Kalamunda U7 (Agreement Area 2, 3 & 4) Structure Plan Amendment Report

Lot 17 (228) Sultana Road, Forrestfield

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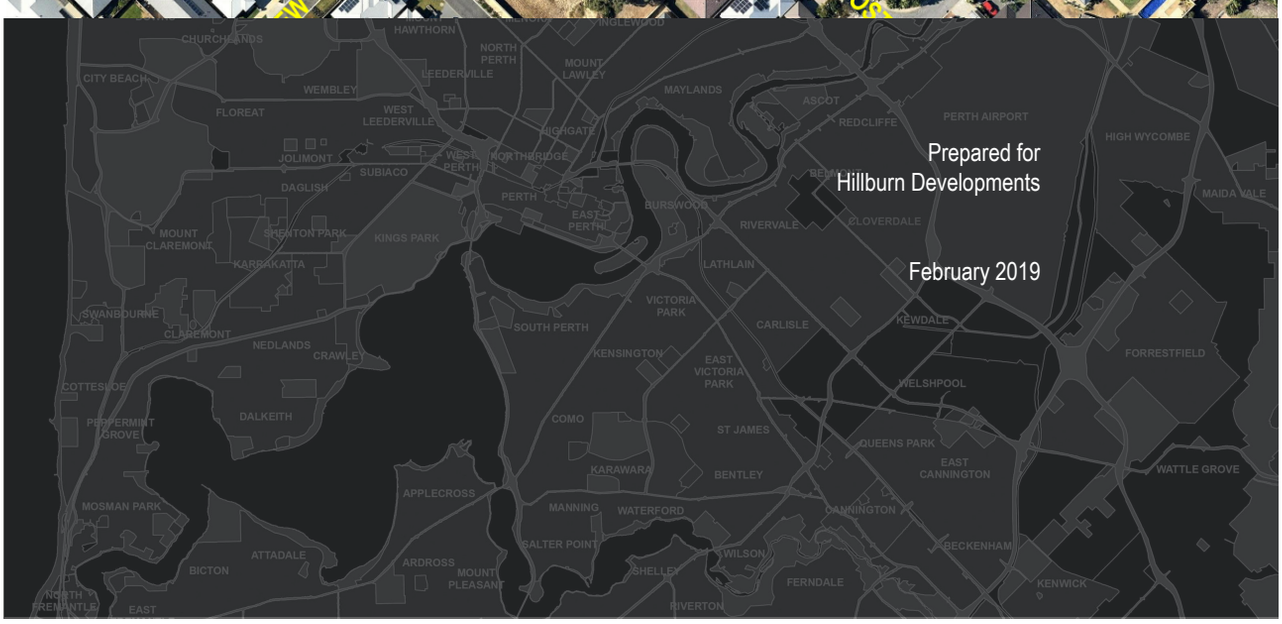

Prepared for
Hillburn Developments

February 2019

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Project details

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Document control

Revision number	File name	Document date
Rev 0	190412 5816 Structure Plan amendment report	12 April 2019

Endorsement page

This structure plan is prepared under the provisions of the
City of Kalamunda Local Planning Scheme No.3

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS ADOPTED BY
RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON

…….....Date

Signed for and on behalf of the Western Australian Planning Commission

……..…….....Signature

an officer of the Commission duly authorised by the Commission pursuant to section 16 of the Planning and Development Act 2005 for that purpose, in the presence of:

……..... Witness

……..... Date

……..... Date of Expiry

Table of amendments

Amendment No.	Summary of the Amendment	Amendment type	Date approved by WAPC
N/A	Unknown	Minor	13th February 2013
N/A	Increasing the residential density coding of Lot 16 (228) Sultana Road, deleting a portion of road, and extending Mangosteen Drive.	Minor	

Executive summary

This amendment to the Outline Development Plan for Agreement Areas 2, 3 & 4 Forrestfield U7 applies to Lot 17 (228) Sultana Road East, Forrestfield (**subject site**) within the municipality of the City of Kalamunda (**City**). It forms part of a broader development area that is progressively being developed for residential purposes. Under the *Planning and Development (Local Planning Schemes) Regulations 2015* (LPS Regs) Outline Development Plans (or similar) are now defined as a 'Structure Plan'. Consequently, the Outline Development Plan for Agreement Areas 2, 3 & 4 Forrestfield U7 will be referred to here in as the Forrestfield U7 Structure Plan (**U7SP**).

The U7SP was originally approved by the Western Australian Planning Commission (**WAPC**) in 15 June 1998. The latest amendment to the U7SP was approved by the WAPC on 13 February 2013.

The proposed amendment is intended to facilitate a more efficient subdivision of the subject site for residential purposes. The justification and rationale for the proposed mix of residential densities, and changes to the movement network are contained within this report, with details provided on the planning background, site conditions and proposed concept plan.

The proposed amendment is intended to provide the necessary information and justification to support the subject site being developed into approximately 32 single residential lots.

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Appendices

1 Introduction

Planning Solutions acts on behalf of Hilburn Developments who act on behalf of the owners of Lot 17 (228) Sultana Road East, Forrestfield (**subject site**).

Planning Solutions has prepared the following report in support of a minor amendment to the U7SP as it applies to the subject site. The amendment changes the structure plan in the following ways:

- Recoding R12.5 and R20 coded land within the subject site to R25, and R40 respectively.
- Removing a section of proposed road connecting Sultana Road to Mangosteen Drive to improve subdivision efficiency.
- Removing a section of proposed road connecting Quince Way and Canopy Circuit to reflect the existing lot layout.

This amendment to the Structure Plan has been prepared in accordance with the City of Kalamunda (**City**) Town Planning Scheme No. 3 (**TPS3**) and the relevant 'deemed provisions' of the *Planning and Development (Local Planning Scheme) Regulations 2015* (**LPS Regs**).

2 Background

On 10 October 1997 the Minister for Planning granted approval for Amendment No 166 to the City of Kalamunda Local Planning Scheme rezoning the land bounded by Hawtin Road, Sultana Road East, Roe Highway and Berkshire Road (known as 'Planning Unit 7' or 'U7') to Urban Development.

Following consultation with local landowners and detailed technical reporting, an Outline Development Plan was prepared in May 1998, and subsequently adopted by Council on 15 June 1998. The most recent amendment to the structure plan was approved by the WAPC on 13 February 2013.

Refer to **Figure 1** for a copy of the current Outline Development Plan.

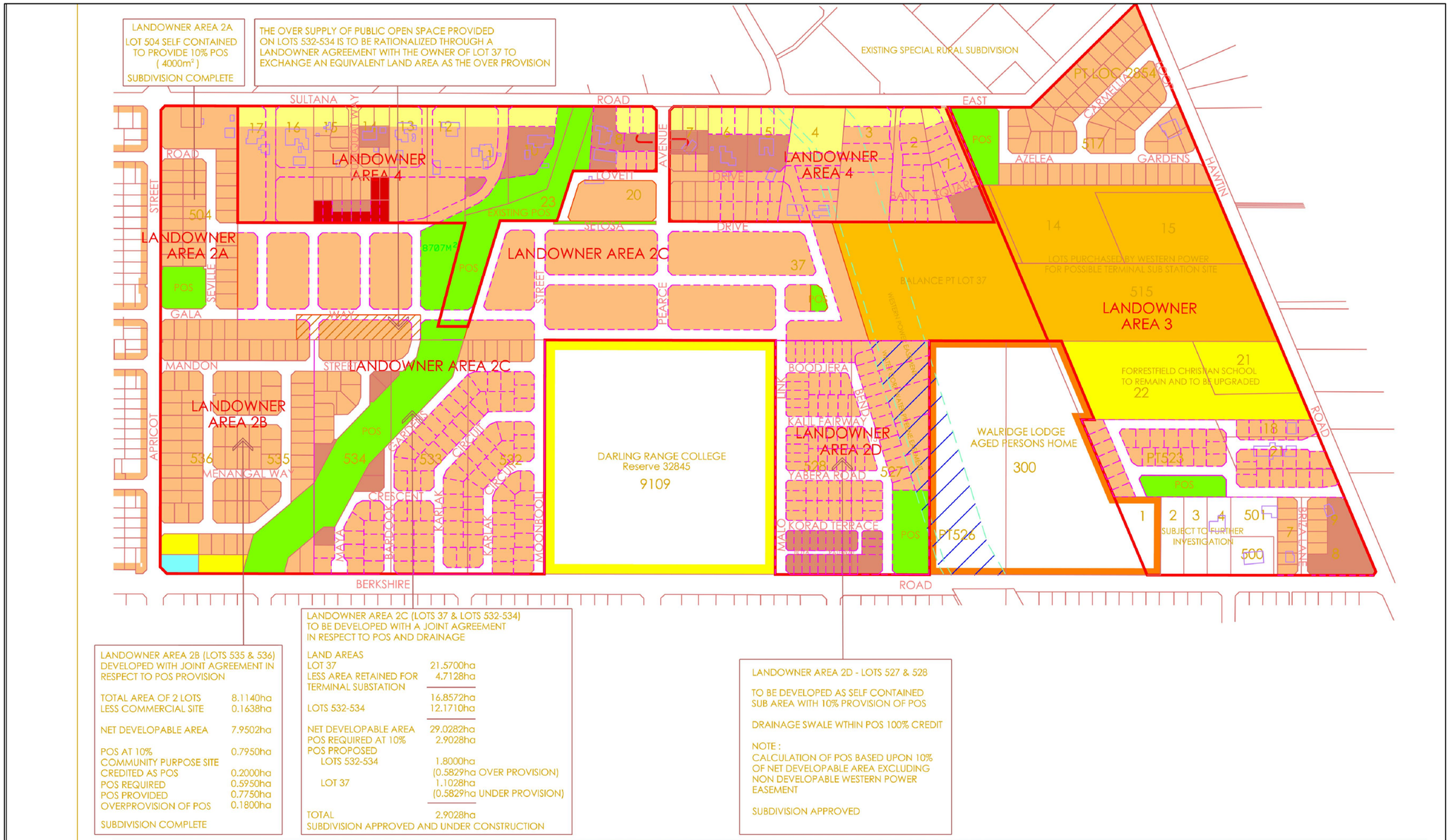
2.1 Site Context

2.1.1 Location and regional context

The subject site has a street address of 228 Sultana Road East, Forrestfield, and is located within the municipality of the City of Kalamunda. It is situated approximately 14km east of the Perth CBD, 8.5 km south of the Midland Activity Centre, and 4.3km south east of the Perth Airport.

The subject site is bound by Sultana Road East to the north, Quince Lane to the south, with residential properties adjoining the eastern and western boundaries. Both roads are sealed and gazetted. An intersection of Roe Highway and Berkshire Road is located approximately 800 metres south-west of the subject site, providing convenient access to metropolitan Perth and Peel and regions beyond.

Development of the surrounding area has occurred in a piecemeal fashion with mostly rural residential properties being subdivided on an individual basis according to the existing U7SP.



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CURRENT OUTLINE DEVELOPMENT PLAN MAP

LOT 16 (234) SULTANA ROAD EAST,
FORRESTFIELD

FIGURE
01

The area to the north of the subject site is referred to as 'Maida Vale South' and is currently zoned 'Rural'.

2.1.2 Area and land use

The subject site comprises a single lot, with an area of approximately 1 hectare (1.0001ha) and frontages of approximately 57m to Sultana Road East, and 57m to Quince Way.

The northern portion of the subject site currently contains a single residential building and an outbuilding. The remaining area of the site is generally vacant, comprising remnant vegetation.

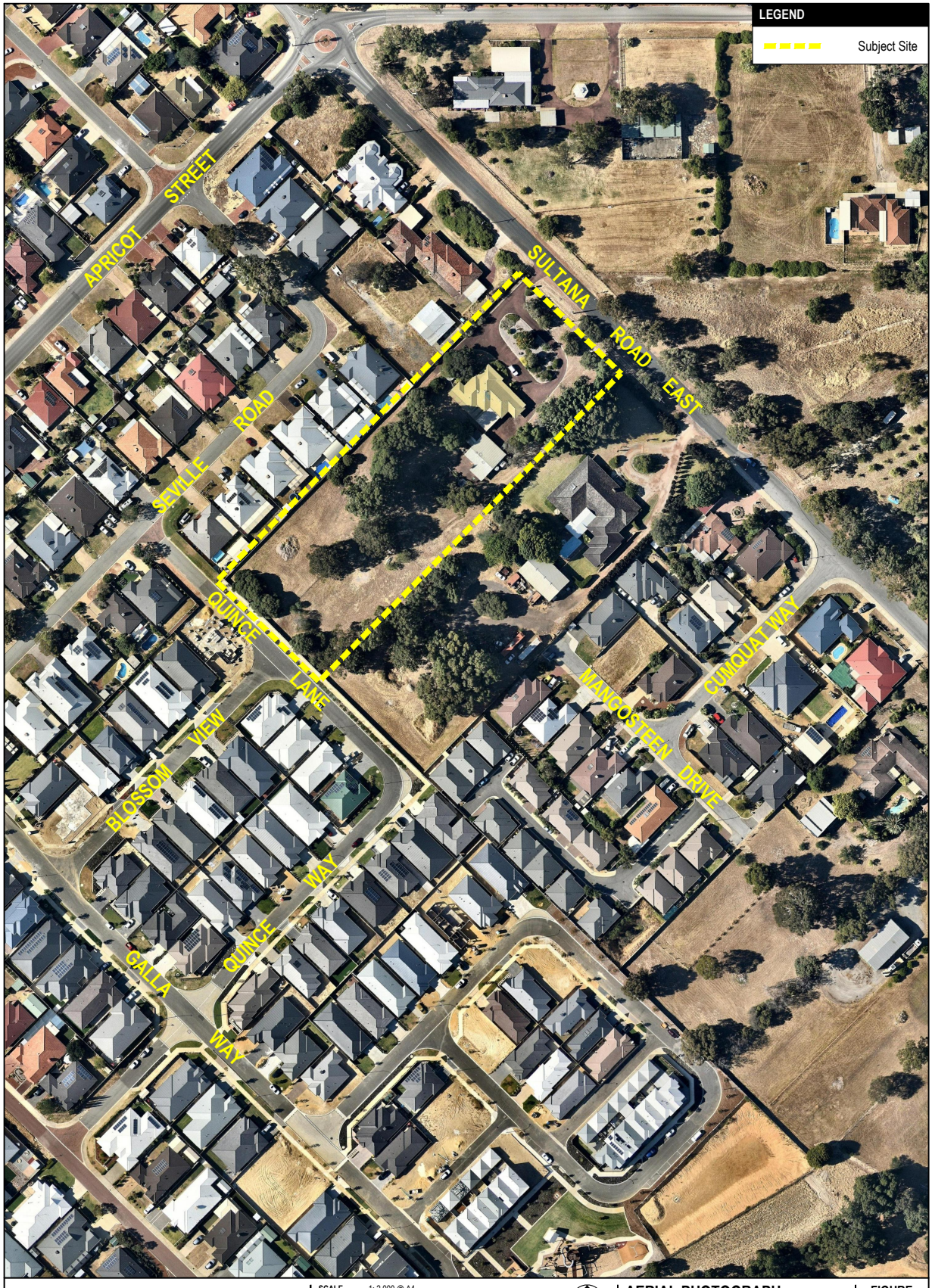
The land is surrounded by predominantly residential uses. The northern side of Sultana Road East generally contains large lot rural-residential properties, whilst to the south and west development generally comprises medium density residential development on Residential R20 zoned land.

Refer **Figure 2**, aerial photograph.

2.1.3 Legal description and ownership

The subject site is currently held in single land ownership and can be legally described as Lot 17 on Plan 13574 Volume 1595 Folio: 548.

Refer **Appendix 1** for a copy of the Certificate of Title.



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AERIAL PHOTOGRAPH

LOT 16 (234) SULTANA ROAD EAST, FORRESTFIELD, WA

FIGURE 02

3 Planning framework

3.1 Zoning and reservations

3.1.1 Metropolitan Region Scheme

Under the provisions of the Metropolitan Region Scheme (**MRS**) the subject site is zoned Urban. The proposed amendment to the structure plan is consistent with the provisions of the MRS and may be approved accordingly.

Figure 3: MRS Zoning Map

3.1.2 City of Kalamunda Town Planning Scheme No. 3

The subject site is zoned Urban Development under the provisions of the City of Kalamunda Town Planning Scheme No. 3 (**TPS3**). TPS3 zoning map. Clause 4.2.1 states the objective of the Development zone is:

> *To provide orderly and proper planning through the preparation and adoption of a Structure Plan setting the overall design principles for the area.*
>
> *To permit the development of land for residential purposes and for commercial and other uses normally associated with residential development.*

In accordance with Clause 6.2.2.1 of TPS3, Council may require a Structure Plan to cover land zoned 'Urban Development'. In this instance, U7SP has been adopted by the City and endorsed by WAPC. Consistent with the provisions of the LPS Regs and the City's TPS3, the proposed Structure Plan will guide the future subdivision and residential development of the subject site.

The proposed structure plan amendment is to be assessed and determined in accordance with Part 4, Schedule 2 – Deemed Provisions of the LPS Regs.

Refer **Figure 4** for TPS3 zoning map.

3.1.3 Outline Development Plan Agreement Areas 2, 3 & 4 Forrestfield U7

Under the provisions of U7SP, the subject site is classified 'Residential', with residential density codes of R12.5 abutting Sultana Road East, and R20 for the remainder of the site. The proposed amendment to the structure plan seeks to rezone R12.5 and R20 areas to R25 and R40 respectively.

3.1.4 Planning and Development (Local Planning Schemes) Regulations 2015

Part 4 clause 29 of Schedule 2 (**Deemed Provisions**) of the LPS Regs specify:

> *A structure plan may be amended by the Commission at the request of the local government or a person who owns land in the area covered by the plan.*

The proposed amendment has been requested by the landowner of the subject site and is therefore consistent with the Regulations.

3.2 Planning strategies

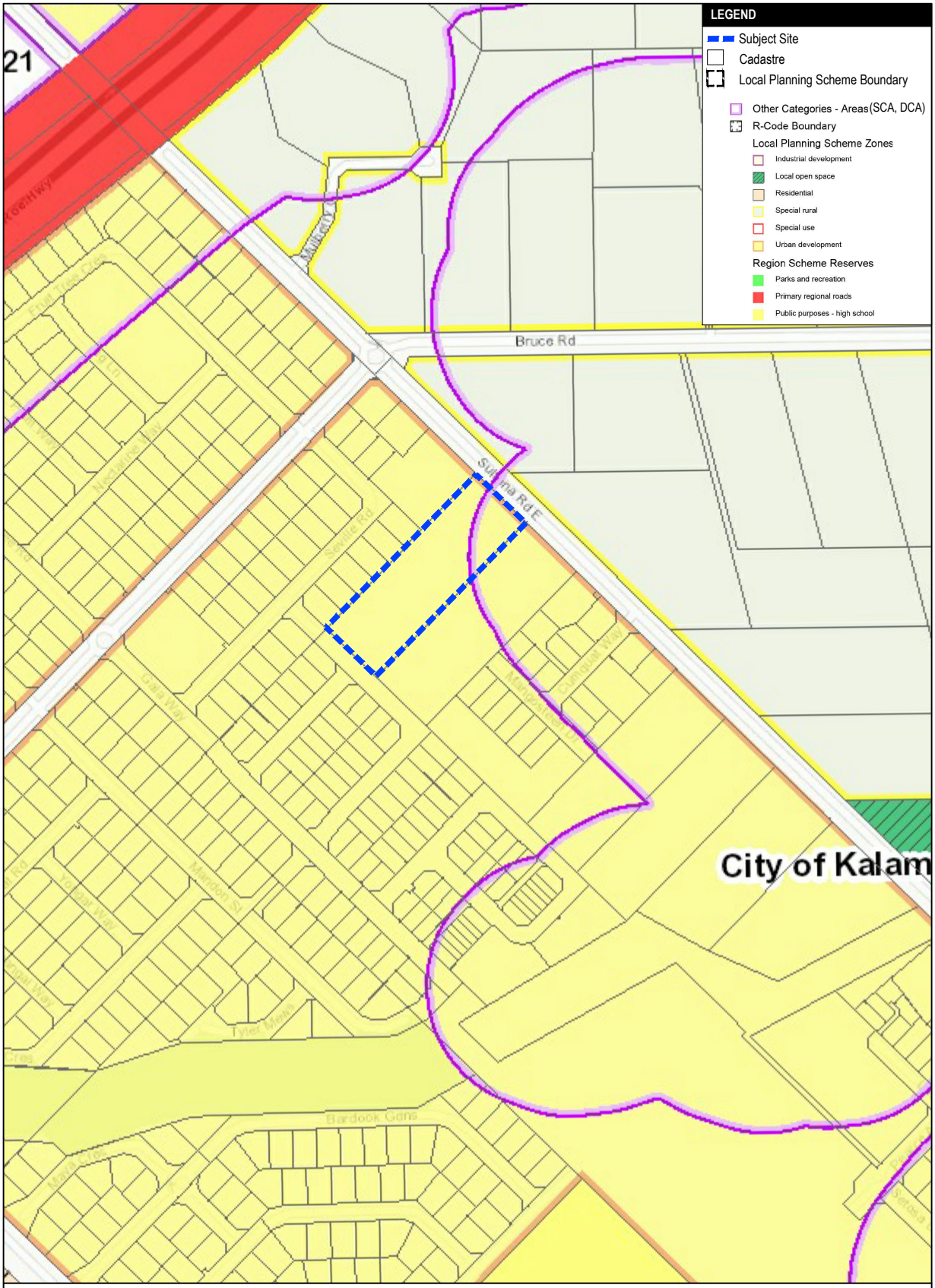
3.2.1 Directions 2031 and Beyond

Directions 2031 and Beyond (**Directions 2031**) is the overarching spatial framework and strategic plan that establishes a vision for the future growth of the Perth and Peel region. It provides the framework to guide detailed planning and delivery of housing, infrastructure and services for a variety of growth scenarios. A medium density connected city model is put forward as the preferred means to achieve a liveable, prosperous, accessible, sustainable and responsible city.

In relation to the proposed structure plan, Directions 2031 promotes a diversity of dwelling types and increased choice for residential areas. Directions 2031 seeks to address population growth scenarios and land use patterns for the medium to long-term increase of more than half a million people in Perth and Peel by 2031, as well as being prepared to provide for a city of 3.5 million people after 2050.

Directions 2031 sets a target of 15 dwellings per gross urban zoned hectare of land in new development areas. The proposed amendment to the structure plan will permit a residential density of 33 dwellings per gross urban zoned hectare for the subject site.

The proposed residential densities within this structure plan are in accordance with the Directions 2031 objectives and density targets. The subject site falls within the north-east sub-region, which is forecast to increase its population levels by approximately 60% (69,000 people), requiring an additional 40,000 dwellings by 2031.



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TPS3 ZONING MAP

LOT 16 (234) SULTANA ROAD EAST, FORRESTFIELD

FIGURE 04

3.2.2 Perth and Peel @ 3.5million and North-East sub-regional Planning Framework

Due to the size and complexity of strategic planning for the metropolitan area, the *Perth and Peel @3.5million* strategy was adopted by the WAPC in March 2018 together with a suite of sub-regional planning framework to provide guidance at the local level.

The North-East Sub-Regional Planning Framework (**Sub-Regional Framework**) is the strategic planning document that encompasses the area of Forrestfield and is intended to guide the delivery of the objectives of Directions 2031. The Sub-Regional Framework sets out proposals to meet future housing, employment and infrastructure needs while protecting environmental and landscape values.

The Sub-Regional Framework suggests the development of land zoned Urban and Urban Deferred to accommodate increased urban infill development and higher densities in undeveloped areas already zoned for urban use.

The Sub-Regional Framework identifies Kalamunda as a key growth area required to accommodate increased infill development in established urban areas. The framework provides a minimum urban infill dwelling target of 11,450 dwellings to accommodate 25,190 people by 2050, with a total dwelling target of 21,040 and additional population target of 46,770.

The proposed amendment is consistent with the strategy as follows:

- The proposed residential development within this structure plan is in accordance with the Sub-Regional Framework urban development objectives and dwelling targets for the Kalamunda local government area.
- The subject site is identified as 'Urban' under the framework and is therefore identified as suitable location for accommodating increased urban development.
- The increase in the proposed densities reflects the Framework's recommendation on increasing residential densities in greenfield developments.
- Bushfire risk assessment and appropriate levels of mitigation have been conducted in support of this amendment, consistent with the Framework recommendations.

The Framework also identifies Maida Vale South (the area directly to the north of the U7SP area containing the subject site) as an 'Urban Expansion Area'.

3.2.3 City of Kalamunda Local Planning Strategy

On 5 February 2013 the City of Kalamunda endorsed the City of Kalamunda Local Planning Strategy 2010 (**2010 Strategy**). This strategy has been prepared to provide the direction for planning and development in conjunction with TPS3.

The proposed amendment is consistent with the key objectives of the strategy applicable to the subject site as follows:

- The development of new dwelling units is described as a priority for the Forrestfield U7 area which includes the subject site.
- Growth in employment around the Perth Airport is identified as driving demand for housing in the Forrestfield area.
- Maida Vale South is identified as an 'Urban Investigation Area' and a rezoning of the area from Rural to Urban Development is proposed with the expectation that a high percentage of future residential development will occur in this formerly rural area.

3.3 Planning policies

3.3.1 State Planning Policies

State Planning Policy No. 3.1 – Residential Design Codes

State Planning Policy 3.1 - Residential Design Codes (**R-Codes**) applies to residential development in Western Australia. Clause 4.2.2 of TPS3 requires the development of land for residential purposes to conform to the provisions of the R-Codes.

The R30 and R40 density codes identified on the proposed Structure Plan are interpreted by the R-Codes. Future subdivision and residential development across the subject site are to comply with the requirements of the R-Codes. There are no additional design guidelines applicable to the subject site.

State Planning Policy No. 3.7 – Planning in Bushfire Prone Areas

State Planning Policy 3.7 – Planning in Bushfire Prone Areas (**SPP3.7**) seeks to implement effective, risk-based land use planning and development to preserve life and reduce the impact of bushfires on property and infrastructure. The policy contains objectives and policy measures, which apply to all land-use development proposals at varying stages of the development process. Refer to Section 5.3.1 of this report for further detail in relation to bushfire risk management.

Liveable Neighbourhoods

Liveable Neighbourhoods is a state policy that guides the structure planning and subdivision of large sites. The proposed amendment has been prepared in accordance with the current (January 2009) version of Liveable Neighbourhoods (**LN**). An updated version of LN was released by the Department of Planning for the purposes of public review in October 2015.

Liveable Neighbourhoods sets a target of 22 dwellings per residential site hectare for greenfield development. The draft policy proposes an increase in this target to 26 dwellings per site hectare.

The amendment would increase the potential density of the subject site from approximately 17 dwellings per site hectare, to 32 dwellings per hectare.

3.4 Pre-lodgement consultation

Prior to preparation and lodgement, the amendment to the Outline Development Plan was discussed at a meeting on 6 August 2018 between Andrew Fowler, Ivana Music and Raktim Barua from the City of Kalamunda, Bryan Slater from Hillburn Developments and Tayne Evershed from Planning Solutions.

4 Site conditions and constraints

Given the subject site is already subject to an approved Structure Plan, prior reporting continues to apply. Some additional reporting including a Bushfire Management Plan and a Geotechnical report has been undertaken, the conclusions of which are contained in the following sections and appendices.

4.1 Landform and soils

4.1.1 Topography

The subject site slopes down from the Sultana Road frontage towards the rear of the property abutting Quince Lane with site levels ranging between approximately 48.0m AHD at the northern boundary to 47.0m AHD at the southern.

Refer to **Appendix 2** Feature Survey.

4.1.2 Soils

Geological mapping for the area shows the subject site to be underlain by the sands of the Bassendean Formation.

Subsurface Conditions

Topsoil is present across much of the site to a depth of about 0.1m. The topsoil is underlain by 0.2 – 0.4m depth of fine to medium grained sand, containing gravel, trace silt with a loose to dense soil profile. The soils encountered are consistent with the expected site conditions. It is important to note that there may be pockets of fill on site that are deeper than that encountered by the investigation boreholes.

Site Classification

The site in its current condition is classified as Class "P". Based on the results of this investigation the presence of clayey sand and trace gravel means that site can be upgraded to Class "S" in accordance with AS 2870-2011 provided that all unsuitable materials are removed and replaced with engineer-controlled sand fill materials.

Drainage

The existing ground conditions are not suitable for on-site disposal of stormwater runoff through the use of soakwells. It is recommended that all stormwater from roofed, paved and driveway areas be collected and detained to reduce peak flow rates prior to discharging off site as per council requirements.

Refer to **Appendix 3**, Geotechnical Investigation report.

Acid Sulphate Soils

The subject landholding is classified as having a low to moderate risk of encountering acid sulphate soils within 3m of the natural surface. Acid sulphate soils are not considered to be a genuine risk for the development of the subject site and do not pose any constraints to development.

4.1.3 Contamination

The subject site is not listed as a contaminated site on the Department of Water and Environment Regulation (**DWER**) database.

4.2 Groundwater

There are no surface waters present on site or within 50m of the site. Ground water was not encountered in any of the boreholes during or immediately after drilling to a depth of 2.5m. However based on the Perth Groundwater Atlas, the groundwater is expected to be encountered approximately 31.0m below the existing ground level. According to a report by KCTT (Refer **Appendix 4**) the site is not likely to experience any issues with groundwater.

4.3 Bushfire hazard

The subject site has been identified by the Fire and Emergency Services Commissioner as 'Bushfire Prone'. State Planning Policy 3.7: Planning in Bushfire Prone Areas (SPP3.7) applies to all land that has been identified as Bushfire Prone and provides guidance as to how land use should address bushfire risk management.

In accordance with the requirements of SPP3.7, a Bushfire Attack Level (BAL) assessment has been undertaken by Western Australian Bushfire Assessment Logic (WABAL). Refer to **Appendix 7** for a copy of the assessment. The assessment results in a BAL of 12.5.

In accordance with SPP3.7, a Bushfire Management Plan has been prepared by to support the Amendment.

Refer to **Appendix 8**, Bushfire Management Plan.

5 Amendment Proposal

5.1 Summary of Proposal

This amendment proposes modifications to the existing structure plan as it applies to the subject lot within Landowner Area 4. The modifications involve:

- Changing the residential density of R12.5 coded land to R25
- Changing the residential density of R20 coded land to R40
- Modifications to the road network through the subject site to improve the efficiency of the subdivision layout.

Refer to **Figure 5** for the ODP Amendment Map.

5.2 Residential

5.2.1 Proposed Density Increase

As detailed above, the proposed amendment provides for the deletion of the residential coding of R12.5 and R20 and the substitution of R25 and R40 coding respectively. This increase in density is expected to yield approximately 32 lots ranging in size from 196m^2 to 427m^2. Based on an average of 2.6 persons per household (2016 ABS Census Data) the population of the subject site would be approximately 83 people.

The amendment would yield a gross density of 32 dwellings per urban hectare, and a net density of 40 dwellings per site hectare. The proposed amendment meets the density targets of Directions 2031 and Liveable Neighbourhoods.

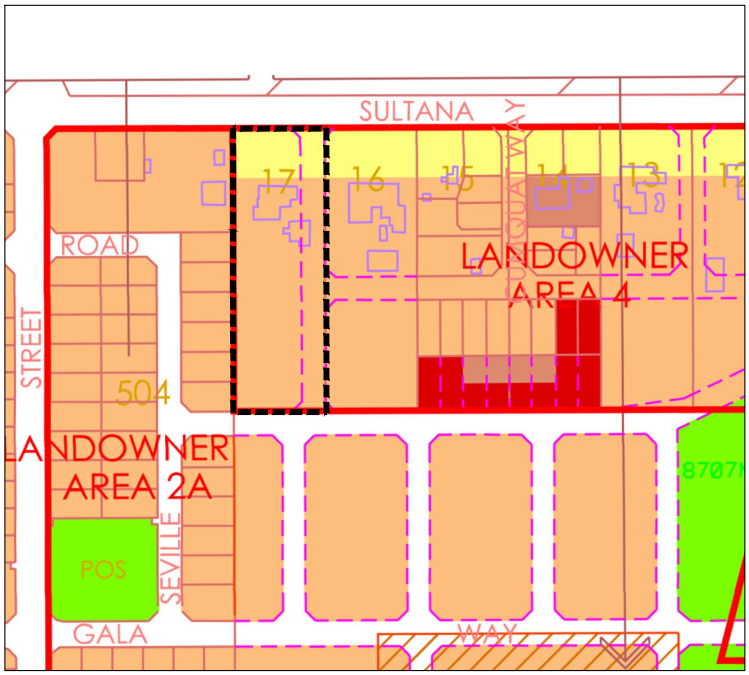
5.2.2 Rural Buffer Zone

The R12.5 coding applies to the area of the site abutting Sultana Road East, a low-density coding evidently intended as a "buffer zone" between the higher density urban development south of the Sultana Road, and the large-lot Special Rural zoned area called Maida Vale South to the north.

The structure plan was originally adopted almost two decades ago, and it is now considered that the R12.5 residential density no longer represents an optimum form of development in light of the current planning framework.

The Sub-regional Framework identifies rural residential development as a relatively inefficient form of development that "can prejudice other future planning options", and that it will become an increasingly limited housing option in future. It specifically identifies the Maida Vale South as an 'Urban Expansion Area'. The City of Kalamunda's local planning strategy identifies Maida Vale South as a future urban centre, and according to their latest guidance, the process of preparing a scheme amendment and structure plan is already underway. When this has been initiated it will propose rezoning the area from Rural to Urban Development.

CITY OF KALAMUNDA
AMENDMENT TO ODP FORRESTFIELD U7

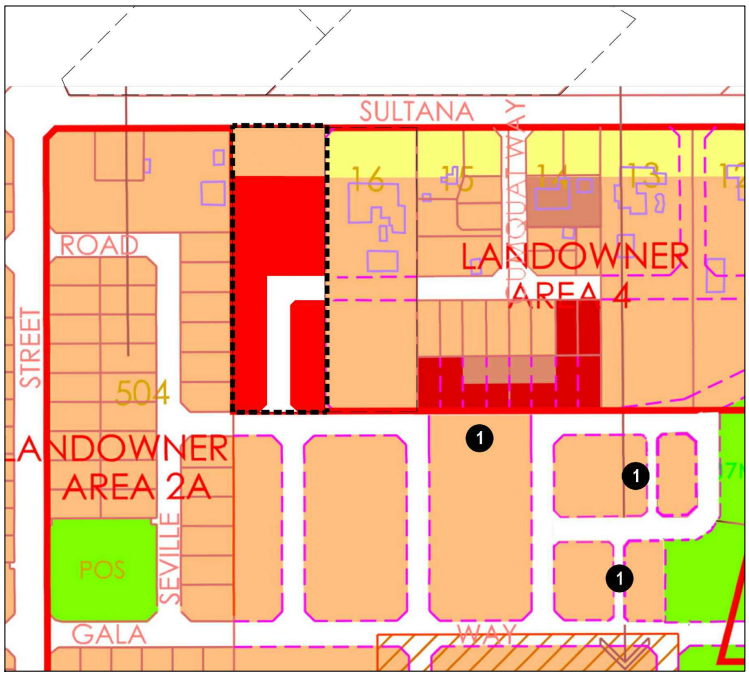


LEGEND

RESIDENTIAL CODES

- Residential R12.5
- Residential R20
- Residential R30
- Residential R40

EXISTING ODP PLAN



LEGEND

RESIDENTIAL CODES

- Residential R12.5
- Residential R20
- Residential R30
- Residential R40

1. Existing ODP does not reflect Lot and Road Layout as constructed. The ODP has been updated to reflect these changes.

PROPOSED ODP PLAN

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SCALE	1:3,000 @ A4
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OUTLINE DEVELOPMENT PLAN AMENDMENT MAP
LOT 16 (234) SULTANA ROAD EAST, FORRESTFIELD

FIGURE 05

Given the changes to the strategic framework and the future development of the adjacent area, the continuation of a R12.5 buffer zone for the purpose of preserving rural amenity is no longer considered justifiable. It is also worth noting that the portions of Area 2A (adjacent to the subject site) and Area 3 (located further south) fronting Sultana Road East have already been developed to a residential density of R20 in reflection of this.

5.3 Movement network

The current ODP shows a future public road running through the site along the eastern boundary of the property connecting Sultana Road East with Quince Lane. A T-junction midway through the site will ultimately connect the subject to an existing road running parallel with Sultana Road East ('Mangosteen Drive').

The amendment proposes the following changes:

- Deleting the northern portion of the future public road that connects to Sultana Road East.
- Relocating the southern portion of the future public road 17m to the north-west through the centre of the subject site to improve lot layout.
- Creating a common driveway access for 10 strata lots accessible from the future road.

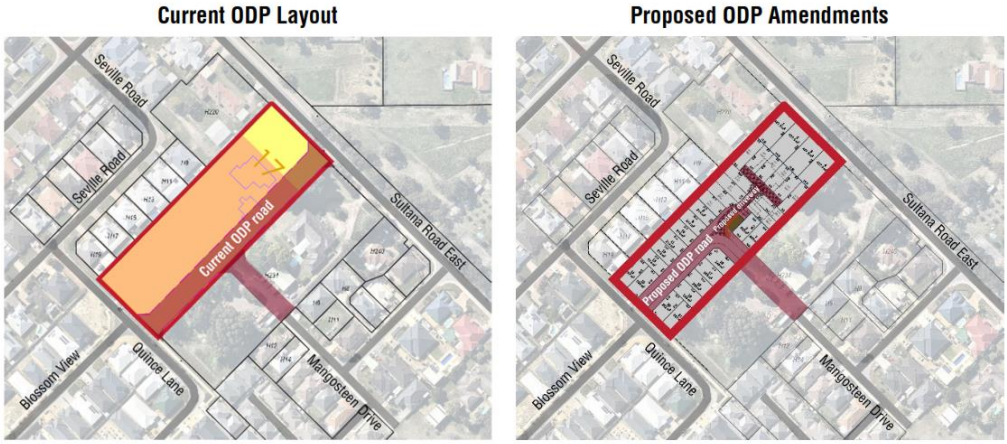

Figure 6: Proposed Changes to Transport Network (Refer Appendix 5 for Traffic Engineering Letter)

Four dwellings will have direct access from Sultana Road East, 24 dwellings will have access from Mangosteen Drive (11 directly and 13 via a common driveway) and four will have access from Quince Lane.

Sultana Road East is not expected to carry more than 3,000 vehicles per day and can be classified as an Access Street "B" under Liveable Neighbourhoods. There is no obstacle to lots having direct vehicular access from Sultana Road East.

Access and traffic movement

The main consequence of the proposed amendment is that direct north-south access between Quince Lane and Sultana Road East will be no longer be provided through the subject site. The deletion of this road will not affect the traffic flows within the neighbourhood since the original access road was never

designed to provide access to through traffic—it was to service homes built on the subject site and adjacent lot (Lot 16).

Crumpet Creek, which flows south-west through a series of reserves (as shown on **Figure 8**) provides a barrier to traffic movement south and east, directing traffic west towards Apricot Street. Apricot Street provides a link between Berkshire Road and Sultana Road East which run in a north-west to south-east direction and provide east-west connectivity through the suburb linking it with Roe Highway.

Removal of the road will not limit access for the proposed lots given that only 4 of the total 21 lots will lose access south through the site, whilst the southern access for the 17 other lots remains unchanged. Northern access for the rear lots is provided via Cumquat Way, approximately 100m to the south-east. This is unlilkely to provide a measurable level of inconvenience.

Access to Public Open Space

Removal of the section of road connecting to Sultana Road East will not negatively impact upon access to public open space. The Movement Network figure (refer **Figure 6**) demonstrates that both Lot 16 and Lot 17 are within 400m of a local park. It should also be noted that as the Special Rural area to the north of Sultana Road East developes, more public open space is likely to become accessible in close proximity to the subject site.

Magosteen Drive re-alignment

The road pavement width of Mangosteen Drive will be maintained at 6m to align with Mangosteen Drive on Lot 16 east of the site to provide two-way access.

The proposed road intersection with Quince Lane has a stagger of approximately 10m to Blossom View. This does not meet with the Liveable Neighbourhoods requirement of 20m, however the conclusion of the traffic engineering report from KCTT is that the proposed road location poses no safety risks due to the low level of traffic generated by either road and the lack of north-south traffic through this access leg (refer **Appendix 5**).

Moreover, a swept path analysis by KCTT demonstrates that a vehicle can navigate the proposed intersection with a 10m stagger in a similar way it would a standard 4-leg intersection without generating any additional conflict points.

Road Deletion

A section of road connecting Quince Way and Canopy Circuit has been deleted on the ODP Plan to reflect the existing lot layout as constructed.

5.3.1 Bushfire Management

Bushfire management has been factored into the design process for the proposed movement network. To ensure that a fire truck can access the lots at the centre of the subject site, a 38m 'T' head turnaround has been included in the design of the common access driveway of the proposed 'Homestead Lot'. A BAL Assessment (refer **Appendix 7**) and Bushfire Management Plan has been provided (refer **Appendix 8**).


LEGEND
Subject Site
Public Open Space
Road Removed
Walkable Routes
Vehicle Movement Lines
Future Road
320m
395m
SEVILLE RD
SULTANA ROAD EAST
ROE HIGHWAY
APRICOT STREET
SEVILLE ROAD
GALA WAY
MANDON STREET
BERKSHIRE ROAD
VEHICLE MOVEMENT TOWARDS APRICOT ST
BARRIER TO VEHICLE MOVEMENT
PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING
PS
SCALE 1: 5,000 @ A4
DATE 12 April 2019
FILE 190412 5816 Movement Network.dwg
REVISION 1/DR/First Draft/10.04.2019
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MOVEMENT NETWORK
LOT 16 (234) SULTANA ROAD EAST, FORRESTFIELD
FIGURE 07
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5.4 Open space

The amendment does not propose any changes to the existing provision of cash-in-lieu of public open space.

5.5 Concept Plans

5.5.1 Subdivision Concept Plan for Lot 17

A copy of a subdivision concept plan for the subject site is included (refer **Figure 4**). The concept plan has been prepared to provide an indication of the potential form development that may take within the amendment area following the changes to the density and movement network.

The concept plan has three stages (refer **Section 6.3**), permitting the retention of a larger Homestead Lot in the middle of the site with subdivision to the north and south of the property. Four freehold lots are located on the northern boundary of the site—these are smaller than the current zoning permits, but consistent with the pattern of development to the east of the site along Sultana Road East.

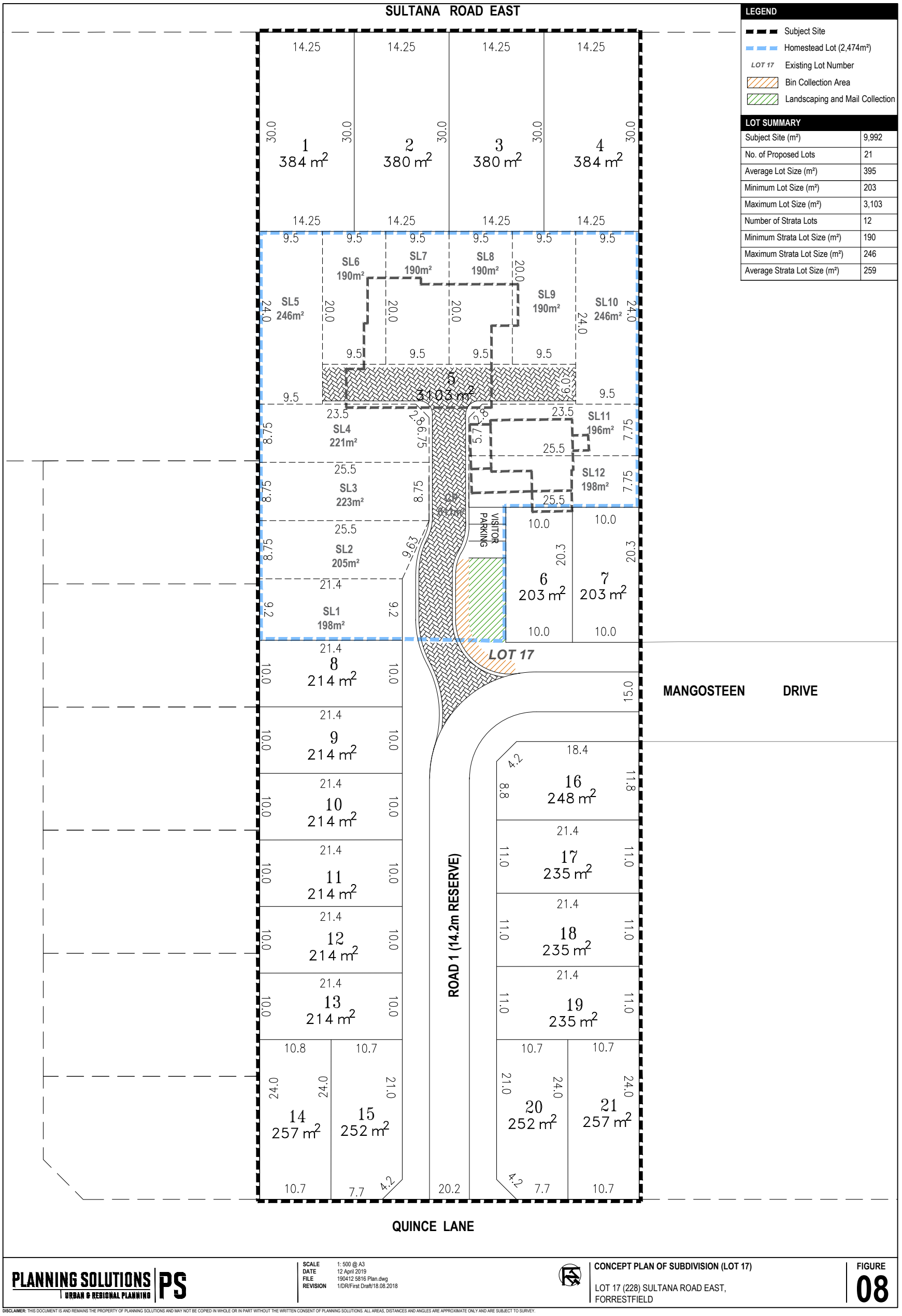
The existing road layout would have provided a lot depth of 42m which is relatively inefficient. In light of government directives to optimise infrastructure ready land, realigning the road to the centre of Lot 17 allows lots to be located on both sides of the road.

Refer **Figure 8** for a copy of the Concept Plan for Lot 17.

5.5.2 Subdivision Concept Plan for Lot 16

A similar concept plan has been prepared to provide an indication of the potential form development may take on the adjacent lot (Lot 16). The concept demonstrates that the proposed amendments to the density coding and movement network will not negatively impede the development potential of the lot. The proposed concept plan demonstrates that Lot 16 can still be developed to its maximum zoned density

Refer **Figure 9** for a copy of the Concept Plan for Lot 16.


SULTANA ROAD EAST
LEGEND
Subject Site
Homestead Lot (2,474m²)
LOT 17 Existing Lot Number
Bin Collection Area
Landscaping and Mail Collection
LOT SUMMARY
Subject Site (m²) 9,992
No. of Proposed Lots 21
Average Lot Size (m²) 395
Minimum Lot Size (m²) 203
Maximum Lot Size (m²) 3,103
Number of Strata Lots 12
Minimum Strata Lot Size (m²) 190
Maximum Strata Lot Size (m²) 246
Average Strata Lot Size (m²) 259
1 384 m²
2 380 m²
3 380 m²
4 384 m²
5 3103 m²
SL1 198m²
SL2 205m²
SL3 223m²
SL4 221m²
SL5 246m²
SL6 190m²
SL7 190m²
SL8 190m²
SL9 190m²
SL10 246m²
SL11 196m²
SL12 198m²
LW 611m²
VISITOR PARKING
6 203 m²
7 203 m²
8 214 m²
9 214 m²
10 214 m²
11 214 m²
12 214 m²
13 214 m²
14 257 m²
15 252 m²
16 248 m²
17 235 m²
18 235 m²
19 235 m²
20 252 m²
21 257 m²
LOT 17
MANGOSTEEN DRIVE
ROAD 1 (14.2m RESERVE)
QUINCE LANE
PLANNING SOLUTIONS URBAN & REGIONAL PLANNING PS
SCALE 1: 500 @ A3
DATE 12 April 2019
FILE 190412 5816 Plan.dwg
REVISION 1/DR/First Draft/18.08.2018
CONCEPT PLAN OF SUBDIVISION (LOT 17)
LOT 17 (228) SULTANA ROAD EAST, FORRESTFIELD
FIGURE 08
DISCLAIMER: THIS DOCUMENT IS AND REMAINS THE PROPERTY OF PLANNING SOLUTIONS AND MAY NOT BE COPIED IN WHOLE OR IN PART WITHOUT THE WRITTEN CONSENT OF PLANNING SOLUTIONS. ALL AREAS, DISTANCES AND ANGLES ARE APPROXIMATE ONLY AND ARE SUBJECT TO SURVEY.

PLANNING SOLUTIONS | PS
URBAN & REGIONAL PLANNING

SCALE 1: 1000 @ A3
DATE 12 April 2019
FILE 190412 5816 Plan.dwg
REVISION 1/DR/First Draft/12.04.2019

SUBDIVISION CONCEPT PLAN - CONTEXT

LOT 16 (234) SULTANA ROAD EAST,
FORRESTFIELD

FIGURE 09

6 Infrastructure coordination, servicing and staging

Investigations into the engineering works and civil infrastructure required to develop the site has been undertaken by KCTT Engineers. The report demonstrates and confirms that the subject site can be readily serviced with power, telecommunications and other essential services (refer to **Appendix 4** for the complete servicing report).

6.1.1 Earthworks

The general tasks associated with the development of the subject site consist of clearing existing vegetation, stripping topsoil on the site and earth working on the existing ground surfaces to achieve finished design levels.

6.2 Services

6.2.1 Water reticulation

DBYD and ESINet information shows there is an existing 200mm diameter CI water main on the northern side of Sultana Road East, and a 100mm diameter P main on the northern side of Quince Lane directly opposite the subject site. Both mains are sufficient for the needs of the site.

The Quince Lane mains will provide the point of connection for all future green-titled lots in Mangosteen Drive with the Sultana Road East mains providing the deferred service connections that will be required for both the proposed green-titled lots (lots 1 to 4) in Stage 1, and the future deferred connection for the Stage 2 strata subdivision.

6.2.2 Sewer reticulation

The Water Corp has existing sewer assets for connection to the subject site in Quince Lane. This main will service all lots in Mangosteen Drive. Consideration needs to be given to the future servicing of the strata lots to the north of Mangosteen Drive as the logical location for connection of sewer for the strata lot. This will be examined in the submission of the green-titled lot development with a connection provided during this process so that future works do not cross completed works in future residential lots.

6.2.3 Power

The subject site will generally be serviced from existing underground power assets in Quince Lane with the future lots in Sultana Road East requiring the undergrounding of existing overhead power assets and subsequent connection. Western Power should be engaged early in the design process to schedule removal of overhead power lines. This may take up to 6 months.

6.2.4 Telecommunications

NBN infrastructure has been provided to surrounding developments, and our expectation is that the subject site will be connected to this infrastructure. This connection should have no bearing on the planning process.

6.2.5 Gas

ATCO Gas has two connections available to the subject site, one on Quince Lane, and one on Sultana Road East.

6.2.6 Drainage

Stormwater drainage in Mangosteen Drive will be designed to suit the 1 in 5-year event, with the road reserve levels designed to suit the 1-in-100-year event, protecting private property from flood inundation.

6.3 Staging

The proposed amendment will enable a staged development of the subject site that will permit the landowner to retain their existing homestead whilst developing a portion of the site. This homestead lot will eventually be developed as 12 strata titled units with a common driveway access.

Lot 19 (Refer **Figure 8** for Subdivision Concept Plan) will be held over as a balance of title to provide space for a vehicle turning circle. Once Mangosteen Drive is constructed on the adjacent Lot 16 and aligned with the subject site, Lot 19 will be created.

6.4 Minor Amendment

The proposed amendment is considered to be a 'minor' amendment given that it does not substantially alter the purpose and intent of the structure plan, adversely impact upon the amenity of neighbouring landowners, or restrict the use and development of adjoining land, or significantly impact on infrastructure provision or the environment.

6.5 Developer contribution arrangements

Refer to existing developer contributions arrangement.

7 Conclusions

The proposed amendment to the U7SP proposes changes to the density coding and movement network on the subject site. Appended technical reports support the development of the subject site in accordance with the proposed changes.

Overall, the amendment reflects the orderly and efficient use of land and infrastructure, and the City's support in progressing this proposal would be appreciated.

Appendix 1:
Certificate of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
17/P13574	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	2/1/2008

VOLUME 1595 FOLIO 564

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.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 17 ON PLAN 13574

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

JEFFREY MICHAEL GLISENTI
MOYA OLIVE GLISENTI
BOTH OF 228 SULTANA ROAD, FORRESTFIELD
AS JOINT TENANTS

(T D393719) REGISTERED 7/1/1987

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

1. K447735 MORTGAGE TO BENDIGO BANK LTD REGISTERED 17/12/2007.

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.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

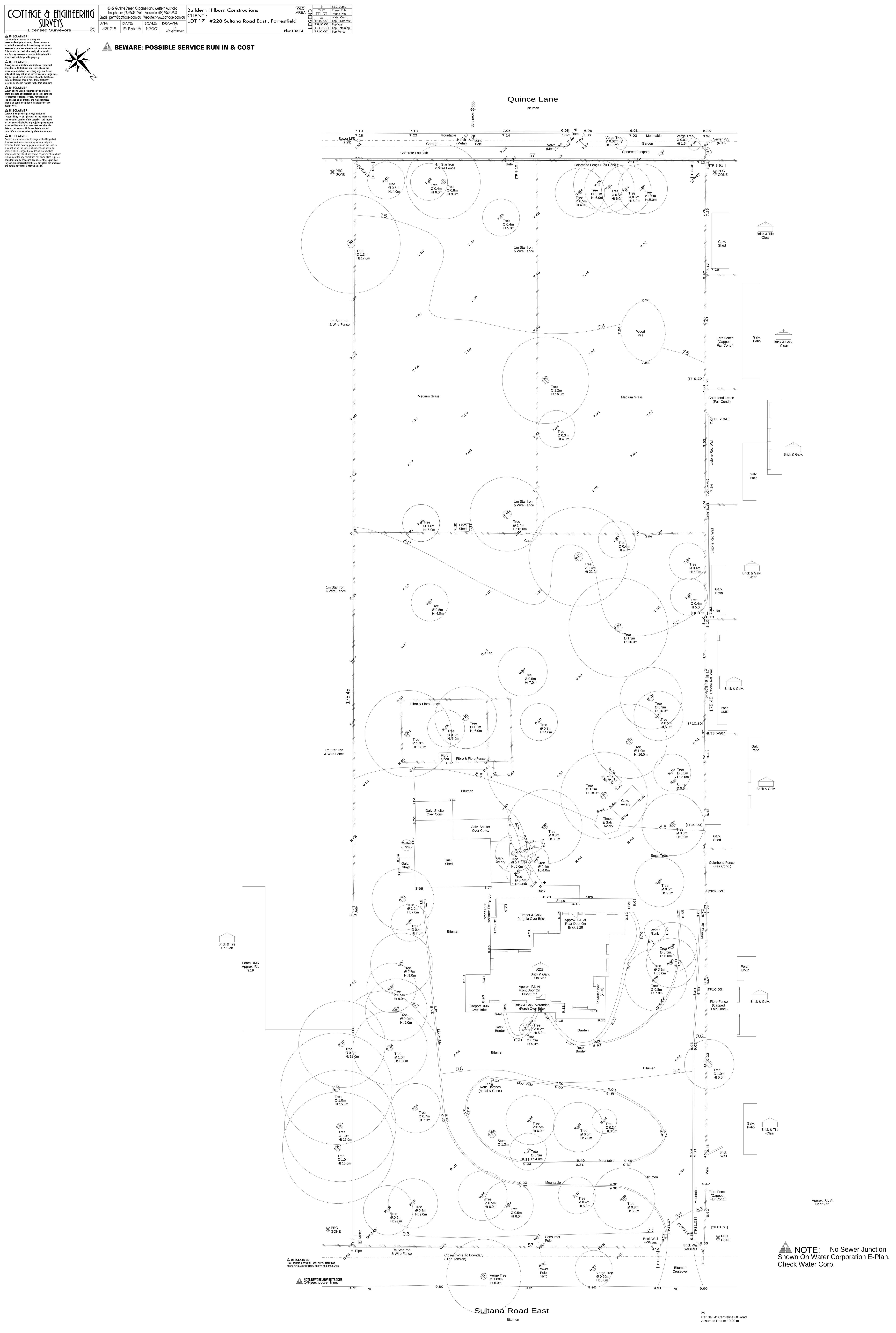
----------END OF CERTIFICATE OF TITLE----------

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:	1595-564 (17/P13574)
PREVIOUS TITLE:	1595-548
PROPERTY STREET ADDRESS:	228 SULTANA RD EAST, FORRESTFIELD.
LOCAL GOVERNMENT AUTHORITY:	CITY OF KALAMUNDA

Appendix 2: Feature Survey


COTTAGE & ENGINEERING SURVEYS
Licensed Surveyors
87-89 Guthrie Street, Osborne Park, Western Australia
Telephone: (08) 9446 7361 Facsimile: (08) 9445 2998
Email : perth@cottage.com.au Website: www.cottage.com.au
J/N: 431718
DATE: 15 Feb 18
SCALE: 1:200
DRAWN: C. Weightman
Builder : Hilburn Constructions
CLIENT :
LOT 17 #228 Sultana Road East , Forrestfield
Plan13574
OLD AREA
LEGEND
SEC Dome
Power Pole
Phone Pits
Water Conn.
[TP10.00] Top Pillar/Post
[TW10.00] Top Wall
[TR10.00] Top Retaining
[TF10.00] Top Fence
DISCLAIMER:
Lot boundaries drawn on survey are based on landgate plan only. Survey does not include title search and as such may not show easements or other interests not shown on plan. Title should be checked to verify all lot details and for any easements or other interests which may affect building on the property.
DISCLAIMER:
Survey does not include verification of cadastral boundaries. All features and levels shown are based on orientation to existing pegs and fences only which may not be on correct cadastral alignment. Any designs based or dependent on the location of existing features should have those features' location verified in relation to the true boundary.
DISCLAIMER:
Survey shows visible features only and will not show locations of underground pipes or conduits for internal or mains services. Verification of the location of all internal and mains services should be confirmed prior to finalisation of any design work.
DISCLAIMER:
Cottage & Engineering surveys accept no responsibility for any physical on site changes to the parcel or portion of the parcel of land shown on this survey including any adjoining neighbours levels and features that have occurred after the date on this survey. All Sewer details plotted from information supplied by Water Corporation.
DISCLAIMER:
Due to lack of survey marks/pegs, all building offset dimensions & features are approximate only and positioned from existing pegs/fences and walls which may not be on the correct alignment and are to be verified when repegged. Any design that involves additions to any structures shown or portion of structures remaining after any demolition has taken place requires boundaries to be repegged and exact offsets provided to your designer/architect before any plans are produced and before any work is started on site.
BEWARE: POSSIBLE SERVICE RUN IN & COST
Quince Lane
Bitumen
Sewer M/S (7.29)
Sewer M/S (6.98)
Concrete Footpath
Colorbond Fence (Fair Cond.)
1m Star Iron & Wire Fence
PEG GONE
Medium Grass
Wood Pile
Fibro Fence (Capped, Fair Cond.)
Colorbond Fence (Fair Cond.)
L'stone Ret. Wall
175.45
57
Fibro & Fibro Fence
Galv. Shelter Over Conc.
Galv. Shed
Galv. Aviary
Timber & Galv. Aviary
Timber Cubby
Water Tank
Timber & Galv. Pergola Over Brick
Approx. F/L At Rear Door On Brick 9.28
#228 Brick & Galv. On Slab
Approx. F/L At Front Door On Brick 9.27
Brick & Galv. Verandah /Porch Over Brick
Carport UMR Over Brick
Meter Box (Gas)
Rock Border
Garden
Retic Hatches (Metal & Conc.)
Bitumen
Mountable
Porch UMR Approx. F/L 9.19
Brick & Tile On Slab
Brick Wall w/Pillars
Consumer Pole
Power Pole (H/T)
Closest Wire To Boundary (High Tension)
Bitumen Crossover
Approx. F/L At Door 9.31
DISCLAIMER:
HIGH TENSION POWER LINES. CHECK TITLE FOR EASEMENTS AND WESTERN POWER FOR SET-BACKS.
NOTE/BEWARE:ADVISE TRADES O/Head power lines
NOTE: No Sewer Junction Shown On Water Corporation E-Plan. Check Water Corp.
Sultana Road East
Bitumen
Ref Nail At Centreline Of Road Assumed Datum 10.00 m
LOT MISCLOSE 0.000 m
SOIL DESCRIPTION
Sand / Clay(Poss)
Refer to Survey
Scale 1:200
0 2 4 6 8

Appendix 3:
Geotechnical Report

Appendix 4:
Infrastructure Servicing Report

INFRASTRUCTURE SERVICING REPORT

Lot 17 Sultana Road East

Forrestfield

Western Australia

January 2019

Rev B

INFRASTRUCTURE SERVICING REPORT

KC00910.000 Lot 17 Sultana Road East Forrestfield, Western Australia

HISTORY AND STATUS OF THE DOCUMENT

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Rev A	05.12.2018	C Kleyweg	C Kleyweg	05.12.2018	Issued for Review
Rev B	10.01.2019	C Kleyweg	C Kleyweg	10.01.2019	Updated Plan Layout

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Revision	Date of issue	Quantity	Issued to
Rev A	05.12.2018	1 (PDF)	Tayne Evershed (Planning Solutions), Bryan Slater (Hilburn Property)
Rev B	10.01.2019	1 (PDF)	Tayne Evershed (Planning Solutions), Bryan Slater (Hilburn Property)

Document Printed	10/01/2019 2:32 PM
File Name	C:\Users\colin\AppData\Local\Box\Box Edit\Documents\qdiEZCAO4kedIVNXaaSygw==\KC00910.000 Sultana Rd West ISR Rev B.docx
Author	Colin Kleyweg
Project Manager	Colin Kleyweg
Name of Project	Lot 17 Sultana Road East, Forrestfield
Name of the Document	Lot 17 Sultana Road East Forrestfield - Infrastructure Servicing Report
Document Version	KC00910.000_Rev B

Prepared By: **KCTT (Trading as Traffic and Transport Pty Ltd)**
ABN 35 148 970 727 |
Postal address: Unit 7 / No 10 Whipple Street Balcatta WA 6021|
Phone: 08 9441 2700 |
Website: www.kctt.com.au |

Table of Contents

1. INTRODUCTION

KCTT have been requested to provide this civil engineering Infrastructure Servicing Report for the proposed development over Lot 17 Sultana Road East, located within the City of Kalamunda. The information herein is provided for inclusion in the Local Structure Planning (LSP) submissions being undertaken by Planning Solutions on behalf of the proponent. The subject landholding lies within Landowner Area No 4 of the Outline Development Plan Agreement Areas 2, 3 & 4 – Forrestfield U7.

Residential development is located immediately to the northwest and to the southwest of the subject property, with Lot 18 Sultana Road East immediately to the southeast of the subject site. Residential development has been completed on the lots to the southeast of Lot 18 Sultana Road East.

This report shows that each of the services are readily available at the boundary of the subject site and that the site is presently developable without requiring adjustment to planning mechanisms or extension of services through private properties, or augmentation / upgrading of services. Each of the services can be designed in consultation with the appropriate authorities. The proposed subdivision layout is logical and it ensures the provision of infrastructure, (particularly that infrastructure reliant on gravity such as wastewater and stormwater drainage) to be laid in a manner that is sympathetic to the natural topography thereby minimising the proposed earthworks.

The information in this report is subject to change through the planning, detailed design and implementation phases of the project as potential issues are resolved and risks mitigated. Each of the regulatory authorities will assess the proposed lot layouts, design implications and changing regulations between now and the time of submission may impact specific detailed design requirements for construction.

1.1 Scope of This Report

The scope of this report is therefore to review at desktop level: -

- **Roads and Roadworks** – The connectivity of roads to the external major road network needs to be considered in the development staging for the landholding. For the green-titled lots at the rear of this landholding, the subdivision requires connection to Quince Lane to the southwest, with future connection to Mangosteen Drive.
- **Stormwater –** The City of Kalamunda will provide technical requirements for stormwater drainage through the detailed design and urban water management phases. Conveyance of internal road drainage and treatment of 1, 5, and 100 year ARI storm events are likely to be the key requirements of any stormwater drainage system, with direct lot connections for all lots less than 300m^2.
- **Wastewater (Sewer) –** The Water Corporation has available sewer in Quince Lane to the southwest of the subject site. All sewer will be required to connect to this location in the southwest.
- **Potable Water Supply –** The Water Corporation has available water in Quince Lane to the southwest of the subject site.
- **Power –** Western Power have underground power connections available in Quince Lane to the southwest of the site and in Sultana Road East to the northeast of the site.
- **Telecommunications –** Existing telecommunications services have been sourced from DBYD with those sources confirming that adjacent subdivisions have been serviced with NBN assets.
- **Gas –** ATCO Gas manage the design and delivery of gas services for residential developments in Western Australia. ATCO Gas will charge for services extended from a location external to each proposed development stage.

1.2 Available Information

- **Dial Before You Dig** – KCTT have collected data through the Dial Before You Dig (DBYD) service to locate existing infrastructure and service locations.
- **Aerial Imagery** (Nearmaps) – Nearmaps has been utilised to obtain aerial imagery of the subject site. We have used this for general review purposes only.
- **Perth Groundwater Atlas** – KCTT have employed the use of the Perth Groundwater Atlas. The database provides general groundwater levels, soil conditions and contour levels for the Perth Metropolitan Region.
- **Landgate SLIP** –The SLIP enabler can reveal information about the topography, soil conditions, surrounding environmentally sensitive areas and planned capital works by the Water Corporation and other regulatory authorities.
- **ESInet** – KCTT have reviewed the existing water and sewerage infrastructure within an 800m radius of the subject site to determine the proximity of existing major service corridors.

2. STUDY AREA

The subject site is a 1-hectare site located at Lot 17 Sultana Road East and is located within Landowner Area No 4 of the Outline Development Plan Agreement Areas 2, 3 & 4 – Forrestfield U7. The existing landholding comprises of a large existing house with buildings set-back approximately 30 to 50 metres from Sultana Road East.

Topography

Preliminary desktop investigations were undertaken using the SLIP Portal on Landgate and ESInet software. The information obtained demonstrates that the land grades generally from RL 49.0m AHD near Sultana Road East toward the southwest to Quince Lane to a general lowpoint at RL 47.0m AHD. For the provision of services, there is not expected to be any importation of fill, because the sewer in Quince Lane is just over 2 metres deep. This provides sufficient fall for any future sewer constructed in Mangosteen Drive. General cut to fill will however be required to bench out each of the proposed lots. This means an allowance for retaining should be considered in any cost estimate for the construction of the proposed green-titled lots off Mangosteen Drive.

2.1 Geotechnical Conditions and Groundwater Levels

KCTT have reviewed the Perth Groundwater Atlas digital files and subsequent data available from the Department of Water. The subject site is not likely to have any issues with groundwater, with groundwater at depths of around 30 metres, based on a groundwater contour intercepting site of RL 17.0m AHD. The subject site however may have some issues with perching of groundwater at higher levels as nominated in geotechnical reporting provided as part of the overall LWMS for the area, mainly due to soils having a plasticity content and being considered as "clayey-sand" from a depth of 0.4 metres. This type of soil system therefore has limited local infiltration capabilities, however the use of localised techniques to minimise the concentration of drainage runoff only to external sources will be considered in the UWMP and in the design phase of this project.

2.2 Acid Sulphate Soils

A review of the available information on the Perth Groundwater Atlas and Landgate's SLIP Portal indicates that the subject landholding is classified as low to moderate risk of encountering acid sulphate soils within 3 metres of the natural surface. No excavations greater than 3 metres are expected for this development, therefore we do not believe that acid sulphate soils are a genuine risk on this project.

2.3 Earthworks

The general tasks associated with land development consist of clearing of existing vegetation, stripping topsoil on the site and earth working of the existing ground surfaces to achieve the finished design levels.

The site will require significant cut to fill in the form of benching proposed lots so that each lot is flat for future home building. The site falls gradually from Sultana Road East (around 49.0m AHD) to Quince Lane (around 47.0m AHD). This means in the southwestern half of the site there will be an approximate 1.0 metre fall through the lots and in the construction of Mangosteen Drive. As part of this project, KCTT will be required to show that our design can tie-in to existing road levels to the southeast of Lot 18 Sultana Road East. The road design levels will be an integral part of setting the earthworks levels for the proposed lots, with the lots to generally sit around 300mm above the proposed road levels.

KCTT will seek to re-use all topsoil within the construction and where required, the material may need to be sieved to remove specific organic matter. The general expectation is for materials to be locally re-used, with minimal reliance on import fill.

2.4 Roadworks

The City of Kalamunda has standard guidelines for road design, which are understood by KCTT as we have recently completed commissions for the City of Kalamunda on the LSP processes in Forrestfield North, encompassing reviews of future geometric road design requirements for a series of roads within the LSP area.

KCTT suggest that the road width for Mangosteen Drive is maintained to meet the existing widths in Mangosteen Drive to the east of the subject site, at 6 metres. The intersection of Mangosteen Drive and Quince Lane should be designed to minimise vehicle entrance speeds. Existing kerb radii in the local area appear to be set at around R10 to R12. There are not expected to be any requirements for islands or brick-paved entry statements to this development.

For the future strata development, the road works will be designed to suit the City of Kalamunda's requirements, with due consideration given to the design of the crossover to Sultana Road East achieving applicable sight distances in Sultana Road East.

2.5 Stormwater Drainage

The stormwater drainage design will need to consider the first stage of green-titled lots in Mangosteen Drive with allowance for a direct connection for future lots in the strata subdivision to the north. The development has been designed such that the strata lots drain to the south toward Mangosteen Drive and Quince Lane, minimizing the requirements for adverse earthworking against the natural fall of the land.

Stormwater drainage design in Mangosteen Drive will be designed to suit the 1 in 5-year event, with the road reserve levels designed to suit the 1 in 100-year event, protecting private property from flood inundation. Further information is provided in the LWMS.

2.6 Wastewater

KCTT have reviewed existing DBYD and ESINet information for existing sewer assets. The Water Corp have existing sewer assets for connection to the subject site in Quince Lane. This main is a 150mm-diameter PVC with a depth of approximately 2.0 metres. This main will service all lots in Mangosteen Drive. The strata lots have been

designed with road access / egress to Mangosteen Drive, therefore the sewer can easily be connected into the proposed main sewer in Mangosteen Drive. This is a logical design as the sewer connection follows the natural fall of the land from the strata development to Mangosteen Drive. KCTT confirm that this design should be completed with excavation at between 1.5m to 2.0m depth throughout the subdivision.

KCTT will work with the Water Corporation to all applicable Water Corporation standards and procedures.

2.7 Water Supply

KCTT have reviewed DBYD and ESINet information and have found that there is an existing 200mm-diameter CI water main on the northern side of Sultana Road East and a 100mm-diameter P main on the northern side of Quince Lane directly opposite the development.

Both of these mains are sufficient for the future development needs of the subject site. The 100mm-diameter main in Quince Lane will provide the point of connection for all future green-titled lots in Mangosteen Drive with the 200mm-diameter main in Sultana Road East providing the deferred service connections that will be required for both the proposed green-titled lots (lots 1 to 4) in Stage 1, and the future deferred connection for the Stage 2 strata subdivision. The size of the connection and meters for the Stage 2 strata development will be determined at the time of the submission to the Water Corporation for the strata development. All other drawing and submission requirements will be discussed with the Water Corporation.

2.8 Power Supply

KCTT will recommend the use of an electrical consultant for liaison and approvals with Western Power. The subject site will generally be serviced from existing underground power assets in Quince Lane, with the future lots in Sultana Road East requiring the undergrounding of existing overhead power assets and subsequent connection.

Western Power should be engaged early in the design process as the scheduling of removal of overhead power lines needs to be completed in full by Western Power. In our experience this process can take up to 6 months for projects of this size.

2.9 Telecommunications

NBN Co is responsible for the installation of fibre in all broad-acre developments of 100 or more lots within the long-term optic fibre footprint. NBN infrastructure has been laid in the developments around this subject landholding. Our expectation is that future development will be connected to this infrastructure and extended under NBN's program.

This will be confirmed separately by a qualified telecommunications consultant and should have no major bearing on the economic development of the subject landholdings, nor on the planning phases.

2.10 Gas Supply

ATCO Gas manage the supply of gas to residential properties. ATCO Gas services in front of the subject site include: -

- Quince Lane – 63mm MDPE on the development side of Quince Lane
- Sultana Road East – 155mm PVC on the development side of Sultana Road East

ATCO Gas typically manages the design of their assets through a collaborative process with KCTT submitting our water plans for coordination.

Appendix 5:
Traffic Engineering Report

Traffic Engineering Letter
KC00910.000 Lot 17 Sultana Road East, Forrestfield

09-01-2019

Hilburn Developments
Unit 1 / No 25 Prestige Parade
Wangara WA 6065

Attn: Bryan Slater

Re: Purpose of the letter

Bryan,

This letter has been prepared in order to examine the impact of the amendment to the ODP for Lot 17 Sultana Road East, Forrestfield.

In summary, having in mind the expected traffic volumes that will be generated by the subject site it is expected that the proposed changes to the ODP will not have any negative impact to the surrounding road network.

KCTT do not believe that the proposed road location poses any safety risks due to a very low level of traffic on both roads and lack of travel desire lines that might affect north/ south travel on this leg. The swept path analysis shows that the stagger of 10m will not cause any additional conflict points compared to a standard 4-leg intersection.

On subsequent pages are details of our findings. If you have any queries, please don't hesitate to contact us.

Regards,

Marina Kleyweg
Director | Principal of Traffic and Transport

Ana Nikolic
Traffic Engineer

Prepared by: **KCTT (Trading as Traffic and Transport Pty Ltd)**
ABN 35 148 970 727 |
Postal **PERTH:** Unit 7, No 10 Whipple Street Balcatta WA 6021 | **BELGRADE**: 23 Hilandarska, Beograd
Phone: 08 9441 2700 |
Website: www.kctt.com.au |

1. Traffic Engineering Letter

1.1 Location

Lot Number	17
Road Name	Sultana Road East
Suburb	Forrestfield
Description of Site	The subject site is a residential development fronting Sultana Road East in Forrestfield.

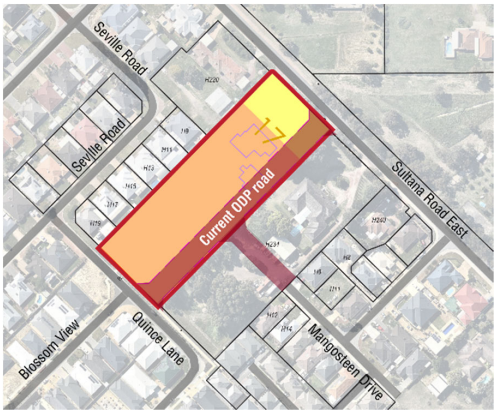
1.2 Proposed changes to the ODP

Outline the proposed changes

The current ODP shows a single road connecting Quince Lane and Sultana Road East.

The proposed amendments to the plan are the shifting of the roads so as to provide a more efficient lot distribution. Therefore, the proposed road south of Manigosteen Drive is slightly shifted to the west, while the north section of the road is closed off. A driveway servicing the strata lots is to connect to the proposed road.
The images below show the difference between the current and proposed road alignments.

Current ODP Layout



Proposed ODP Amendments

What is the impact of the proposed changes?

Given the committed capital transport infrastructure, it is expected that the proposed changes would be beneficial, providing opportunity for densifying the area.

The proposed driveway servicing the 10 lot survey strata development is to be classified as a right of way (ROW) and will be 6.0m wide providing a two-way access.

Based on traffic modelling performed by KCTT for KC00332.000 Maida Vale and KC00604.000 Forrestfield North it is not expected that Sultana Road East would carry more than 3,000 vehicles per day. Based on anticipated traffic volumes, Sultana Road East can be deemed equivalent to a Liveable Neighbourhoods classification of Access Street "B". Therefore, there is no obstacle for lots having vehicular access directly from Sultana Road East.

It is expected that the four lots in the northern part of the proposed development with direct access to Sultana Road East would generate up to 3 vehicle trips in the peak hour.

The southern part of the proposed development would generate up to 23 vehicle trips in the peak hour. These vehicles will be accessing the development via Manigosteen Drive or Quince Lane. Strata lots will be accessible by a driveway connected to the proposed road.

The peak hour volume assumptions have been based on a rate of 0.8 VPH for residential developments in the peak hour as per WAPC Guidelines.

The proposed road has a stagger of approximately 10m (centreline to centreline) to Blossom View. This does not comply with the Liveable Neighbourhoods requirement of 20m. However, Blossom View currently serves only 11 lots (9 vehicle trips in the peak hour). KCTT do not believe that the proposed road location poses any safety risks due to a very low level of traffic on both roads and lack of travel desire lines that might affect north/ south travel on this leg. Moreover, KCTT have performed a swept path analysis which clearly shows that there would be no issues caused by the proposed intersection stagger.

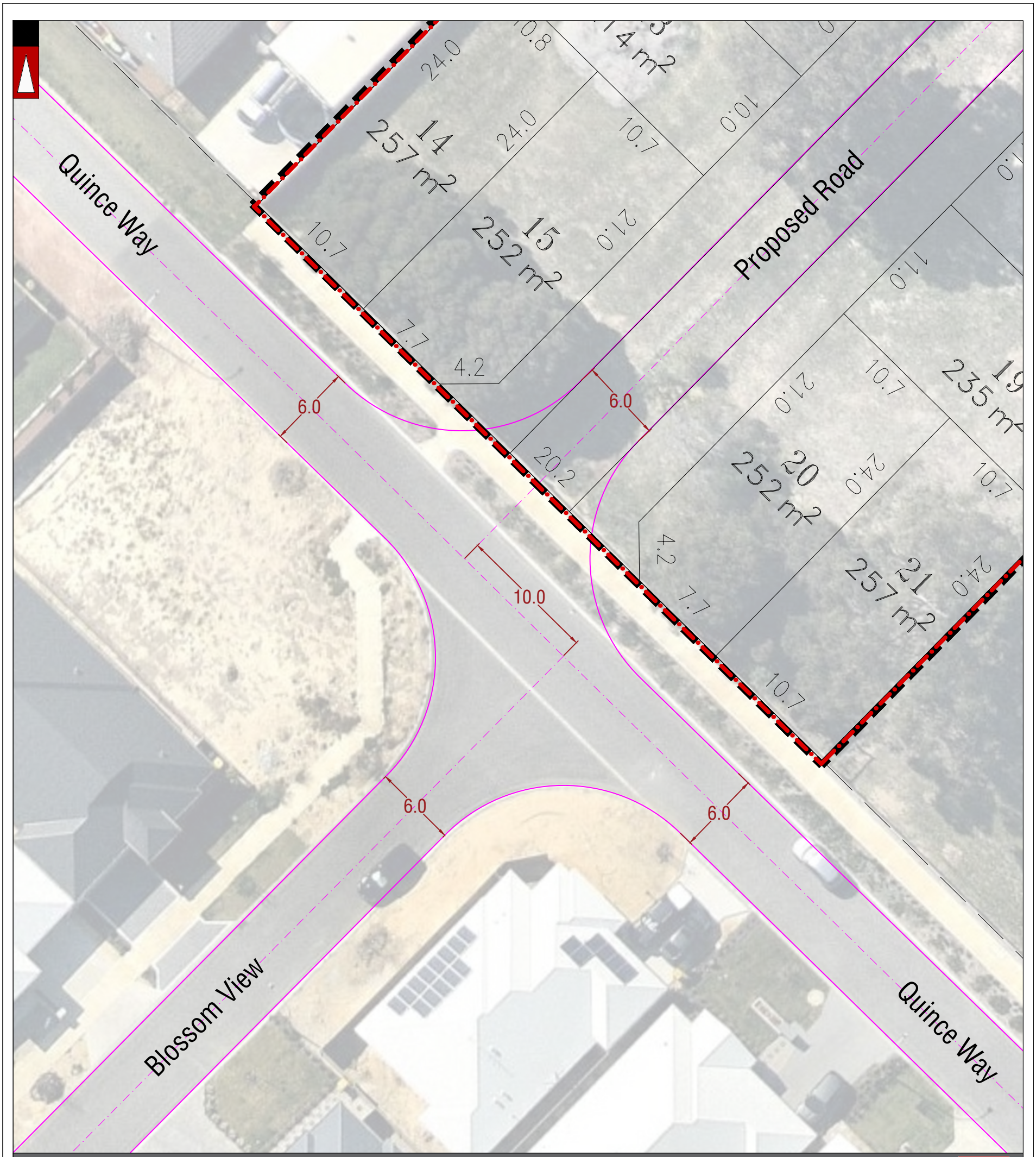
Having in mind the expected traffic volumes that will be generated by the subject site it is expected that the proposed changes to the ODP will not have any negative impact to the surrounding road network.

1.3 Swept path analysis

Which vehicle was used to perform the analysis?	B99 Passenger Vehicle 5.2m
Describe the performance	The vehicle can navigate the proposed intersection with a 10m stagger in a similar way that it would a standard 4-leg intersection. There will be no additional conflict points caused by the stagger. The swept paths are shown in the Appendix accompanying this letter.

Appendix

Vehicle Turning Circle Plan



NO	DATE	AMENDMENT
A	09-01-2019	ISSUED FOR REVIEW

PROJECT:
Lot 17 Sultana Road, East Forrestfield ODP

TITLE:
Intersection stagger indicative layout

DRAWING NUMBER:
KC00910.000_S20

DRAWN BY:
A.N.

Civil & Traffic Engineering Consultants
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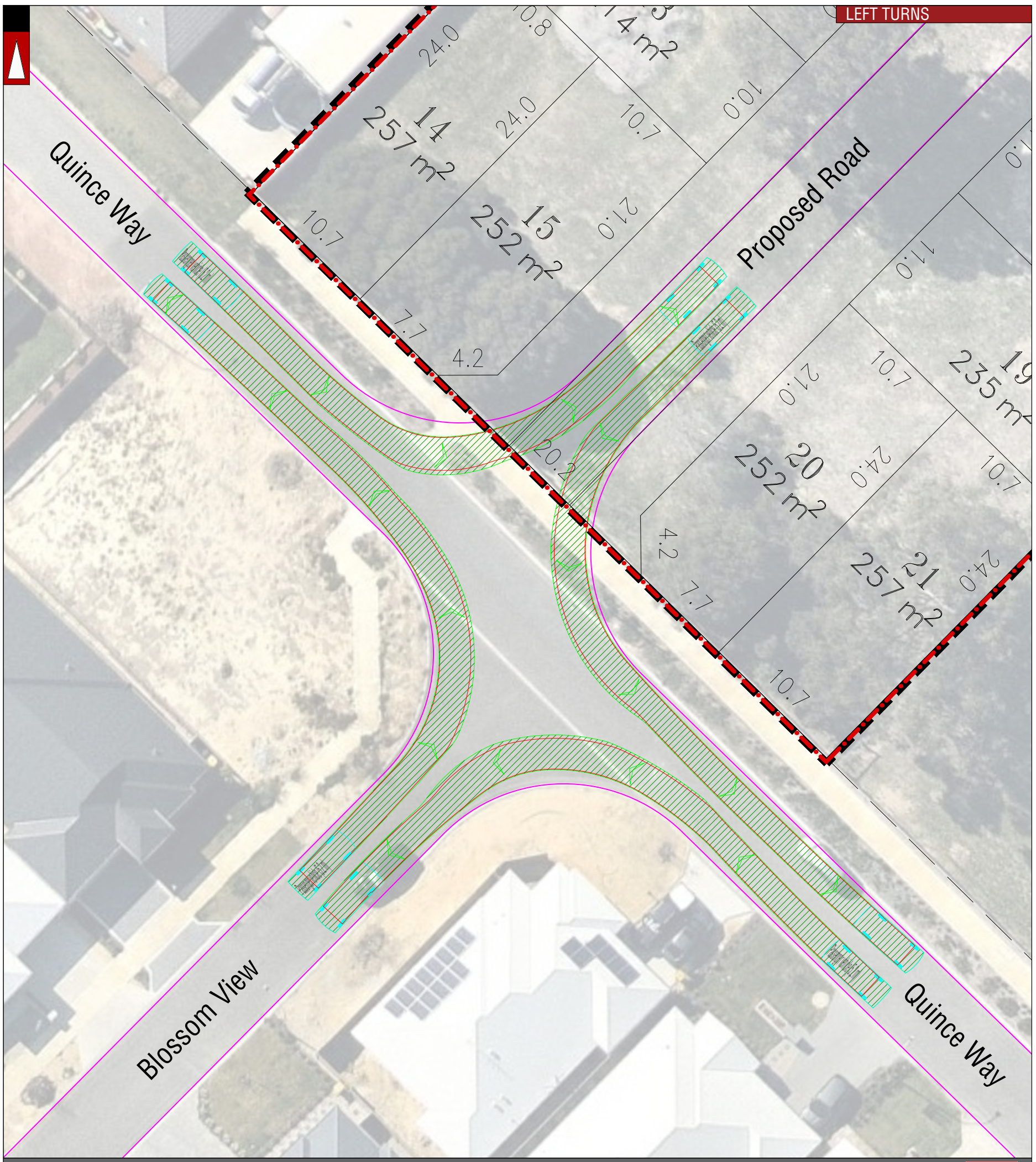

NO	DATE	AMENDMENT
A	09-01-2019	ISSUED FOR REVIEW

PROJECT: Lot 17 Sultana Road, East Forrestfield ODP

TITLE: Vehicle Turning Circle Plan - B99 Passenger Vehicle (5.2m)

DRAWING NUMBER: KC00910.000_S21

DRAWN BY: A.N.

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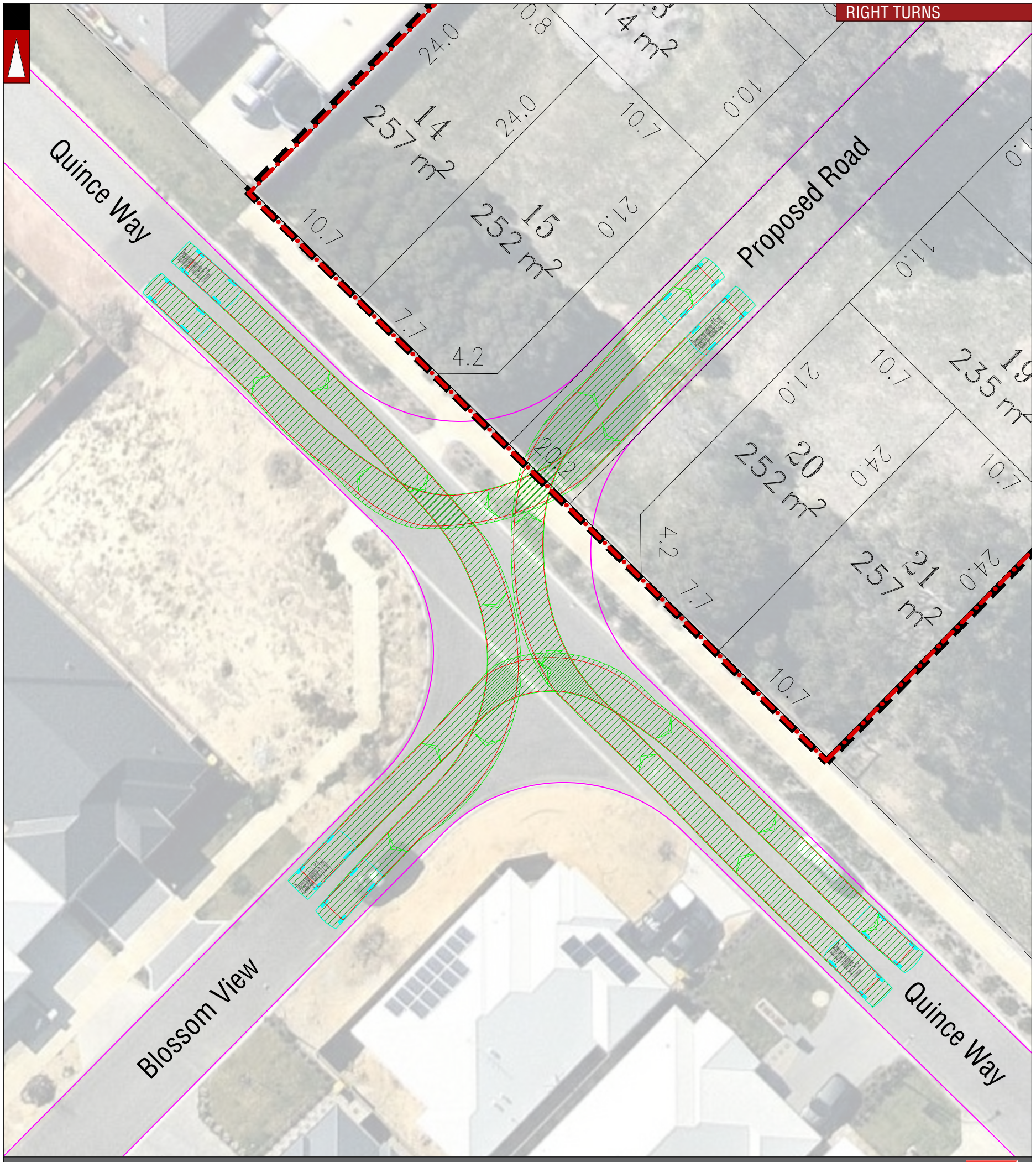

Passenger vehicle (5.2 m)

Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	1.804m
Min Body Ground Clearance	0.295m
Track Width	1.840m
Lock to Lock Time	4.00s
Kerb to Kerb Turning Radius	6.300m

Lot boundary

Wheel Path (Forward Vehicle Motion)

Vehicle Chasis Envelope (Forward Vehicle Motion)

Indicative Kerb

Certified System™ Quality ISO 9001 SAI GLOBAL

LEGEND

NO	DATE	AMENDMENT
A	09-01-2019	ISSUED FOR REVIEW

PROJECT: Lot 17 Sultana Road, East Forrestfield ODP

TITLE: Vehicle Turning Circle Plan - B99 Passenger Vehicle (5.2m)

DRAWING NUMBER: KC00910.000_S22

DRAWN BY: A.N.

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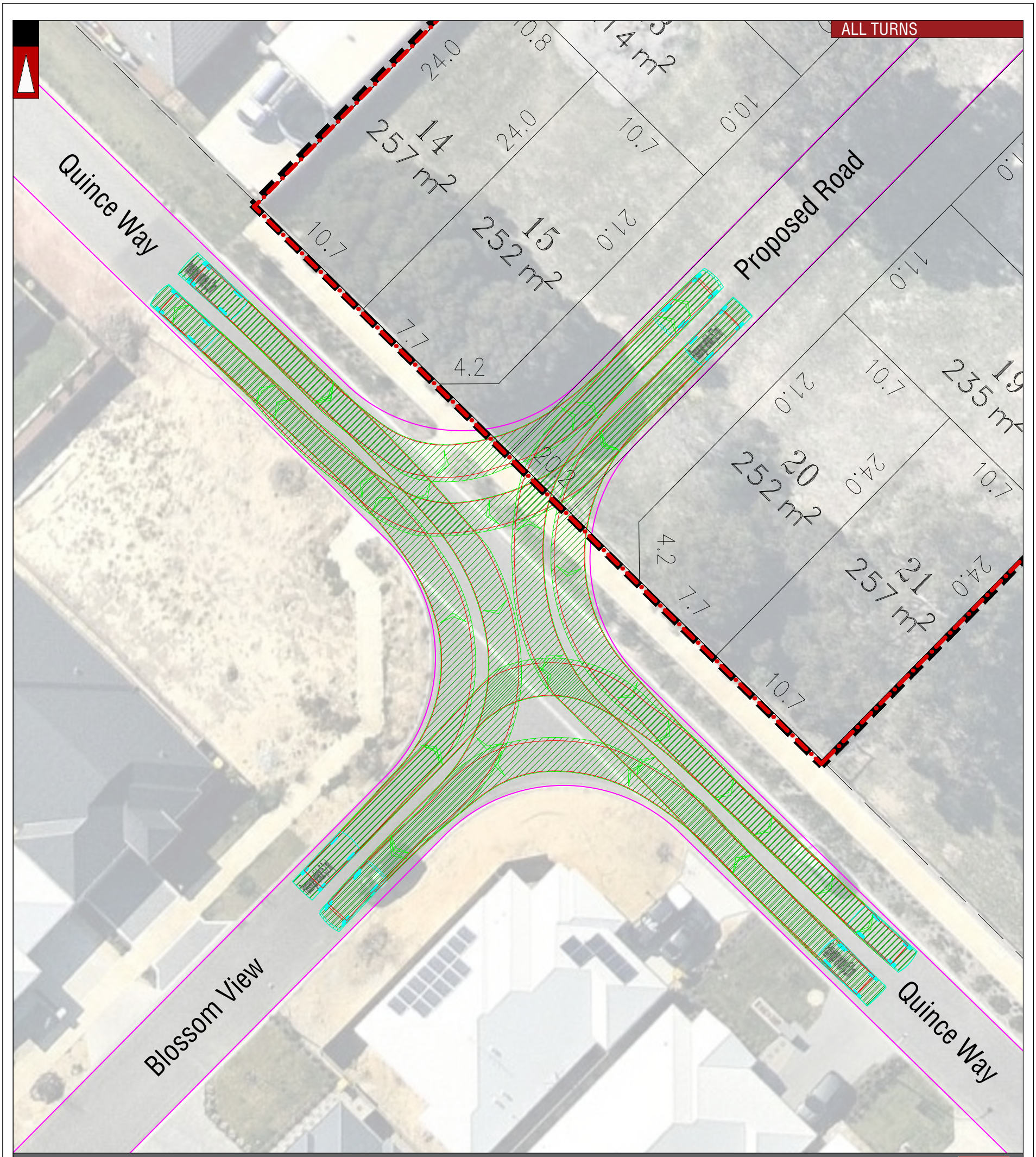
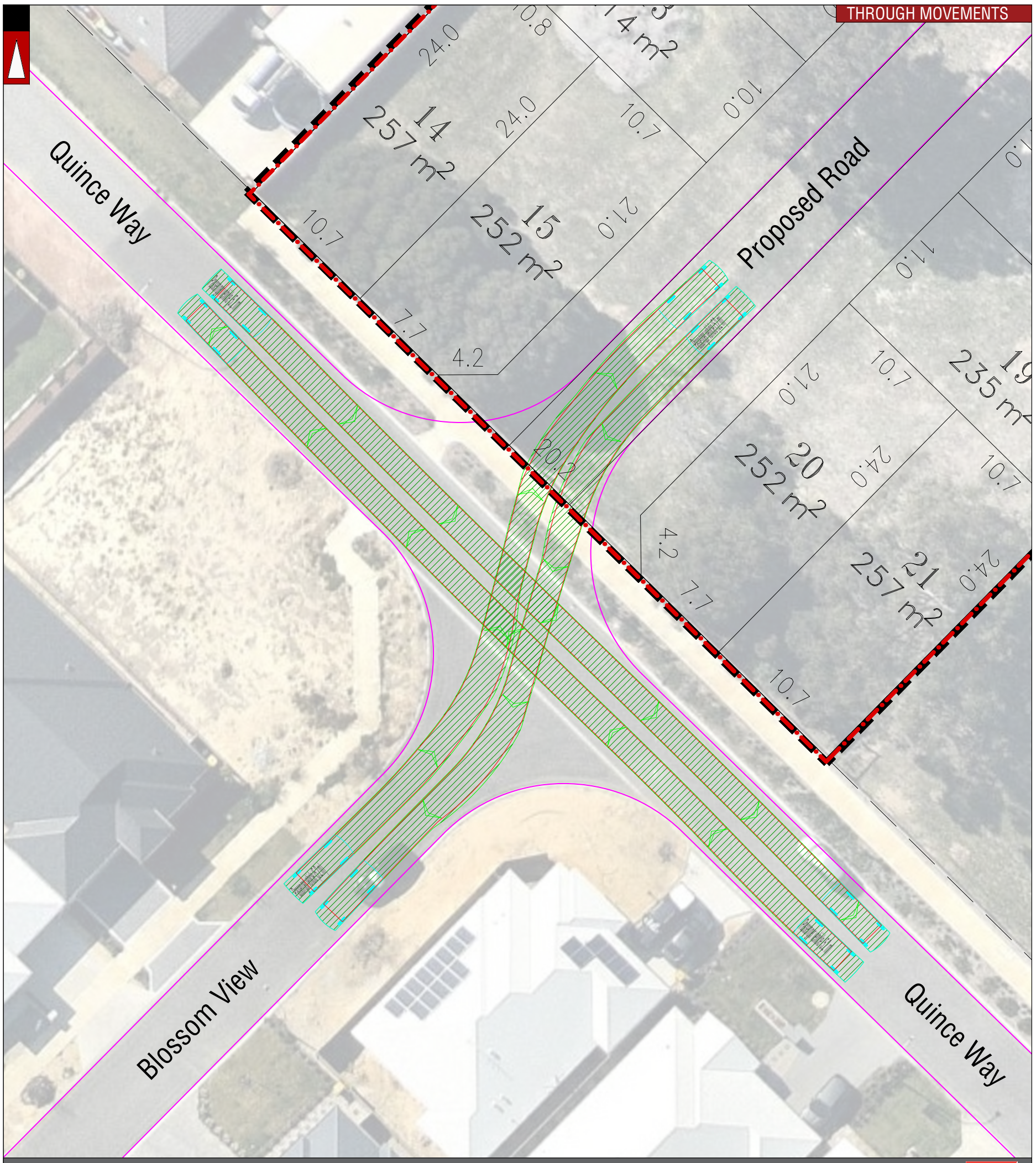


			PROJECT: Lot 17 Sultana Road, East Forrestfield ODP	DRAWN BY:	Civil & Traffic Engineering Consultants Suite 7 No 10 Whipple Street Balcatta WA 6021 PH: 08 9441 2700 WEB: www.kctt.com.au
			TITLE: Vehicle Turning Circle Plan - B99 Passenger Vehicle (5.2m)	A.N.	
A	09-01-2019	ISSUED FOR REVIEW	DRAWING NUMBER: KC00910.000_S23		
NO	DATE	AMENDMENT			



NO	DATE	AMENDMENT
A	09-01-2019	ISSUED FOR REVIEW

PROJECT: Lot 17 Sultana Road, East Forrestfield ODP

TITLE: Vehicle Turning Circle Plan - B99 Passenger Vehicle (5.2m)

DRAWING NUMBER: KC00910.000_S24

DRAWN BY: A.N.

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Appendix 6:
Urban Water Management Plan

kctt

Urban Water Management Plan

Lot 17 Sultana Road East, Forrestfield

KC00910.005

Revision B

Date: 09-Jan-19



Prepared By: KCTT (Trading as KC Traffic and Transport Pty Ltd)
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Rev B	09.01.2018	L. Harris	C. Kleyweg	09.01.2018	Issued For Submission

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Revision	Date issued	Quantity	Issued to
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Rev B	09.01.2018	1 (PDF)	Tayne Evershed (Planning Solutions); Bryan Slater (Hilburn Developments)

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Author	Lachlan Harris
Project Manager / Project Director	Lachlan Harris / Colin Kleyweg
Project	Lot 17 Sultana Road East, Forrestfield
Name of the Document	Urban Water Management Plan for Lot 17 Sultana Road East, Forrestfield
Document Version	KC00910.005_R01_Rev B

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APPENDICES

EXECUTIVE SUMMARY

This document outlines the Urban Water Management Plan (UWMP) for the proposed subdivisional development of Lot 17 Sultana Road East, Forrestfield. The principles and strategies defined herein have been developed in accordance with the guidelines in Better Urban Water Management (BUWM) (WAPC, 2008), and in consultation with the City of Kalamunda's Stormwater Design Guidelines for Subdivisional and Property Development.

This UWMP has been prepared to support the proposed amendments to the Outline Development Plan Agreement Areas 2, 3 & 4, Forrestfield U7 specifically relating to Lot 17 Sultana Road East, Forrestfield.

The pre-development characteristics of the subject site are principally supportive of the development proposal; however, the main parameter for the in-fill design is the integration with both existing topography and existing infrastructure.

One of the main objectives of this UWMP is to detail the best management practise for the management of Stormwater for the Study Area for both minor and major events. Ultimately, Stormwater runoff from the site will be conveyed downstream (to the southeast) to an existing basin within an existing POS site. The effectiveness, efficiency, and benefits provided by the best management practises require a collaborative effort between local governments, developers, and relevant regulatory authorities.

The parties involved in the development of the Study Area shall be aware of their responsibilities and commitments to the concepts and outcomes outlined here in this report. With all parties working together to implement and undertake the necessary measures to monitor and maintain the drainage system designed specifically for this subdivision.

Table E1 - Study Area Information

Site Overview	Description
Subject Site Location	Lot 17 Sultana Road East, Forrestfield WA
Study Area	The proposed development is an urban in-fill development, surrounded by residential development to the, west, south and east, and rural residential to the north. The area covered by this UWMP is approximately 1 hectare, bordered by Sultana Road East to the north, Quince Lane to the south and existing dwellings to the east and west. The development will be undertaken in 2 separate stages.
Existing Use	The site is currently occupied by a single storey residential dwelling, sheds and uncleared trees and shrubs. The site does not currently feature any form of wetlands throughout its entirety, nor does it have any significant environmental constraints that will limit the proposed development. It is proposed the existing dwelling will be retained in the short to medium term.
Proposed Development(s)	Lot 17 Sultana Road East, Forrestfield is proposed to be completed in 2 stages subdivision as below: • 16 x R40 residential lots, with associated infrastructure, inclusive of the construction of roadways, some of which are extensions of existing roads, plus 4 x R25 residential lots, with associated infrastructure, fronting an existing road. • 1 x R40 lot, retaining the existing dwelling with the ability to develop as a future 12 lot strata subdivision.

Table E2 - Executive Summary of Key Design Parameters

Key UWMP Element	Design and Compliance Objectives (Table E1)
Water Conservation Strategy (Section 4)	The potable water supply will be provided by the Water Corporation via the existing scheme water system in Sultana Road East and in Quince Lane. Wastewater will be disposed of via the sewer reticulation systems in Sultana Road East for all lots fronting Sultana Road East, and via Quince Lane for all other lots. The water and wastewater reticulation plans will be submitted for approval by the Water Corporation. The development will include the following water efficiency measures to aid in achieving potable water consumption targets: • Water efficient fixtures and fittings within future dwellings *(responsibility of the lot owner at the time of building approvals)* • Education material provided at the point of sale for each residential lot *(responsibility of the proponent)* • Waterwise landscaping – lot scale landscaping will be encouraged to be based on waterwise landscape principles.
Stormwater Management (Section 5)	Management of the minor events will require detention in the underground pit and pipe system to maintain post-development flows to predevelopment amounts for the 63.2% AEP and 20% AEP. There is sufficient separation to groundwater for the proposed development however it is expected subsoil may be required to manage any perching of groundwater that occurs due to site remediation works, pending further detailed geotechnical works that find perched groundwater systems. As indicated in the geotechnical report, the use of soakwells for the infiltration of runoff on site is not promoted due to the in-situ soil strata. Where no other engineering solution is possible they can be implemented as a last resort option as the infiltration rates calculated for the site show small scale infiltration is possible. In this case, KCTT will discuss the provision of additional permeable materials below and around any proposed soak wells to aid in localised infiltration, as the use of localised infiltration is in accordance with the principles of BUWM. Any soakwells utilised will replace the need for lot connection points and be used to manage runoff generated up to and including the 20% AEP, the volume required for each individual soakwell shall be $0.0122 * A_C$ where A_C is the impervious (roof) area in square metres. Stormwater runoff from the proposed road reserve and lots fronting it will drain to the south connecting into existing residential subdivisions for both the 20% AEP, and for overland flow purposes. This overland and piped flow will then flow south east via Quince Lane and Gala Way before discharging into an existing POS Basin and then ultimately Crumpet Creek. The drainage system for both management strategies will remain consistent and consist of gully pits and reinforced concrete pipes traversing the development area (under roads). Runoff from major events (above the 20% AEP and up to and including the 1% AEP) will be conveyed via the road reserves and enter the system. An orifice plate is to be installed maintaining

Key UWMP Element	Design and Compliance Objectives (Table E1)
	flows leaving the proposed strata development to pre-development flows and the underground pit and pipe system designed to detain excess. All lots are to be set a minimum of 0.3m above the gutter level of roads adjoining that lot.
Groundwater Management (Section 6)	There is currently sufficient clearance above groundwater table levels. Due to in-situ material and proposed remediation works required there may be a requirement for subsoil drainage to manage and mitigate the potential for perched groundwater occurring, should specific geotechnical testing during the design process find evidence of perched groundwater. Existing subsoil drainage IL's adjacent to the development are deemed suitable for connection. This may be preferred over connection directly into stormwater drainage, however this will be determined in the detailed design phase of this project in consultation with the City of Kalamunda.
Management of Subdivision Works (Section 7)	Dust management, erosion, sediment controls and maintenance of infrastructure will all be implemented to ensure the impacts of construction are minimised. The Superintendents for each development will actively manage these items during the construction in the role of Superintendents' Representatives. In accordance with the City of Kalamunda's requirements for the Department of Environment and Conservation – A guideline for managing dust and associated contaminants from land development sites, contaminated sites, remediation and other related activities will be included in the specifications.
Monitoring (Section 8)	The post-development monitoring programme will cover the requirements of the drainage system and be to the satisfaction of the City of Kalamunda.

1. PROPOSED URBAN SUBDIVISION

This UWMP encompasses the proposed residential subdivision of Lot 17 (No. 228) Sultana Road East, Forrestfield. For the purpose of this report, the subdivision will be referred to as the "Study Area" herein.

The total proposed yield for the landholding is 9,992m2 being split into 21 urban residential lots (1 of which is proposed to be further subdivided into 12 strata lots). The site is located approximately 15 km east of the Perth Central Business District (CBD) within the eastern corridor of the Perth Metropolitan Region. The locality of the developments can be seen in Appendix C.

The subdivision of the Study Area is an urban infill project, surrounded by existing residential developments to the south, west and east, with existing special rural subdivision lots on the opposite side of Sultana Road. The land use breakdown of the Study Area (Stage 1) has been provided below:

Table 1 - Land Use breakdown of Study Area

Land Use	Number of Parcels	Area (m^2)
Residential Lots (R25)	4	1,710
Residential Lots (R40)	17	6,764
Road / Road Reserves	1	1,518
Public Open Space (POS)	0	0
Total	**25**	**9,992**

1.1 DESIGN OBJECTIVES AND CRITERIA

This Urban Water Management Plan (UWMP) has been provided to support the proposed development of the Study Area. The strategy presented in this UWMP is generally based on those outlined within the City of Kalamunda Stormwater Design Guidelines for Subdivisional and Property Development of October 2018, and best practice water sensitive urban design that aims to integrate sustainability and the provision of functional residential areas. Furthermore, the design for the proposed development has been guided by the documents subsequently listed:

- West Swan East Local Water Management Strategy 2nd Revision (JDA, 2014)
- Better Urban Water Management (WAPC, 2008);
- Urban Water Management Plans (Department of Water (DoW), 2008); and
- Stormwater Management Manual for Western Australia (DoW, 2004 – 2007).

The plans, designs, and strategies for development identified herein address the potential development constraints, surrounding environment, existing site conditions, and future residential use. The key elements implemented within the development are outlined in Table 2 – Design Objectives and Criteria below.

Table 2 - Design Objectives and Criteria

UWMP Element	Objective	LWMS Criteria	UWMP Relevant Design Criteria
Water Conservation Strategy (Section 4)	Ensure efficient water balance	• Consider alternative fit for purpose water sources where appropriate and cost-effective. • Aim to achieve State Water Plan target of 100 kL/person/year.	Potable water will be supplied by the Water Corporation via the existing scheme water system. Wastewater will be disposed of through the public sewer system. The development will include the following water efficiency measures to aid in achieving potable water consumption targets: • Mandatory water efficient fixtures and fittings within the buildings; and • Education material will be provided at the point of sale for each residential lot Waterwise landscaping packages recommended for each residential lot
Stormwater Management (Section 5)	Provide on-site detention of minor storm events and provide water quality improvement devices where possible.	• All 63.2% and 20% AEP event runoff to be captured at source where possible	Capture and conveyance of Stormwater runoff within the Study Area is promoted in design.
	Post-development discharge volume and peak flow be maintained relative to pre-development conditions.	• Post-development critical 63.2% and 20% AEP peak flow shall be consistent with pre-development peak flow at the discharge points of all subdivisions into waterways	Stormwater drainage managed within Study Area with the use of underground detention systems to account for extra runoff expected as a result of development.
	Manage flood risk to people and property	• Manage surface water flows from major events to protect infrastructure and assets from flooding and inundation.	Finished lot levels set above 1% AEP flood levels.
Water Quality (Section 5 & 6)	Maintain groundwater quality at pre-development levels.	• Manage and minimise changes in groundwater quality following development.	Development not set to adversely impact on pre-existing groundwater quality levels. Infrastructure set above MGL levels.

UWMP Element	Objective	LWMS Criteria	UWMP Relevant Design Criteria
Groundwater Management (Section 6)	Provide sufficient separation to groundwater to prevent flooding and manage quality.	• Critical infrastructure set above Ground Water Level	Finished levels set above groundwater level, and critical infrastructure such as power substation (if required) site set with adequate separation to ground water.
Construction Management (Section 7)	Control impacts of construction, minimise where possible	• Multiple LWMS objectives covered in managing this item.	Dust management, erosion, sediment controls and maintenance of infrastructure will all be implemented to ensure the impacts of construction are minimised. KCTT will actively manage these items during the construction in our role as Superintendent representatives, the dust management measures required for the proposed works is addressed in the management matrix table in the general specifications, derived from DEC guidelines.
Monitoring (Section 8)	Identify contingency plans and responsibility arrangements.	• Structural treatment measures such as infiltration storages (must monitor performance)	The post-development monitoring programme will address all requirements of the drainage design system.

2. PLANNING SUMMARY

2.1 PLANNING PREPARATION

This UWMP supports the proposed subdivision of the Study Area in stage one into 21 urban residential lots of varying sizes, consistent with the structure planning for this area (Outline Development Plan Agreement Areas 2, 3 & 4, Forrestfield U7), with a second potential future stage to subdivide the homestead lot into 12 strata lots. To achieve a water-sensitive urban design, this UWMP addresses the principles and strategies that are required for best planning practices for the sustainable use of water resources. These principles focus on key elements such as the consideration of groundwater, water balance, conservation, use and efficiency, and the management of flood events.

Moreover, urbanisation in the Forrestfield area is supported in the "Outline Development Plan Agreement Areas 2, 3 & 4, Forrestfield U7". The rationale for the proposed development is in keeping with the pattern of urban development in the predefined precincts, and with existing developments surrounding the Study Area, the 'in-fill' nature of the project makes the development proposal logical.

The design and management practices enclosed consider integrated water cycle management as its use on similar projects has demonstrated it to be an effective way to manage water resource management issues typically associated with urban development. Additionally, this UWMP has been prepared to be consistent with the Department of Water's (DoW) "*Guidelines for preparing plans and for complying with subdivision conditions.*"

3. EXISTING SITE CHARACTERISTICS

3.1 EXISTING INFORMATION

The Study Area currently is comprised of 1 existing residential dwelling, an existing shed and a red bitumen hardstand/driveway. It is estimated from aerial imagery the rear 60% remains uncleared. Vegetation across the site comprises of low-level grass and numerous large trees. The site sits within the City of Kalamunda's Outline Development Plan Agreement Areas 2, 3 & 4, Forrestfield U7 area. The developable area is currently zoned for R20 and R12.5 residential development, within the current proposal for amendment to the Outline Development Plan R25 and R40 zoning. No Public Open Spaces are planned within the Study Area, the surrounding land uses can be seen in Appendix E. The proposed subdivision layout is provided in Appendix B.

Adjacent land uses include urban residential housing to the west, south and east of the site, with special rural residential to the north of the site.

3.2 ENVIRONMENTAL CONSIDERATIONS

Preliminary desktop investigations of the Study Area assessed potential environmental constraints to urban development. Information obtained from the Department of Planning reveal no bush forever protected areas are present throughout or within close proximity of the Study Area.

Furthermore, the proposed development is not expected to encounter any environmentally sensitive areas, nor does it propose to adversely impact the surrounding environment.

3.3 CLIMATE

The Study Area experiences a Mediterranean climate, with warm dry summers and cool wet winters. The nearest weather station in operation for average annual rainfall statistics is the Bureau of Meteorology's Maida Vale station (Site No. 009182, 31.97°S, 116.02°E). The long term annual average rainfall data obtained from this station (for information gathered from 1975 to 2018) is approximately 805mm.

Table 3 - Average Monthly Rainfall Statistics

Month	*Average Monthly Rainfall (mm)
January	16.7mm
February	20.2mm
March	19.0mm
April	36.4mm
May	101.9mm
June	153.2mm
July	162.4mm
August	130.2mm
September	87.3mm
October	41.6mm
November	28.9mm
December	9.7mm

*Source: Bureau of Meteorology. Maida Vale weather station (*Average from 1975 – 2018).*

3.4 TOPOGRAPHY

The topography of the Study Area is relatively flat, with a gentle slope (approx. 2%) down from the Sultana Road East frontage at approx. 49m AHD (front) to the Quince Lane frontage of the property at approx. 46.5m AHD (rear), as seen in Appendix F. A few raised undulations are present throughout the site, particularly in the location of the existing residential dwelling.

The proposed development will have connections to existing infrastructure at both existing frontages and be required to conform to the existing levels of the roads and dwellings / boundaries that border the Study Area. Consideration in this regard will be given to the fencing levels of adjoining properties where new retaining walls are required.

3.5 WETLANDS

The Geomorphic Wetland mapping of the Study Area was assessed using the Department of Parks and Wildlife mapping tools available through the Data WA Web Mapping Service. The preliminary desktop assessment of the Study Area found no classified wetlands located on or nearby and so the Study Area is considered to have relatively low conservation value, thus a management strategy for wetlands preservation is not required.

3.6 GEOTECHNICAL CHARACTERISTICS

Preliminary desktop investigations of the Study Area discussed in the completed Geotechnical Investigation (by Structerre Consulting Engineers indicate a geologic profile over this site is classified as Bassendean Sand (Sand, S8 or S10) overlaying the Guildford Formation (Pebbly Silt, Mgs1). Bassendean Sands are characterised by light grey to yellow, fine to medium-grained, sub-rounded quartz of Aeolian Origin.

Geotechnical investigations on site were undertaken by Structerre in February of 2018. The geotechnical investigation took place over the entire Study Area, verifying the geotechnical characteristics of the site. The following description is a summary of the field studies:

- **Topsoil** – 0.1m Thick.
- **Fill (Sand)** – 0.2 to 0.4m Thick. Fine to medium grained, non-plastic, with gravel, trace silt, trace organic material, loos to dense.
- **Natural** – 0.4 – 2.5m. Clayey Sand, low plasticity, trace gravel.

The Geotechnical Report is included in Appendix D of this UWMP.

3.6.1 INFILTRATION / PERMEABILITY

In-situ permeability testing undertaken by Structerre (2018) was carried out adjacent to test locations BH02 and BH07 at depths of 1.0m (pit locations are illustrated on the map included in the Structerre Geotechnical Report). The measured and derived permeability for the soil in these test locations were found to be 0.6m/day and 0.8m/day respectively.

Based on the analysis of the permeability testing (of the encountered ground conditions), a preliminary permeability value of 0.6m/day has been used for drainage calculations over the Study Area. The use of soak wells is not generally considered a suitable means of managing the runoff generated from development in this area, however KCTT will discuss this with the City of Kalamunda and seek approval to provide sand / gravel materials directly under soak wells to improve local permeability and to increase the ability of the site to incorporate some local infiltration. The incorporation of local infiltration has three benefits: -

- It is in accordance with the principles of BUWM
- It limits the sizing of downstream infrastructure within the development
- It limits the pressure on downstream City of Kalamunda infrastructure and limits the severity of downstream flash flooding by providing some additional localised infiltration capacities and capabilities.

Should the City of Kalamunda prefer no localised infiltration, KCTT will therefore design all residential lots to be connected to directly to the proposed road network pit and pipe infrastructure via lot connection pits.

3.6.2 Acid Sulphate Soils

Preliminary Acid Sulphate Soil (ASS) investigations were not undertaken as part of the geotechnical investigations and Regional Mapping of ASS risk indicates the Study Area is located in an area with moderate to low risk of ASS occurring within 3 metres of the natural surface. Given there are no proposed excavations of 3 metres or greater for these works, we believe there is not requirement for acid sulphate soils studies.

3.7 Pre-Development Surface Water Hydrology

There are no existing major surface water features found within the Study Area, however Crumpet Creek is nearby and from review of existing topography of both the study area and surrounding properties, runoff flows towards this naturally occurring creek before discharging into the Water Corporation Main Drain at the boundary of the Perth Airport. Crumpet Creek is dry in summer months, typically flowing annually between August and October.

Maintaining downstream flows at pre-development levels is an important part of the design philosophy for Crumpet Creek and its uses. KCTT will confirm all pre-development flows are maintained to this asset as part of the detailed design phase of this project.

3.8 Pre-Development Groundwater Hydrology

Perth Groundwater Atlas details for May of 2003 groundwater was estimated as being 17m AHD, which based on the approximate current surface levels is a separation of 30 metres. It is understood there are two aquifer formations underlying the Study Area, organised in descending order of depth from natural surface:

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

Though these geologic formations are not discussed in detail in this UWMP, they are considered in detail in the LWMS completed as part of the nearby The Hales Estate.

3.8.1 Pre-Development Groundwater Levels

No groundwater monitoring bores are available for the study area at the time of writing this report. However, no groundwater was encountered during undertaking of the geotechnical investigations, with boreholes completed up to 2.5 metres in depth. It is important to note that groundwater levels vary throughout the year and given the in-situ soil strata identified in the Structerre Geotechnical report there may be potential for groundwater to become perched in areas during winter months.

3.8.2 Pre-Development Groundwater Quality

No groundwater quality data specific for the Study Area is available at the time of writing this report. Review of groundwater monitoring for the neighbouring development completed as part of the LWMS for The Hales Estate suggests predevelopment groundwater is of better quality than relevant water quality guidelines.

4. WATER SUSTAINABILITY INITIATIVES

4.1 General Considerations for Development

The proposed water conservation strategies implemented for the development of the Study Area have been developed in accordance with the water use sustainability initiatives. Potential areas of potable water use reduction involve replacing potable water use with non-potable use. However, the risks associated with the failure to reach an appropriate water quality standard must not outweigh the benefits of implementing the alternative option.

Strategies that do not include the substitution of potable water include promoting waterwise landscaping initiatives, involving the use of appropriate plants. Other water conservation efforts will focus on encouraging the community to use water efficient appliances and devices and provide educational programs that highlight the importance of the home owner's role in preserving potable water resources.

It should be noted that this development does not include the creation of any Public Open Space (POS), though the drainage from the proposed development will be conveyed to the POS basin located at the corner of Gala Way and Mandon Street. Details of water efficiency measures for this basin are deemed to be included in the UWMP document for that particular development.

4.2 Water Conservation and Efficiency Measures

The site lies within the Perth Metropolitan water supply area serviced by the Water Corporation. Potable water will be supplied through a connection to the mains water supply (made through the Water Corporation). The conservation strategies and efficiency measures proposed aim to achieve a reduction in potable water use.

General consensus on the use of scheme water in Perth's households is that it is unsustainable and measures need to be put in place to achieve significant reductions in potable water use. The Perth household average potable water use as at 2008/09 was 277 kilolitres (kL) or 106kL per person according to the "Perth Residential Water Use Study" undertaken by the Water Corporation (Water Corporation 2003). The use of potable water for irrigation purposes contributed 39% of this total. While this is a marked decrease from the last study performed in 2003, where residential household use was at 128kL, Perth is still one of the highest water using cities in Australia.

The general approach to implement water conservation measures will be to encourage a 'waterwise' development. The water conservation strategy for this development will aim to reduce scheme water demand by incorporating a variety of effective initiatives, which include the provision of the following:

- Use of higher density residential zoning and smaller lots to reduce garden use of water – development will consist of R40 lots, with the average area of the lots being 351m^2;
- Promotion of use of waterwise practises including water efficient household fixtures and fittings, limiting the amount of potable water use through water efficient 3 star WELS rated shower heads, 4 star WELS rated tap fittings in all kitchen sinks, bathroom basins, and vanities, waterwise landscaping, and at least 4 star toilets and appliances (AAA rated washing machines);
- Gas hot water system with a minimum 5 stars WELS rating (alternatively, the use of a solar hot water system or high energy efficient electric heating pump may be appropriate);
- Encouraging hot water outlets be located close to the hot water system or a recirculating hot water supply to minimise wastage of energy and water;
- Covering all new swimming pools as now required by legislation; and
- Maximising on site retention of stormwater.

4.3 WATERWISE LANDSCAPING

The waterwise landscaping measures proposed for this development aim to reduce the amount of water used for irrigation by recommending the use of low water use plants, soil amendments and efficient irrigation systems. The following principles should be implemented where practical:

- Waterwise vegetation – Plants must have low watering requirements and be suited to the local area, local native species preferred;
- Gardens will be mulched or filled with pine bark mulch (particle size between 15-75mm) to reduce evaporation. Garden beds will be mulched to 75mm with a product certified to AS4454;
- Hydro-zoning of plants of similar water requirements;
- Where required, soil shall be improved with soil conditioner certified to be planted and a minimum depth of 300mm for garden beds; and
- Reticulation systems shall be designed and installed according to best water efficient practices.

5. STORMWATER DRAINAGE MANAGEMENT

The UWMP aim is to successfully manage Stormwater runoff for critical storm events such as the 63.2%, 18.1% and 1% AEP events, in accordance with LWMS principles, strategies and quantities minimising the impact development has on runoff quantities coming from the Study Area. Urbanisation of the land will require effective management of runoff within the proposed development to ensure post development flows mimic pre-development flows. The geotechnical investigation undertaken by Structerre has identified that the use of soak wells in the Study Area is not feasible as the underlying soil conditions are not suitable for drainage purposes. This Chapter addresses the management of surface runoff for both major and minor events.

At this stage, KCTT are likely to be the consulting engineer for proposed subdivision. Drainage systems and overland flows in the proposed subdivisional roads will be designed to allow overland flow to flow from subdivision and into the POS area basin constructed as part of neighbouring development before out letting to the existing open drain that ultimately discharges in the Woodlupine Brook.

The Stormwater drainage system for the proposed development will consist of a network of interconnected reinforced concrete pipes to convey captured runoff from the 63.2% and 20% AEP ("minor") storm events into the drainage basins located at the intersection of Gala Way and Mandon Street. Surface flow will navigate road reserve areas within the development and be captured by strategically placed gully pits for the minor events, with roadways handling the flows for the 1% AEP event in excess of those conveyed in the piped network. The primary objective in designing for these events is the protection of private property from inundation and retaining flows to the downstream drainage systems.

The following sections provide further detail on the strategy, calculations, and management of Stormwater to ensure that best management practices of stormwater management and flood protection area achieved.

5.1 DRAINAGE CALCULATIONS

The drainage calculations undertaken for this project employ hydrologic methods outlined in the Australian Rainfall & Runoff (ARR) 2016 publication. The methods adopted are appropriate for the type of catchment in which the Study Area exists, with the design parameters used calibrated for the given site environment.

The drainage calculations undertaken for the Study Area assess the hydrological impact of the development as a result of urbanisation. The resulting design solutions manage storm events on a qualitative and quantitative basis such that the critical post development flow characteristics of the site mirror pre-development characteristics, and Stormwater is effectively managed within the development.

5.1.1 RUNOFF COEFFICIENTS

The choice of runoff coefficient for drainage design can greatly influence the design of soil and water management structures included in the treatment systems for a particular site. The subsequent runoff coefficients have been selected based on the information provided in the completed geotechnical report and upon review of City of Kalamunda's Stormwater Design Guidelines for Subdivisional and Property Development.

The runoff coefficients for the drainage calculations on the Study Area are provided in Table 9 below. The coefficients provided account for each of the critical storm events for the Study Area. These coefficients are also illustrated in the drainage calculations in Appendix G.

Table 4 - Runoff Coefficients

	Storm Event		
Type	63.2% AEP	20% AEP	1% AEP
Lots (R25 - 40)	0.85	0.85	0.95
Road	0.85	0.85	0.99
Pre-development	0.22	0.35	0.50

5.1.2 Catchment Areas and Hydrology

The hydrologic assessment of the Study Area is based on the urbanisation of the 'catchment', with the catchment area being defined as the area bound by the spatial lot boundaries of the Study Area.

Contributing areas to the catchment were then broken down as road reserve areas, lot runoff areas, and verge areas, each of these having the necessary parameters factored into drainage calculations (permeability, runoff losses, development category etc.).

It should be noted that the geotechnical report for the site was assessed to determine the infiltration capacity of the soils over the Study Area. The assigned volumetric runoff coefficient was based on the findings from the geotechnical report and best reflects the geology of the entire site.

5.1.3 Time of Concentration

Time of concentration calculations have been undertaken to allow calculation of the runoff within the catchment in order to determine the position and size of the inlets required to control both flow-width and discharge capacity within the development. The time of concentration varies depending on other catchment data. Care has been taken in design to assign appropriate catchment conditions in accordance with the required analysis.

The maximum time of concentration for the 1% AEP storm event was calculated as 19 minutes (for high intensity rainfall for a short duration), this said, the critical storm duration for design has been calculated as the 1 hour 1% AEP event.

5.2 Stormwater Management of Minor Events

The design parameters for the management of stormwater of minor events will be to promote at source detention, with some potential for localised infiltration for events up to the 20% AEP event. The drainage system is made up of the detention pits, drainage lot connections, and a piped drainage system.

As mentioned previously in this report, runoff from lots will be directed to street drainage via lot connection pits. The lot connection pits will be installed to achieve required clearances from the building and property boundaries.

The lot size over the proposed development varies, consisting of R25 and 40 lots of varying sizes from 310m^2 to a potential grouped housing lot of 890m^2. Due to in-situ soil strata and the potential for perched groundwater all green title residential lots where possible will be provided with lot connections points. As there is an absence of suitable drainage network in Sultana Road, the 4 proposed R25 green title lots fronting Sultana Road and proposed retained homestead will be required to utilise soakwells to manage the minor event on site. While the geotechnical report discusses the unsuitability for the use of soakwells, permeability results suggest there is some scope for infiltration (retention) techniques to be used where detention solutions are not available or are impractical.

5.2.1 Public Safety

Inlet pit spacing is to be designed such that gutter flow widths are kept within acceptable limits as prescribed in the below table to ensure pedestrian and vehicle movements can be completed in a safe manner.

Table 5 - Maximum Allowable Gutter Flow Widths

Type	Allowable Flow Width
Two Way Cross Fall	1.5m
One Way Cross Fall	2.0m
Access/Lane Ways	2.5m
Pedestrian Ramps/Footpath Crossings	0.5m

5.3 Stormwater Management of Major Events

This UWMP conservatively assumes that some drainage will come directly back onto the road in the 18.1% event as it is unrealistic for all area of the lot to direct all runoff directly to lot connection points and therefore this runoff has been assumed to be captured by the pit and pipe system. Further lot connection points will have inadequate capacity to manage major events over this minor storm event, therefore runoff generated from major events will flow from lots onto the road reserve.

The major drainage system has been designed for AEP events up to the 1% AEP. The major drainage system consists of a network of concrete pit and pipes, laid under roadways, both existing and proposed, plus the roadways themselves. The pipes have been sized based on flows from the 20% AEP event, restricting inundation for that particular event.

Runoff from major events will enter the piped drainage system via gully pits spread throughout the proposed development. From here, runoff water will then be conveyed into downstream drainage basins, with outflow restricted through the use of orifice plate to predevelopment flows. The permissible site discharge (PSD) calculated in accordance the City of Kalamunda's Stormwater Design Guidelines for Subdivisional and Property Development has determined the maximum allowed outflow of the Study Area for the 20% AEP is 0.055m^3/s.

Stormwater modelling indicates that there will be minor areas of inundation in the 1% AEP event. This inundation is limited to roadways which generally serve as 1% AEP flood paths. All lots are to be set above these inundation levels. All roads are to be graded in accordance with the overland flow paths described above, as outlined in the flow paths plan shown in Appendix H.

5.3.1 Flood Protection

The main Stormwater drainage strategy is proposed to dispose of water from all events by directing runoff along roadways and piped networks to constructed detention drainage basins. This is to ensure delivery of the 1% AEP storm. Piped drainage systems will be sized in accordance with the intensity of the 20% AEP event, and carry the overflow to the temporary basin.

All lot levels are above the adjoining road levels, with finished floor levels having at least 0.3m clearance above the estimated 1% AEP flood levels on the road in front of the lots.

5.4 Water Quality Management

This chapter addresses the water quality management approach for the development of the Study Area. Though it is not strictly an objective of managing major events to treat for quality, the control measures implemented will

provide some level of quality management. Structural and non-structural controls will be implemented to manage the quality of smaller rainfall events.

5.4.1 Non-Structural Controls

Non-structural controls such as public awareness and community education can be used to support the structural controls in achieving Stormwater quality management. The following non-structural controls will be used in the development of the Study Area:

- Nutrient control through landscaping – planting of appropriate native species managed together with an appropriate fertiliser, pesticide and irrigation regime (drought tolerant gardens to lot purchasers via landscaping packages). Utilization of groundwater bores for gardening will be promoted where applicable.
- Waste and construction management – management of litter, sediment and organic material by regular street sweeping, and discouraging waste dumping in drainage channels (such as the temporary basin) through restricted access or landscaping design.

5.4.2 Structural Controls

The structural controls used as part of this drainage design include the detention and infiltration of minor events in vegetated treatment areas in existing downstream POS areas sized with capacity for the 63.2% AEP event.

6. GROUNDWATER MANAGEMENT

The focus of groundwater management for the Study Area is to ensure groundwater perching in imported sand required as part of earthworks remediation (as detailed in the Geotechnical Report) is suitably dealt with post development. Levels are to be maintained within their existing natural regime, and where applicable, developed land is provided with enough clearance above groundwater levels.

There is existing subsoil located in the road reserve of Blossom View and Quince Way, from review of as-constructed information it has suitable invert level for connection into from the proposed road reserve of the Study Area.

This is existing subsoil drains west towards discharging in the Gala Way POS at the intersection with Apricot Street.

6.1 GROUNDWATER QUALITY TARGETS

The import fill operations undertaken for this development (detailed in previous and subsequent sections) are not large in scale, and the known depth to groundwater is significant consequently, the existing groundwater levels across the Study Area are unlikely to rise as a result of development of the land.

By maintaining groundwater levels as close as possible to existing levels, the likelihood of an impact on groundwater dependent ecosystems is reduced. As the design for the Study Area ensures adequate infrastructure separation, there is a reduced risk of export of groundwater, thus it is unlikely that any nutrient rich groundwater will be exported.

The post development monitoring of groundwater is not deemed necessary as the rate of groundwater movement is not set to change significantly between pre-development and post development conditions.

6.2 IMPORT FILL MANAGEMENT

Earthworks will be undertaken across the site to provide adequate site remediation as required (to obtain as minimum site classification of “Class S”) and to ensure that the post-development landform is consistent with the levels of adjacent properties.

Where imported fill is required, clean sand that is free of organic matter or other deleterious material will be used. The fines content shall be less than 5% to promote drainage as per the engineering guidelines for subdivisional development (IPWEA, 2011).

KCTT also believes in the re-use of existing materials, inclusive of top soils which can be screened for organic material and re-used with 2 parts clean import fill to 1 part screened topsoil at depths of greater than 300mm in bulk earthworks. This strategy would require approval by suitably qualified Geotechnical Engineer prior to implementation.

7. MONITORING AND MAINTENANCE

7.1 PRE-DEVELOPMENT

Preliminary desktop investigations have been undertaken to establish site characteristics to determine any potential impacts (if any) that development of the Study Area may have.

7.2 CONSTRUCTION MANAGEMENT

Management of subdivision works will ensure that any potential environmental impacts to the surrounding environments are minimised through the implementation of correct management measures and exercising best management practices.

7.2.1 DRAINAGE INFRASTRUCTURE

Thorough inspection of the entry points to the drainage network will be undertaken during the construction phase and prior to Practical Completion to ensure all litter and clogging sediment is removed. These control measures are implemented to ensure that the drainage infrastructure is not adversely impacted during the construction phase and will maintain function and efficiency post construction.

7.2.2 DUST AND SEDIMENT CONTROL

Dust is generated when there is sufficient wind velocity and frequency to lift fine particles from a surface. The susceptibility of the particles to the uplift is dependent on the size and weight of the particles as well as the compaction and moisture content of the ground. Consequently, the mitigation of the issue of dust is controlled by addressing the parameters for uplift. The strategy employed gives consideration to the surrounding land uses, the closest sensitive receptors and the prevailing wind and climatic condition for the season in which the works are to be conducted.

Dust management is required to ensure the health and amenity of neighbours and employees, good visibility on site, maintenance of machinery and equipment, and maintenance of the surrounding water quality. Environmental protection measures to mitigate adverse effects include:

- Stabilisation of disturbed areas in a timely manner;
- Exposed soils managed by wetting down; and
- Truck loads to be covered and washed down prior to entering and leaving the site.

A non-potable source of water should be used for dust control wherever possible.

The construction will occur in a manner consistent with the approved Erosion and Sediment Management Plan put forth by the approved contractor for the works. Management of the sediment during development is a key factor in the success of installed best management practises. The DER requires that all development construction projects, including road and infrastructure construction, implement sediment and erosion control measures. Measures include:

- Install temporary sediment fences and controls around Stormwater drainage infrastructure to ensure sediment clogging does not occur;
- Designated construction transport routes across of the site;
- Single transport entry points with shake down grids; and
- Street sweeping to reduce sand drift.

7.2.3 DEWATERING

Dewatering operations are not expected to be required as part of construction works for the development due to the significant separation between surface levels and groundwater.

7.3 POST DEVELOPMENT MONITORING

As part of the Best Management Practices incorporated into the drainage system design, a monitoring program is to be implemented post construction.

As mentioned previously in Section 6.1, post development groundwater monitoring is not deemed to be necessary.

Though there is no surface water areas on the site, the health and functionality of the constructed drainage structures will require regular maintenance to ensure efficient operation. Maintenance inspections should be scheduled to be conducted after significant storm events, the inspections should place focus on the time taken for the temporary system to drain, potential scouring within the outlet basin, and build ups of sediment.

The findings from monitoring inspections and maintenance schedule should be discussed with the City of Kalamunda. Information collected from monitoring programs will be summarised in report format by the developer and provided to the City of Kalamunda for review. The effectiveness of the maintenance regime may also be reviewed throughout the life of the drainage system, should any of the previous monitoring reports determine an inefficiency in the maintenance program. A monitoring plan has subsequently been provided in Table 12.

Table 6 - Monitoring Schedule

Item	Location	Maintenance Trigger / Indicator	Action Required	Maintenance Interval			
				As Required	Monthly	Quarterly	Biannually
Surface water quality (physical parameters and nutrient levels)	Downstream drainage basin	Basin not emptying and available for recharge; Change of colour of water being held in basin	1st step is to monitor visual appearance and emptying time of basin. If the colour of water becomes green, or the emptying time is longer than 72 hours, samples shall be collected for testing.		✓ (for winter months: June to October)		
Erosion inspection	Downstream drainage basin, around inlet	The presence of severe erosion in drainage locations; Batters in temporary drainage basin suffering from erosion.	Investigate extent of erosion and determine cause. Rectify cause with maintenance or replacement works			✓	
Rubbish and litter inspections	Throughout the development	Rubbish or litter blocking drainage structures or detracting from the visual appearance of the development	Remove litter, identify source, and respond accordingly.	✓			
Sediment build up inspections	Within drainage pits; downstream drainage basin	Build-up of sediments in drainage pits or on the surface of the temporary drainage basin (restricting infiltration)	Investigate – determine cause of sediment source. Remove accumulated specimens, replace filter material if req'd			✓	
Weed control (assessment of vegetation health)	Throughout the development	Highly invasive weeds and/or dead plants (pattern of plant deaths)	Manually remove. Use of chemicals must be approved (near waterways)				✓
Street drainage (assessment of effectiveness)	Throughout the development	Impaired function due to litter, sediments, or damaged infrastructure	Identify source, clear obstructions, rectify damages if req'd			✓	

8. UWMP RECOMMENCDATIONS IMPLEMENTATION PLAN

8.1 ROLES AND RESPONSIBILITIES

Table 7 - UWMP Recommendations Implementation Plan

Management Commitment / Item	Responsibility (funding where applicable)
Construction of street drainage system and temporary drainage basin	Developer
Maintenance and monitoring of street drainage system	Developer (defects liability period) City of Kalamunda (handed over after defects liability)
Construction of lot connection pits and connection to provided lot connection points	Lot owners (after lot purchase)
Design and construction of the required water and sewer reticulation in consultation with the Water Corporation	Developer
Appropriate fill levels achieved for necessary clearance requirements	Developer
Planting of vegetation consistent with City of Kalamunda requirements	Developer / Lot Owner (after lot purchase)
Water sensitive landscaping of the streetscape	City of Kalamunda
Education and encouragement of waterwise practices for lot owners	Developer (at the point of sale)
Maintain water and sewer supply system	Water Corporation
Prepare and submit report covering findings from monitoring program	Developer

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APPENDIX A: UWMP CHECKLIST

The following is the summary / checklist for an Urban Water Management Plan in accordance with the Department of Waters Guidelines for preparing plans and for complying with subdivision conditions.

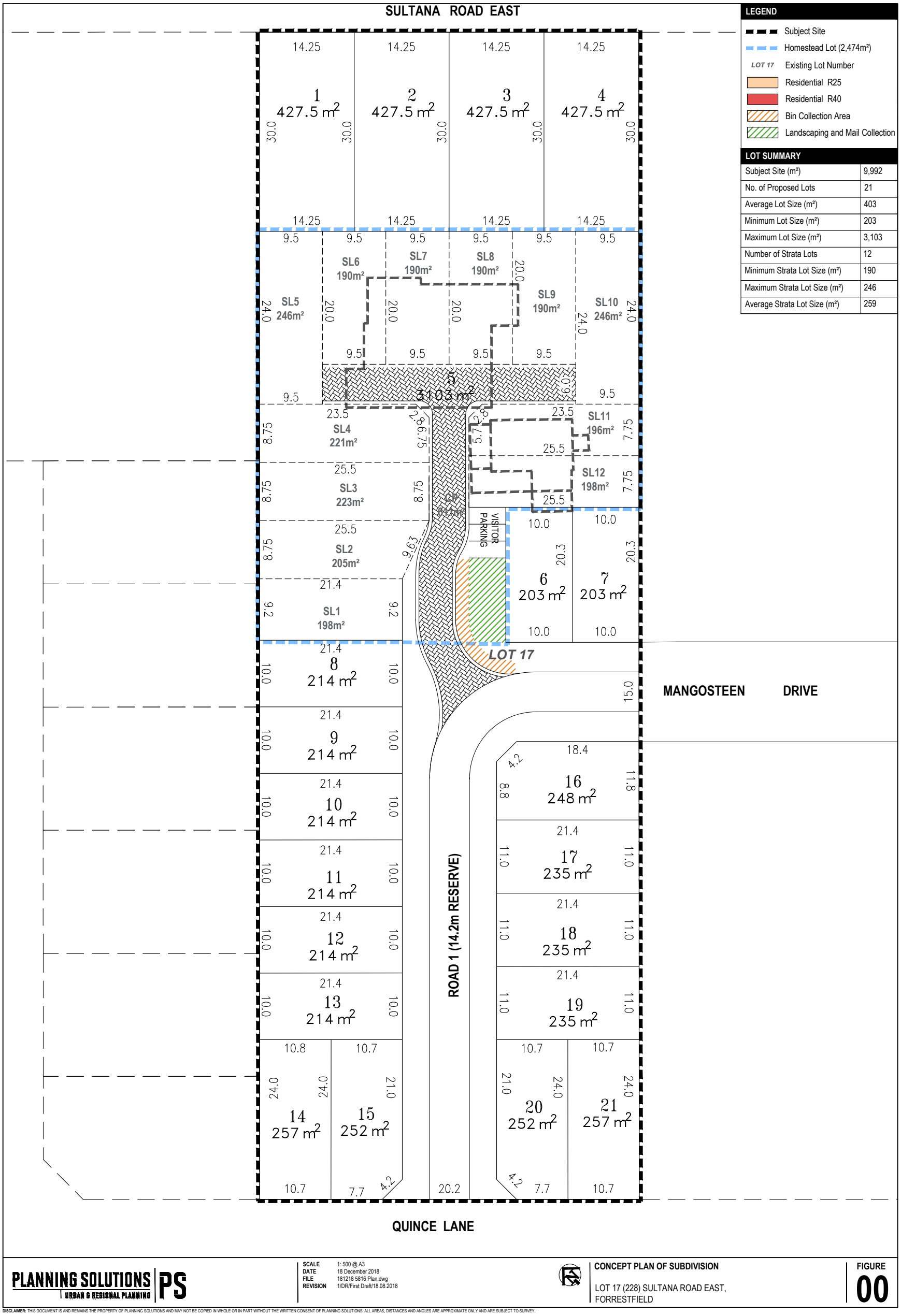
UWMP Item (Deliverable Item)	**Status** (Y/N)	**Comments/Proposals**
Summary		
Design elements and requirements (Table form)		Development of design elements and compliance with design objectives.
Design requirements for critical control points (Table form)		Key design requirements for detailed design – critical control points and elements.
Planning Approval		
Location plan		Location plan, adjoining lots, key landscape features and roads, local water management strategy.
Site context plan		Structure plan, zoning and land use.
Subdivision layout plan		Subdivision plan and/or approval (WAPC).
OR a combination of the above		-
Design Objectives		
*No deliverable items required		Agreed design objectives and demonstration of compliance.
Site Characteristics		
**Addressed in document		Existing information and more detailed assessments (monitoring) of site; explanation of how the site characteristics affect the design.
Site condition plan		Site conditions – existing topography/contours, aerial photo underlay, major physical features.
Geotechnical plan		Geotechnical – topography, test pit locations, soil zones and descriptions, site classification zones, proposed earthworks and approximate finished contour levels.
Environmental plan, plus supporting data where appropriate		Environmental – sensitive or significant vegetation areas, wetlands and buffers, waterways and buffers, contaminated sites.
Surface water plan		Surface water – topography, 100-year floodways and flood fringe areas, 100-year proposed flow paths, water quality of flows entering and leaving (if applicable).
Landscape plan		Landscape – proposed public open spaces, water source, bore(s), lake details (if applicable), approx. watering requirements and water

		balance, indicative irrigation schedule; demonstrate compliance with *Interim position statement: Constructed lakes (if applicable).*
Water Sustainability Initiatives		
**Addressed in document		Water supply and efficiency measures.
Alternative supply scheme and plan		Fit-for-purpose strategy and agreed actions; if non-potable supply, support with water balance.
**Addressed in document		Wastewater management.
Stormwater and Groundwater Management		
Preliminary 100-year ARI event inundation plan		Flood protection – peak flow rates, top water levels at control points, 100-year flow paths – floodways and flood fringe zones and/or along roads and reserves, 100-year inundation areas and volumes.
Long section of critical points		
*1 year ARI event management addressed in document		Stormwater management system – storage areas, flows and hydraulic grade lines for both major and minor events including controlling inverts (critical control points); locations and arrangements for agreed structural and non-structural management practices and treatment trains, supported by sizing criteria, areas of inundation, flow paths and cross sections; show integration with landscaping.
*5 year ARI event management addressed in document		
Typical cross sections		
Groundwater/subsoil plan – addressed in the document		Post-development groundwater levels and fill requirements (including existing and final surface levels), outlet controls, and any subsoils (showing drawdown/effects near sensitive environments; describe modelling assumptions.
Typical cross section (max and minimum)		
**Addressed in document		Actions to address acid sulphate soils or contamination.
**Addressed in document – See Appendix C for adjustment of building envelopes		Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages.
NA for this development		Management of disease vectors and nuisance insects.
Other Issues – Landscape Concept		
**Relevant section addressed in the document, no POS in this development.		Provide a separate section on managing public open spaces if a number of water efficiency (and other) strategies are to be implemented. Address plant species selection, nutrient application and irrigation management.
**Addressed in document		If a constructed water body is proposed and has been endorsed in the local water management plan, the UWMP shall address all of the requirements of the Department of Water's *Interim position statement: Constructed lakes* and any local government requirements or policies.

**Addressed in document		Where significant environmental areas exist on or near the site, additional measures are likely to be needed to ensure their protection. Provide information about the areas' current hydrology and demonstrate that it will not be dissimilar post-development.
Managing Subdivision Works		
**Addressed in document		Management of construction activities including dewatering, acid sulphate soils, constructed best-management practices, and dust, sediment and erosion control – timing and possible staging.
Monitoring Program		
**Addressed in document		Sampling and assessment plan including duration and arrangements for ongoing actions.
Implementation Plan		
**Addressed in document		Roles, responsibilities, funding for implementation.
**Addressed in document		Agreed maintenance arrangements.
**Addressed in document		Assessment and review.

APPENDIX B: SUBDIVISION PLAN

DRAFT FOR CLIENT REVIEW



PLANNING SOLUTIONS | PS
URBAN & REGIONAL PLANNING

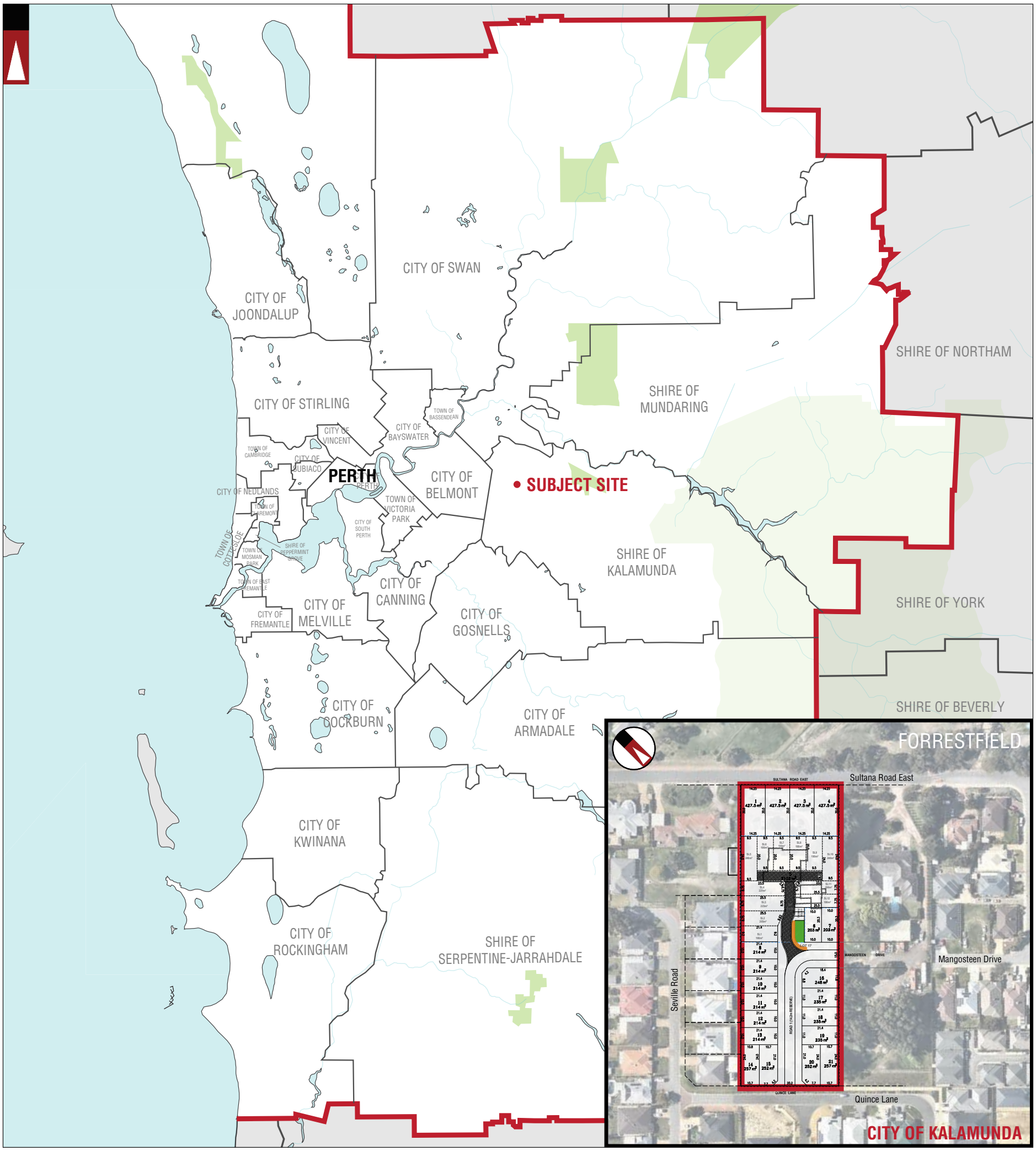
SCALE	1: 500 @ A3
DATE	18 December 2018
FILE	181218 5816 Plan.dwg
REVISION	1/DR/First Draft/18.08.2018

CONCEPT PLAN OF SUBDIVISION

LOT 17 (228) SULTANA ROAD EAST, FORRESTFIELD

FIGURE 00

APPENDIX C: SITE LOCALITY



Parks and Recreation
Public Facilities
Water
Location Boundary
Railway
Road
Cadastral Boundary
DAYTON Local Government Name
Reid Highway Street Name

LEGEND

Certified System Quality ISO 9001 SAI GLOBAL

			PROJECT: Lot 17 (228) Sultana Road East, ForrestfieldH	DRAWN BY: J.S.	Civil & Traffic Engineering Consultants Suite 7 No 10 Whipple Street Balcatta WA 6021 PH: 08 9441 2700 WEB: www.kctt.com.au
			TITLE: Site Location Plan		
B	09-01-2019	PROPOSED LAYOUT AMENDED	DRAWING NUMBER: KC00910.000_S01		
A	26-11-2018	ISSUED FOR REVIEW			
No	DATE	AMENDMENT			

kctt

APPENDIX D: GEOTECHNICAL INVESTIGATION

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GE2.4.002

GEOTECHNICAL INVESTIGATION

For: Hilburn Constructions

Project Address: Lot 17 #228 Sultana Road, Forrestfield

Project Number: D185869

Job Number: J196103

Revision Number: 0

Author: Margie Mortera

Date: 19/2/2018

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STRUCterre consulting engineers

PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

1. PROJECT DETAILS

1.1. Introduction

At the request of Bryan Slater of Hilburn Constructions, Structerre Consulting Engineers (Structerre) have conducted a Geotechnical Investigation at Lot 17 #228 Sultana Road, Forrestfield. The purpose of the investigation was to provide the following for residential subdivision purposes:

- An assessment of subsurface soil profile and groundwater conditions across the proposed area of development;
- Site classification in accordance with AS 2870-2011 Residential Slabs and Footings;
- Wind Classification in accordance with AS 4055-2012 Wind Loads for Housing;
- Recommendations for stormwater drainage design;
- Recommendations on earthworks and site preparation; and
- Provision of a footing detail considering anticipated surface movement and sand pad thickness.

Terms of reference for this investigation were presented in a Structerre Consulting Engineers proposal reference Q73191 (dated 19 January 2018), which was submitted to and accepted by Hilburn Constructions.

1.2. Site Description

The site is located at Lot 17 #228 Sultana Road, Forrestfield, City of Kalamunda. Sultana Road lies to the northeast of the site and residential properties to the southeast, southwest and northwest.

The site slopes down towards the rear section. At the time of the field investigation an existing house and shed occupied the site. The front and the rear areas of the property were covered in vegetation with small to medium sized trees.

1.3. Field Investigation – Scope of Works

The field investigation was carried out on 12 February 2018 and comprised:

- 7 x Sample Retrieval Probes (SRP) to a depth of 2.5m over the site for material assessment and soil profiling;
- 2 x In situ percolation tests to determine the permeability of the materials within the upper 1.0m; and
- 7 x Dynamic Cone Penetrometer (DCP) tests in accordance with AS 1289.6.3.2 (1997) to a depth of 2.0m for evaluation of relative densities of the upper layers.

The borehole, percolation and DCP test locations are shown on the attached site plan in Appendix 1.

A suitability qualified geotechnical personnel from Structerre supervised the fieldwork and all fieldwork, interpretation and terminology used in this report are in accordance with the guidelines presented in AS1726-2017 Geotechnical Site Investigations.

2. DESK STUDY

2.1. Geological Setting

The Perth sheet 1: 50,000 Environmental Geology Series (Part Sheets 2034 III and 2134 III, 1986) prepared by the Geological Survey of Western Australia indicates that the following geological layers underlie the site:

- SAND (S8 or S10) – very light grey at surface, yellow at depth, fine to medium grained, sub-rounded, quartz, moderately sorted of eolian origin (Bassendean Sand Qpb), underlain by
- Pebbly SILT (Mgs1) – strong brown silt with common, fine to occasionally coarse-grained, sub-rounded laterite quartz, heavily weathered granite pebble, some fine to medium-grained quartz sand, of alluvial origin (Guildford Formation Qpa)

2.2. Ground Surface and Groundwater Level

The Perth Groundwater Atlas (Waters & Rivers Commission) indicates the ground surface level at this site was approximately 47.0m to 48.0m Australian Height Datum (AHD).

The May 2003 groundwater level at the site was approximately 17.0m AHD. It should be noted that the groundwater levels can vary significantly due to seasonal variation and the data from the recorded maximum levels should be used only as a guide.

2.3. Earthquake Coefficient

In accordance with AS 1170.4-2007 Structural Design Actions the site is located within an area with an earthquake acceleration coefficient of between 0.09 and 0.10.

2.4. Wind Classification

In accordance with AS 4055-2012 Wind Loads for Housing, wind classification of this site falls within the non-cyclonic “N1” category.

3. RESULTS OF THE INVESTIGATION

3.1. Subsurface Soil Profile

The subsurface soil profile presented below was determined from the ground conditions encountered within the boreholes and through the interpretation of the DCP test results:

Table 1 – Subsurface Soil Profile

Depth to Base of Strata (m)	Material Description
0.1	TOPSOIL
0.2 – 0.4 (Ave. 0.3)	FILL: SAND (fine to medium grained), non-plastic, with gravel, trace silt, trace organic material, loose to dense
Not Penetrated (>2.5m)	NATURAL: clayey SAND, low plasticity, trace gravel,

The soils encountered are consistent with the expected site conditions as predicted from the Environmental Geology Map. It is important to note that there may be pockets of fill on site that are deeper than that encountered by the investigation boreholes. The subsurface soil conditions encountered are presented in the bore logs, within Appendix 3.

3.2. Groundwater

Groundwater was not encountered in any of the boreholes during or immediately after drilling. However, based on the Perth Groundwater Atlas, the groundwater is expected to be encountered approximately 31.0m below the existing ground level.

3.3. Percolation Testing

Percolation testing of the in situ soils was undertaken in two locations. Results of the testing are summarised below:

Table 2 – In Situ Percolation Test Results

Test Location	Testing Depth	Soil Type	Permeability
1	0 - 1.0m	SAND to clayey SAND	0.6m/day
2	0 - 1.0m	SAND to clayey SAND	0.8m/day

3.4. Laboratory Test Results

Selected soil samples were tested for Atterberg Limits.

3.4.1. Atterberg Limits

Atterberg Limits were tested by Structerre's in-house NATA accredited laboratory. Results of the testing are summarised below:

Table 3 – Atterberg Limit Test Results

Sample	Test Hole	Depth (m)	Soil Description	Liquid Limit % AS1289 3.1.2	Plastic Limit % AS1289 3.2.1	Plasticity Index % AS1289 3.3.1	Linear Shrinkage % AS1289 3.4.1
1	SRP1	0.5 – 1.5	Sandy CLAY trace gravel	22	13	9	3

Test results indicate that the natural Clayey SAND trace gravel has low shrink swell capacity or degree of expansion.

A copy of the results are presented in Appendix 4.

4. GEOTECHNICAL CONSTRUCTION CONSIDERATIONS

4.1. Site Classification

AS 2870-2011 Residential Slabs and Footings provide guidance on site classification for residential slabs and footing design based on the expected ground surface movement and depth of expected moisture changes.

Table 4 – Classification Based on Site Reactivity

AS 2870-2011 Residential Slabs and Footings - Clause 2.1.2 Table 2.1	
Class	**Foundation**
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes (0<ys≤20mm)
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes (20<ys≤40mm)
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes (40<ys≤60mm)
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes (60<ys≤75mm)
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes (ys>75mm)
Clause 2.1.3 Classification of other Sites	
P	Sites which include soft or unstable foundations such as soft clay or silt or loose sands, landslip, mine subsidence, collapsing soils and soils subject to erosion, reactive sites subject to abnormal moisture conditions and site that cannot be classified in accordance to Table 2.1

The site in its current condition is classified as Class “P”. Based on results of this investigation the site can be upgraded to a Class “S” in accordance with AS 2870-2011 provided that all unsuitable materials are removed and replaced with engineer-controlled sand fill materials in accordance with the earthwork recommendations outlined in Section 4.3 of this report.

Footings suitable for this site should be adopted to accommodate expected ground surface movements of approximately y_s = 7mm associated with the presence of low reactive clayey SAND trace gravel deposits within the building site.

4.2. Drainage

The existing ground conditions are not suitable for on-site disposal of stormwater runoff through the use of soakwells. It is recommended that all stormwater from roofed, paved and driveway areas be collected and detained to reduce peak flow rates prior to discharging off site as per council requirements.

4.3. Earthworks

All earthworks shall be undertaken in accordance with AS 3798-2007 Guidelines on earthworks for commercial and residential developments and are to include the following:

- All unsuitable materials to be stripped and removed from the site. Unsuitable materials include topsoil, deleterious and organic materials.
- It is considered that the near surface loose sand FILL requires improvement. Therefore, it is proposed to excavate and stockpile the materials for reuse, provided it is free from clay/silt (i.e. <5%), deleterious and organic materials. The depth of excavation may vary depending on conditions encountered and is subject to inspection. However, it is envisaged that the average depth of excavation would be approximately 0.6m. Should the site levels be reduced the excavated materials can be reused or removed off site.
- Excavation should not be greater than 2.0m and/or undermine the surrounding structures. A 1V: 2H slope should be maintained for temporary excavations. If excavation is required closer than the 1V: 2H slope would allow or deeper, it is recommended that this office be contacted for retaining system design.
- Proof compact the exposed base. The compaction requirements are set out in the table below, as per AS 3798-2007:

Table 5 – Compaction Requirements

Item	Application	Minimum relative compaction, %	
		Minimum density ratio (Standard Compaction Effort) (Cohesive soils)	Minimum density index (Cohesionless soils)
1	Residential - lot, fill, house, sites	95	70

- After excavation and proof compaction, the excavated base is to be inspected and approved by a representative from this office prior to backfilling. At this stage it can be assessed whether any further materials need to be removed or whether further compaction of the base is required.
- A minimum of 0.6m sand cover is to be maintained above the reactive material in order to achieve a Class “S” site with y_s = 7mm.

- The ground level should be built up to design levels with the stockpiled sand FILL and imported fill, if required. The imported fill should consist of free draining sand with not more than 5% passing a 75µm sieve and be free of organic matter and other deleterious materials. The fill materials should be placed in layers not exceeding 300mm loose thickness and compacted to achieve a minimum 8 PSP blows over the interval 150 – 450mm, 9 PSP blows over the interval 450 – 750mm and 11 PSP blows over the interval 750 -1050mm.
- After remedial earthworks have been completed, the earthworks should be inspected and approved by a representative from this office.

5. CONCLUSIONS

A site investigation has been carried out at the site of the proposed residential development to assess the geotechnical conditions. Parameter and design recommendations are incorporated in the body of the report. The following conclusions have been drawn from the site investigation:

- The average subsurface soil profile encountered comprised topsoil to 0.1m, sand FILL to 0.4m, underlain by Clayey SAND trace gravel to the investigated depth of 2.5m.
- Groundwater or perched water was not encountered across the site to the depth of 2.5m.
- It is considered that the site is not suitable for on-site drainage.
- The site can be classified as Class “S” in accordance with AS 2870-2011 due to presence of low reactive Clayey SAND trace gravel deposits within the building site, provided that the recommended earthworks are undertaken.
- The full scope of the recommended earthworks is presented in Section 4.3, but generally comprises:
    - Stripping of topsoil and unsuitable materials
    - Proof compaction of the base
    - Placement of sand fill to required level
    - Compaction to final level

6. LIMITATION OF FIELD INVESTIGATIONS

This report has been prepared in accordance with generally accepted consulting practice for Hilburn Constructions using information supplied at the time and for the project specific requirements as understood by Structerre. To the best of our knowledge the information contained in this report is accurate at the date of issue, however it should be emphasised that any changes to ground conditions and/or the proposed structures may invalidate the recommendations given herein.

The conclusions and recommendations in this report are based on the site conditions revealed through selective point sampling, representing the conditions of the site in total, although the area investigated represents only a small portion of the site. The actual characteristics may vary significantly between successive test locations and sample intervals other than where observations, explorations and investigations have been made.

The materials and their geotechnical properties presented in this report may not represent the full range of materials and strengths that actually exist on site and the recommendations should be regarded as preliminary in nature. Allowances should be made for variability in ground conditions and any consequent impact on the development. Structerre accepts no responsibility and shall not be liable for any consequence of variations in ground conditions.

If ground conditions encountered during construction are different to that described in this report, this office should be notified immediately.

For and behalf of

STRUCTERRE CONSULTING ENGINEERS

Author: Margie Mortera
Employee Title: Geotechnical Assistant

Authorised By: David Harding
Employee Title: Geotechnical Supervisor

Job #	Revision	Authored	Checked	Authorised
J196103	0	MM	DO	DO

STRUCterre consulting engineers

PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

7. REFERENCES

Department of Water – Perth Groundwater Atlas

Geological Survey of Western Australia 1:50,000 Environmental Geology Series

AS 1170.4-2007 Structural design actions – Earthquake actions in Australia

AS 1289.3.1.2-2009 Methods of testing soils for engineering purposes – Soil classification tests – Determination of the liquid limit of a soil

AS 1289.3.2.1-2009 Methods of testing soils for engineering purposes – Soil classification tests – Determination of the plastic limit of a soil

AS 1289.3.3.1-2009 Methods of testing soils for engineering purposes – Soil classification tests – Calculation of the plasticity index of a soil

AS 1289.3.4.1-2009 Methods of testing soils for engineering purposes – Soil classification tests – Determination of the linear shrinkage of a soil

AS 1289.6.3.2-1997 Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the penetration resistance of a soil – 9kg dynamic cone penetrometer test

AS 1726-2017 Geotechnical site investigation

AS 2870-2011 Residential slabs and footings

AS 3798-2007 Guidelines on earthworks for commercial and residential developments

AS 4055-2012 Wind loads for housing

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PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

APPENDIX 1 – SITE LOCATION MAP

N

LEGEND

BH Borehole
PERC Percolation Test

Note: Showing approximate locations only

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PROJECT #: D185869	CLIENT: **Hilburn Constructions**
JOB #: J196103	
SCALE: NTS	TITLE: Geotechnical Investigation
DATE: 12/02/2018	DRAWN BY: MM / CHECKED BY: DH

DOC: GE:3.001

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PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

APPENDIX 2 – SITE PHOTOS

Photo 1

Photo 2

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PROJECT #:	D185869
JOB #:	J196103
CLIENT:	**Hilburn Constructions**
SCALE:	NTS
TITLE:	Site Photographs
DATE:	12/02/2018
DRAWN BY:	MM
CHECKED BY:	DH

DOC:GE:3.008

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PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

APPENDIX 3 – BORELOGS

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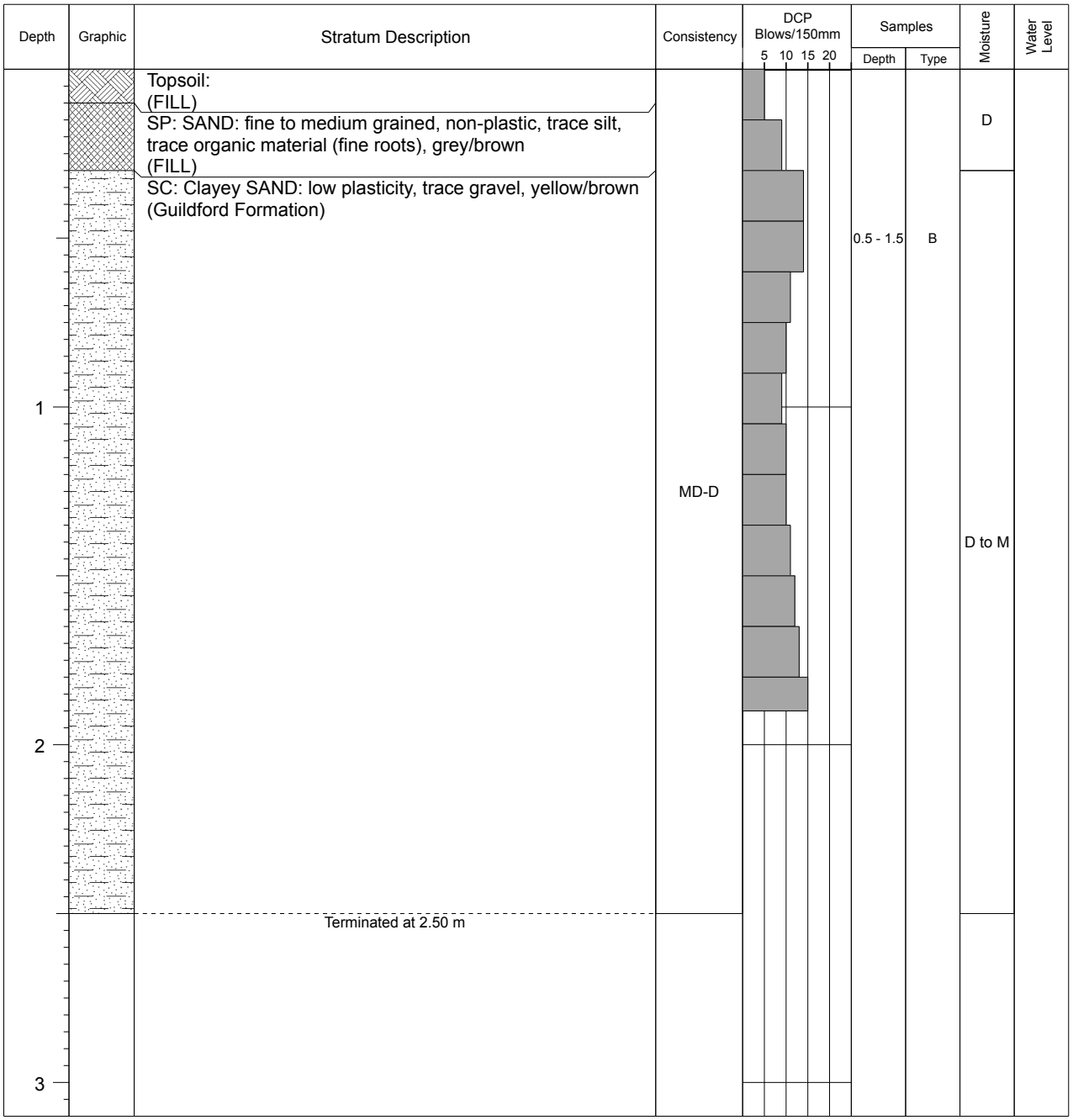
Project Lot 17 #228 Sultana Road, Forrestfield

Client Hilburn Constructions

Test No. **BH01**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	4046479
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462620



Remarks

1. Termination reason: Target depth
2. Hole stability: Hole stable
3. Samples taken: As indicated
4. Co-ordinate system: WGS 84

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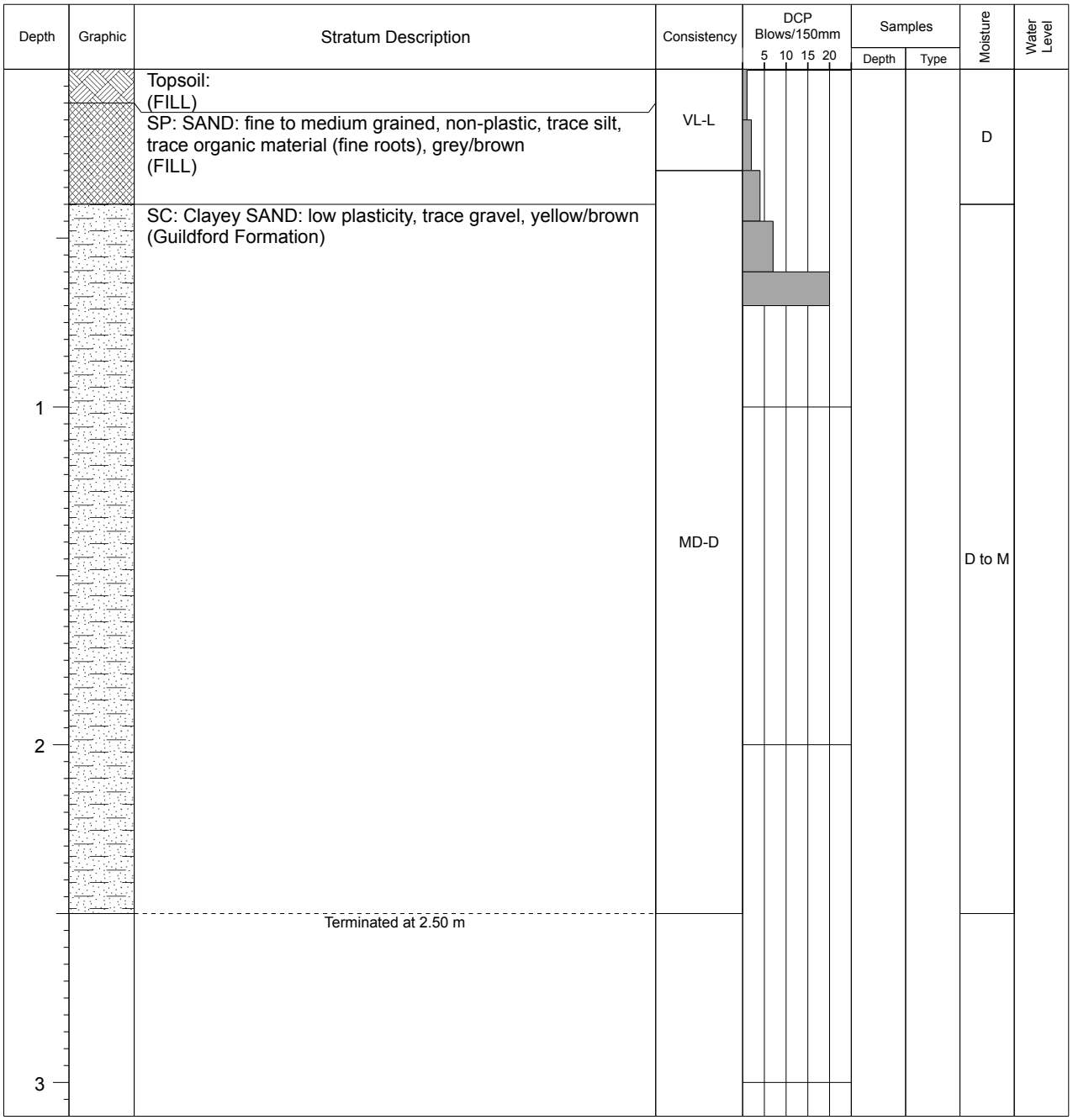
Project Lot 17 #228 Sultana Road, Forrestfield

Client Hilburn Constructions

Test No. **BH02**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	406458
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462622



Remarks

1. Termination reason: Target depth
2. Hole stability: Hole stable
3. Samples taken: None
4. Co-ordinate system: WGS 84

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Client Hilburn Constructions

Test No. **BH03**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	406448
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462566

Depth	Graphic	Stratum Description	Consistency	DCP Blows/150mm (5 10 15 20)	Samples Depth	Samples Type	Moisture	Water Level
		Topsoil: (FILL)					D	
		SP: SAND: fine to medium grained, non-plastic, trace silt, trace organic material (fine roots), grey/brown (FILL)						
		SC: Clayey SAND: low plasticity, trace gravel, yellow/brown (Guildford Formation)	MD-D				D to M	
1								
2								
		Terminated at 2.30 m						
3								

Remarks

1. Termination reason: Refusal - interpreted on cemented ground
2. Hole stability: Hole stable
3. Samples taken: None
4. Co-ordinate system: WGS 84

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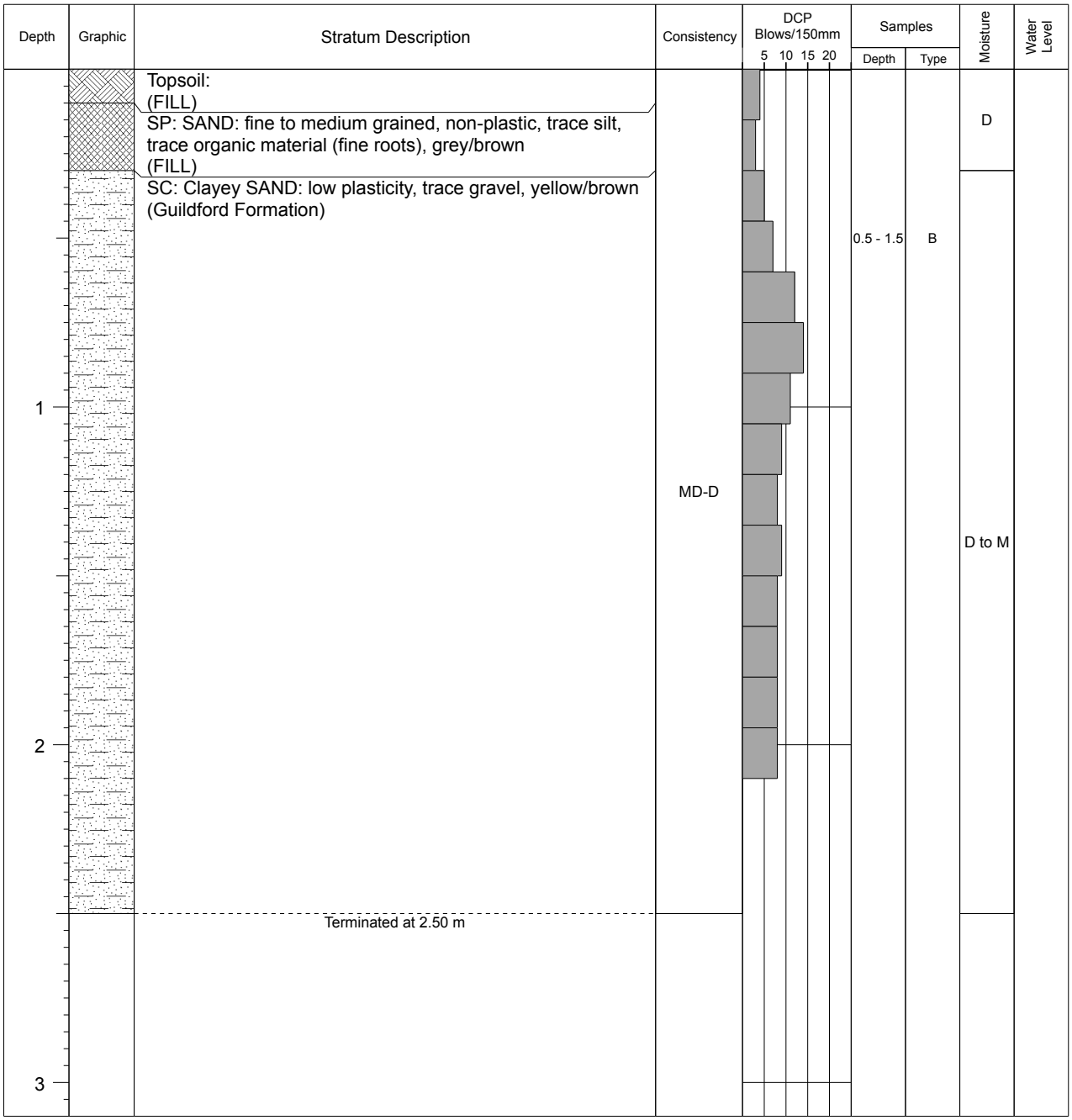
Project Lot 17 #228 Sultana Road, Forrestfield

Client Hilburn Constructions

Test No. **BH04**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	406413
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462588



Remarks

1. Termination reason: Target depth
2. Hole stability: Hole stable
3. Samples taken: As indicated
4. Co-ordinate system: WGS 84

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Project Lot 17 #228 Sultana Road, Forrestfield

Client Hilburn Constructions

Test No. **BH05**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	406385
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462558

Depth	Graphic	Stratum Description	Consistency	DCP Blows/150mm (5 10 15 20)	Samples Depth	Samples Type	Moisture	Water Level
		Topsoil: (FILL)	D-VD				D	
		SP: SAND: fine to medium grained, non-plastic, trace silt, trace organic material (fine roots), grey/brown (FILL)						
		SC: Clayey SAND: low plasticity, trace gravel, yellow/brown (Guildford Formation)					D to M	
1								
2								
		Terminated at 2.50 m						
3								

Remarks

1. Termination reason: Target depth
2. Hole stability: Hole stable
3. Samples taken: None
4. Co-ordinate system: WGS 84

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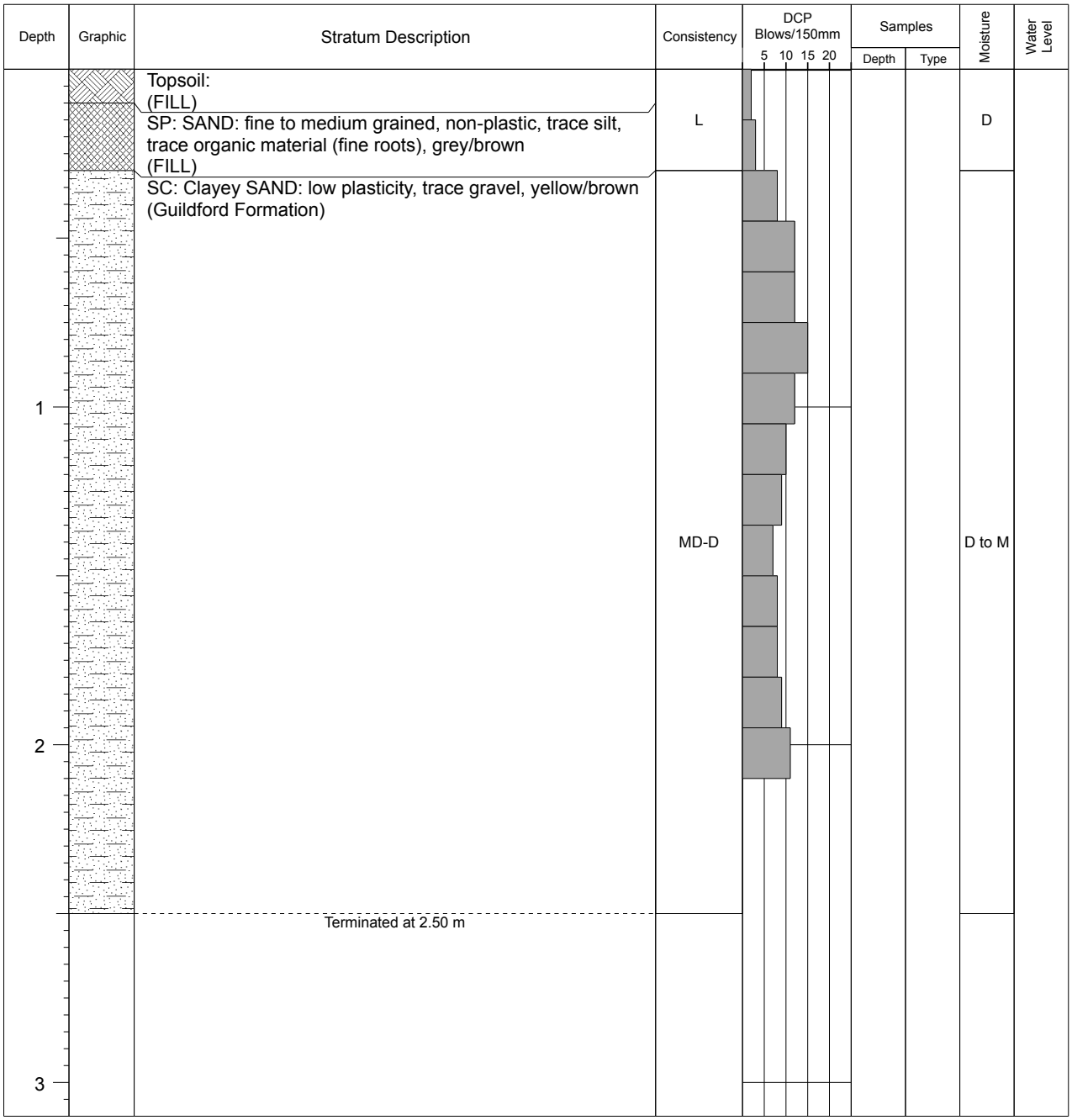
Project Lot 17 #228 Sultana Road, Forrestfield

Client Hilburn Constructions

Test No. **BH06**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	406397
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462518



Remarks

1. Termination reason: Target depth
2. Hole stability: Hole stable
3. Samples taken: None
4. Co-ordinate system: WGS 84

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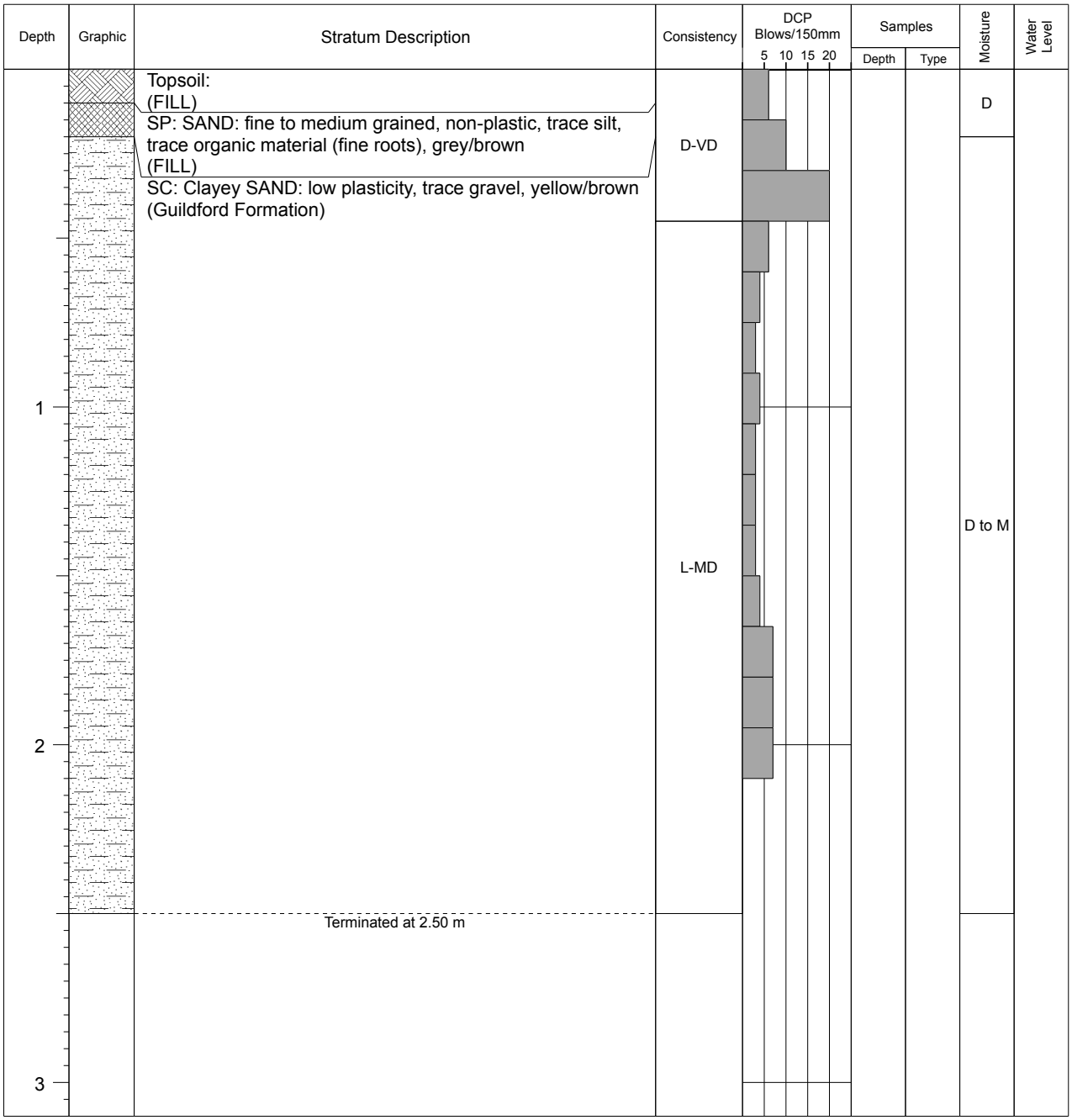
Project Lot 17 #228 Sultana Road, Forrestfield

Client Hilburn Constructions

Test No. **BH07**

Project No.	D185869	**Logged By**	Cheyne Quesnel	**Machine**	Soil Retrieval Probe	**Easting**	406397
Job No.	J196103	**Date**	12/02/2018	**Hole Dia.**	65mm	**Northing**	6462518



Remarks

1. Termination reason: Target depth
2. Hole stability: Hole stable
3. Samples taken: None
4. Co-ordinate system: WGS 84

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PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

APPENDIX 4 – LABORATORY TEST RESULTS

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Residential Geotechnical Commercial & Infrastructure
Inspect & Investigate Energy Assessment Environmental

Sample No.	**31018**	**Client**	Hilburn Constructions
Job No.	J196103	**Project**	Lot 17, #228 Sultana Road, Forrestfield

SAMPLE DETAILS

BH No. / Depth : 1 0.5-1.5m
Sample History : 50°C Oven Dried

Sampling Method Client
Sample Preparation AS 1289 1.1

ATTERBERG LIMITS

Description	Method	Result (%)
Liquid Limit	AS 1289.3.1.2	22
Plastic Limit	AS 1289.3.2.1	13
Plasticity Index	AS 1289.3.3.1	9
Linear Shrinkage	AS 1289.3.4.1	2.5
Nature of Shrinkage		Flat

PARTICLE SIZE DISTRIBUTION

Method: AS 1289.3.6.1
Description: Particle size distribution by sieve analysis

Sieve Size (mm)	% Passing
19.0	100
2.36	99
0.425	83
0.075	26

AS 1726:2017 Clause 6.1
Material Description: Clayey SAND trace gravel
AS Group Symbol: SC

Accredited for compliance with ISO/IEC 17025
NATA
WORLD RECOGNISED ACCREDITATION
STRUCTERRE CONSULTING ENGINEERS BALCATTA LABORATORY ACCREDITATION NUMBER 18742

Wayne Rozmianiec
Laboratory Manager

Date: 19-Feb-18

Soils Analysis Workbook with Full PSD V 2.19 12-Feb-18 AS 1289.3.6.1 SAW Rev 1NATA Jan-15

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STRUCterre consulting engineers

PROJECT No: D185869
JOB No: J196103
PROJECT ADDRESS: Lot 17 #228 Sultana Road, Forrestfield
CLIENT: Hilburn Constructions

APPENDIX 5 – BORELOG TERMINOLOGY

STRUCterre consulting engineers

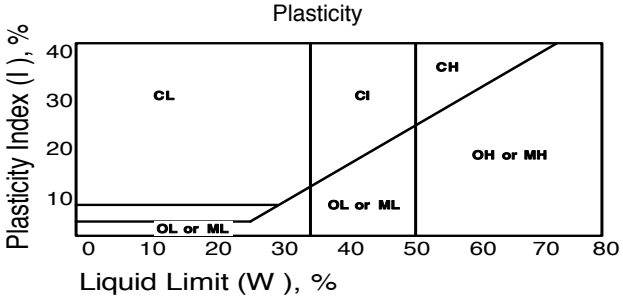
Residential Geotechnical Commercial & Infrastructure
Inspect & Investigate Energy Assessment Environmental

BOREHOLE TERMINOLOGY

Particle Size Distribution

Major Division	Subdivision	Size
Boulders		>200mm
Cobbles		200 - 63mm
Gravel	Coarse	63 - 20mm
	Medium	20- 6mm
	Fine	6 - 2.36mm
Sand	Coarse	2.36 - 0.6mm
	Medium	0.6 - 0.2mm
	Fine	0.2 - 0.075mm

Plasticity



Consistency of Cohesive Soils

Term	Undrained Strength Su (kPa)	Field Guide
Very Soft	< 12	Exudes between the fingers when squeezed in hand
Soft	12 - 25	Can be moulded by light finger pressure
Firm	25 - 50	Can be moulded by strong finger pressure
Stiff	50 - 100	Cannot be moulded by Fingers. Can be indented by thumb.
Very Stiff	100 - 200	Can be indented by thumb nail
Hard	> 200	Can be indented with difficulty by thumb nail.
Friable	-	Crumbles or powders when scraped by thumbnail

Consistency/Density of Non-Cohesive Soils

Term	Density Index (%)	SPT "N" Value Comparison
Very Loose	< 15	0 - 4
Loose	15 - 35	4 - 10
Medium Dense	35 - 65	10 - 30
Dense	65 - 85	30 - 50
Very Dense	> 85	> 50

Moisture Content

D	Dry
M	Moist
W	Wet
S	Saturated

Minor Components

Term	Assessment Guide	Proportion of Minor Component In:
Trace	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component	Coarse grained soils: < 5 % Fine grained soils: <15%
With	Presence easily detected by feel or eye, soil properties little different to general properties of primary component	Coarse grained soils: 5 - 12 % Fine grained soils: 15 - 30%

Soil Legend

FILL	CLAY	GRAVEL	CONCRETE
TOPSOIL	SILT	LIMESTONE	COMBINATIONS
PEAT	SAND	BEDROCK	eg: Clay, Silty, Sandy

USCS

GW	Well graded gravel	SC	Clayey sand	OL	Organic low plasticity silt
GP	Poorly graded gravel	SM	Silty sand	ML	Low plasticity silt
SW	Well graded sand			MH	High plasticity silt
SP	Poorly graded sand			OH	Organic high plasticity silt

CL	Low plasticity clay
CI	Intermediate plasticity clay
CH	High plasticity clay
PT	Peat

DOC:GE:3.003

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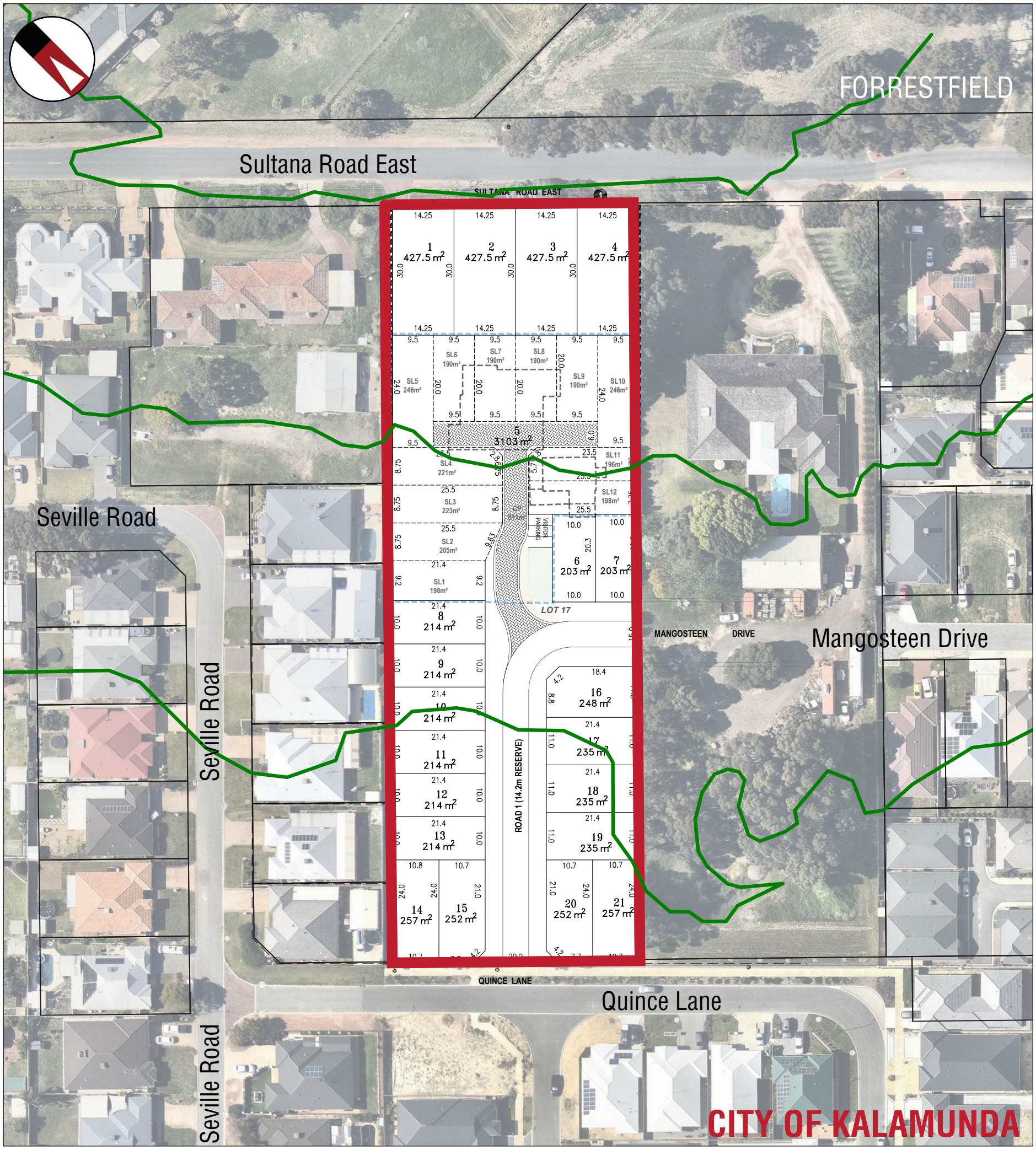
APPENDIX E: SURROUNDING LAND USE

			PROJECT: Lot 17 (228) Sultana Road East, ForrestfieldH	DRAWN BY:	Civil & Traffic Engineering Consultants Suite 7 No 10 Whipple Street Balcatta WA 6021 PH: 08 9441 2700 WEB: www.kctt.com.au
			TITLE: Surrounding Land Use Plan	J.S.	
B	09-01-2019	PROPOSED LAYOUT AMENDED	DRAWING NUMBER: KC00910.000_S02		kctt
A	26-11-2018	ISSUED FOR REVIEW			
No	DATE	AMENDMENT			

APPENDIX F: SITE TOPOGRAPHY



Parks and Recreation
Public Facilities
Water
Contour
Location Boundary
Railway
Road
Cadastral Boundary
DAYTON Local Government Name
Reid Highway Street Name

Certified System Quality ISO 9001 SAI GLOBAL

LEGEND

No	DATE	AMENDMENT
B	09-01-2019	PROPOSED LAYOUT AMENDED
A	26-11-2018	ISSUED FOR REVIEW

PROJECT: Lot 17 (228) Sultana Road East, ForrestfieldH

TITLE: Site Topography Plan

DRAWING NUMBER: KC00910.000_S03

DRAWN BY: J.S.

Civil & Traffic Engineering Consultants
Suite 7 No 10 Whipple Street Balcatta WA 6021
PH: 08 9441 2700
WEB: www.kctt.com.au

kctt

APPENDIX G: DRAINAGE CALCULATIONS AND SPREADSHEETS

Runoff Calculations

Date
9/01/2019
KCTT Reference
KC00910.000
Client
Hilburn Constructions

Project
Lot 17 Sultana Road East, Forrestfield

Pre-Development Runoff

AEP	Rainfall Intensity I, (mm/hr)	Time, Hrs	Runoff Coefficient, C	Catchment Area, Ha	Peak Runoff, Q (m3/s)	Total Est Runoff, Q (m3)
63.2%	47.7	0.167	0.22	0.9992	0.02913	17.511
20%	56.1	0.25	0.35	0.9992	0.05450	49.0482
1%	84.6	0.33	0.5	0.9992	0.11741	139.478

Post-Development Runoff

AEP	Location	Rainfall Intensity I, (mm/hr)	Time, Hrs	Runoff Coefficient, C	Catchment Area, Ha	Peak Runoff, Q (m3/s)	Total Est Runoff, Q (m3)
63.2%	Lot 6 - 21	47.7	0.167	0.85	0.3661	0.04123	24.78869
	Road Reserve	47.7	0.167	0.85	0.1518	0.0171	10.2784
				Total	0.5179	0.05833	35.06709
20%	Lot 6 - 21	56.1	0.25	0.85	0.3661	0.04849	43.6437
	Road Reserve	56.1	0.25	0.85	0.1518	0.02011	18.09646
				Total	0.5179	0.0686	61.74015
1%	Lot 6 - 21	84.6	0.33	0.95	0.3661	0.08173	97.09741
	Road Reserve	84.6	0.33	0.99	0.1518	0.03532	41.95573
	Homestead Lot	84.6	0.33	0.95	0.3103	0.06927	82.29808
	Lot 1 - 4	84.6	0.33	0.95	0.171	0.03818	45.35279
				Total	0.9992	0.2245	266.704

IFD Table

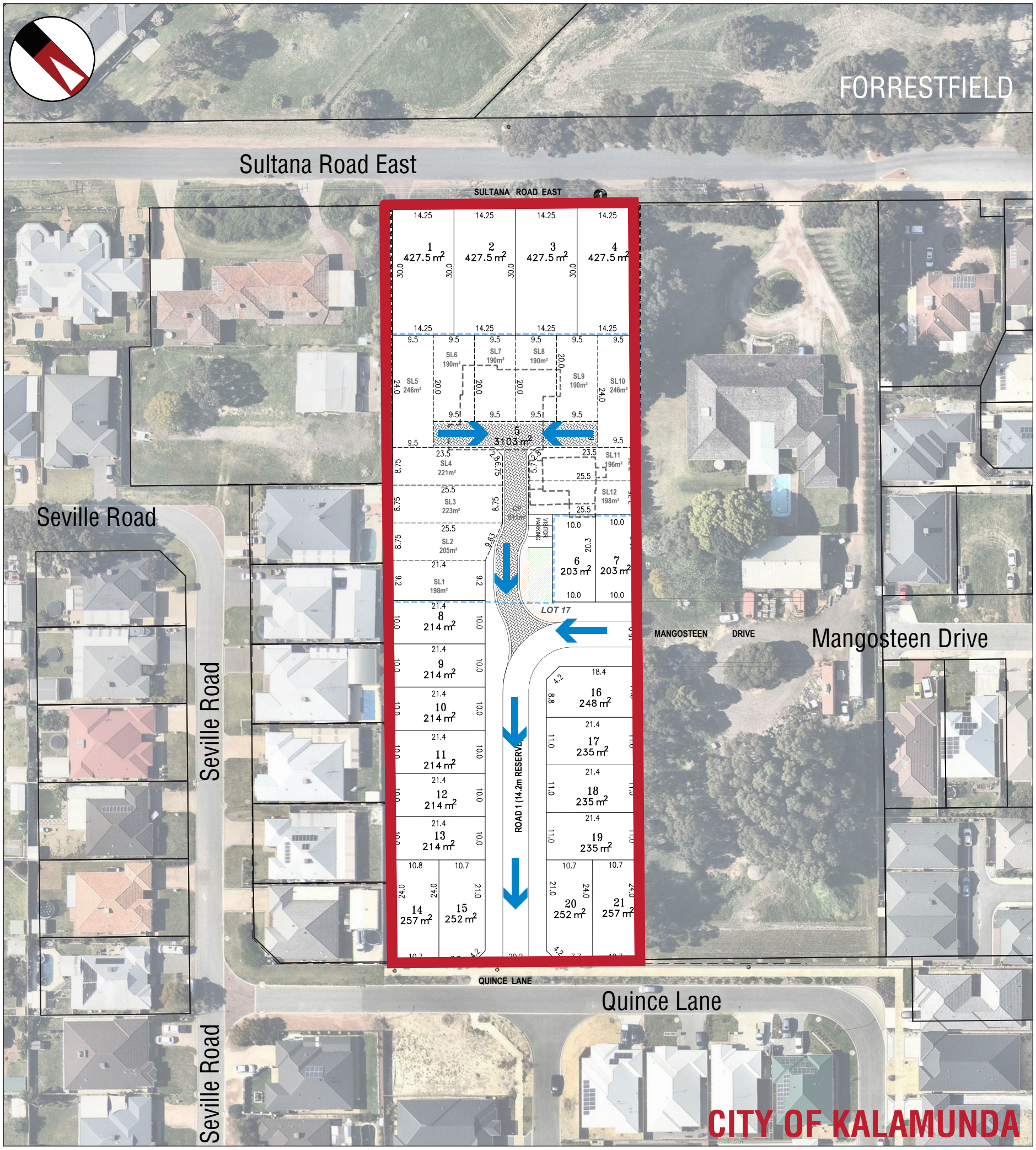
Date
9/01/2019
KCTT Reference
KC00910.000
Client
Hilburn Constructions

Project
Lot 17 Sultana Road East, Forrestfield

		Annual Exceedance Probability (AEP)						
	Duration	63.2%	50%	20%	10%	5%	2%	1%
Mins	1	101	111	146	172	197	233	262
	2	88.2	96.7	125	145	165	195	219
	3	78.8	86.6	112	131	150	177	199
	4	71.5	78.8	103	120	138	163	183
	5	65.6	72.4	94.7	111	127	151	170
	10	47.7	52.8	69.7	81.8	94.2	111	125
	15	38.4	42.5	56.1	65.8	75.7	89.4	100
	20	32.5	36	47.5	55.6	63.9	75.4	84.6
	25	28.5	31.5	41.5	48.6	55.8	65.8	73.8
	30	25.5	28.2	37	43.3	49.7	58.7	65.8
	45	19.9	21.9	28.6	33.4	38.4	45.3	50.9
Hours	1	16.6	18.3	23.7	27.7	31.9	37.7	42.5
	1.5	12.9	14.1	18.2	21.3	24.6	29.3	33.2
	2	10.7	11.7	15.2	17.7	20.5	24.5	27.9
	3	8.33	9.08	11.7	13.8	16	19.2	22.1
	4.5	6.46	7.04	9.09	10.7	12.5	15.2	17.5
	6	5.4	5.88	7.6	8.97	10.5	12.8	14.8
	9	4.19	4.56	5.91	6.99	8.18	10	11.6
	12	3.49	3.8	4.93	5.83	6.83	8.36	9.7
	18	2.69	2.94	3.81	4.49	5.23	6.37	7.36
	24	2.23	2.43	3.15	3.7	4.29	5.19	5.96
	30	1.92	2.1	2.72	3.18	3.66	4.4	5.02
	36	1.7	1.86	2.4	2.8	3.2	3.82	4.34
	48	1.4	1.54	1.97	2.28	2.58	3.05	3.42
	72	1.07	1.17	1.49	1.7	1.91	2.21	2.44
	96	0.883	0.969	1.23	1.4	1.55	1.78	1.95
	120	0.768	0.842	1.06	1.21	1.34	1.53	1.67
	144	0.689	0.755	0.954	1.08	1.21	1.38	1.51
	168	0.632	0.692	0.877	0.999	1.12	1.28	1.4

* Taken from Bureau of Meteorology website - http://www.bom.gov.au/water/designRainfalls/ifd/

APPENDIX H: OVERLAND FLOW PATHS



Parks and Recreation
Public Facilities
Water
Flow Path Direction
Location Boundary
Railway
Road
Cadastral Boundary
DAYTON Local Government Name
Reid Highway Street Name

LEGEND

Certified System Quality ISO 9001 SAI GLOBAL

No	DATE	AMENDMENT
B	09-01-2019	PROPOSED LAYOUT AMENDED
A	26-11-2018	ISSUED FOR REVIEW

PROJECT: Lot 17 (228) Sultana Road East, ForrestfieldH

TITLE: Overland Flow Path Plans

DRAWING NUMBER: KC00910.000_S04

DRAWN BY: J.S.

Civil & Traffic Engineering Consultants
Suite 7 No 10 Whipple Street Balcatta WA 6021
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kctt

Appendix 7:
Bushfire Attack Level (BAL) Assessment

AS 3959 BAL Assessment Report

This report has been prepared by an Accredited BPAD Practitioner using the Simplified Procedure (Method 1) as detailed in Section 2 of AS 3959 – 2009 (Incorporating Amendment Nos 1, 2 and 3). FPA Australia makes no warranties as to the accuracy of the information provided in the report. All enquiries related to the information and conclusions presented in this report must be made to the BPAD Accredited Practitioner.

Property Details and Description of Works

Address Details	**Unit no**	**Street no**	**Lot no**	**Street name / Plan Reference**	
		228	17	Sultana Road East	
	Suburb			**State**	**Postcode**
	Forrestfield			WA	6112
Local government area	City of Kalamunda				
Main BCA class of the building	N/A	**Use(s) of the building**		N/A	
Description of the building or works	Proposed Subdivision				

Report Details

Report / Job Number	Report Version	Assessment Date	Report Date
J010250	1	12 February 2019	14 February 2019

BPAD Accredited Practitioner Details

Name
Sarina Gorman

Company Details
WABAL BushfireAssessmentLogic

Report Checked By:
John Greenwood

I hereby declare that I am a BPAD accredited bushfire practitioner.
Accreditation No. BPAD 42204
Signature
Date 14 February 2019

Authorised Practitioner Stamp

Reliance on the assessment and determination of the Bushfire Attack Level contained in this report should not extend beyond a period of 12 months from the date of issue of the report. If this report was issued more than 12 months ago, it is recommended that the validity of the determination be confirmed with the Accredited Practitioner and where required an updated report issued.

BAL Assessment Report

Fire Protection Association Australia **Life Property Environment**

WABCA
WESTERN AUSTRALIA
BUILDING CERTIFIERS AND ASSESSORS

WABAL
BushfireAssessmentLogic

N

0m 50m 100m

Scale 1:2000 at A3
Date of Aerial Photo: 22 December 2018

LEGEND

- Assessment area
- 150m radius
- Subject land
- Proposed cadastre
- Vegetation/plot boundary
- Class A
- Class B
- Class C
- Class D
- Class E
- Class F
- Glass G
- Area to be modified to low threat state
- Excluded as per 2.2.3.2
- Photo point
- Proposed building

ADDRESS:
Lot 17 - No. 228 Sultana Road East, Forrestfield

INSPECTION: 12 February 2019	REPORT: 14 February 2019	REV: 1
1	Issued to Client	
1		
1		

Sarina Gorman
BPAD Level 1

BPAD Accredited Practitioner Level 1

Vegetation Classification

All vegetation within 100m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2009. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified below.

Photo ID:	1	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 1 refers to the surrounding urban vegetation, which has been excluded as being managed and low threat.			

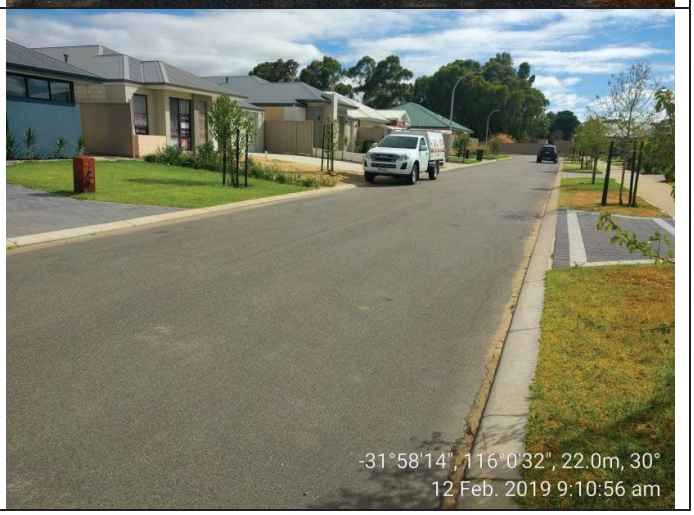
Photo ID:	2	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 1.			

BAL Assessment Report

Fire Protection Association Australia Life Property Environment

Photo ID:	3	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 1.			

Photo ID:	4	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 1.			



BAL Assessment Report

Fire Protection Association Australia Life Property Environment

Photo ID:	5	**Plot:**	2
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 2 refers to the surrounding vegetation, which has been excluded under clause 2.2.3.2(f) of AS3959-2009 as it is a maintained public reserve.			

Photo ID:	6	**Plot:**	2
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 2.			

Photo ID:	7	**Plot:**	3
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 3 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	8	**Plot:**	3
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 3.			

Photo ID:	9	**Plot:**	4
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 4 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	10	**Plot:**	4
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 4.			

Photo ID:	11	**Plot:**	4
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 4.			

Photo ID:	12	**Plot:**	5
Vegetation Classification or Exclusion Clause			
Class G Grassland			
Description / Justification for Classification			
Plot 5 is an area of Class G vegetation located 24 metres from the proposed site on flat land.			

Photo ID:	13	**Plot:**	5
Vegetation Classification or Exclusion Clause			
Class G Grassland			
Description / Justification for Classification			
An alternative view of Plot 5.			

Photo ID:	14	Plot:	6
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 6 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	15	Plot:	7
Vegetation Classification or Exclusion Clause			
Class B Woodland			
Description / Justification for Classification			
Plot 7 is an area of Class B vegetation located 134 metres from the proposed site on flat land.			

BAL Assessment Report

Fire Protection Association Australia Life Property Environment

Photo ID:	16	**Plot:**	8
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(b)			
Description / Justification for Classification			
Plot 8 refers to the surrounding vegetation, which has been excluded under clause 2.2.3.2(b) of AS3959-2009 as it is less than 1ha in area and not within 100 metres of other areas of vegetation being classified.			

Photo ID:	17	**Plot:**	8
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(b)			
Description / Justification for Classification			
An alternative view of Plot 8.			

BAL Assessment Report

Fire Protection Association Australia Life Property Environment

Photo ID:	18	**Plot:**	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 9 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	19	**Plot:**	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

BAL Assessment Report

Fire Protection Association Australia Life Property Environment

Photo ID:	20	**Plot:**	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Photo ID:	21	**Plot:**	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Photo ID:	22	**Plot:**	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Relevant Fire Danger Index

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 2.4.5	*Table 2.4.4*	*Table 2.4.3*	*Table 2.4.2*

Potential Bushfire Impacts

The potential bushfire impact to the site / proposed development from each of the identified vegetation plots are identified below.

Plot	Vegetation Classification	Effective Slope	Separation (m)	BAL
1	Excludable – Clause 2.2.3.2(f)	N/A	N/A	BAL – LOW
2	Excludable – Clause 2.2.3.2(f)	N/A	N/A	BAL – LOW
3	Excludable – Clause 2.2.3.2(f)	N/A	N/A	BAL – LOW
4	Excludable – Clause 2.2.3.2(f)	N/A	N/A	BAL – LOW
5	Class G Grassland	Flat/Upslope	24m	BAL – 12.5
6	Excludable – Clause 2.2.3.2(f)	N/A	N/A	BAL – LOW
7	Class B Woodland	Flat/Upslope	134m	BAL – LOW
8	Excludable – Clause 2.2.3.2(b)	N/A	N/A	BAL – LOW
9	Excludable – Clause 2.2.3.2(f)	N/A	N/A	BAL – LOW

Table 1: BAL Analysis

Determined Bushfire Attack Level (BAL)

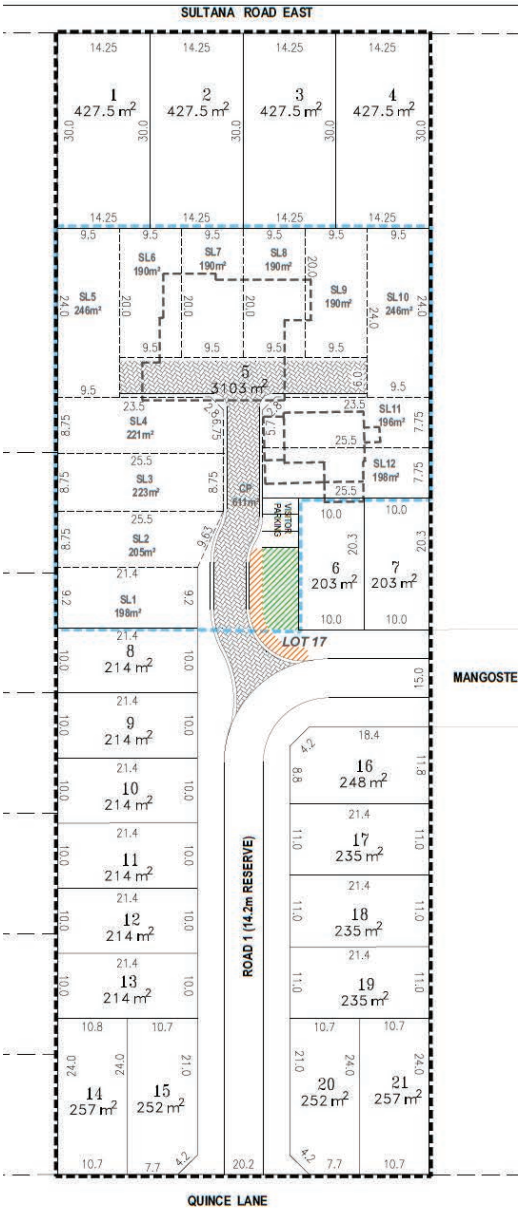
The Determined Bushfire Attack Level (highest BAL) for the site / proposed development has been determined in accordance with clause 2.2.6 of AS 3959-2009 using the above analysis.

Determined Bushfire Attack Level	**BAL – 12.5**

BAL Assessment Report

Fire Protection Association Australia Life Property Environment

Appendix 1: Plans and Drawings		
Plans and drawings relied on to determine the bushfire attack level		
Drawing / Plan Description Concept Plan		
Job Number -	**Revision** -	**Date of Revision**



Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2009

This Certificate has been issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme. The certificate details the conclusions of the full Bushfire Attack Level Assessment Report (full report) prepared by the Accredited Practitioner.

Property Details and Description of Works

Address Details	**Unit no**	**Street no**	**Lot no**	**Street name / Plan Reference**	
		228	17	Sultana Road East	
	Suburb			**State**	**Postcode**
	Forrestfield			WA	6112
Local government area	City of Kalamunda				
Main BCA class of the building	N/A	**Use(s) of the building**	N/A		
Description of the building or works	Proposed Subdivision				

Determination of Highest Bushfire Attack Level

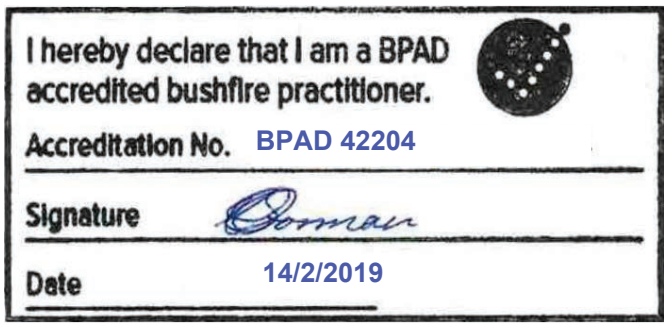
AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 1	Class G - Grassland	Flat/Upslope	24m	BAL-12.5

BPAD Accredited Practitioner Details

Name
Sarina Gorman

Company Details
WABAL

I hereby certify that I have undertaken the assessment of the above site and determined the Bushfire Attack Level stated above in accordance with the requirements of AS 3959-2009 (Incorporating Amendments 1, 2 and 3).



Authorised Practitioner Stamp

Reliance on the assessment and determination of the Bushfire Attack Level contained in this certificate should not extend beyond a period of 12 months from the date of issue of the certificate. If this certificate was issued more than 12 months ago, it is recommended that the validity of the determination be confirmed with the Accredited Practitioner and where required an updated certificate issued.

Appendix 8:
Bushfire Management Plan

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lot 17 No. 228 Sultana Road East, Forrestfield 6112

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 12 Month February Year 2019

Report author: John Greenwood

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: 36633 Accreditation expiry: Month April Year 2019

Bushfire management plan version number: 1

Bushfire management plan date: Day 27 Month March Year 2019

Client/business name: Hillburn Constructions 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  Date 27/03/2019

WABAL
BushfireAssessmentLogic

Bushfire Management Plan
Proposed Subdivision

Lot 17 – No. 228 Sultana Road East, Forrestfield, WA, 6112

27th March 2019

Suite 14 Centre Park Business Centre
755 Albany Hwy East Victoria Park WA 6101

Telephone | +61 8 9355 5484
Email | info@WABAL.com.au
www.WABAL.com.au

WABAL is a subsidiary of WABCA Pty Ltd
ATF The Greenwood Trust
ABN 14566572499
REG NO: 226
WABCA

Table of Contents

Executive Summary

Bushfires present a significant risk to people, property and the environment. Each year, thousands of bushfires destroy or damage houses, sheds and garages, commercial and industrial buildings, vehicles and vast hectares of bushland across Western Australia. People have also been killed or seriously injured during bushfires. Therefore, reducing the likelihood and impact of bushfires is crucial for maintaining safer communities, mitigating the potential loss of life, property and infrastructure and the associated financial and emotional impact.

This Bushfire Management Plan has been commissioned by Hillburn Constructions Pty Ltd (on behalf of the property owners Jeffery & Moya Glisenti) to detail the bushfire management methods and requirements that will need to be implemented for the development of Lot 17 - No. 228 Sultana Road East, Forrestfield (The Site). The proposed development includes the subdivision of the 9,992m^2 subject site into 21 lots and 12 strata lots. The Bushfire Management Plan has been prepared in accordance with the bushfire protection criteria and acceptable solutions as outlined in Guidelines for Planning in Bushfire Prone Areas version 1.3 (December 2017). The major recommendations made within the plan include the implementation of applicable bushfire protection measures, to satisfy the requirements of State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015).

Approved by:

John Greenwood
MSc(Curtin) BAppSc (Building Surveying) MAIBS, MAIB
Director

Document Control
Client: Hillburn Constructions Pty Ltd (on behalf of the property owners Jeffery & Moya Glisenti)

Report Version	Purpose	Issue Date	Report Author
Rev 1	Bushfire Management Plan (BMP) for subdivision development application	27/03/2019	John Greenwood BPAD Level 2

Disclaimer: The measures contained in this bushfire management plan are considered to be minimum standards and they do not guarantee that a building will not be damaged in a bushfire. All surveys, forecasts, projections and recommendations made in this report associated with the project are made in good faith on the basis of information available to WABAL at the time; and achievement of the level of implementation of fire precautions will depend among other things on the actions of the landowners or occupiers over which WABAL has no control. Notwithstanding anything contained therein, WABAL will not, except as the law may require, be liable for any loss or other consequences (whether or not due to the negligence of the consultants, their servants or agents) arising out of the services rendered by the consultants.

Any recommendations made within this Plan relating to the clearing or modification of vegetation to meet setback requirements does not constitute approval or authority to modify or remove vegetation. All such approvals must be undertaken in consultation with the relevant authorities.

1.0 Proposal Details

The proposed development includes splitting the 9,992m^2 subject site into 21 lots ranging in size from 203m^2 to 3,103m^2 and the homestead lot (within the subject site) into 12 strata lots ranging in size from 190m^2 to 240m^2 as per Figure 1 below. For the purpose of this assessment, it is assumed that the proposed development will comply with the City's local planning scheme.

The application of State Planning Policy 3.7 is triggered by the site being located within an area that is designated as being prone to bushfires as per Figure 2. The proposal consists of a development application where a Bushfire Attack Level (BAL) rating above BAL-LOW will apply for certain lots within the proposed subdivision upon completion.

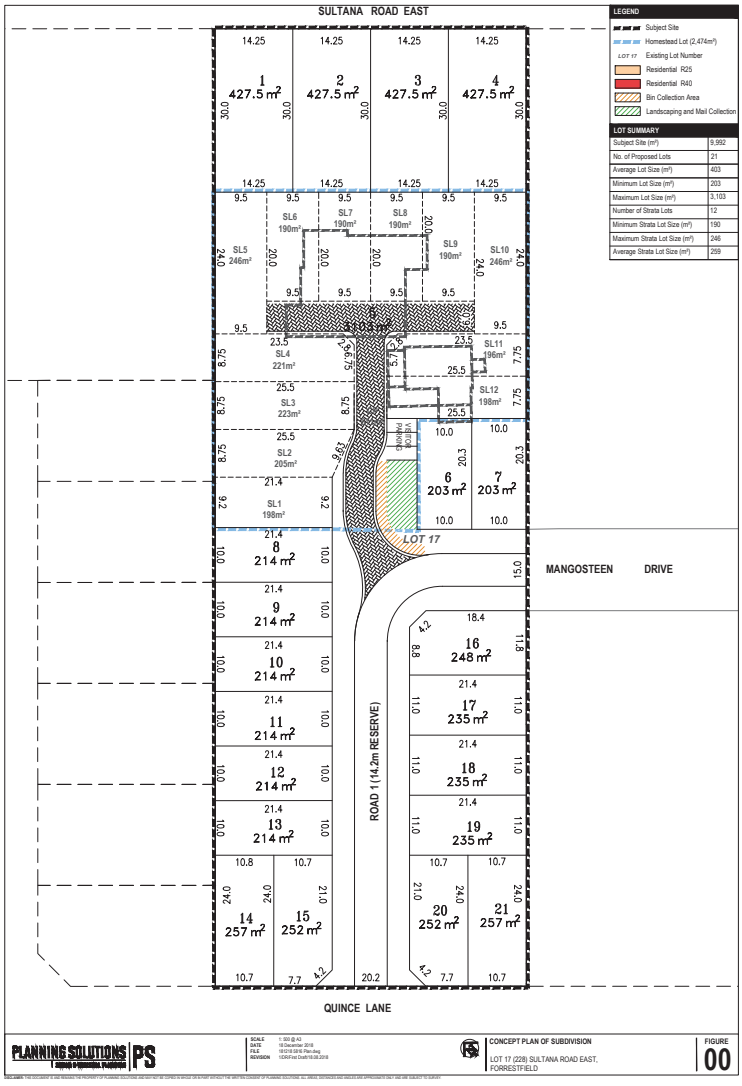


Figure 1: Proposed Site Plan

Figure 2: Map of Bushfire Prone Areas (Source: DFES dated 25/03/2019)

2.0 Environmental Considerations

Some bushfire prone areas also have high biodiversity values. SPP 3.7 policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values.

The proposal achieves compliance with Acceptable Solutions A1.1 and A2.1 in accordance with the Guidelines for Planning in Bushfire Prone Areas. The BAL rating that applies to the proposed subdivision does not exceed BAL-12.5 and the subject site has been excluded from classification under Clause 2.2.3.2(f) of AS3959 as managed and low threat (Please refer to *Section 3.0 Bushfire Assessment Report* of this BMP for further detail). The removal of on-site native vegetation for the purpose of achieving compliance with A1.1 and A2.1 is not required, therefore, environmental considerations have not been addressed for the purposes of this proposal.

3.0 Bushfire Assessment Results

A BAL Assessment is required in accordance with clause 6.5 of SPP 3.7. A Bushfire Attack Level (BAL) assessment conducted in accordance with AS3959 for the proposed subdivision was completed on 12th February 2019.

3.1 Assessment Inputs

All vegetation within 150m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2009. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified below. Please refer to the Bushfire Attack Level (BAL) Contour Map in Section 3.2 of this BMP for the BAL ratings that apply for each proposed lot and strata lot.

Photo ID:	1	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 1 refers to the surrounding urban vegetation, which has been excluded as being managed and low threat.			

Photo ID:	2	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 1.			

Photo ID:	3	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 1.			

Photo ID:	4	**Plot:**	1
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 1.			

Photo ID:	5	Plot:	2
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 2 refers to the surrounding vegetation, which has been excluded under clause 2.2.3.2(f) of AS3959-2009 as it is a maintained public reserve.			

Photo ID:	6	Plot:	2
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 2.			

Photo ID:	7	Plot:	3	
Vegetation Classification or Exclusion Clause				
Excludable – Clause 2.2.3.2(f)				
Description / Justification for Classification				
Plot 3 refers to the surrounding vegetation, which has been excluded as being low threat.				
Photo ID:	8	**Plot:**	3	
Vegetation Classification or Exclusion Clause				
Excludable – Clause 2.2.3.2(f)				
Description / Justification for Classification				
An alternative view of Plot 3.				

Photo ID:	9	Plot:	4
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 4 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	10	Plot:	4
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 4.			

Photo ID:	11	Plot:	4
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 4.			

Photo ID:	12	**Plot:**	5
Vegetation Classification or Exclusion Clause			
Class G Grassland			
Description / Justification for Classification			
Plot 5 is an area of Class G vegetation located 24 metres from the proposed site on flat land.			

Photo ID:	13	**Plot:**	5
Vegetation Classification or Exclusion Clause			
Class G Grassland			
Description / Justification for Classification			
An alternative view of Plot 5.			

Photo ID:	14	Plot:	6
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 6 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	15	Plot:	7
Vegetation Classification or Exclusion Clause			
Class B Woodland			
Description / Justification for Classification			
Plot 7 is an area of Class B vegetation located 134 metres from the proposed site on flat land.			

Photo ID:	16	Plot:	8
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(b)			
Description / Justification for Classification			
Plot 8 refers to the surrounding vegetation, which has been excluded under clause 2.2.3.2(b) of AS3959-2009 as it is less than 1ha in area and not within 100 metres of other areas of vegetation being classified.			

Photo ID:	17	Plot:	8
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(b)			
Description / Justification for Classification			
An alternative view of Plot 8.			

Photo ID:	18	Plot:	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
Plot 9 refers to the surrounding vegetation, which has been excluded as being low threat.			

Photo ID:	19	Plot:	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Photo ID:	20	Plot:	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Photo ID:	21	Plot:	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Photo ID:	22	Plot:	9
Vegetation Classification or Exclusion Clause			
Excludable – Clause 2.2.3.2(f)			
Description / Justification for Classification			
An alternative view of Plot 9.			

Figure 3 - BAL Vegetation Classification Map

Fire Protection Association Australia Life Property Environment

WABCA
WESTERN AUSTRALIA
BUILDING CERTIFIERS AND ASSESSORS

WABAL
BushfireAssessmentLogic

N

0m 50m 100m

Scale 1:2000 at A3
Date of Aerial Photo: 22 December 2018

LEGEND

- Assessment area
- Subject land
- Proposed cadastre
- Vegetation/plot boundary
- Photo Point
- Class A
- Class B
- Class C
- Class D
- Class E
- Class F
- Glass G
- Area to be modified to low threat state
- Excluded as per 2.2.3.2

ADDRESS:
Lot 17 - No. 228 Sultana Road East, Forrestfield 6112

INSPECTION:	REPORT:	REV:
12/02/2019	27/03/2019	1

1	Issued to Client
1	
1	

John Greenwood
BPAD Level 2

I hereby declare that I am a BPAD accredited bushfire practitioner.
Accreditation No. BPAD 36633
Signature
Date 27/03/2019

BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 2

3.2 Assessment Outputs

BAL (Bushfire Attack Level) Determination Using Methodology from Section 2.2.1 of current adopted AS3959-2009 and Table 2.4.3 for Fire Danger Index (FDI) 80. Please refer to Table 1 and the BAL Contour Map (Figure 4) provided below for the Bushfire Attack Level (BAL) ratings that apply to the proposed lots and strata lots.

Proposed Lot / Strata Lot (SL) Number	Bushfire Attack Level (BAL) rating
1	BAL-12.5
2	BAL-12.5
3	BAL-12.5
4	BAL-12.5
5	Refer to SL1 – SL12
6	BAL-LOW
7	BAL-LOW
8	BAL-LOW
9	BAL-LOW
10	BAL-LOW
11	BAL-LOW
12	BAL-LOW
13	BAL-LOW
14	BAL-LOW
15	BAL-LOW
16	BAL-LOW
17	BAL-LOW
18	BAL-LOW
19	BAL-LOW
20	BAL-LOW
21	BAL-LOW
SL1	BAL-LOW
SL2	BAL-LOW
SL3	BAL-LOW
SL4	BAL-LOW
SL5	BAL-LOW
SL6	BAL-LOW
SL7	BAL-LOW
SL8	BAL-LOW
SL9	BAL-LOW
SL10	BAL-LOW
SL11	BAL-LOW
SL12	BAL-LOW

Table 1: Summary of Bushfire Attack (BAL) Ratings for Proposed Lots and Strata Lots (SL)

Figure 4 - BAL Contour Map

Fire Protection Association Australia Life Property Environment

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BUILDING CERTIFIERS AND ASSESSORS

WABAL
BushfireAssessmentLogic

0m 50m 100m

Scale 1:2000 at A3
Date of Aerial Photo: 22 December 2018

N

LEGEND

- Assessment area
- Subject land
- Proposed cadastre
- Vegetation/plot boundary
- BAL - Low
- BAL - 12.5
- BAL - 19
- BAL - 29
- BAL - 40
- BAL - FZ

ADDRESS:
Lot 17 - No. 228 Sultana Road East, Forrestfield 6112

INSPECTION: 12/02/2019	REPORT: 27/03/2019	REV: 1
1	Issued to Client	
1		
1		

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4.0 Assessment against bushfire protection criteria

For each of the elements listed within Appendix 4 of the Guidelines for Planning in Bushfire Prone areas, the intent is demonstrated by addressing the relevant acceptable solutions for this proposal. Justification statements for the proposals compliance or non-compliance with the relevant acceptable solutions is detailed in Table 2 below. In accordance with SPP 3.7 Part 6.5(c) this proposal provides an assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance within the boundary of the development site. Please refer to Figure 5 for a spatial representation of how compliance with the applicable acceptable solutions will be achieved.

Bushfire Protection Criteria	Method of Compliance Acceptable Solutions	Proposed bushfire management strategies
Element 1: Location	A1.1 Development Location	The proposed lots and strata lots will be located on site so as to allow a sufficient separation distance from the classified vegetation to achieve a BAL – 12.5 rating or below.
Element 2: Sitting and design	A2.1 Asset Protection Zone (APZ)	Asset Protection Zone (APZ) requirements are achieved and shall continue to be maintained through the management of the proposed lots and strata lots in a low threat state in perpetuity, as per AS3959 and Schedule 1 of the Guidelines (Appendix 6.1). Fuel load management and fire hazard reduction requirements will also apply in accordance with the City of Kalamunda Fire Hazard Reduction Notice (Appendix 6.3). Compliance with Acceptable Solution A2.1 is, therefore, achieved.
Element 3: Vehicular access	A3.1 Two access routes	Access to lots SL1 to SL12 and lots 6 to 21 will be via the proposed road reserve and private road (common property driveway). The road reserve within the proposed subdivision will discharge onto Quince Lane. From here two (2) different vehicular access routes are available in either a North Westerly direction (towards Seville Road) or South Easterly direction towards Quince Way which connects into Gala Way to the South. Lots 1 to 4 will discharge onto Sultana Road East. From here travel is available in either an Easterly direction along Sultana Road East (towards Hawtin Road) or West along Sultana Road East then South along Apricot Street to Berkshire Road.
	A3.2 Public road	The public road shown within the road reserve as identified on the proposed site plan (Figure 1) must meet the vehicular access technical requirements of Table 6, Column 1 (Appendix 6.2) to achieve compliance with Acceptable Solution A3.2.

		All proposed lots to be developed that will be serviced by the road reserve and common property driveway have achieved a BAL-LOW rating (Figure 4).
	A3.3 Cul-de-sac (including dead-end road)	Not Applicable The twelve (12) strata lots are serviced by a private road (common property driveway). Please refer to A3.5 for details. *Note:* The combined length of the road reserve and common property driveway does not exceed a length of 200m.
	A3.4 Battle-axe	There are no proposed battle-axe access legs to the proposed lots. A3.4 is therefore not applicable for this proposal.
	A3.5 Private driveway longer than 50 metres	The proposed access is shown in the site plan (Figure 1) in Section 1.0 of this BMP. The private road (common property driveway) is 6 metres in width and includes a T-shaped turn around area that complies with the design requirements of Figure 22 in the Guidelines (Appendix 6.2). The common property driveway must also meet the following requirements in accordance with the Guidelines: • Vehicular access technical requirements in Table 6, Column 3 (Appendix 6.2). • Any bridges or culverts must be able to support a minimum weight capacity of 15 tonnes. • All-weather surface (i.e. compacted gravel, limestone or sealed). All proposed lots to be developed that will be serviced by the road reserve and common property driveway have achieved a BAL-LOW rating (Figure 4).
	A3.6 Emergency access way	Not Applicable
	A3.7 Fire service access routes (perimeter roads)	Not Applicable
	A3.8 Firebreak width	Please refer to Appendix 6.3 of this BMP for a copy of the City of 2018-2019 City Kalamunda Fire Hazard Reduction Notice. Note: Firebreak Notices are updated annually, therefore, property owners and/or occupiers must ensure they

		meet the requirements of the most up to date Fire Hazard Reduction Notice.
Element 4: Water	A4.1 Reticulated areas	The area must be provided with reticulated water (including hydrants) to Water Corporation and Department of Fire and Emergency Services Standards. The Water Corporation of WA's Water Reticulation Standard No. 63 is considered to be the baseline criteria for developments and will be applied to this Site. The nearest existing street hydrants in the area are shown in Figure 5.
	A4.2 Non-reticulated areas	Not Applicable
	A4.3 Individual lots within non-reticulated areas (only for use if creating 1 additional lot and cannot be applied cumulatively)	Not Applicable

Table 2: Compliance Summary

Figure 5: Spatial representation of the proposed risk management strategies

Fire Protection Association Australia Life Property Environment

NOTES

1) Access/egress in two (2) different directions
2) Class G - Grassland primary vegetation plot
3) Vegetation within subject site to continue to be maintained in low threat state as per Schedule 1 Element 2 and City of Kalamunda Firebreak Notice.
4) Nearest existing fire hydrants to development
5) Landscaping and road reserve (where applicable) to be maintained in a low threat state as reticulated garden/low threat vegetation excluded 2.2.3.2(f).
6) Service road includes both public road and common property driveway (combined length less than 200m) with a T-shaped turn-around bay approx. 38m in length with 6m trafficable surface.

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WABAL
BushfireAssessmentLogic

N

0m 25m 50m

Date of Aerial Photo: 22 December 2018

LEGEND

- Subject land
- Proposed cadastre
- Asset Protection Zone
- Vegetation Plot boundary
- Common property driveway
- Public Road
- Landscaped Areas
- Water Hydrant
- 1 Notes

PROPERTY/ASSESSMENT DETAILS

Owner: Jeffery & Moya Glisenti
Lot/No: Lot 17 / No. 228
Street: Sultana Road East
Locality: Forrestfield 6112
Prepared by: John Greenwood
Company: WABAL
Accreditation Level: BPAD Level 2
BPAD Accreditation Number: 36633
Accreditation Expiry Date: April 2019

INSPECTION: 12/02/2019	REPORT: 27/03/2019	REV: 1
1	Issued to Client	
1		
1		

John Greenwood
BPAD Level 2

I hereby declare that I am a BPAD accredited bushfire practitioner. Accreditation No. BPAD 36633. Signature. Date 27/03/2019

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

5.0 Responsibilities for Implementation and Management of Bushfire Measures

This Bushfire Management Plan becomes operational as a condition of development approval. Through the implementation of this Bushfire Management Plan, the following responsibilities have been determined.

5.1 Landowners' Responsibilities

The landowners' in succession will be responsible for:

- Being aware of the bushfire risk potentially affecting their property, with an understanding that bushfire threat can never be fully removed;
- Reading, understanding and complying with this Bushfire Management Plan;
- Ensuring the ongoing implementation of this Bushfire Management Plan, including providing successive landowners with a copy of this Bushfire Management Plan, and making them aware of the responsibilities outlined in this Bushfire Management Plan;
- Continue to maintain the property in a low threat state in accordance with the City of Kalamunda Fire Hazard Reduction Notice and Schedule 1 of the Guidelines to minimize potential bushfire fuels to mitigate the risk of fire on the property;
- Ensuring that the lot complies with any Fire Control Notice issued by the City of Kalamunda. To be carried out and maintained annually;
- Complying with the instructions of DFES Fire Services, the City of Kalamunda and/or volunteer fire services as may be issued under the Act for the purposes of maintaining the property or during the event of a bushfire; and
- Any new building works, including those included within the works currently proposed and all future works, are to comply with the bushfire protection provisions of the Building Act, Building Regulations, National Construction Code and AS 3959 -2009 (where applicable).

5.2 Developer's Responsibilities

The developer(s) of the subject site and Homestead Lot shall be required to carry out works that include the following:

- Establishing the proposed lots as a low-fuel zones and continuing to maintain these areas as a low-fuel zone in accordance with Schedule 1 Element 2 of the Guidelines until individual lots are sold;
- Establishing landscaping and road reserve (where applicable) as reticulated garden/low threat vegetation pursuant to AS3959 2.2.3.2(f);
- Lodging a section 70A Notification on each Certificate of Title proposed by the subdivision. The notification shall alert purchasers of land and successors in Title of the responsibilities of this Bushfire Management Plan;
- Maintaining fire hazard reduction and fire breaks to the required standard in accordance with the City of Kalamunda Fire Hazard Reduction Notice until individual lots are sold; and
- Supply a copy of this Bushfire Management Plan and the Bushfire Survival Manual to each property owner on sale of the allotment. A copy of the approved Bushfire Management Plan must be attached to all Contracts of Sale for the Lot.

5.3 Local Authority Responsibilities

To maintain the reduced level of risk and threat of fire, the City of Kalamunda will be responsible for undertaking and implementing measures to facilitate the protection of assets from the threat and risk of bush fire:

- Continue to provide the community with advice on bushfire prevention and preparedness;
- Issue annual fire control notices under the provisions of the Bush Fires Act 1954;
- Ensuring a Section 70A notification is placed on the Certificate of Title for the Lot advising future landowners of the existence of this Bushfire Management Plan;
- Ensure the provisions within this Bushfire Management Plan are adhered to and incorporated into the development approval for this proposal; and
- Inspect and issue notice to the landowner, or otherwise undertake remedial works where the owner has not complied with any fire control notices under the provisions of the Bush Fires Act 1954

6.0 Appendices

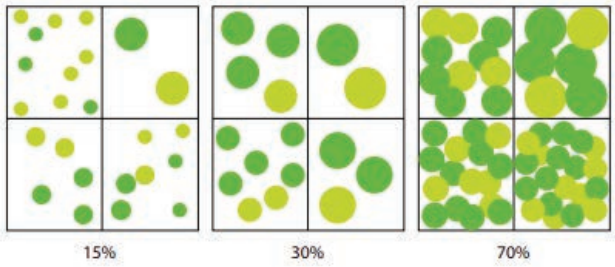
6.1 Schedule 1: Standards for Asset Protection Zones, Appendix 4 of the Guidelines

ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

- **Fences:** within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.
- **Objects:** within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.
- **Fine Fuel load:** combustible dead vegetation matter less than 6 millimetres in thickness reduced to and maintained at an average of two tonnes per hectare.
- **Trees (> 5 metres in height):** trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy.

Figure 18: Tree canopy cover – ranging from 15 to 70 per cent at maturity



- **Shrubs (0.5 metres to 5 metres in height):** should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m² in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.
- **Ground covers (<0.5 metres in height):** can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 millimetres in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.
- **Grass:** should be managed to maintain a height of 100 millimetres or less.

Source: Guidelines for Planning in Bushfire Prone Areas

6.2 Vehicular Access Technical Requirements

Table 6: Vehicular access technical requirements

TECHNICAL REQUIREMENTS	1 Public road	2 Cul-de-sac	3 Private driveway	4 Emergency access way	5 Fire service access routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal clearance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	N/A	4.5	4.5	4.5
Maximum grade <50 metres	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15	15	15	15
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius (m)	8.5	8.5	8.5	8.5	8.5
*Refer to E3.2 Public roads: Trafficable surface					

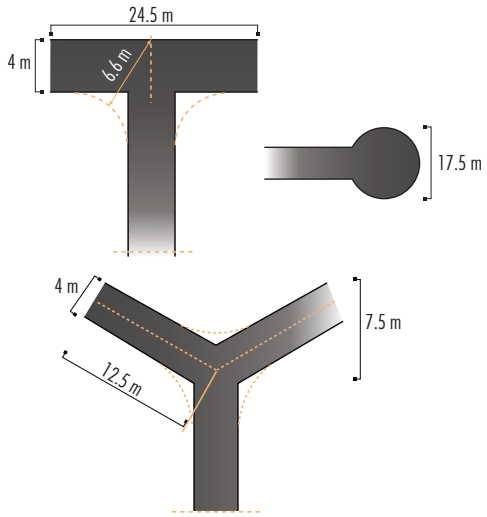
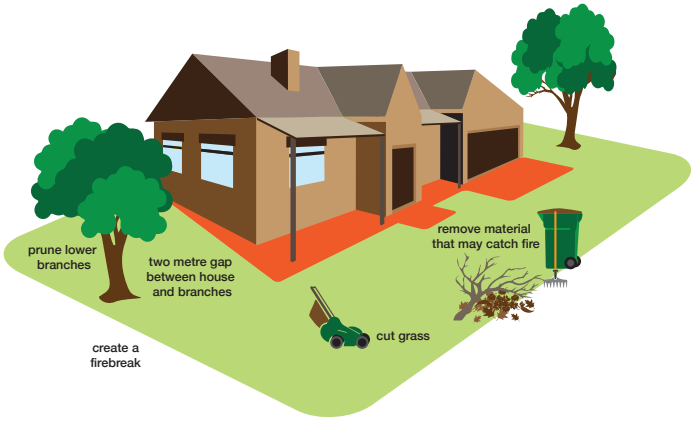


Figure 22: Design requirements for a private driveway longer than 50 metres
Turning areas should allow type 3.4 fire appliances to turn safely

Source: Guidelines for Planning in Bushfire Prone Areas

6.3 City of Kalamunda 2018/2019 Fire Hazard Reduction Notice

City of Kalamunda 2018/2019 **Fire Hazard Reduction Notice**



ADDITIONAL WORKS

In addition to the noted requirements, regardless of land size and location, the City of Kalamunda or its duly authorised officer(s) may require you to undertake additional works on your property to improve access and/ or undertake further hazard reduction (Additional Works) where, in the opinion of the officer, such Additional Works are necessary to prevent the outbreak and/or the spread of a bush fire.

FIREBREAK VARIATIONS

If you consider for any reason that it is impractical to clear firebreaks as required by this Notice, or if natural features render firebreaks unnecessary, you may apply in writing to the City of Kalamunda or its duly authorised officers, not later than 1 October 2018, for alternative positions, or other methods of fire prevention on your land.

If permission is not granted, you must comply with the requirements of this Notice. This applies to variations to the Asset Protection Zone as well. The Chief Bush Fire Control Officer reserves the right to review and revoke any variation granted at any time.

FUEL DUMPS AND DEPOTS

You are required to remove all flammable matter within (10) metres of where fuel drums, fuel ramps or fuel dumps are located, and where fuel drums, whether containing fuel or not, are.

By order of the City of Kalamunda.

Rhonda Hardy
CHIEF EXECUTIVE OFFICER

Phone 9257 9999
Email enquiries@kalamunda.wa.gov.au
Web www.kalamunda.wa.gov.au/fire

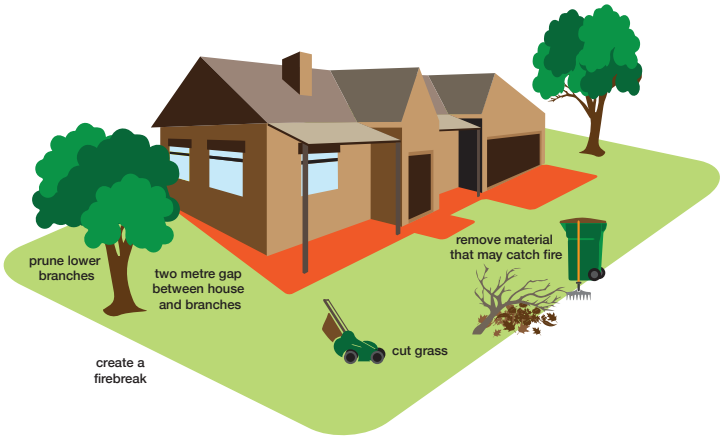
DEFINITIONS

Fuel load
This is the leaf litter on the ground inclusive of leaves, twigs (up to 6mm diameter) and bark. A litter depth of 15mm from the top of the layer to the mineral earth beneath is indicative of approximately 8 tonnes per hectare.

city of kalamunda

J010250 27

City of Kalamunda 2018/2019 **Fire Hazard Reduction Notice**



ADDITIONAL WORKS

In addition to the noted requirements, regardless of land size and location, the City of Kalamunda or its duly authorised officer(s) may require you to undertake additional works on your property to improve access and/ or undertake further hazard reduction (Additional Works) where, in the opinion of the officer, such Additional Works are necessary to prevent the outbreak and/or the spread of a bush fire.

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By order of the City of Kalamunda.

Rhonda Hardy
CHIEF EXECUTIVE OFFICER

Phone 9257 9999
Email enquiries@kalamunda.wa.gov.au
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DEFINITIONS

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Applicant Declaration:

I declare that the information provided is true and correct to the best of my knowledge.

John Greenwood
MSc (Curtin) BAppSc (Building Surveying) MAIBS, MAIB
Level 1 Building Surveyor BPAD36633 (Level 2)
WABAL & WABCA Group
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Tel +61 8 9355 5484 | Email | Website | Submit