloride	1	mg/L	70	34	-	-
Conductivity (at 25°C)	10	uS/cm	390	450	-	-
Fluoride (Total)	0.5	mg/L	< 0.5	< 0.5	-	-
Nitrate & Nitrite (as N)	0.05	mg/L	12	12	-	-
Nitrate (as N)	0.02	mg/L	12	12	-	-
Nitrite (as N)	0.02	mg/L	0.02	< 0.02	-	-
pH (at 25 °C)	0.1	pH Units	6.2	6.1	-	-
Phosphate total (as P)	0.01	mg/L	1.9	1.8	-	-
Phosphorus reactive (as P)	0.01	mg/L	1.5	1.5	-	-
Sulphate (as SO4)	5	mg/L	61	64	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	10	mg/L	430	-	-	-
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	1.0	2.0	-	-
Total Nitrogen (as N)*	0.2	mg/L	-	-	-	-
Hardness mg equivalent CaCO3/L	5	mg/L	230	180	-	-
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	22	24	-	-
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	-	-
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	-	-
Total Alkalinity (as CaCO3)	20	mg/L	22	24	-	-
Ion Balance Set						
Ionic Balance	0.01	%	19	28	-	-
Total Anions	0.01	meq/L	4.6	3.8	-	-
Total Cations	0.01	meq/L	6.9	6.7	-	-
Alkali Metals						
Calcium	0.5	mg/L	75	58	-	-
Magnesium	0.5	mg/L	10	8.6	-	-
Potassium	0.5	mg/L	19	23	-	-
Sodium	0.5	mg/L	43	58	-	-

Client Sample ID			WS01D	DUP01	RB01	FB01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L21-No58205	L21-No58206	L21-No58207	L21-No58208
Date Sampled			Nov 22, 2021	Nov 22, 2021	Nov 22, 2021	Nov 22, 2021
Test/Reference	LOR	Unit				
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	0.40	0.42	-	-
Arsenic	0.001	mg/L	-	-	< 0.001	-
Arsenic (filtered)	0.001	mg/L	0.003	0.004	-	-
Barium (filtered)	0.02	mg/L	0.03	0.03	-	-
Beryllium (filtered)	0.001	mg/L	< 0.001	0.002	-	-
Boron (filtered)	0.05	mg/L	0.10	0.17	-	-
Cadmium	0.0002	mg/L	-	-	< 0.0002	-
Cadmium (filtered)	0.0002	mg/L	< 0.0002	0.0006	-	-
Chromium	0.001	mg/L	-	-	< 0.001	-
Chromium (filtered)	0.001	mg/L	0.001	0.001	-	-
Copper	0.001	mg/L	-	-	< 0.001	-
Copper (filtered)	0.001	mg/L	0.002	0.002	-	-
Gold (filtered)	0.05	mg/L	< 0.05	< 0.05	-	-
Iron (filtered)	0.05	mg/L	0.86	0.83	-	-
Lead	0.001	mg/L	-	-	< 0.001	-
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	-	-
Manganese (filtered)	0.005	mg/L	0.028	0.028	-	-
Mercury	0.0001	mg/L	-	-	< 0.0001	-
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Molybdenum (filtered)	0.005	mg/L	0.014	0.014	-	-
Nickel	0.001	mg/L	-	-	< 0.001	-
Nickel (filtered)	0.001	mg/L	0.001	0.002	-	-
Selenium (filtered)	0.001	mg/L	0.002	0.005	-	-
Zinc	0.005	mg/L	-	-	< 0.005	-
Zinc (filtered)	0.005	mg/L	< 0.005	0.005	-	-
Alkali Metals (filtered)						
Magnesium (filtered)	0.5	mg/L	8.9	8.6	-	-
Microbiology						
Faecal Coliforms ^{N19}	1	CFU/100mL	< 1	-	-	-
E. Coli ^{N19}	1	CFU/100mL	< 1	-	-	-
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	-	-	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	-	-	< 0.001	< 0.001
Anthracene	0.001	mg/L	-	-	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	-	-	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	-	-	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	-	-	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	-	-	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	-	-	< 0.001	< 0.001
Chrysene	0.001	mg/L	-	-	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	-	-	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	-	-	< 0.001	< 0.001
Fluorene	0.001	mg/L	-	-	< 0.001	< 0.001
Indeno(1,2,3-cd)pyrene	0.001	mg/L	-	-	< 0.001	< 0.001
Naphthalene	0.001	mg/L	-	-	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	-	-	< 0.001	< 0.001
Pyrene	0.001	mg/L	-	-	< 0.001	< 0.001
Total PAH*	0.001	mg/L	-	-	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	-	-	81	99
p-Terphenyl-d14 (surr.)	1	%	-	-	110	52

Client Sample ID			WS01D Water L21-No58205 Nov 22, 2021	DUP01 Water L21-No58206 Nov 22, 2021	RB01 Water L21-No58207 Nov 22, 2021	FB01 Water L21-No58208 Nov 22, 2021
Sample Matrix						
Eurofins Sample No.						
Date Sampled						
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.002	mg/L	-	-	< 0.002	< 0.002
4,4'-DDD	0.0002	mg/L	-	-	< 0.0002	< 0.0002
4,4'-DDE	0.0002	mg/L	-	-	< 0.0002	< 0.0002
4,4'-DDT	0.0002	mg/L	-	-	< 0.0002	< 0.0002
a-HCH	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Aldrin	0.0002	mg/L	-	-	< 0.0002	< 0.0002
b-HCH	0.0002	mg/L	-	-	< 0.0002	< 0.0002
d-HCH	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Dieldrin	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Endosulfan I	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Endosulfan II	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Endosulfan sulphate	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Endrin	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Endrin aldehyde	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Endrin ketone	0.0002	mg/L	-	-	< 0.0002	< 0.0002
g-HCH (Lindane)	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Heptachlor	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Heptachlor epoxide	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Hexachlorobenzene	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Methoxychlor	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Toxaphene	0.005	mg/L	-	-	< 0.005	< 0.005
Aldrin and Dieldrin (Total)*	0.0002	mg/L	-	-	< 0.0002	< 0.0002
DDT + DDE + DDD (Total)*	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Vic EPA IWRG 621 OCP (Total)*	0.002	mg/L	-	-	< 0.002	< 0.002
Vic EPA IWRG 621 Other OCP (Total)*	0.002	mg/L	-	-	< 0.002	< 0.002
Dibutylchloroendate (surr.)	1	%	-	-	int	int
Tetrachloro-m-xylene (surr.)	1	%	-	-	121	54
Organophosphorus Pesticides						
Azinphos-methyl	0.002	mg/L	-	-	< 0.002	< 0.002
Bolstar	0.002	mg/L	-	-	< 0.002	< 0.002
Chlorfenvinphos	0.02	mg/L	-	-	< 0.02	< 0.02
Chlorpyrifos	0.002	mg/L	-	-	< 0.002	< 0.002
Chlorpyrifos-methyl	0.002	mg/L	-	-	< 0.002	< 0.002
Coumaphos	0.02	mg/L	-	-	< 0.02	< 0.02
Demeton-S	0.002	mg/L	-	-	< 0.002	< 0.002
Demeton-O	0.002	mg/L	-	-	< 0.002	< 0.002
Diazinon	0.002	mg/L	-	-	< 0.002	< 0.002
Dichlorvos	0.002	mg/L	-	-	< 0.002	< 0.002
Dimethoate	0.002	mg/L	-	-	< 0.002	< 0.002
Disulfoton	0.002	mg/L	-	-	< 0.002	< 0.002
EPN	0.002	mg/L	-	-	< 0.002	< 0.002
Ethion	0.002	mg/L	-	-	< 0.002	< 0.002
Ethoprop	0.002	mg/L	-	-	< 0.002	< 0.002
Ethyl parathion	0.002	mg/L	-	-	< 0.002	< 0.002
Fenitrothion	0.002	mg/L	-	-	< 0.002	< 0.002
Fensulfothion	0.002	mg/L	-	-	< 0.002	< 0.002
Fenthion	0.002	mg/L	-	-	< 0.002	< 0.002
Malathion	0.002	mg/L	-	-	< 0.002	< 0.002
Merphos	0.002	mg/L	-	-	< 0.002	< 0.002

Client Sample ID			WS01D	DUP01	RB01	FB01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L21-No58205	L21-No58206	L21-No58207	L21-No58208
Date Sampled			Nov 22, 2021	Nov 22, 2021	Nov 22, 2021	Nov 22, 2021
Test/Reference	LOR	Unit				
Organophosphorus Pesticides						
Methyl parathion	0.002	mg/L	-	-	< 0.002	< 0.002
Mevinphos	0.002	mg/L	-	-	< 0.002	< 0.002
Monocrotophos	0.002	mg/L	-	-	< 0.002	< 0.002
Naled	0.002	mg/L	-	-	< 0.002	< 0.002
Omethoate	0.02	mg/L	-	-	< 0.02	< 0.02
Phorate	0.002	mg/L	-	-	< 0.002	< 0.002
Pirimiphos-methyl	0.02	mg/L	-	-	< 0.02	< 0.02
Pyrazophos	0.002	mg/L	-	-	< 0.002	< 0.002
Ronnel	0.002	mg/L	-	-	< 0.002	< 0.002
Terbufos	0.002	mg/L	-	-	< 0.002	< 0.002
Tetrachlorvinphos	0.002	mg/L	-	-	< 0.002	< 0.002
Tokuthion	0.002	mg/L	-	-	< 0.002	< 0.002
Trichloronate	0.002	mg/L	-	-	< 0.002	< 0.002
Triphenylphosphate (surr.)	1	%	-	-	int	int
Phenols (Halogenated)						
2-Chlorophenol	0.003	mg/L	-	-	< 0.003	< 0.003
2,4-Dichlorophenol	0.003	mg/L	-	-	< 0.003	< 0.003
2,4,5-Trichlorophenol	0.01	mg/L	-	-	< 0.01	< 0.01
2,4,6-Trichlorophenol	0.01	mg/L	-	-	< 0.01	< 0.01
2,6-Dichlorophenol	0.003	mg/L	-	-	< 0.003	< 0.003
4-Chloro-3-methylphenol	0.01	mg/L	-	-	< 0.01	< 0.01
Pentachlorophenol	0.01	mg/L	-	-	< 0.01	< 0.01
Tetrachlorophenols - Total	0.03	mg/L	-	-	< 0.03	< 0.03
Total Halogenated Phenol*	0.01	mg/L	-	-	< 0.01	< 0.01
Phenols (non-Halogenated)						
2-Cyclohexyl-4,6-dinitrophenol	0.1	mg/L	-	-	< 0.1	< 0.1
2-Methyl-4,6-dinitrophenol	0.03	mg/L	-	-	< 0.03	< 0.03
2-Nitrophenol	0.01	mg/L	-	-	< 0.01	< 0.01
2,4-Dimethylphenol	0.003	mg/L	-	-	< 0.003	< 0.003
2,4-Dinitrophenol	0.03	mg/L	-	-	< 0.03	< 0.03
2-Methylphenol (o-Cresol)	0.003	mg/L	-	-	< 0.003	< 0.003
3&4-Methylphenol (m&p-Cresol)	0.006	mg/L	-	-	< 0.006	< 0.006
Total cresols*	0.01	mg/L	-	-	< 0.01	< 0.01
4-Nitrophenol	0.03	mg/L	-	-	< 0.03	< 0.03
Dinoseb	0.1	mg/L	-	-	< 0.1	< 0.1
Phenol	0.003	mg/L	-	-	< 0.003	< 0.003
Phenol-d6 (surr.)	1	%	-	-	66	int
Total Non-Halogenated Phenol*	0.1	mg/L	-	-	< 0.1	< 0.1

Client Sample ID			TB01
Sample Matrix			Water
Eurofins Sample No.			L21-No58209
Date Sampled			Nov 22, 2021
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	0.02	mg/L	< 0.02
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	96
Naphthalene ^{N02}	0.01	mg/L	< 0.01
Total Recoverable Hydrocarbons			
TRH C6-C10	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Nov 26, 2021	7 Days
BTEX - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Nov 26, 2021	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Nov 26, 2021	7 Days
Total Recoverable Hydrocarbons - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Nov 26, 2021	7 Days
Eurofins Suite B4A			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Nov 26, 2021	7 Days
Polycyclic Aromatic Hydrocarbons - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Melbourne	Nov 26, 2021	7 Days
Phenols (Halogenated) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Melbourne	Nov 26, 2021	7 Days
Phenols (non-Halogenated) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Melbourne	Nov 26, 2021	7 Days
Carbamate Pesticides - Method: LTM-ORG-2290 Carbamates in waters and soils by HPLC	Melbourne	Nov 26, 2021	7 Days
Acid Herbicides - Method: LTM-ORG-2180 Phenoxy Acid Herbicides	Melbourne	Nov 26, 2021	14 Days
Conductivity (at 25°C) - Method: LTM-INO-4030 Conductivity	Melbourne	Nov 26, 2021	28 Days
pH (at 25 °C) - Method: LTM-GEN-7090 pH in water by ISE	Melbourne	Nov 26, 2021	0 Hours
Ion Balance Set - Method: APHA 1030E (1)	Melbourne	Nov 24, 2021	
Heavy Metals (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Nov 25, 2021	180 Days
Metals M8 - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Nov 26, 2021	28 Days
Metals M8 filtered - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Nov 25, 2021	28 Days
Alkali Metals (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Nov 25, 2021	180 Days
Polycyclic Aromatic Hydrocarbons (Trace level) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)	Melbourne	Nov 26, 2021	7 Days
Phenols (Halogenated) - Low level - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)	Melbourne	Nov 26, 2021	7 Days
Phenols (non-Halogenated) - Low level - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)	Melbourne	Nov 26, 2021	7 Days
Suite B14: OCP/OPP (trace level)			
Organophosphorus Pesticides (Trace level) - Method: LTM-ORG-2200 Organophosphorus Pesticides by GC-MS (USEPA 8270)	Melbourne	Nov 26, 2021	7 Days
Organochlorine Pesticides (Trace level) - Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8270) trace	Melbourne	Nov 26, 2021	7 Days
Eurofins Suite B19E: Total N, TKN, NOx, NO2, NO3, NH3, Total P, Reactive P			
Ammonia (as N) - Method: APHA 4500-NH3 Ammonia Nitrogen by FIA	Melbourne	Nov 26, 2021	28 Days
Nitrate & Nitrite (as N) - Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA	Melbourne	Nov 26, 2021	28 Days

Description	Testing Site	Extracted	Holding Time
Nitrate (as N) - Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA	Melbourne	Nov 26, 2021	28 Days
Nitrite (as N) - Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA	Melbourne	Nov 26, 2021	2 Days
Phosphate total (as P) - Method: LTM-INO-4040 Phosphate by CFA	Melbourne	Nov 26, 2021	28 Days
Phosphorus reactive (as P) - Method: APHA 4500-P	Melbourne	Nov 26, 2021	2 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Nov 26, 2021	28 Days
Eurofins Suite B11F: Cl/SO4/Alkalinity/Total F			
Chloride - Method: LTM-INO-4090 Chloride by Discrete Analyser	Melbourne	Nov 26, 2021	28 Days
Fluoride (Total) - Method: APHA 4500 F-C Fluoride by Ion Selective Electrode	Melbourne	Nov 26, 2021	28 Days
Sulphate (as SO4) - Method: LTM-INO-4110 Sulfate by Discrete Analyser	Melbourne	Nov 26, 2021	28 Days
Alkalinity (speciated) - Method: LTM-INO-4250 Alkalinity by Electrometric Titration	Melbourne	Nov 26, 2021	14 Days
Total Dissolved Solids Dried at 180°C ± 2°C - Method: LTM-INO-4170 Total Dissolved Solids in Water	Melbourne	Nov 26, 2021	28 Days
Eurofins Suite B11D: Na/K/Ca/Mg and Hardness			
Hardness mg equivalent CaCO3/L - Method: APHA 2340B Hardness by Calculation	Melbourne	Nov 26, 2021	28 Days
Alkali Metals - Method: LTM-MET-3010 Alkali Metals Sulfur Silicon Phosphorus by ICP-AES	Melbourne	Nov 26, 2021	180 Days
Suite B14: OCP/OPP			
Organochlorine Pesticides - Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8270)	Melbourne	Nov 26, 2021	7 Days
Organophosphorus Pesticides - Method: LTM-ORG-2200 Organophosphorus Pesticides by GC-MS (USEPA 8270)	Melbourne	Nov 26, 2021	7 Days

Company Name: Western Environmental Pty Ltd (WA)
Address: Level 3, 25 Prowse Street
West Perth
WA 6005

Order No.:
Report #: 843809
Phone: 08 6162 8980
Fax:

Received: Nov 24, 2021 2:30 PM
Due: Dec 1, 2021
Priority: 5 Day
Contact Name: Jackie Cox

Project Name:
Project ID: P21.185

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Perth Laboratory - NATA # 2377 Site # 2370																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										</

Company Name:	Western Environmental Pty Ltd (WA)	Order No.:		Received:	Nov 24, 2021 2:30 PM
Address:	Level 3, 25 Prowse Street West Perth WA 6005	Report #:	843809	Due:	Dec 1, 2021
Project Name:		Phone:	08 6162 8980	Priority:	5 Day
Project ID:	P21.185	Fax:		Contact Name:	Jackie Cox

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						% Clay	Aluminium (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Conductivity (at 25°C)	E. Coli	Faecal Coliforms	Gold (filtered)	HOLD	Iron (filtered)	Magnesium (filtered)	Manganese (filtered)	Molybdenum (filtered)	pH (at 25 °C)	Selenium (filtered)	Carbamate Pesticides	Acid Herbicides	Metals M8	Metals M8 filtered	Suite B14: OCP/OPP	Ion Balance Set	Moisture Set	Cation Exchange Capacity	Eurofins Suite B1	Eurofins Suite B4A	BTEXN and Volatile TRH	Hardness	Eurofins Suite B11D: Na/K/Ca/Mg and	Eurofins Suite B11F: Cl/SO4/Alkalinity/Total P	Eurofins Suite B3 (Trace level)	Total Dissolved Solids Dried at 180°C ± 2°C	Suite B14: OCP/PP (trace level)		
Perth Laboratory - NATA # 2377 Site # 2370																																								
Melbourne Laboratory - NATA # 1261 Site # 1254											X			X	X					X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X							X	X	X	X		X				X														
Brisbane Laboratory - NATA # 1261 Site # 20794						X																																		
Mayfield Laboratory - NATA # 1261 Site # 25079																																								
External Laboratory												X	X																											
10	TP04-0.15	Nov 22, 2021		Soil	L21-No58158																			X		X		X												
11	TP04-0.5	Nov 22, 2021		Soil	L21-No58159										X																									
12	TP04-1.0	Nov 22, 2021		Soil	L21-No58160										X																									
13	TP05-0.15	Nov 22, 2021		Soil	L21-No58161																	X	X	X		X		X												
14	TP05-0.5	Nov 22, 2021		Soil	L21-No58162										X																									
15	TP05-1.0	Nov 22, 2021		Soil	L21-No58163										X																									
16	TP06-0.15	Nov 22, 2021		Soil	L21-No58164																			X		X		X												
17	TP06-0.5	Nov 22, 2021		Soil	L21-No58165											X																								
18	TP06-1.0	Nov 22, 2021		Soil	L21-No58166											X																								
19	TP07-0.15	Nov 22, 2021		Soil	L21-No58167																			X		X		X												
20	TP07-0.5	Nov 22, 2021		Soil	L21-No58168											X																								

Company Name: Western Environmental Pty Ltd (WA)
Address: Level 3, 25 Prowse Street
West Perth
WA 6005

Order No.:
Report #: 843809
Phone: 08 6162 8980
Fax:

Received: Nov 24, 2021 2:30 PM
Due: Dec 1, 2021
Priority: 5 Day
Contact Name: Jackie Cox

Project Name:
Project ID: P21.185

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						% Clay	Aluminium (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Conductivity (at 25 °C)	E. Coli	Faecal Coliforms	Gold (filtered)	HOLD	Iron (filtered)	Magnesium (filtered)	Manganese (filtered)	Molybdenum (filtered)	pH (at 25 °C)	Selenium (filtered)	Carbamate Pesticides	Acid Herbicides	Metals M8	Metals M8 filtered	Suite B14: OCP/OPP	Ion Balance Set	Moisture Set	Cation Exchange Capacity	Eurofins Suite B1	Eurofins Suite B4A	BTEXN and Volatile TRH	Hardness	Eurofins Suite B11D: Na/K/Ca/Mg and NO ₂ , NO ₃ , NH ₃ , Total P, Reactive P	Eurofins Suite B11E: Total N, TKN, NO _x	Eurofins Suite B11F: Cl/SO ₄ /Alkalinity/Total F	Eurofins Suite B3 (Trace level)	Total Dissolved Solids Dried at 180 °C ± 2 °C	Suite B14: UCP/PP (trace level)	
Perth Laboratory - NATA # 2377 Site # 2370																																								
Melbourne Laboratory - NATA # 1261 Site # 1254											X			X	X					X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X							X	X	X	X						X														
Brisbane Laboratory - NATA # 1261 Site # 20794						X																																		
Mayfield Laboratory - NATA # 1261 Site # 25079																																								
External Laboratory												X	X																											
21	TP07-1.0	Nov 22, 2021		Soil	L21-No58169										X																									
22	TP08-0.15	Nov 22, 2021		Soil	L21-No58170																			X		X		X												
23	TP08-0.5	Nov 22, 2021		Soil	L21-No58171										X																									
24	TP08-1.0	Nov 22, 2021		Soil	L21-No58172										X																									
25	TP09-0.15	Nov 22, 2021		Soil	L21-No58173																	X	X	X		X		X												
26	TP09-0.5	Nov 22, 2021		Soil	L21-No58174										X																									
27	TP09-1.0	Nov 22, 2021		Soil	L21-No58175										X																									
28	TP10-0.15	Nov 22, 2021		Soil	L21-No58176																	X	X	X		X		X												
29	TP10-0.5	Nov 22, 2021		Soil	L21-No58177											X																								
30	TP10-1.0	Nov 22, 2021		Soil	L21-No58178										X																									
31	TP11-0.15	Nov 22, 2021		Soil	L21-No58179																			X		X		X												

Company Name: Western Environmental Pty Ltd (WA)
Address: Level 3, 25 Prowse Street
West Perth
WA 6005

Project Name:
Project ID: P21.185

Order No.:
Report #: 843809
Phone: 08 6162 8980
Fax:

Received: Nov 24, 2021 2:30 PM
Due: Dec 1, 2021
Priority: 5 Day
Contact Name: Jackie Cox

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						% Clay	Aluminium (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Conductivity (at 25°C)	E. Coli	Faecal Coliforms	Gold (filtered)	HOLD	Iron (filtered)	Magnesium (filtered)	Manganese (filtered)	Molybdenum (filtered)	pH (at 25 °C)	Selenium (filtered)	Carbamate Pesticides	Acid Herbicides	Metals M8	Metals M8 filtered	Suite B14: OCP/OPP	Ion Balance Set	Moisture Set	Cation Exchange Capacity	Eurofins Suite B1	Eurofins Suite B4A	BTEXN and Volatile TRH	Hardness	Eurofins Suite B11D: Na/K/Ca/Mg and	Eurofins Suite B11F: Cl/SO4/Alkalinity/Total P	Eurofins Suite B3 (Trace level)	Total Dissolved Solids Dried at 180°C ± 2°C	Suite B14: OCP/OPP (trace level)			
Perth Laboratory - NATA # 2377 Site # 2370																																									
Melbourne Laboratory - NATA # 1261 Site # 1254											X			X	X						X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X						X	X	X	X		X					X															
Brisbane Laboratory - NATA # 1261 Site # 20794						X																																			
Mayfield Laboratory - NATA # 1261 Site # 25079																																									
External Laboratory												X	X																												
32	TP11-0.5	Nov 22, 2021		Soil	L21-No58180										X																										
33	TP11-1.0	Nov 22, 2021		Soil	L21-No58181										X																										
34	TP12-0.15	Nov 22, 2021		Soil	L21-No58182																			X		X		X													
35	TP12-0.5	Nov 22, 2021		Soil	L21-No58183										X																										
36	TP12-1.0	Nov 22, 2021		Soil	L21-No58184										X																										
37	TP13-0.15	Nov 22, 2021		Soil	L21-No58185																			X		X		X													
38	TP13-0.5	Nov 22, 2021		Soil	L21-No58186										X																										
39	TP13-1.0	Nov 22, 2021		Soil	L21-No58187										X																										
40	TP14-0.15	Nov 22, 2021		Soil	L21-No58188																			X		X		X													
41	TP14-0.5	Nov 22, 2021		Soil	L21-No58189										X																										
42	TP14-1.0	Nov 22, 2021		Soil	L21-No58190										X																										

Company Name: Western Environmental Pty Ltd (WA)
Address: Level 3, 25 Prowse Street
West Perth
WA 6005

Order No.:
Report #: 843809
Phone: 08 6162 8980
Fax:

Received: Nov 24, 2021 2:30 PM
Due: Dec 1, 2021
Priority: 5 Day
Contact Name: Jackie Cox

Project Name:
Project ID: P21.185

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						% Clay	Aluminium (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Conductivity (at 25 °C)	E. Coli	Faecal Coliforms	Gold (filtered)	HOLD	Iron (filtered)	Magnesium (filtered)	Manganese (filtered)	Molybdenum (filtered)	pH (at 25 °C)	Selenium (filtered)	Carbamate Pesticides	Acid Herbicides	Metals M8	Metals M8 filtered	Suite B14: OCP/OPP	Ion Balance Set	Moisture Set	Cation Exchange Capacity	Eurofins Suite B1	Eurofins Suite B4A	BTEXN and Volatile TRH	Hardness	Eurofins Suite B11D: Na/K/Ca/Mg and	Eurofins Suite B11F: Cl/SO4/Alkalinity/Total P	Eurofins Suite B3 (Trace level)	Total Dissolved Solids Dried at 180°C ± 2°C	Suite B14: UCP/PP (trace level)		
Perth Laboratory - NATA # 2377 Site # 2370																																								
Melbourne Laboratory - NATA # 1261 Site # 1254											X			X	X					X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X							X	X	X		X					X														
Brisbane Laboratory - NATA # 1261 Site # 20794						X																																		
Mayfield Laboratory - NATA # 1261 Site # 25079																																								
External Laboratory												X	X																											
43	TP15-0.15	Nov 22, 2021		Soil	L21-No58191																	X	X	X		X		X												
44	TP15-0.5	Nov 22, 2021		Soil	L21-No58192										X																									
45	TP15-1.0	Nov 22, 2021		Soil	L21-No58193										X																									
46	TP16-0.15	Nov 22, 2021		Soil	L21-No58194																			X		X		X												
47	TP16-0.5	Nov 22, 2021		Soil	L21-No58195										X																									
48	TP16-1.0	Nov 22, 2021		Soil	L21-No58196										X																									
49	TP17-0.15	Nov 22, 2021		Soil	L21-No58197																			X		X		X												
50	TP17-0.5	Nov 22, 2021		Soil	L21-No58198										X																									
51	TP17-1.0	Nov 22, 2021		Soil	L21-No58199										X																									
52	TP18-0.15	Nov 22, 2021		Soil	L21-No58200																	X	X	X		X		X												
53	TP18-0.5	Nov 22, 2021		Soil	L21-No58201										X																									

Company Name: Western Environmental Pty Ltd (WA)
Address: Level 3, 25 Prowse Street
West Perth
WA 6005

Order No.:
Report #: 843809
Phone: 08 6162 8980
Fax:

Received: Nov 24, 2021 2:30 PM
Due: Dec 1, 2021
Priority: 5 Day
Contact Name: Jackie Cox

Project Name:
Project ID: P21.185

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						% Clay	Aluminium (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Conductivity (at 25 °C)	E. Coli	Faecal Coliforms	Gold (filtered)	HOLD	Iron (filtered)	Magnesium (filtered)	Manganese (filtered)	Molybdenum (filtered)	pH (at 25 °C)	Selenium (filtered)	Carbamate Pesticides	Acid Herbicides	Metals M8	Metals M8 filtered	Suite B14: OCP/OPP	Ion Balance Set	Moisture Set	Cation Exchange Capacity	Eurofins Suite B1	Eurofins Suite B4A	BTEXN and Volatile TRH	Hardness	Eurofins Suite B11D: Na/K/Ca/Mg and NO ₂ , NO ₃ , NH ₃ , Total P, Reactive P	Eurofins Suite B11F: Cl/SO ₄ /Alkalinity/Total F	Eurofins Suite B3 (Trace level)	Total Dissolved Solids Dried at 180°C ± 2°C	Suite B14: OCP/OPP (trace level)	
Perth Laboratory - NATA # 2377 Site # 2370																																							
Melbourne Laboratory - NATA # 1261 Site # 1254											X			X	X					X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X						X	X	X	X		X					X													
Brisbane Laboratory - NATA # 1261 Site # 20794						X																																	
Mayfield Laboratory - NATA # 1261 Site # 25079																																							
External Laboratory												X	X																										
54	TP18-1.0	Nov 22, 2021		Soil	L21-No58202											X																							
55	DUP01	Nov 22, 2021		Soil	L21-No58203																				X		X		X										
56	DUP02	Nov 22, 2021		Soil	L21-No58204											X																							
57	WS01D	Nov 22, 2021		Water	L21-No58205		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X		X			X				X	X	X	X	X
58	DUP01	Nov 22, 2021		Water	L21-No58206		X	X	X	X	X			X		X	X	X	X	X	X	X	X	X		X		X			X			X	X	X	X		X
59	RB01	Nov 22, 2021		Water	L21-No58207																			X		X					X								
60	FB01	Nov 22, 2021		Water	L21-No58208																						X				X								
61	TB01	Nov 22, 2021		Water	L21-No58209																												X						
62	BG01	Nov 22, 2021		Soil	L21-No58210	X																		X				X	X										
Test Counts						1	2	2	2	2	2	1	1	2	37	2	2	2	2	2	2	10	10	21	2	21	2	20	1	2	2	2	1	2	2	2	2	1	2

Internal Quality Control Review and Glossary

General

- Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
- This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs..

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

- Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
- For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Acid Herbicides							
2,4-D	mg/L	< 0.001			0.001	Pass	
2,4-DB	mg/L	< 0.001			0.001	Pass	
2,4,5-T	mg/L	< 0.001			0.001	Pass	
2,4,5-TP	mg/L	< 0.001			0.001	Pass	
Actril (loxynil)	mg/L	< 0.001			0.001	Pass	
Dicamba	mg/L	< 0.001			0.001	Pass	
Dichlorprop	mg/L	< 0.001			0.001	Pass	
Dinitro-o-cresol	mg/L	< 0.001			0.001	Pass	
Dinoseb	mg/L	< 0.001			0.001	Pass	
MCPA	mg/L	< 0.001			0.001	Pass	
MCPB	mg/L	< 0.001			0.001	Pass	
Mecoprop	mg/L	< 0.001			0.001	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Method Blank							
Phenols (Halogenated) - Low level							
2-Chlorophenol	mg/L	< 0.00005			0.00005	Pass	
2,4-Dichlorophenol	mg/L	< 0.00005			0.00005	Pass	
2,4,5-Trichlorophenol	mg/L	< 0.0001			0.0001	Pass	
2,4,6-Trichlorophenol	mg/L	< 0.0001			0.0001	Pass	
2,6-Dichlorophenol	mg/L	< 0.00005			0.00005	Pass	
4-Chloro-3-methylphenol	mg/L	< 0.0001			0.0001	Pass	
Pentachlorophenol	mg/L	< 0.001			0.001	Pass	
Tetrachlorophenols - Total	mg/L	< 0.0005			0.0005	Pass	
Total Halogenated Phenol*	mg/L	-			0.001	N/A	
Method Blank							
Phenols (non-Halogenated) - Low level							
2-Cyclohexyl-4,6-dinitrophenol	mg/L	< 0.01			0.01	Pass	
2-Methyl-4,6-dinitrophenol	mg/L	< 0.0005			0.0005	Pass	
2-Methylphenol (o-Cresol)	mg/L	< 0.00005			0.00005	Pass	
2-Nitrophenol	mg/L	< 0.0001			0.0001	Pass	
2,4-Dimethylphenol	mg/L	< 0.00005			0.00005	Pass	
2,4-Dinitrophenol	mg/L	< 0.0005			0.0005	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/L	< 0.0001			0.0001	Pass	
4-Nitrophenol	mg/L	< 0.0005			0.0005	Pass	
Dinoseb	mg/L	< 0.01			0.01	Pass	
Phenol	mg/L	< 0.00005			0.00005	Pass	
Total Non-Halogenated Phenol*	mg/L	-			0.01	N/A	
Method Blank							
Organophosphorus Pesticides (Trace level)							
Azinphos-methyl	mg/L	< 0.001			0.001	Pass	
Bolstar	mg/L	< 0.001			0.001	Pass	
Chlorfenvinphos	mg/L	< 0.001			0.001	Pass	
Chlorpyrifos	mg/L	< 0.01			0.01	Pass	
Chlorpyrifos-methyl	mg/L	< 0.001			0.001	Pass	
Coumaphos	mg/L	< 0.01			0.01	Pass	
Demeton-O	mg/L	< 0.001			0.001	Pass	
Demeton-S	mg/L	< 0.01			0.01	Pass	
Diazinon	mg/L	< 0.001			0.001	Pass	
Dichlorvos	mg/L	< 0.001			0.001	Pass	
Dimethoate	mg/L	< 0.001			0.001	Pass	
Disulfoton	mg/L	< 0.001			0.001	Pass	
EPN	mg/L	< 0.001			0.001	Pass	
Ethion	mg/L	< 0.001			0.001	Pass	
Ethoprop	mg/L	< 0.001			0.001	Pass	
Ethyl parathion	mg/L	< 0.001			0.001	Pass	
Fenitrothion	mg/L	< 0.001			0.001	Pass	
Fensulfothion	mg/L	< 0.001			0.001	Pass	
Fenthion	mg/L	< 0.001			0.001	Pass	
Malathion	mg/L	< 0.001			0.001	Pass	
Merphos	mg/L	< 0.001			0.001	Pass	
Methyl parathion	mg/L	< 0.001			0.001	Pass	
Mevinphos	mg/L	< 0.001			0.001	Pass	
Monocrotophos	mg/L	< 0.001			0.001	Pass	
Naled	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Omethoate	mg/L	< 0.001			0.001	Pass	
Phorate	mg/L	< 0.001			0.001	Pass	
Pirimiphos-methyl	mg/L	< 0.01			0.01	Pass	
Pyrazophos	mg/L	< 0.001			0.001	Pass	
Ronnel	mg/L	< 0.001			0.001	Pass	
Terbufos	mg/L	< 0.001			0.001	Pass	
Tetrachlorvinphos	mg/L	< 0.001			0.001	Pass	
Tokuthion	mg/L	< 0.001			0.001	Pass	
Trichloronate	mg/L	< 0.001			0.001	Pass	
Method Blank							
Organochlorine Pesticides (Trace level)							
4.4'-DDD	mg/L	< 0.00001			0.00001	Pass	
4.4'-DDE	mg/L	< 0.00001			0.00001	Pass	
4.4'-DDT	mg/L	< 0.00001			0.00001	Pass	
a-HCH	mg/L	< 0.00001			0.00001	Pass	
Aldrin	mg/L	< 0.00001			0.00001	Pass	
b-HCH	mg/L	< 0.00001			0.00001	Pass	
Chlordanes - Total	mg/L	< 0.00001			0.00001	Pass	
d-HCH	mg/L	< 0.00001			0.00001	Pass	
Dieldrin	mg/L	< 0.00001			0.00001	Pass	
Endosulfan I	mg/L	< 0.00001			0.00001	Pass	
Endosulfan II	mg/L	< 0.00001			0.00001	Pass	
Endosulfan sulphate	mg/L	< 0.00001			0.00001	Pass	
Endrin	mg/L	< 0.00001			0.00001	Pass	
Endrin aldehyde	mg/L	< 0.00001			0.00001	Pass	
Endrin ketone	mg/L	< 0.00001			0.00001	Pass	
g-HCH (Lindane)	mg/L	< 0.00001			0.00001	Pass	
Heptachlor	mg/L	< 0.00001			0.00001	Pass	
Heptachlor epoxide	mg/L	< 0.00001			0.00001	Pass	
Hexachlorobenzene	mg/L	< 0.00001			0.00001	Pass	
Methoxychlor	mg/L	< 0.00001			0.00001	Pass	
Toxaphene	mg/L	< 0.002			0.002	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Conductivity (at 25°C)	uS/cm	< 10			10	Pass	
Fluoride (Total)	mg/L	< 0.5			0.5	Pass	
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Phosphorus reactive (as P)	mg/L	< 0.01			0.01	Pass	
Sulphate (as SO ₄)	mg/L	< 5			5	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C	mg/L	< 10			10	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO ₃)	mg/L	< 20			20	Pass	
Carbonate Alkalinity (as CaCO ₃)	mg/L	< 10			10	Pass	
Hydroxide Alkalinity (as CaCO ₃)	mg/L	< 20			20	Pass	
Total Alkalinity (as CaCO ₃)	mg/L	< 20			20	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Barium (filtered)	mg/L	< 0.02			0.02	Pass	
Beryllium (filtered)	mg/L	< 0.001			0.001	Pass	
Boron (filtered)	mg/L	< 0.05			0.05	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Gold (filtered)	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Molybdenum (filtered)	mg/L	< 0.005			0.005	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Alkali Metals (filtered)							
Magnesium (filtered)	mg/L	< 0.5			0.5	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/L	< 0.002			0.002	Pass	
4,4'-DDD	mg/L	< 0.0002			0.0002	Pass	
4,4'-DDE	mg/L	< 0.0002			0.0002	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
4,4'-DDT	mg/L	< 0.0002			0.0002	Pass	
a-HCH	mg/L	< 0.0002			0.0002	Pass	
Aldrin	mg/L	< 0.0002			0.0002	Pass	
b-HCH	mg/L	< 0.0002			0.0002	Pass	
d-HCH	mg/L	< 0.0002			0.0002	Pass	
Dieldrin	mg/L	< 0.0002			0.0002	Pass	
Endosulfan I	mg/L	< 0.0002			0.0002	Pass	
Endosulfan II	mg/L	< 0.0002			0.0002	Pass	
Endosulfan sulphate	mg/L	< 0.0002			0.0002	Pass	
Endrin	mg/L	< 0.0002			0.0002	Pass	
Endrin aldehyde	mg/L	< 0.0002			0.0002	Pass	
Endrin ketone	mg/L	< 0.0002			0.0002	Pass	
g-HCH (Lindane)	mg/L	< 0.0002			0.0002	Pass	
Heptachlor	mg/L	< 0.0002			0.0002	Pass	
Heptachlor epoxide	mg/L	< 0.0002			0.0002	Pass	
Hexachlorobenzene	mg/L	< 0.0002			0.0002	Pass	
Methoxychlor	mg/L	< 0.0002			0.0002	Pass	
Toxaphene	mg/L	< 0.005			0.005	Pass	
Method Blank							
Organophosphorus Pesticides							
Azinphos-methyl	mg/L	< 0.002			0.002	Pass	
Bolstar	mg/L	< 0.002			0.002	Pass	
Chlorfenvinphos	mg/L	< 0.02			0.02	Pass	
Chlorpyrifos	mg/L	< 0.002			0.002	Pass	
Chlorpyrifos-methyl	mg/L	< 0.002			0.002	Pass	
Coumaphos	mg/L	< 0.02			0.02	Pass	
Demeton-S	mg/L	< 0.002			0.002	Pass	
Demeton-O	mg/L	< 0.002			0.002	Pass	
Diazinon	mg/L	< 0.002			0.002	Pass	
Dichlorvos	mg/L	< 0.002			0.002	Pass	
Dimethoate	mg/L	< 0.002			0.002	Pass	
Disulfoton	mg/L	< 0.002			0.002	Pass	
EPN	mg/L	< 0.002			0.002	Pass	
Ethion	mg/L	< 0.002			0.002	Pass	
Ethoprop	mg/L	< 0.002			0.002	Pass	
Ethyl parathion	mg/L	< 0.002			0.002	Pass	
Fenitrothion	mg/L	< 0.002			0.002	Pass	
Fensulfothion	mg/L	< 0.002			0.002	Pass	
Fenthion	mg/L	< 0.002			0.002	Pass	
Malathion	mg/L	< 0.002			0.002	Pass	
Merphos	mg/L	< 0.002			0.002	Pass	
Methyl parathion	mg/L	< 0.002			0.002	Pass	
Mevinphos	mg/L	< 0.002			0.002	Pass	
Monocrotophos	mg/L	< 0.002			0.002	Pass	
Naled	mg/L	< 0.002			0.002	Pass	
Omethoate	mg/L	< 0.02			0.02	Pass	
Phorate	mg/L	< 0.002			0.002	Pass	
Pirimiphos-methyl	mg/L	< 0.02			0.02	Pass	
Pyrazophos	mg/L	< 0.002			0.002	Pass	
Ronnel	mg/L	< 0.002			0.002	Pass	
Terbufos	mg/L	< 0.002			0.002	Pass	
Tetrachlorvinphos	mg/L	< 0.002			0.002	Pass	
Tokuthion	mg/L	< 0.002			0.002	Pass	
Trichloronate	mg/L	< 0.002			0.002	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Phenols (Halogenated)							
2-Chlorophenol	mg/L	< 0.003			0.003	Pass	
2,4-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2,4,5-Trichlorophenol	mg/L	< 0.01			0.01	Pass	
2,4,6-Trichlorophenol	mg/L	< 0.01			0.01	Pass	
2,6-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
4-Chloro-3-methylphenol	mg/L	< 0.01			0.01	Pass	
Pentachlorophenol	mg/L	< 0.01			0.01	Pass	
Tetrachlorophenols - Total	mg/L	< 0.03			0.03	Pass	
Method Blank							
Phenols (non-Halogenated)							
2-Cyclohexyl-4,6-dinitrophenol	mg/L	< 0.1			0.1	Pass	
2-Methyl-4,6-dinitrophenol	mg/L	< 0.03			0.03	Pass	
2-Nitrophenol	mg/L	< 0.01			0.01	Pass	
2,4-Dimethylphenol	mg/L	< 0.003			0.003	Pass	
2,4-Dinitrophenol	mg/L	< 0.03			0.03	Pass	
2-Methylphenol (o-Cresol)	mg/L	< 0.003			0.003	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/L	< 0.006			0.006	Pass	
4-Nitrophenol	mg/L	< 0.03			0.03	Pass	
Dinoseb	mg/L	< 0.1			0.1	Pass	
Phenol	mg/L	< 0.003			0.003	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	92			70-130	Pass	
TRH C10-C14	%	105			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	94			70-130	Pass	
Toluene	%	92			70-130	Pass	
Ethylbenzene	%	87			70-130	Pass	
m&p-Xylenes	%	89			70-130	Pass	
Xylenes - Total*	%	89			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	95			70-130	Pass	
TRH C6-C10	%	92			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	109			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	%	84			70-130	Pass	
Acenaphthylene	%	81			70-130	Pass	
Anthracene	%	78			70-130	Pass	
Benz(a)anthracene	%	71			70-130	Pass	
Benzo(a)pyrene	%	89			70-130	Pass	
Benzo(b&j)fluoranthene	%	101			70-130	Pass	
Benzo(g,h,i)perylene	%	79			70-130	Pass	
Benzo(k)fluoranthene	%	94			70-130	Pass	
Chrysene	%	84			70-130	Pass	
Dibenz(a,h)anthracene	%	76			70-130	Pass	
Fluoranthene	%	84			70-130	Pass	
Fluorene	%	86			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Indeno(1.2.3-cd)pyrene	%	74			70-130	Pass	
Naphthalene	%	85			70-130	Pass	
Phenanthrene	%	77			70-130	Pass	
Pyrene	%	78			70-130	Pass	
LCS - % Recovery							
Phenols (Halogenated) - Low level							
2-Chlorophenol	%	112			30-130	Pass	
2.4-Dichlorophenol	%	63			25-140	Pass	
2.4.5-Trichlorophenol	%	111			30-130	Pass	
2.4.6-Trichlorophenol	%	111			30-130	Pass	
2.6-Dichlorophenol	%	61			30-130	Pass	
4-Chloro-3-methylphenol	%	100			30-130	Pass	
Pentachlorophenol	%	64			30-130	Pass	
Tetrachlorophenols - Total	%	103			30-130	Pass	
LCS - % Recovery							
Phenols (non-Halogenated) - Low level							
2-Cyclohexyl-4.6-dinitrophenol	%	69			30-130	Pass	
2-Methyl-4.6-dinitrophenol	%	60			30-130	Pass	
2-Methylphenol (o-Cresol)	%	40			30-130	Pass	
2-Nitrophenol	%	61			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	%	92			30-130	Pass	
4-Nitrophenol	%	61			30-130	Pass	
Dinoseb	%	70			30-130	Pass	
Phenol	%	43			30-130	Pass	
LCS - % Recovery							
Organophosphorus Pesticides (Trace level)							
Diazinon	%	88			70-130	Pass	
Dimethoate	%	86			70-130	Pass	
Ethion	%	104			70-130	Pass	
Fenitrothion	%	90			70-130	Pass	
Methyl parathion	%	90			70-130	Pass	
Mevinphos	%	74			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides (Trace level)							
4.4'-DDD	%	90			70-130	Pass	
4.4'-DDE	%	104			70-130	Pass	
4.4'-DDT	%	90			70-130	Pass	
a-HCH	%	75			70-130	Pass	
Aldrin	%	98			70-130	Pass	
b-HCH	%	95			70-130	Pass	
Chlordanes - Total	%	98			70-130	Pass	
d-HCH	%	100			70-130	Pass	
Dieldrin	%	104			70-130	Pass	
Endosulfan I	%	100			70-130	Pass	
Endosulfan II	%	92			70-130	Pass	
Endosulfan sulphate	%	109			70-130	Pass	
Endrin	%	104			70-130	Pass	
Endrin ketone	%	85			70-130	Pass	
g-HCH (Lindane)	%	96			70-130	Pass	
Heptachlor	%	109			70-130	Pass	
Heptachlor epoxide	%	104			70-130	Pass	
Methoxychlor	%	99			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	106			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chloride	%	101			70-130	Pass	
Conductivity (at 25°C)	%	105			70-130	Pass	
Fluoride (Total)	%	97			70-130	Pass	
Nitrate & Nitrite (as N)	%	99			70-130	Pass	
Nitrate (as N)	%	99			70-130	Pass	
Nitrite (as N)	%	107			70-130	Pass	
Phosphate total (as P)	%	90			70-130	Pass	
Sulphate (as SO ₄)	%	112			70-130	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C	%	101			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO ₃)	%	95			70-130	Pass	
Total Alkalinity (as CaCO ₃)	%	99			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	104			80-120	Pass	
Magnesium	%	97			80-120	Pass	
Potassium	%	98			80-120	Pass	
Sodium	%	96			80-120	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	106			80-120	Pass	
Arsenic	%	95			80-120	Pass	
Arsenic (filtered)	%	105			80-120	Pass	
Barium (filtered)	%	100			80-120	Pass	
Beryllium (filtered)	%	99			80-120	Pass	
Boron (filtered)	%	90			80-120	Pass	
Cadmium	%	92			80-120	Pass	
Cadmium (filtered)	%	101			80-120	Pass	
Chromium	%	91			80-120	Pass	
Chromium (filtered)	%	104			80-120	Pass	
Copper	%	88			80-120	Pass	
Copper (filtered)	%	101			80-120	Pass	
Gold (filtered)	%	100			80-120	Pass	
Iron (filtered)	%	102			80-120	Pass	
Lead	%	89			80-120	Pass	
Lead (filtered)	%	102			80-120	Pass	
Manganese (filtered)	%	103			80-120	Pass	
Mercury	%	84			80-120	Pass	
Mercury (filtered)	%	113			80-120	Pass	
Molybdenum (filtered)	%	105			80-120	Pass	
Nickel	%	88			80-120	Pass	
Nickel (filtered)	%	104			80-120	Pass	
Selenium (filtered)	%	102			80-120	Pass	
Zinc	%	95			80-120	Pass	
Zinc (filtered)	%	115			80-120	Pass	
LCS - % Recovery							
Alkali Metals (filtered)							
Magnesium (filtered)	%	102			80-120	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	84			70-130	Pass	
Acenaphthylene	%	104			70-130	Pass	
Anthracene	%	90			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benz(a)anthracene	%	86			70-130	Pass	
Benzo(a)pyrene	%	90			70-130	Pass	
Benzo(b&j)fluoranthene	%	82			70-130	Pass	
Benzo(g,h,i)perylene	%	107			70-130	Pass	
Benzo(k)fluoranthene	%	113			70-130	Pass	
Chrysene	%	95			70-130	Pass	
Dibenz(a,h)anthracene	%	89			70-130	Pass	
Fluoranthene	%	84			70-130	Pass	
Fluorene	%	74			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	91			70-130	Pass	
Naphthalene	%	72			70-130	Pass	
Phenanthrene	%	84			70-130	Pass	
Pyrene	%	78			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	103			70-130	Pass	
4,4'-DDD	%	118			70-130	Pass	
4,4'-DDE	%	95			70-130	Pass	
4,4'-DDT	%	81			70-130	Pass	
a-HCH	%	102			70-130	Pass	
Aldrin	%	95			70-130	Pass	
b-HCH	%	77			70-130	Pass	
d-HCH	%	90			70-130	Pass	
Dieldrin	%	86			70-130	Pass	
Endosulfan I	%	105			70-130	Pass	
Endosulfan II	%	78			70-130	Pass	
Endosulfan sulphate	%	96			70-130	Pass	
Endrin	%	77			70-130	Pass	
Endrin aldehyde	%	83			70-130	Pass	
Endrin ketone	%	100			70-130	Pass	
g-HCH (Lindane)	%	86			70-130	Pass	
Heptachlor	%	99			70-130	Pass	
Heptachlor epoxide	%	116			70-130	Pass	
Hexachlorobenzene	%	73			70-130	Pass	
Methoxychlor	%	88			70-130	Pass	
LCS - % Recovery							
Organophosphorus Pesticides							
Diazinon	%	89			70-130	Pass	
Dimethoate	%	89			70-130	Pass	
Ethion	%	123			70-130	Pass	
Fenitrothion	%	78			70-130	Pass	
Methyl parathion	%	81			70-130	Pass	
Mevinphos	%	78			70-130	Pass	
LCS - % Recovery							
Phenols (Halogenated)							
2-Chlorophenol	%	112			25-140	Pass	
2,4-Dichlorophenol	%	50			25-140	Pass	
2,4,5-Trichlorophenol	%	33			25-140	Pass	
2,4,6-Trichlorophenol	%	43			25-140	Pass	
2,6-Dichlorophenol	%	38			25-140	Pass	
4-Chloro-3-methylphenol	%	100			25-140	Pass	
Pentachlorophenol	%	64			25-140	Pass	
Tetrachlorophenols - Total	%	63			25-140	Pass	
LCS - % Recovery							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenols (non-Halogenated)									
2-Cyclohexyl-4,6-dinitrophenol			%	69			25-140	Pass	
2-Methyl-4,6-dinitrophenol			%	60			25-140	Pass	
2-Nitrophenol			%	57			25-140	Pass	
2-Methylphenol (o-Cresol)			%	36			25-140	Pass	
3&4-Methylphenol (m&p-Cresol)			%	39			25-140	Pass	
4-Nitrophenol			%	61			25-140	Pass	
Dinoseb			%	70			25-140	Pass	
Phenol			%	43			25-140	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M21-No72371	NCP	%	100			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M21-No72371	NCP	%	92			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Benzo(a)pyrene	M21-No51444	NCP	%	99			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	M21-No66089	NCP	%	107			70-130	Pass	
Nitrate & Nitrite (as N)	L21-No62341	NCP	%	101			70-130	Pass	
Nitrate (as N)	L21-No62341	NCP	%	101			70-130	Pass	
Nitrite (as N)	M21-No66089	NCP	%	103			70-130	Pass	
Phosphate total (as P)	M21-No64472	NCP	%	81			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	B21-No60945	NCP	%	116			75-125	Pass	
Magnesium	B21-No60945	NCP	%	104			75-125	Pass	
Potassium	B21-No60945	NCP	%	107			75-125	Pass	
Sodium	B21-No53765	NCP	%	85			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium (filtered)	S21-No64963	NCP	%	100			75-125	Pass	
Arsenic (filtered)	S21-No64963	NCP	%	102			75-125	Pass	
Barium (filtered)	S21-De05223	NCP	%	95			75-125	Pass	
Beryllium (filtered)	S21-No64963	NCP	%	98			75-125	Pass	
Boron (filtered)	S21-No71190	NCP	%	101			75-125	Pass	
Cadmium (filtered)	S21-No64963	NCP	%	98			75-125	Pass	
Chromium (filtered)	S21-No64963	NCP	%	97			75-125	Pass	
Copper (filtered)	S21-No64963	NCP	%	93			75-125	Pass	
Iron (filtered)	S21-No64963	NCP	%	94			75-125	Pass	
Lead (filtered)	S21-No64963	NCP	%	94			75-125	Pass	
Manganese (filtered)	S21-De05223	NCP	%	80			75-125	Pass	
Mercury (filtered)	S21-No64963	NCP	%	101			75-125	Pass	
Molybdenum (filtered)	S21-No64963	NCP	%	103			75-125	Pass	
Nickel (filtered)	S21-No64963	NCP	%	95			75-125	Pass	
Selenium (filtered)	S21-No64963	NCP	%	94			75-125	Pass	
Zinc (filtered)	S21-No64963	NCP	%	92			75-125	Pass	
Spike - % Recovery									
Alkali Metals (filtered)				Result 1					
Magnesium (filtered)	S21-No64963	NCP	%	92			75-125	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	L21-No58206	CP	%	99			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	L21-No58206	CP	%	94			70-130	Pass	
Toluene	L21-No58206	CP	%	93			70-130	Pass	
Ethylbenzene	L21-No58206	CP	%	92			70-130	Pass	
m&p-Xylenes	L21-No58206	CP	%	94			70-130	Pass	
o-Xylene	L21-No58206	CP	%	94			70-130	Pass	
Xylenes - Total*	L21-No58206	CP	%	94			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	L21-No58206	CP	%	77			70-130	Pass	
TRH C6-C10	L21-No58206	CP	%	97			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M21-No60976	NCP	%	91			75-125	Pass	
Cadmium	M21-No60976	NCP	%	92			75-125	Pass	
Chromium	M21-No60976	NCP	%	91			75-125	Pass	
Copper	M21-No60976	NCP	%	89			75-125	Pass	
Lead	M21-No60976	NCP	%	92			75-125	Pass	
Mercury	M21-No60976	NCP	%	92			75-125	Pass	
Nickel	M21-No60976	NCP	%	89			75-125	Pass	
Zinc	M21-No60976	NCP	%	93			75-125	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M21-No51444	NCP	%	90			70-130	Pass	
Acenaphthylene	M21-No51444	NCP	%	77			70-130	Pass	
Anthracene	M21-No51444	NCP	%	96			70-130	Pass	
Benz(a)anthracene	M21-No51444	NCP	%	93			70-130	Pass	
Benzo(a)pyrene	M21-No51444	NCP	%	99			70-130	Pass	
Benzo(b&j)fluoranthene	M21-No51444	NCP	%	80			70-130	Pass	
Benzo(g,h,i)perylene	M21-No51444	NCP	%	119			70-130	Pass	
Benzo(k)fluoranthene	M21-No51444	NCP	%	89			70-130	Pass	
Chrysene	M21-No51444	NCP	%	112			70-130	Pass	
Dibenz(a,h)anthracene	M21-No51444	NCP	%	82			70-130	Pass	
Fluoranthene	M21-No51444	NCP	%	82			70-130	Pass	
Fluorene	M21-No51444	NCP	%	88			70-130	Pass	
Indeno(1,2,3-cd)pyrene	M21-No51444	NCP	%	83			70-130	Pass	
Naphthalene	M21-No51444	NCP	%	86			70-130	Pass	
Phenanthrene	M21-No51444	NCP	%	84			70-130	Pass	
Pyrene	M21-No51444	NCP	%	89			70-130	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
Chlordanes - Total	M21-No59762	NCP	%	105			70-130	Pass	
4,4'-DDD	M21-No59762	NCP	%	104			70-130	Pass	
4,4'-DDE	M21-No59762	NCP	%	100			70-130	Pass	
4,4'-DDT	M21-No59762	NCP	%	87			70-130	Pass	
a-HCH	M21-No59762	NCP	%	104			70-130	Pass	
Aldrin	M21-No59762	NCP	%	92			70-130	Pass	
b-HCH	M21-No59762	NCP	%	112			70-130	Pass	
d-HCH	M21-No59762	NCP	%	97			70-130	Pass	
Dieldrin	M21-No59762	NCP	%	101			70-130	Pass	
Endosulfan I	M21-No59762	NCP	%	90			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan II	M21-No59762	NCP	%	90			70-130	Pass	
Endosulfan sulphate	M21-No59762	NCP	%	110			70-130	Pass	
Endrin	M21-No59762	NCP	%	107			70-130	Pass	
Endrin aldehyde	M21-No59762	NCP	%	100			70-130	Pass	
Endrin ketone	M21-No59762	NCP	%	124			70-130	Pass	
g-HCH (Lindane)	M21-No59762	NCP	%	94			70-130	Pass	
Heptachlor	M21-No59762	NCP	%	105			70-130	Pass	
Heptachlor epoxide	M21-No59762	NCP	%	103			70-130	Pass	
Hexachlorobenzene	M21-No59762	NCP	%	100			70-130	Pass	
Methoxychlor	M21-No59762	NCP	%	114			70-130	Pass	
Spike - % Recovery									
Organophosphorus Pesticides				Result 1					
Dimethoate	M21-No59762	NCP	%	106			70-130	Pass	
Ethion	M21-No59762	NCP	%	100			70-130	Pass	
Fenitrothion	M21-No59762	NCP	%	113			70-130	Pass	
Methyl parathion	M21-No59762	NCP	%	77			70-130	Pass	
Mevinphos	M21-No59762	NCP	%	72			70-130	Pass	
Spike - % Recovery									
Phenols (Halogenated)				Result 1					
2-Chlorophenol	M21-No51444	NCP	%	79			30-130	Pass	
2,4-Dichlorophenol	M21-No51444	NCP	%	58			30-130	Pass	
2,4,5-Trichlorophenol	M21-No51444	NCP	%	54			30-130	Pass	
2,4,6-Trichlorophenol	M21-No51444	NCP	%	60			30-130	Pass	
2,6-Dichlorophenol	M21-No51444	NCP	%	53			30-130	Pass	
4-Chloro-3-methylphenol	M21-No51444	NCP	%	72			30-130	Pass	
Pentachlorophenol	M21-No51444	NCP	%	91			30-130	Pass	
Tetrachlorophenols - Total	M21-No51444	NCP	%	55			30-130	Pass	
Spike - % Recovery									
Phenols (non-Halogenated)				Result 1					
2-Cyclohexyl-4,6-dinitrophenol	M21-No45804	NCP	%	119			30-130	Pass	
2-Methyl-4,6-dinitrophenol	M21-No51444	NCP	%	55			30-130	Pass	
2-Nitrophenol	M21-No51444	NCP	%	85			30-130	Pass	
2,4-Dinitrophenol	M21-No45804	NCP	%	103			30-130	Pass	
2-Methylphenol (o-Cresol)	M21-No51444	NCP	%	72			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	M21-No51444	NCP	%	83			30-130	Pass	
Dinoseb	M21-No51444	NCP	%	74			30-130	Pass	
Phenol	M21-No51444	NCP	%	45			30-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	L21-No58205	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	M21-No58559	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	M21-No58559	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	M21-No58559	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M21-No60589	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	M21-No60589	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	M21-No60589	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	M21-No60589	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	M21-No60589	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	M21-No60589	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	

Duplicate								
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD		
Naphthalene	M21-No60589	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
TRH C6-C10	M21-No60589	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Duplicate								
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD		
TRH >C10-C16	M21-No58559	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
TRH >C16-C34	M21-No58559	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass
TRH >C34-C40	M21-No58559	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass
Duplicate								
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD		
Benzo(a)pyrene	M21-No59760	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Ammonia (as N)	M21-No66089	NCP	mg/L	0.25	0.25	3.0	30%	Pass
Chloride	N21-No57296	NCP	mg/L	120	110	6.0	30%	Pass
Fluoride (Total)	L21-No58205	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass
Nitrate & Nitrite (as N)	L21-No62341	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Nitrate (as N)	L21-No62341	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Nitrite (as N)	M21-No66089	NCP	mg/L	1.1	1.1	<1	30%	Pass
Phosphate total (as P)	B21-No60694	NCP	mg/L	0.05	0.05	2.0	30%	Pass
Sulphate (as SO ₄)	S21-No68421	NCP	mg/L	16	17	12	30%	Pass
Total Dissolved Solids Dried at 180°C ± 2°C	S21-No68417	NCP	mg/L	570	580	2.1	30%	Pass
Duplicate								
Alkali Metals				Result 1	Result 2	RPD		
Calcium	B21-No60945	NCP	mg/L	140	120	8.0	30%	Pass
Magnesium	B21-No60945	NCP	mg/L	280	260	8.0	30%	Pass
Potassium	B21-No60945	NCP	mg/L	6.2	5.4	13	30%	Pass
Sodium	B21-No53765	NCP	mg/L	8.0	7.9	1.0	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Aluminium (filtered)	L21-No62327	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Arsenic (filtered)	L21-No62327	NCP	mg/L	0.005	0.004	5.0	30%	Pass
Barium (filtered)	L21-No62327	NCP	mg/L	0.02	0.02	3.0	30%	Pass
Beryllium (filtered)	L21-No62327	NCP	mg/L	0.001	< 0.001	19	30%	Pass
Boron (filtered)	L21-No62327	NCP	mg/L	0.47	0.46	2.0	30%	Pass
Cadmium (filtered)	L21-No62327	NCP	mg/L	0.0004	0.0003	23	30%	Pass
Chromium (filtered)	L21-No62327	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Copper (filtered)	L21-No62327	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Iron (filtered)	L21-No62327	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Lead (filtered)	L21-No62327	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Manganese (filtered)	L21-No62327	NCP	mg/L	0.12	0.12	3.0	30%	Pass
Mercury (filtered)	L21-No62327	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Molybdenum (filtered)	L21-No62327	NCP	mg/L	0.093	0.092	1.0	30%	Pass
Nickel (filtered)	L21-No62327	NCP	mg/L	0.006	0.006	7.0	30%	Pass
Selenium (filtered)	L21-No62327	NCP	mg/L	0.004	0.002	46	30%	Fail
Zinc (filtered)	L21-No62327	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Alkali Metals (filtered)				Result 1	Result 2	RPD		
Magnesium (filtered)	L21-No62327	NCP	mg/L	120	120	2.0	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Conductivity (at 25°C)	L21-No58206	CP	uS/cm	450	460	2.0	30%	Pass
pH (at 25 °C)	L21-No58206	CP	pH Units	6.1	6.1	pass	30%	Pass

Duplicate								
Alkalinity (speciated)				Result 1	Result 2	RPD		
Bicarbonate Alkalinity (as CaCO ₃)	L21-No58206	CP	mg/L	24	29	18	30%	Pass
Carbonate Alkalinity (as CaCO ₃)	L21-No58206	CP	mg/L	< 10	< 10	<1	30%	Pass
Hydroxide Alkalinity (as CaCO ₃)	L21-No58206	CP	mg/L	< 20	< 20	<1	30%	Pass
Total Alkalinity (as CaCO ₃)	L21-No58206	CP	mg/L	24	29	18	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Arsenic	M21-No60976	NCP	mg/L	0.003	0.003	3.0	30%	Pass
Cadmium	M21-No60976	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Chromium	M21-No60976	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Copper	M21-No60976	NCP	mg/L	0.003	0.003	2.0	30%	Pass
Lead	M21-No60976	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Mercury	M21-No60976	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Nickel	M21-No60976	NCP	mg/L	0.002	0.002	2.0	30%	Pass
Zinc	M21-No60976	NCP	mg/L	0.018	0.018	<1	30%	Pass
Duplicate								
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD		
Acenaphthene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Acenaphthylene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Anthracene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benz(a)anthracene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(a)pyrene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(b&j)fluoranthene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(g,h,i)perylene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(k)fluoranthene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Chrysene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Dibenz(a,h)anthracene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Fluoranthene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Fluorene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Indeno(1,2,3-cd)pyrene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Naphthalene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Phenanthrene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Pyrene	M21-No62436	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Organochlorine Pesticides				Result 1	Result 2	RPD		
Chlordanes - Total	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
4,4'-DDD	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
4,4'-DDE	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
4,4'-DDT	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
α-HCH	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Aldrin	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
β-HCH	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
δ-HCH	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Dieldrin	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Endosulfan I	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Endosulfan II	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Endosulfan sulphate	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Endrin	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Endrin aldehyde	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Endrin ketone	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
γ-HCH (Lindane)	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Heptachlor	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Heptachlor epoxide	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Hexachlorobenzene	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Methoxychlor	M21-No62436	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Toxaphene	M21-No59760	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass

Duplicate								
Organophosphorus Pesticides				Result 1	Result 2	RPD		
Azinphos-methyl	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Bolstar	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Chlorfenvinphos	M21-No62436	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Chlorpyrifos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Chlorpyrifos-methyl	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Coumaphos	M21-No62436	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Demeton-S	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Demeton-O	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Diazinon	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Dichlorvos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Dimethoate	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Disulfoton	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
EPN	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ethion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ethoprop	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ethyl parathion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Fenitrothion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Fensulfothion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Fenthion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Malathion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Merphos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Methyl parathion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Mevinphos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Monocrotophos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Naled	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Omethoate	M21-No62436	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Phorate	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Pirimiphos-methyl	M21-No62436	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Pyrazophos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ronnel	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Terbufos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Tetrachlorvinphos	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Tokuthion	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Trichloronate	M21-No62436	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Duplicate								
Phenols (Halogenated)				Result 1	Result 2	RPD		
2-Chlorophenol	M21-No62436	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass
2,4-Dichlorophenol	M21-No62436	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass
2,4,5-Trichlorophenol	M21-No62436	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
2,4,6-Trichlorophenol	M21-No62436	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
2,6-Dichlorophenol	M21-No62436	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass
4-Chloro-3-methylphenol	M21-No62436	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Pentachlorophenol	M21-No62436	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Tetrachlorophenols - Total	M21-No62436	NCP	mg/L	< 0.03	< 0.03	<1	30%	Pass
Duplicate								
Phenols (non-Halogenated)				Result 1	Result 2	RPD		
2-Cyclohexyl-4,6-dinitrophenol	M21-No62436	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass
2-Methyl-4,6-dinitrophenol	M21-No62436	NCP	mg/L	< 0.03	< 0.03	<1	30%	Pass
2-Nitrophenol	M21-No62436	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
2,4-Dimethylphenol	M21-No62436	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass
2,4-Dinitrophenol	M21-No62436	NCP	mg/L	< 0.03	< 0.03	<1	30%	Pass
2-Methylphenol (o-Cresol)	M21-No62436	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass
3&4-Methylphenol (m&p-Cresol)	M21-No62436	NCP	mg/L	< 0.006	< 0.006	<1	30%	Pass
4-Nitrophenol	M21-No62436	NCP	mg/L	< 0.03	< 0.03	<1	30%	Pass

Duplicate								
Phenols (non-Halogenated)				Result 1	Result 2	RPD		
Dinoseb	M21-No62436	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass
Phenol	M21-No62436	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N19	Analysis performed by Eurofins Promicro Pty Ltd under NATA Accreditation No. 2561
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Rhys Thomas	Analytical Services Manager
Vivian Wang	Senior Analyst-Volatile (VIC)
Scott Beddoes	Senior Analyst-Inorganic (VIC)
John Nguyen	Senior Analyst-Metal (NSW)
Joseph Edouard	Senior Analyst-Organic (VIC)
Emily Rosenberg	Senior Analyst-Metal (VIC)



Kim Rodgers
Business Unit Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

APPENDIX C

Groundwater Monitoring Laboratory Results
from 19 November 2024 (MPL)

Certificate of Analysis PFK1262

Client Details

Client	JDA Consultant Hydrologists
Contact	Greg Willett
Address	PO Box 117, SUBIACO, WA, 6904

Sample Details

Your Reference	J7370 - lot9001 Lyon Rd Wandi
Number of Samples	1 Water
Date Samples Received	19/11/2024
Date Instructions Received	19/11/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for soils and on an as received basis for other matrices.

Report Details

Date Results Requested by	26/11/2024
Date of Issue	26/11/2024

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Andrew Townsend, Microbiological Analyst Ben Carpenter, Metals Technician Hien Luong, Chemist Lien Tang, Assistant Operations Manager Lucas Yui, Inorganics Team Leader Michael Mowle, Inorganics Supervisor Todd Lee, Group Operations Manager Varsha Ho Wing, Inorganics and Metals Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PFK1262

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PFK1262-01	WS01d	Water	19/11/2024	19/11/2024

Sample Comments

WS01d Sample(s) was/were received with headspace, analytical results may be affected.

Certificate of Analysis PFK1262

Volatile Organic Compounds - Fumigants (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
2,2-Dichloropropane	µg/L	1.0	<1.0
1,2-Dichloropropane	µg/L	1.0	<1.0
cis-1,3-Dichloropropene	µg/L	1.0	<1.0
trans-1,3-Dichloropropene	µg/L	1.0	<1.0
1,2-Dibromoethane	µg/L	1.0	<1.0

Certificate of Analysis PFK1262

Volatile Organic Compounds - MAH (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Benzene	µg/L	1.0	<1.0
Toluene	µg/L	1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0
Styrene	µg/L	1.0	<1.0
ortho-Xylene	µg/L	1.0	<1.0
Isopropylbenzene	µg/L	1.0	<1.0
n-Propylbenzene	µg/L	1.0	<1.0
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0
tert-Butylbenzene	µg/L	1.0	<1.0
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0
sec-Butylbenzene	µg/L	1.0	<1.0
4-Isopropyltoluene	µg/L	1.0	<1.0
n-Butyl benzene	µg/L	1.0	<1.0

Certificate of Analysis PFK1262

Volatile Organic Compounds - Halogenated Aliphatics (Water)

Envirolab ID Your Reference Date Sampled	Units	PQL	PFK1262-01 WS01d 19/11/2024
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10
Chloromethane	µg/L	10	<10
Vinyl chloride	µg/L	10	<10
Bromomethane	µg/L	10	<10
Chloroethane	µg/L	10	<10
Trichlorofluoromethane (Freon-11)	µg/L	10	<10
1,1-Dichloroethene	µg/L	1.0	<1.0
trans-1,2-Dichloroethene	µg/L	1.0	<1.0
1,1-Dichloroethane	µg/L	1.0	<1.0
cis-1,2-Dichloroethene	µg/L	1.0	<1.0
Bromochloromethane	µg/L	1.0	<1.0
Chloroform	µg/L	1.0	<1.0
1,1,1-Trichloroethane	µg/L	1.0	<1.0
1,1-Dichloropropene	µg/L	1.0	<1.0
Carbon Tetrachloride	µg/L	1.0	<1.0
1,2-Dichloroethane	µg/L	1.0	<1.0
Trichloroethene	µg/L	1.0	<1.0
Dibromomethane	µg/L	1.0	<1.0
Bromodichloromethane	µg/L	1.0	<1.0
1,1,2-Trichloroethane	µg/L	1.0	<1.0
1,3-Dichloropropane	µg/L	1.0	<1.0
Tetrachloroethene	µg/L	1.0	<1.0
Dibromochloromethane	µg/L	1.0	<1.0
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0
Bromoform	µg/L	1.0	<1.0
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0
1,2,3-Trichloropropane	µg/L	1.0	<1.0
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0
Hexachlorobutadiene	µg/L	1.0	<1.0

Certificate of Analysis PFK1262

Volatile Organic Compounds - Halogenated Aromatics (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Chlorobenzene	µg/L	1.0	<1.0
Bromobenzene	µg/L	1.0	<1.0
2-Chlorotoluene	µg/L	1.0	<1.0
4-Chlorotoluene	µg/L	1.0	<1.0
1,3-Dichlorobenzene	µg/L	1.0	<1.0
1,4-Dichlorobenzene	µg/L	1.0	<1.0
1,2-Dichlorobenzene	µg/L	1.0	<1.0
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0

Certificate of Analysis PFK1262

Volatile Organic Compounds - Other VOCs (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Cyclohexane	µg/L	1.0	<1.0

Certificate of Analysis PFK1262

Volatile Organic Compounds - Surrogates (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Surrogate Dibromofluoromethane	%		97.3
Surrogate Toluene-D8	%		97.6
Surrogate 4-Bromofluorobenzene	%		98.0

Certificate of Analysis PFK1262

Volatile TRH and BTEX (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
TRH C6-C9	µg/L	10	<10
TRH C6-C10	µg/L	10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0
Benzene	µg/L	1.0	<1.0
Toluene	µg/L	1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0
ortho-Xylene	µg/L	1.0	<1.0
Total Xylene	µg/L	3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0
Surrogate Dibromofluoromethane	%		97.3
Surrogate Toluene-D8	%		97.6
Surrogate 4-Bromofluorobenzene	%		98.0

Certificate of Analysis PFK1262

Semi-volatile TRH (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
TRH C10-C14	µg/L	50	<50
TRH C15-C28	µg/L	100	<100
TRH C29-C36	µg/L	100	<100
Total +ve TRH C10-C36	µg/L	50	<50
TRH >C10-C16	µg/L	50	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	<50
TRH >C16-C34 (F3)	µg/L	100	<100
TRH >C34-C40 (F4)	µg/L	100	<100
Total +ve TRH >C10-C40	µg/L	50	<50
Surrogate o-Terphenyl	%		86.4

Certificate of Analysis PFK1262

Polycyclic Aromatic Hydrocarbons (Water)

Envirolab ID Your Reference Date Sampled	Units	PQL	PFK1262-01 WS01d 19/11/2024
Naphthalene	µg/L	0.10	<0.10
Acenaphthylene	µg/L	0.10	<0.10
Acenaphthene	µg/L	0.10	<0.10
Fluorene	µg/L	0.10	<0.10
Phenanthrene	µg/L	0.10	<0.10
Anthracene	µg/L	0.10	<0.10
Fluoranthene	µg/L	0.10	<0.10
Pyrene	µg/L	0.10	<0.10
Benzo(a)anthracene	µg/L	0.10	<0.10
Chrysene	µg/L	0.10	<0.10
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20
Benzo(a)pyrene	µg/L	0.10	<0.10
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10
Benzo(g,h,i)perylene	µg/L	0.10	<0.10
Total +ve PAH	µg/L	0.10	<0.10
Surrogate p-Terphenyl-D14	%		79.7

Certificate of Analysis PFK1262

Organochlorine Pesticides (Water)

Envirolab ID Your Reference Date Sampled	Units	PQL	PFK1262-01 WS01d 19/11/2024
alpha-BHC	µg/L	0.20	<0.20
Hexachlorobenzene	µg/L	0.20	<0.20
beta-BHC	µg/L	0.20	<0.20
gamma-BHC	µg/L	0.20	<0.20
delta-BHC	µg/L	0.20	<0.20
Heptachlor	µg/L	0.20	<0.20
Aldrin	µg/L	0.20	<0.20
Heptachlor epoxide	µg/L	0.20	<0.20
trans-Chlordane	µg/L	0.20	<0.20
cis-Chlordane	µg/L	0.20	<0.20
Endosulfan I	µg/L	0.20	<0.20
4,4'-DDE	µg/L	0.20	<0.20
Dieldrin	µg/L	0.20	<0.20
Endrin	µg/L	0.20	<0.20
4,4'-DDD	µg/L	0.20	<0.20
Endosulfan II	µg/L	0.20	<0.20
Endrin aldehyde	µg/L	0.20	<0.20
4,4'-DDT	µg/L	0.20	<0.20
Endosulfan sulfate	µg/L	0.20	<0.20
Endrin ketone	µg/L	0.20	<0.20
Methoxychlor	µg/L	0.20	<0.20
Mirex	µg/L	0.20	<0.20
Total +ve OCP	µg/L	0.20	<0.20
Surrogate 4-chloro-3-nitrobenzotrifluoride	%		75.4

Certificate of Analysis PFK1262

Organophosphorus Pesticides (Water)

Envirolab ID Your Reference Date Sampled	Units	PQL	PFK1262-01 WS01d 19/11/2024
Dichlorvos	µg/L	0.20	<0.20
Dimethoate	µg/L	0.20	<0.20
Diazinon	µg/L	0.20	<0.20
Chlorpyrifos-methyl	µg/L	0.20	<0.20
Ronnel	µg/L	0.20	<0.20
Fenitrothion	µg/L	0.20	<0.20
Malathion	µg/L	0.20	<0.20
Chlorpyrifos	µg/L	0.20	<0.20
Parathion	µg/L	0.20	<0.20
Bromophos-ethyl	µg/L	0.20	<0.20
Ethion	µg/L	0.20	<0.20
Coumaphos	µg/L	0.20	<0.20
Disulfoton	µg/L	0.20	<0.20
Fenamiphos	µg/L	0.20	<0.20
Fenthion	µg/L	0.20	<0.20
Methidathion	µg/L	0.20	<0.20
Mevinphos	µg/L	0.20	<0.20
Parathion-methyl	µg/L	0.20	<0.20
Phorate	µg/L	0.20	<0.20
Phosalone	µg/L	0.20	<0.20
Azinphos-methyl	µg/L	0.20	<0.20
Surrogate 4-chloro-3-nitrobenzotrifluoride	%		75.4

Certificate of Analysis PFK1262

Dissolved Low Level Metals (Water)

Envirolab ID Your Reference Date Sampled	Units	PQL	PFK1262-01 WS01d 19/11/2024
Silver	mg/L	0.0010	<0.0010
Aluminium	mg/L	0.010	0.21
Arsenic	mg/L	0.0010	0.0020
Gold	mg/L	0.0010	<0.0010
Boron	mg/L	0.020	0.071
Barium	mg/L	0.0010	0.010
Beryllium	mg/L	0.00050	<0.00050
Cadmium	mg/L	0.00010	<0.00010
Cobalt	mg/L	0.0010	<0.0010
Chromium	mg/L	0.0010	<0.0010
Copper	mg/L	0.0010	0.0014
Iron	mg/L	0.010	0.65
Mercury	mg/L	0.000050	<0.000050
Manganese	mg/L	0.0010	0.014
Molybdenum	mg/L	0.0010	0.010
Nickel	mg/L	0.0010	<0.0010
Lead	mg/L	0.0010	<0.0010
Selenium	mg/L	0.0010	<0.0010
Tin	mg/L	0.0010	<0.0010
Zinc	mg/L	0.0010	0.0033

Certificate of Analysis PFK1262

Inorganics - Physical Parameters (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
pH	pH units		6.0
Electrical Conductivity	µS/cm	2.0	510
Total Dissolved Solids	mg/L	5.0	320

Certificate of Analysis PFK1262

Inorganics - Ionic Balance and Indexes (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	32
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	32
Chloride	mg/L	1.0	70
Sulfate	mg/L	1.0	53
Calcium	mg/L	0.50	30
Magnesium	mg/L	0.50	7.9
Potassium	mg/L	0.50	17
Sodium	mg/L	0.50	36
Hardness (calc) equivalent CaCO3	mg/L	3.0	110
Ionic Balance	%		1.6
Total Anions	mg/L	7.0	160
Anions as meq	meq/L	0.59	3.6
Total Cations	mg/L	2.0	91
Cations as meq	meq/L	0.10	4.2

Certificate of Analysis PFK1262

Inorganics - Miscellaneous and Common Anions (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Fluoride	mg/L	0.10	0.29

Certificate of Analysis PFK1262

Inorganics - Nutrients (Water)

Envirolab ID Your Reference Date Sampled	Units	PQL	PFK1262-01 WS01d 19/11/2024
Ammonia as N	mg/L	0.0050	0.11
Nitrate as N	mg/L	0.0050	4.2
Nitrate as NO3 by calculation	mg/L	0.020	18
Nitrite as N	mg/L	0.0050	0.039
Nitrite as NO2 by calculation	mg/L	0.020	0.13
NOx as N	mg/L	0.0050	4.2
TKN as N by calculation	mg/L	0.10	0.96
Organic Nitrogen by calc.	mg/L	0.10	0.85
Total Nitrogen	mg/L	0.10	5.2
Phosphate as P	mg/L	0.0050	1.5
Total Phosphorus	mg/L	0.010	1.4

Certificate of Analysis PFK1262

Microbiological Suite (Water)

Envirolab ID	Units	PQL	PFK1262-01
Your Reference			WS01d
Date Sampled			19/11/2024
Thermotolerant Coliforms	cfu/100mL	1	<10
E.coli	cfu/100mL	1	<10

Certificate of Analysis PFK1262

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - ION	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis can be completed outside of the recommended holding times. Solids are reported from a 1:5 water extract unless otherwise specified. Alternatively, pH is determined in a 1:5 extract using 0.01M calcium chloride or a solid is extracted at a ratio of 1:2.5 (AS1289.4.3.1), pH is measured in the extract.
INORG-002	Conductivity and Salinity - measured using a conductivity cell at 25°C. Soil results reported from a 1:5 Soil:Water extract unless otherwise specified. Please note Resistivity is estimated by calculation and may not correlate with results otherwise obtained using the Resistivity current method (based on AS 1289.4.4.1), depending on the nature of the soil being analysed.
INORG-006	Alkalinity - determined titrimetrically based on APHA latest edition 2320-B. Solids reported from a 1:5 water extract unless otherwise specified. Total Carbon Dioxide - determined by calculation in accordance with APHA latest edition,4500-CO2 D.
INORG-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180±10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation: TDS = EC*0.6
INORG-026	Fluoride determined by ion selective electrode (ISE) based on APHA latest edition, 4500-F-C. Solids are reported from a 1:5 water extract unless otherwise specified.
INORG-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% i.e. total anions = total cations +/-15%.
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-060_TP	Total Phosphorus - determined colourimetrically using APHA latest edition 4500-P J. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-081	Anions determined by Ion Chromatography. Waters samples are filtered on receipt prior to analysis. Solids are analysed from a water extract. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.Salt forms and/or anion/cation forms (e.g. FeO, PbO, ZnO, BO3) are determined stoichiometrically from the base metal concentration.
METALS-022 REE	Determination of various metals by ICP-MS.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
ORG-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
ORG-022	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.
ORG-022_OC	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.

Certificate of Analysis PFK1262

Method Summary

Method ID	Methodology Summary
ORG-022_PAH	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and solids using DCM/Acetone/Methanol. For PAHs:- Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, for Total +ve calculations, the PQL is reflective of the lowest individual PQL and therefore, for example, "Total +ve PAHs" is simply a sum of the positive individual PAHs.
ORG-023	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Soils are extracted with Methanol, diluted and analysed by purge and trap GC-MS.
ORG-023_F1_TOT	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Solids are extracted with Methanol, diluted and analysed by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

Certificate of Analysis PFK1262

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Certificate of Analysis PFK1262

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PFK1262

Client Details

Client	JDA Consultant Hydrologists
Your Reference	J7370 - lot9001 Lyon Rd Wandl
Date Issued	26/11/2024

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	No	QC Frequency Outliers Exist - See detailed list below

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PFK1262

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Fumigants Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
VOC - MAH Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
Halogenated Aliphatics Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
Halogenated Aromatics Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
Other VOC Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
VOC - Surrogates Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
vTRH&MBTEXN Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
sTRH Water	1	19/11/2024	22/11/2024	23/11/2024	Yes
PAH Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
OCP Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
OPP (21 list) Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
Dissolved Metals (LL) Water	1	19/11/2024	20/11/2024	22/11/2024	Yes
Dissolved Metals (LL)-Hg Water	1	19/11/2024	25/11/2024	25/11/2024	Yes
EC Water	1	19/11/2024	20/11/2024	21/11/2024	Yes
pH Water	1	19/11/2024	20/11/2024	21/11/2024	Yes
TDS Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
Alkalinity Suite Water	1	19/11/2024	20/11/2024	21/11/2024	Yes
Chloride Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
Dissolved Cations Water	1	19/11/2024	20/11/2024	21/11/2024	Yes
Ion Balance Water	1	19/11/2024	20/11/2024	22/11/2024	Yes
	1	19/11/2024	22/11/2024	26/11/2024	Yes
Sulfate Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
Fluoride Water	1	19/11/2024	21/11/2024	22/11/2024	Yes
Nitrogen - Ammonia Water	1	19/11/2024	21/11/2024	21/11/2024	Yes
Nitrogen - Nitrate Water	1	19/11/2024	21/11/2024	21/11/2024	Yes
Nitrogen - Nitrite Water	1	19/11/2024	21/11/2024	21/11/2024	Yes
Nitrogen - NOx Water	1	19/11/2024	21/11/2024	21/11/2024	Yes
Nitrogen - Total N Water	1	19/11/2024	20/11/2024	21/11/2024	Yes
Phosphate as P Water	1	19/11/2024	21/11/2024	21/11/2024	Yes
TKN as N calc Water	1	19/11/2024	21/11/2024	26/11/2024	Yes
Total Phosphorus Water	1	19/11/2024	22/11/2024	22/11/2024	Yes
E. coli & T.T.coli Water	1	19/11/2024	19/11/2024	19/11/2024	Yes

Data Quality Assessment Summary PFK1262

Outliers: Matrix Spike

METALS-020 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFK3479

Sample ID	Analyte	% Limits	% Recovery
BFK3479-MS1#	Calcium	70 - 130	##[1]
BFK3479-MS1#	Magnesium	70 - 130	##[1]
BFK3479-MS1#	Sodium	70 - 130	##[1]

METALS-022 | Dissolved Low Level Metals (Water) | Batch BFK3476

Sample ID	Analyte	% Limits	% Recovery
BFK3476-MS1#	Boron	70 - 130	##[1]

METALS-022 REE | Dissolved Low Level Metals (Water) | Batch BFK3480

Sample ID	Analyte	% Limits	% Recovery
PFK1262-01	Gold	70 - 130	##[2]

ORG-022_OC | Organochlorine Pesticides (Water) | Batch BFK3930

Sample ID	Analyte	% Limits	% Recovery
BFK3930-MS2#	Aldrin	60 - 140	42.2[3]

Data Quality Assessment Summary PFK1262

Outliers: QC Frequency

ORG-023 | Volatile Organic Compounds - Fumigants (Water) | Batch BFK3714

Analysis	QC Type	Expected	Reported
Fumigants	Duplicate	1	0
	Matrix Spike	1	0
Halogenated Aliphatics	Duplicate	1	0
	Matrix Spike	1	0
Halogenated Aromatics	Duplicate	1	0
	Matrix Spike	1	0
Other VOC	Duplicate	2	0
	Matrix Spike	1	0

ORG-023_F1_TOT | Volatile Organic Compounds - MAH (Water) | Batch BFK3714

Analysis	QC Type	Expected	Reported
VOC - MAH	Duplicate	1	0
	Matrix Spike	1	0
vTRH&MBTEXN	Duplicate	1	0
	Matrix Spike	1	0

Quality Control PFK1262

ORG-023 | Volatile Organic Compounds - Fumigants (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
2,2-Dichloropropane	µg/L	1.0	<1.0	[NA]
1,2-Dichloropropane	µg/L	1.0	<1.0	105
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	119
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	121
1,2-Dibromoethane	µg/L	1.0	<1.0	99.5

ORG-023_F1_TOT | Volatile Organic Compounds - MAH (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
Benzene	µg/L	1.0	<1.0	101
Toluene	µg/L	1.0	<1.0	106
Ethylbenzene	µg/L	1.0	<1.0	112
meta+para Xylene	µg/L	2.0	<2.0	109
Styrene	µg/L	1.0	<1.0	[NA]
ortho-Xylene	µg/L	1.0	<1.0	110
Isopropylbenzene	µg/L	1.0	<1.0	[NA]
n-Propylbenzene	µg/L	1.0	<1.0	[NA]
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	[NA]
tert-Butylbenzene	µg/L	1.0	<1.0	[NA]
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	[NA]
sec-Butylbenzene	µg/L	1.0	<1.0	[NA]
4-Isopropyltoluene	µg/L	1.0	<1.0	[NA]
n-Butyl benzene	µg/L	1.0	<1.0	[NA]

ORG-023 | Volatile Organic Compounds - Halogenated Aliphatics (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	[NA]
Chloromethane	µg/L	10	<10	[NA]
Vinyl chloride	µg/L	10	<10	[NA]
Bromomethane	µg/L	10	<10	[NA]
Chloroethane	µg/L	10	<10	[NA]
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	[NA]
1,1-Dichloroethene	µg/L	1.0	<1.0	[NA]
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	[NA]
1,1-Dichloroethane	µg/L	1.0	<1.0	107
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	[NA]
Bromochloromethane	µg/L	1.0	<1.0	[NA]
Chloroform	µg/L	1.0	<1.0	113
1,1,1-Trichloroethane	µg/L	1.0	<1.0	105
1,1-Dichloropropene	µg/L	1.0	<1.0	[NA]
Carbon Tetrachloride	µg/L	1.0	<1.0	[NA]
1,2-Dichloroethane	µg/L	1.0	<1.0	107
Trichloroethene	µg/L	1.0	<1.0	103
Dibromomethane	µg/L	1.0	<1.0	[NA]
Bromodichloromethane	µg/L	1.0	<1.0	103
1,1,2-Trichloroethane	µg/L	1.0	<1.0	[NA]
1,3-Dichloropropane	µg/L	1.0	<1.0	[NA]
Tetrachloroethene	µg/L	1.0	<1.0	111
Dibromochloromethane	µg/L	1.0	<1.0	99.3
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	[NA]
Bromoform	µg/L	1.0	<1.0	95.4
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	[NA]
1,2,3-Trichloropropane	µg/L	1.0	<1.0	[NA]

Quality Control PFK1262

ORG-023 | Volatile Organic Compounds - Halogenated Aliphatics (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	[NA]
Hexachlorobutadiene	µg/L	1.0	<1.0	[NA]

ORG-023 | Volatile Organic Compounds - Halogenated Aromatics (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
Chlorobenzene	µg/L	1.0	<1.0	[NA]
Bromobenzene	µg/L	1.0	<1.0	[NA]
2-Chlorotoluene	µg/L	1.0	<1.0	[NA]
4-Chlorotoluene	µg/L	1.0	<1.0	[NA]
1,3-Dichlorobenzene	µg/L	1.0	<1.0	[NA]
1,4-Dichlorobenzene	µg/L	1.0	<1.0	101
1,2-Dichlorobenzene	µg/L	1.0	<1.0	[NA]
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	95.0
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	[NA]

ORG-023 | Volatile Organic Compounds - Other VOCs (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
Cyclohexane	µg/L	1.0	<1.0	115

ORG-023 | Volatile Organic Compounds - Surrogates (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
Surrogate Dibromofluoromethane	%		99.8	99.6
Surrogate Toluene-D8	%		99.1	101
Surrogate 4-Bromofluorobenzene	%		99.8	101

ORG-023_F1_TOT | Volatile TRH and BTEX (Water) | Batch BFK3714

Analyte	Units	PQL	Blank	LCS %
TRH C6-C9	µg/L	10	<10	94.9
TRH C6-C10	µg/L	10	<10	98.4
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	[NA]
Benzene	µg/L	1.0	<1.0	101
Toluene	µg/L	1.0	<1.0	104
Ethylbenzene	µg/L	1.0	<1.0	106
meta+para Xylene	µg/L	2.0	<2.0	103
ortho-Xylene	µg/L	1.0	<1.0	109
Total Xylene	µg/L	3.0	<3.0	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	[NA]
Surrogate Dibromofluoromethane	%		99.8	101
Surrogate Toluene-D8	%		99.1	103
Surrogate 4-Bromofluorobenzene	%		99.8	102

Quality Control PFK1262

ORG-020 | Semi-volatile TRH (Water) | Batch BFK3930

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3930-DUP1#	BFK3930-DUP2#		
				Samp QC RPD %	Samp QC RPD %		
TRH C10-C14	µg/L	50	<50	<50 <50 [NA]	2280 2240 1.64	95.6	101
TRH C15-C28	µg/L	100	<100	<100 <100 [NA]	3610 3800 4.93	92.4	99.3
TRH C29-C36	µg/L	100	<100	<100 <100 [NA]	1570 1800 13.4	92.3	99.0
TRH >C10-C16	µg/L	50	<50	<50 <50 [NA]	2430 2400 0.969	94.9	102
TRH >C16-C34 (F3)	µg/L	100	<100	<100 <100 [NA]	4450 4810 7.84	92.5	99.1
TRH >C34-C40 (F4)	µg/L	100	<100	<100 <100 [NA]	934 1120 17.9	89.5	97.3
Surrogate o-Terphenyl	%		83.9	88.5 79.0	91.7 79.1	95.3	89.0

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022_PAH | Polycyclic Aromatic Hydrocarbons (Water) | Batch BFK3930

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3930-DUP1#	BFK3930-DUP2#		
				Samp QC RPD %	Samp QC RPD %		
Naphthalene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	84.1	75.8
Acenaphthylene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	[NA]	[NA]
Acenaphthene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	82.3	74.3
Fluorene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	81.1	77.7
Phenanthrene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	84.5	78.9
Anthracene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	[NA]	[NA]
Fluoranthene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	82.0	80.0
Pyrene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.20 <0.20 [NA] [4]	83.4	80.3
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	[NA]	[NA]
Chrysene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	75.7	65.9
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20 <0.20 [NA]	<0.20 <0.20 [NA]	[NA]	[NA]
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	72.3	62.9
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	[NA]	[NA]
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	[NA]	[NA]
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10 <0.10 [NA]	<0.10 <0.10 [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	%		81.1	86.5 77.2	85.2 75.8	83.3	75.1

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFK1262

ORG-022_OC | Organochlorine Pesticides (Water) | Batch BFK3930

Analyte	Units	PQL	Blank	DUP1			DUP2			LCS %	Spike % BFK3930-MS2 #
				BFK3930-DUP1#			BFK3930-DUP2#				
				Samp	QC	RPD %	Samp	QC	RPD %		
alpha-BHC	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	80.2	74.9
Hexachlorobenzene	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
beta-BHC	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	77.5	77.2
gamma-BHC	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
delta-BHC	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Heptachlor	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	84.4	72.5
Aldrin	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	79.0	42.2[3]
Heptachlor epoxide	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	81.7	75.0
trans-Chlordane	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
cis-Chlordane	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Endosulfan I	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
4,4'-DDE	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	78.7	60.5
Dieldrin	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	82.7	74.6
Endrin	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	77.9	75.6
4,4'-DDD	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	84.0	73.3
Endosulfan II	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Endrin aldehyde	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
4,4'-DDT	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Endosulfan sulfate	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	60.4	67.5
Endrin ketone	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Methoxychlor	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Mirex	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Surrogate 4-chloro-3-nitrobenzotrifluoride	%		75.7	86.7 / 72.5			83.0 / 71.9			85.4	75.6

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022 | Organophosphorus Pesticides (Water) | Batch BFK3930

Analyte	Units	PQL	Blank	DUP1			DUP2			LCS %	Spike %
				BFK3930-DUP1#			BFK3930-DUP2#				
				Samp	QC	RPD %	Samp	QC	RPD %		
Dichlorvos	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	79.9	73.2
Dimethoate	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Diazinon	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Chlorpyrifos-methyl	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	76.2	72.7
Ronnel	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	75.7	72.7
Fenitrothion	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	70.8	77.9
Malathion	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	75.6	79.2
Chlorpyrifos	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	75.8	70.4
Parathion	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	74.5	80.7
Bromophos-ethyl	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Ethion	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	76.1	67.5
Coumaphos	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Disulfoton	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Fenamiphos	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Fenthion	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Methidathion	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Mevinphos	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Parathion-methyl	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Phorate	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Phosalone	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Azinphos-methyl	µg/L	0.20	<0.20	<0.20	<0.20	[NA]	<0.20	<0.20	[NA]	[NA]	[NA]
Surrogate 4-chloro-3-nitrobenzotrifluoride	%		75.7	86.7 / 72.5			83.0 / 71.9			85.4	75.6

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFK1262

METALS-022 | Dissolved Low Level Metals (Water) | Batch BFK3476

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3476-DUP1#	PFK1262-01		
				Samp QC RPD %	Samp QC RPD %		
Aluminium	mg/L	0.010	<0.010	0.0116 0.0109 [NA]	0.214 0.223 4.23	102	82.1
Arsenic	mg/L	0.0010	<0.0010	0.00126 0.00130 [NA]	0.00202 0.00208 [NA]	105	112
Barium	mg/L	0.0010	<0.0010	0.0218 0.0218 0.316	0.00999 0.00997 0.271	104	105
Beryllium	mg/L	0.00050	<0.00050	<0.00050 <0.00050 [NA]	<0.00050 <0.00050 [NA]	103	98.5
Boron	mg/L	0.020	<0.020	1.38 1.45 4.85	0.0709 0.0656 [NA]	105	##[1]
Cadmium	mg/L	0.00010	<0.00010	<0.00010 <0.00010 [NA]	<0.00010 <0.00010 [NA]	109	102
Chromium	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	102	105
Cobalt	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	104	104
Copper	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	0.00135 0.00132 [NA]	100	95.1
Iron	mg/L	0.010	<0.010	0.0527 0.0525 0.245	0.645 0.645 0.0329	106	107
Lead	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	102	97.3
Manganese	mg/L	0.0010	<0.0010	0.0235 0.0238 1.27	0.0139 0.0143 2.87	99.0	82.6
Molybdenum	mg/L	0.0010	<0.0010	0.00164 0.00168 [NA]	0.0101 0.0104 2.90	104	110
Nickel	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	103	104
Selenium	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	109	108
Silver	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	106	98.9
Tin	mg/L	0.0010	<0.0010	<0.0010 <0.0010 [NA]	<0.0010 <0.0010 [NA]	109	111
Zinc	mg/L	0.0010	<0.0010	0.00344 <0.0010 [NA] [5]	0.00331 0.00298 [NA]	100	94.6

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022 REE | Dissolved Low Level Metals (Water) | Batch BFK3480

Analyte	Units	PQL	Blank	DUP1		LCS %	Spike %
				PFK1262-01			
				Samp QC RPD %			
Gold	mg/L	0.0010	<0.0010	<0.0010	<0.0010 [NA]	105	##[2]

METALS-021 | Dissolved Low Level Metals (Water) | Batch BFK4173

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK4173-DUP1#	BFK4173-DUP2#		
				Samp QC RPD %	Samp QC RPD %		
Mercury	mg/L	0.000050	<0.000050	<0.000050 <0.000050 [NA]	<0.000050 <0.000050 [NA]	108	106

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-001 | Inorganics - Physical Parameters (Water) | Batch BFK3515

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %
				BFK3515-DUP1#	BFK3515-DUP2#	
				Samp QC RPD %	Samp QC RPD %	
pH	pH units		5.8	7.0 7.0 0.00	8.0 8.0 0.126	102
Electrical Conductivity	µS/cm	2.0	<2.0	242 235 2.90	677 663 1.99	99.1

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-018 | Inorganics - Physical Parameters (Water) | Batch BFK3944

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %
				BFK3944-DUP1#	BFK3944-DUP2#	
				Samp QC RPD %	Samp QC RPD %	
Total Dissolved Solids	mg/L	5.0	<5.0	545 548 0.549	1980 1780 10.6	101

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFK1262

METALS-020 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFK3479

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3479-DUP1#	BFK3479-DUP2#		BFK3479-MS1#
				Samp QC RPD %	Samp QC RPD %		
Calcium	mg/L	0.50	<0.50	41.2 41.1 0.370	72.9 73.5 0.923	98.2	##[1]
Magnesium	mg/L	0.50	<0.50	34.9 34.6 0.866	1.28 1.30 [NA]	97.6	##[1]
Potassium	mg/L	0.50	<0.50	12.3 12.3 0.0244	14.4 14.3 0.502	104	87.5
Sodium	mg/L	0.50	<0.50	255 254 0.326	232 237 2.22	98.6	##[1]
Hardness (calc) equivalent CaCO3	mg/L	3.0	<3.0	247 245 0.659	187 189 0.938	[NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-006 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFK3515

Analyte	Units	PQL	Blank	DUP1			DUP2			LCS %
				BFK3515-DUP1#			BFK3515-DUP2#			
				Samp	QC	RPD %	Samp	QC	RPD %	
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	47.3	49.4	4.32	86.4	85.6	0.919	[NA]
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0	[NA]	<5.0	<5.0	[NA]	[NA]
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0	[NA]	<5.0	<5.0	[NA]	[NA]
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	47.3	49.4	4.32	86.4	85.6	0.911	97.5

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-081 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFK3974

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3974-DUP1#	BFK3974-DUP2#		
				Samp QC RPD %	Samp QC RPD %		
Chloride	mg/L	1.0	<1.0	98.9 99.1 0.182	511 512 0.0462	91.4	87.8
Sulfate	mg/L	1.0	<1.0	32.8 33.0 0.578	55.0 55.0 0.0871	87.7	100

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-026 | Inorganics - Miscellaneous and Common Anions (Water) | Batch BFK3820

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3820-DUP1#	BFK3820-DUP2#		BFK3820-MS1#
				Samp QC RPD %	Samp QC RPD %		
Fluoride	mg/L	0.10	<0.10	0.149 0.155 [NA]	0.272 0.269 [NA]	112	106

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127 | Inorganics - Nutrients (Water) | Batch BFK3450

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3450-DUP1#	BFK3450-DUP2#		BFK3450-MS1#
				Samp QC RPD %	Samp QC RPD %		
Total Nitrogen	mg/L	0.10	<0.10	2.13 2.31 [NA]	3.43 3.04 12.0	111	110

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057 | Inorganics - Nutrients (Water) | Batch BFK3765

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				BFK3765-DUP1#	BFK3765-DUP2#		
				Samp QC RPD %	Samp QC RPD %		
Ammonia as N	mg/L	0.0050	<0.0050	0.00544 0.00540 [NA]	<0.0050 <0.0050 [NA]	94.7	94.3
Nitrate as N	mg/L	0.0050	<0.0050	3.80 3.83 0.721	0.00808 0.00760 [NA]	117	118
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	0.0181 0.0182 [NA]	<0.0050 <0.0050 [NA]	110	126
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	3.82 3.85 0.720	0.00924 0.00835 [NA]	117	118
Phosphate as P	mg/L	0.0050	<0.0050	0.0244 0.0229 [NA]	<0.0050 <0.0050 [NA]	102	105

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFK1262

INORG-060_TP | Inorganics - Nutrients (Water) | Batch BFK3887

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %	Spike %
				PFK1262-01	BFK3887-DUP2#		
				Samp QC RPD %	Samp QC RPD %		
Total Phosphorus	mg/L	0.010	<0.010	1.40 1.31 6.58	0.172 0.155 10.5	120	127

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001B | Microbiological Suite (Water) | Batch BFK3363

Analyte	Units	PQL	Blank	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	[NA]
E.coli	cfu/100mL	1	<1	[NA]

QC Comments

Identifier	Description
[1]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[2]	Spike recovery is outside routine acceptance criteria (70-130%), this may be due to suspected non-homogeneity and/or matrix interference effects. However, an acceptable recovery was achieved for the LCS.
[3]	Spike recovery is outside routine acceptance criteria (60-140%). Where recoveries of <20% and >200% are attributable to matrix interference effects, there will be a high uncertainty associated with the parent result.
[4]	PQL(s) has/have been raised due to interferences from analytes (other than those being tested) in sample.
[5]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.

APPENDIX D

Preliminary & detailed Site Investigation Report –
Laboratory Results Summary (WEPL)

Table 2
Groundwater Laboratory Analytical Results

	Halogenated Benzenes	Herbicides											Organochlorine Pesticides									
	Hexachlorobenzene	2,4,5-Trichlorophenoxy Acetic Acid	2,4,5-TP (Silvex)	Hedonal	2,4-Dichlorprop	4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	Dicamba	Dinoseb	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-Chlorophenoxy Butanoic Acid		Thiobencarb	Organochlorine pesticides EPAVic	Other organochlorine pesticides EPAVic	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	d-BHC	
	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL	0.01	0.001	0.001	0.001	0.001	1	1	1	1	1	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs	0.1 ^{#8}	0.036 ^{#1}	NE	0.28 ^{#1}	NE	NE	NE	NE	NE	NE	NE	0.0028 ^{#1}	NE	NE	NE	NE	NE	NE	NE	0.08 ^{#1}	NE	
ANZG (2018) Freshwater 99% LOSP Toxicant DGVs - Bioaccumulating Toxicant	0.05 ^{#13}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
WHO Drinking Water Quality Guidelines 4th Ed	NE	NE	NE	NE	NE	90	NE	NE	NE	NE	10	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
ANZECC 2000 Irrigation Long Term Trigger Values	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
DOH NPUG	NE	1	0.01	0.3	1	NE	1,000	NE	400	NE	NE	0.4	NE	NE	NE	NE	NE	3	NE	20	NE	

Field ID	Sample Code	Date																			
WS01D	L21-No58205	22/11/2021	<0.01	<0.001	<0.001	<0.001	<0.001	<1	<1	<1	<1	<1	200	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
WS01D	L22-Ja21198	20/01/2022	-	<0.001	<0.001	<0.001	<0.001	<1	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-

Comments

#1 Moderate reliability

#2 High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#3 Very high reliability

#4 Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#5 Low reliability

#6 High reliability

#7 Unknown reliability. Recommended for application for slightly to moderately disturbed ecosystems.

#8 Unknown reliability

#9 High reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species).

#10 Low reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#11 Moderate reliability. DGV may not protect key test species from acute (and chronic) toxicity. Check toxicant DGV technical brief for spread of data and its significance. This DGV is greater than the value for acute toxicity (Warne et al., 2018).

#12 Inorganic, Accounting for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection level DGV is used for slightly to moderately disturbed systems.

#13 Accounting for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection level DGV is used for slightly to moderately disturbed systems.

#14 Recommended for application for slightly to moderately disturbed ecosystems (to protect key species from chronic toxicity).

#15 Recommended for application for slightly to moderately disturbed ecosystems (to protect key species from chronic toxicity). However, this DGV may still not protect key test species from chronic toxicity.

#16 To account for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection level DGV is used for slightly to moderately disturbed systems.

#17 Recommended for application for slightly to moderately disturbed ecosystems (to protect key species from acute and chronic toxicity).

#18 A: Provisional guideline value because calculated guideline value is below the achievable quantification level. T: Provisional guideline value because the calculated guideline value is below the level that can be achieved through practical treatment methods, source protection etc.

#19 P: Provisional guideline value because of uncertainties in the health database.

#20 Staining of laundry and sanitary ware may occur below guideline value

#21 C: Concentrations of the substance at or below the health-based guideline value may affect the appearance, taste or odour of the water leading to consumer complaints.

#22 Volume of water consumed and intake from other sources should be considered when setting national standards

#23 Applies to aldicarb sulfoxide and aldicarb sulfone

#24 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.

#25 To obtain F2 subtract naphthalene from the >C10 - C16 fraction.

#26 for groundwater systems

#27 To minimise bioclogging of irrigation equipment

#28 Value less than 10x health value due to health effects on livestock and domestic animals

#29 Ammonia as NH3 has been calculated from Ammonia as N

Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs

ANZG, March 2021, ANZG (2018) Freshwater 99% LOSP Toxicant DGVs - Bioaccumulating Toxicant

World Health Organization, 2011, WHO DWQG 4th Ed

2013, NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand

DoE, 2000, ANZECC 2000 Irrigation Long Term Trigger Values

DoH, 2014, DOH NPUG

APPENDIX E

Stormwater Modelling Results



Environmental and Water Resource Software

PCSump Version 6.1



Project Number/Name: J7370: Lot 132, 9035 & Part Lot 9001 Lyon Rd, Wand: LWN

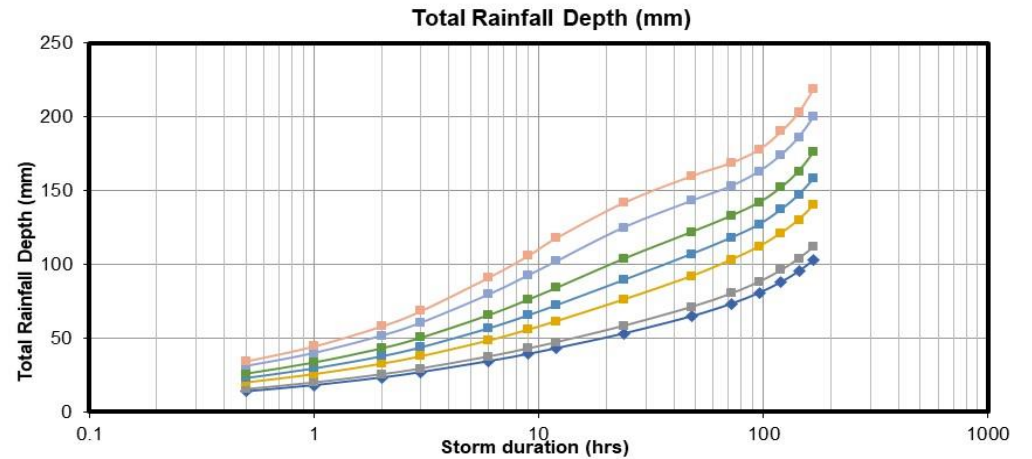
Project Description:
Southern Catchment
Drainage Basin - 1% AEP

Model Selection:	Deep Water Table Model
Design AEP(EY)/ARI	1% AEP (100 year ARI)
Design Rainfall Region:	Perth Metro
Design Rainfall Location:	CUSTOM
Latitude:	32.1875 (S)
Longitude:	115.8625 (E)
Temporal Pattern:	West Flatlands
Climate Change Selection (Y/N)	N
Effective Service Life	
Consequence of Failure	
Adjustment Applied	

Swale Selection (Y/N) N

Total Rainfall Depth (mm)							
Duration	EY	Annual Exceedance Probability (AEP)					
	1 EY	50%	20%	10%	5%	2%	1%
30 min	13.9	15.3	19.9	23.2	26.4	31	34.5
1 hour	18.1	19.8	25.5	29.7	33.9	39.8	44.6
2 hour	23.3	25.4	32.6	37.9	43.5	51.6	58.2
3 hour	27	29.4	37.7	44	50.7	60.4	68.6
6 hour	34.4	37.5	48.3	56.8	65.9	79.5	91.2
9 hour	39.3	43	55.7	65.6	76.4	92.5	106
12 hour	43.2	47.2	61.4	72.4	84.3	102	118
24 hour	53.2	58.4	76.1	89.5	104	125	142
48 hour	64.9	71.2	91.9	107	122	143	160
72 hour	73.3	80.3	103	118	133	153	169
96 hour	80.8	88.3	112	127	142	163	178
120 hour	88	96.1	121	137	152	174	190
144 hour	95.3	104	130	147	163	186	203
168 hour	103	112	140	158	176	200	219

Basin:



Type	Area (ha)	IL (mm)	CL (mm/hr)	PL(%)
Lots	2.883	15	10	
Road Reserve	1.015	1.5		10.0%

Basin Parameters:

Soil Characteristics:	
Saturated Hydraulic Cond. (m/day)	5
Clogged Layer Permeability (m/day)	
Clogged Layer Thickness (mm)	
Soil Suction (cm)	-5
Porosity	0.2
Aquifer Storage Coefficient	
Base of Aquifer (mAHD)	
Design Groundwater Level (mAHD)	
Initial Conditions:	
Water Depth in Basin (m)	0
Wetting Front Depth (m)	0
Initial Degree of Soil Saturation (%)	20%
Basin Geometry:	
Stage-Area-Volume Relationship Entered (Y/N)	N
Base Length (m)	372
Base Width (m)	2.5
Average Slope (1 in X)	0.000001
Basin Base Elevation (mAHD)	26
Maximum Allowable TWL (mAHD)	27

Pipe Outflow:

Entrance Type	
Pipe Diameter (mm)	
Pipe Length (m)	
Upstream Invert Level (mAHD)	
Downstream Invert Level (mAHD)	

Weir Outflow:

Weir Type:	
Weir Coefficient	
Weir Width (m)	
Weir Level (mAHD)	

**Project Number / Name:**

J7370: Lot 132, 9035 & Part Lot 9001 Lyon Rd, Wand: LWMS

Project Description:

Southern Catchment

Drainage Basin - 1% AEP

Model Selection:**Deep Water Table Model****Results:**

Critical	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m³]	Area [m²]	Temporal Pattern No.
	1	30 min	34.5	1%	0.69	26.69	0.31	637	930	8
	2	1 hour	44.6	1%	0.87	26.87	0.13	806	930	1
	3	2 hour	58.2	1%	1	27.00	0.00	931	930	3
	4	3 hour	68.6	1%	0.94	26.94	0.06	875	930	7
	5	6 hour	91.2	1%	0.81	26.81	0.19	751	930	9
	6	9 hour	106.0	1%	0.63	26.63	0.37	584	930	2
	7	12 hour	118.0	1%	0.44	26.44	0.56	409	930	9
	8	24 hour	142.0	1%	0.31	26.31	0.69	291	930	7
	9	48 hour	160.0	1%	0.02	26.02	0.98	18	930	8
	10	72 hour	169.0	1%	0	26.00	1.00	-	930	1
	11	96 hour	178.0	1%	0	26.00	1.00	-	930	1
	12	120 hour	190.0	1%	0	26.00	1.00	-	930	1
	13	144 hour	203.0	1%	0.2	26.20	0.80	183	930	9
14	168 hour	219.0	1%	0	26.00	1.00	-	930	1	
	3	2 hour	58.2	1%	1	27.00	0.00	931	930	3

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured **Red**, Maximum Capacity of the Basin has been Exceeded



Environmental and Water Resource Software

PCSump Version 6.1



Project Number/Name: J7370: Lot 132, 9035 & Part Lot 9001 Lyon Rd, Wand: LWN

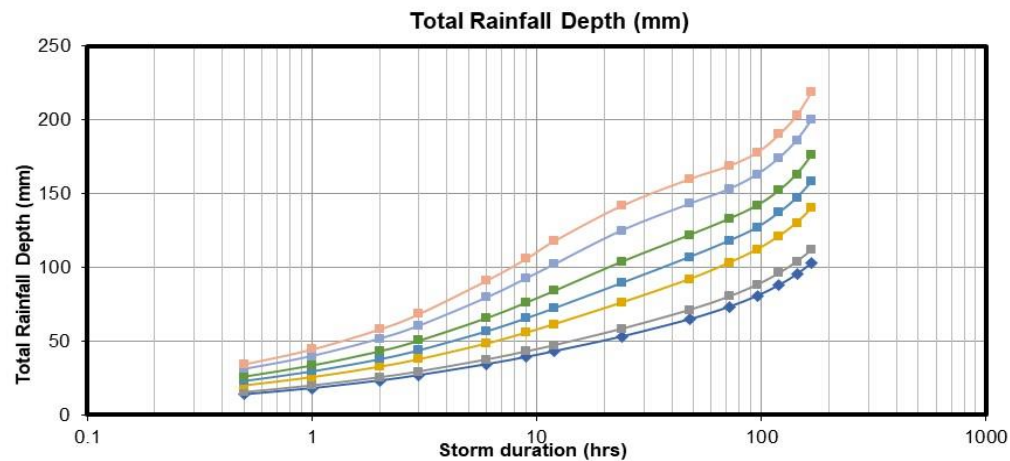
Project Description: Southern Catchment
Drainage Basin - 1% AEP

Model Selection:	Deep Water Table Model
Design AEP(EY)/ARI	20% AEP (4.48 year ARI)
Design Rainfall Region:	Perth Metro
Design Rainfall Location:	CUSTOM
Latitude:	32.1875 (S)
Longitude:	115.8625 (E)
Temporal Pattern:	West Flatlands
Climate Change Selection (Y/N)	N
Effective Service Life	
Consequence of Failure	
Adjustment Applied	

Swale Selection (Y/N) N

Total Rainfall Depth (mm)							
Duration	EY	Annual Exceedance Probability (AEP)					
	1 EY	50%	20%	10%	5%	2%	1%
30 min	13.9	15.3	19.9	23.2	26.4	31	34.5
1 hour	18.1	19.8	25.5	29.7	33.9	39.8	44.6
2 hour	23.3	25.4	32.6	37.9	43.5	51.6	58.2
3 hour	27	29.4	37.7	44	50.7	60.4	68.6
6 hour	34.4	37.5	48.3	56.8	65.9	79.5	91.2
9 hour	39.3	43	55.7	65.6	76.4	92.5	106
12 hour	43.2	47.2	61.4	72.4	84.3	102	118
24 hour	53.2	58.4	76.1	89.5	104	125	142
48 hour	64.9	71.2	91.9	107	122	143	160
72 hour	73.3	80.3	103	118	133	153	169
96 hour	80.8	88.3	112	127	142	163	178
120 hour	88	96.1	121	137	152	174	190
144 hour	95.3	104	130	147	163	186	203
168 hour	103	112	140	158	176	200	219

Basin:



Type	Area (ha)	IL (mm)	CL (mm/hr)	PL(%)
Lots	2.883	15	10	
Road Reserve	1.015	1.5		10.0%

Basin Parameters:

Soil Characteristics:	
Saturated Hydraulic Cond. (m/day)	5
Clogged Layer Permeability (m/day)	
Clogged Layer Thickness (mm)	
Soil Suction (cm)	-5
Porosity	0.2
Aquifer Storage Coefficient	
Base of Aquifer (mAHD)	
Design Groundwater Level (mAHD)	
Initial Conditions:	
Water Depth in Basin (m)	0
Wetting Front Depth (m)	0
Initial Degree of Soil Saturation (%)	20%
Basin Geometry:	
Stage-Area-Volume Relationship Entered (Y/N)	N
Base Length (m)	372
Base Width (m)	2.5
Average Slope (1 in X)	0.000001
Basin Base Elevation (mAHD)	26
Maximum Allowable TWL (mAHD)	27

Pipe Outflow:

Entrance Type	
Pipe Diameter (mm)	
Pipe Length (m)	
Upstream Invert Level (mAHD)	
Downstream Invert Level (mAHD)	

Weir Outflow:

Weir Type:	
Weir Coefficient	
Weir Width (m)	
Weir Level (mAHD)	

**Project Number / Name:**

J7370: Lot 132, 9035 & Part Lot 9001 Lyon Rd, Wand: LWMS

Project Description:

Southern Catchment

Drainage Basin - 1% AEP

Model Selection:**Deep Water Table Model****Results:**

Critical	Design Storms			Maximum (Mean of Temporal Patterns)						
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m³]	Area [m²]	Temporal Pattern No.
	1	30 min	19.9	20%	0.17	26.17	0.83	161	930	1
	2	1 hour	25.5	20%	0.21	26.21	0.79	195	930	2
	3	2 hour	32.6	20%	0.24	26.24	0.76	222	930	4
	4	3 hour	37.7	20%	0.21	26.21	0.79	195	930	1
	5	6 hour	48.3	20%	0.17	26.17	0.83	162	930	3
	6	9 hour	55.7	20%	0.09	26.09	0.91	86	930	3
	7	12 hour	61.4	20%	0.04	26.04	0.96	38	930	9
	8	24 hour	76.1	20%	0.02	26.02	0.98	20	930	6
	9	48 hour	91.9	20%	0	26.00	1.00	-	930	1
	10	72 hour	103.0	20%	0	26.00	1.00	-	930	1
	11	96 hour	112.0	20%	0	26.00	1.00	-	930	1
	12	120 hour	121.0	20%	0	26.00	1.00	-	930	1
	13	144 hour	130.0	20%	0	26.00	1.00	-	930	1
	14	168 hour	140.0	20%	0	26.00	1.00	-	930	1
3	2 hour	32.6	20%	0.24	26.24	0.76	222	930	4	

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured **Red**, Maximum Capacity of the Basin has been Exceeded

Suite 1, 27 York St, Subiaco WA 6008
PO Box 117, Subiaco WA 6904
Ph: +61 8 9388 2436

www.jdahydro.com.au

info@jdahydro.com.au

