great places

LOTS 55 + 56
COTTONWOOD CRESCENT
STRUCTURE PLAN

Prepared for Gay Street Property Holdings
December 2020

ENDORSEMENT PAGE

This Structure Plan is prepared under the provisions of the City of Stirling Local Planning Scheme No. 3.

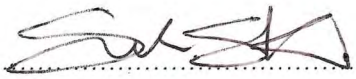
IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

24-Mar-2021
..... Date

Signed for and on behalf of the Western Australian Planning Commission

.....

An officer of the Commission duty authorised by the Commission pursuant to Section 16 of the *Planning and Development Act 2005* for that purpose, in the presence of:



..... Witness

24-Mar-2021 ..... Date

24-Mar-2031 ..... Date of Expiry

TABLE OF AMENDMENTS

Amendment no.	Summary of amendment	Amendment Type	Date approvaed by WAPC
1			

TABLE OF DENSITY PLANS

Density Plan no.	Area of density plan application	Date endorsed by WAPC
1		

DOCUMENT STATUS

Revision	Comment	Author	Approved by	Issue Date
A	Issued for Client Comment	KV	TT	160415
B	Issued to City of Stirling for Comment	KV	TT	160609
C	Lodged with City of Stirling	KV	TT	161024
D	Modified following EPBC assessment	KV	TT	190625
E	Modified following City Liasion	KV	TT	191202
F	Modified following WAPC Liaision	KV	TT	200714
G	Modified - WAPC Schedule of Modications	KV	TT	201027
H/I	Modified - WAPC Schedule of Modications	KV	TT	201202

PRE LODGEMENT CONSULTATION

Agency	Date of Consultation	Method of Consultation	Summary of Consultation
Department of Planning	May 2013	Meeting	Discuss Structure Plan design and MAX Light Rail Plan
City of Stirling	January 2013	Meeting	Discuss Structure Plan design and POS
City of Stirling	May 2014	Meeting	Discuss Remnant Vegetation
City of Stirling	April 2015	Liason	POS Design
City of Stirling	July 2015	Email	Approval Process
Western Power	April 2016	Correspondence	Feasibility Study provided confirming network capacity is available
Water Corporation	April 2016	Email	Discuss upgrades to downstream sewer connection
ATCO	April 2016	Email	Confirmed network capacity
NBN	March-May 2016	Email	Development requiest submitted
Water Corporation	April 2016	Email	Water planning provided
Western Power	May 2016	Email	Feasibility confirmed for revised plan
Water Corporation	May 2016	Email	Feasibility confirmed for revised plan
City of Stirling	May 2016	Meeting	Discuss Modifications to LSP
City of Stirling	September 2016	Meeting	Discuss Modifications to LSP
WAPC, City of Stirling	May 2019	Meetings	Agree LSP Modifications and assessment process

PROJECT DETAILS

Project lead		In collaboration with	
Prepared for_	Gay Street Property Holdings WA Housing Authority	Traffic and transport_	GTA Consultants
		Servicing and Engineering_	Pritchard Francis
		Environmental_	RPS, Ecoscape
Prepared by_	RobertsDay	Bushfire_	Strategen
		Acoustics_	Herring Storer

EXECUTIVE SUMMARY

This Structure Plan provides the statutory mechanism and supporting technical studies for the redevelopment and subdivision of Lots 55 and 56 Cottonwood Crescent, Dianella (subject site). The Structure Plan will assist with fulfilling the State Government and City of Stirling's strategic direction in relation to housing supply and affordability, and is consistent with the City's strategic vision for the locality, as outlined by the Dianella Local Area Plan.

The Structure Plan proposes a range of residential densities and provides for housing diversity to meet market and affordability demands. It also includes an east-west aligned public open space corridor providing direct connections to surrounding areas.

It is anticipated that the Structure Plan area will accommodate approximately 502 People on 63 lots.

The following Summary Table provides key planning outcomes of the Structure Plan:

Item	Data	Section number referenced within the structure plan report
Total area covered by the structure plan	7.011 ha	Section 1.3.3
Area of each land use proposed: Residential Public Open Space/ Drainage	 4.082 ha 1.528 ha	Section 3.0
Estimated lot yield	63 lots	Section 3.0
Estimated number of dwellings	201 dwellings	Section 3.0
Estimated residential site density	28.7 dwellings per site ha 36.7 dwellings per gross urban ha	Section 3.0
Estimated population	502 people	Section 3.0
Number of high schools	0	Section 3.8
Number of primary schools	0	Section 3.8
Estimated commercial floor space	0	Section 3.9
Estimated number and % of public open space:	0.6552ha (10.7%)	Section 3.2
Estimated number and area of natural area and biodiversity assets (tree retention)	0.761 ha	Section 3.2

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Appendix B: Environmental Assessment

B1 Lot 55 Level 1 Flora and Vegetation Survey RPS

B2 Lot 56 Level 2 Flora Survey Ecoscape

B3 Draft Conservation Area Management Plan

Appendix C: Engineering Services Report Pritchard Francis

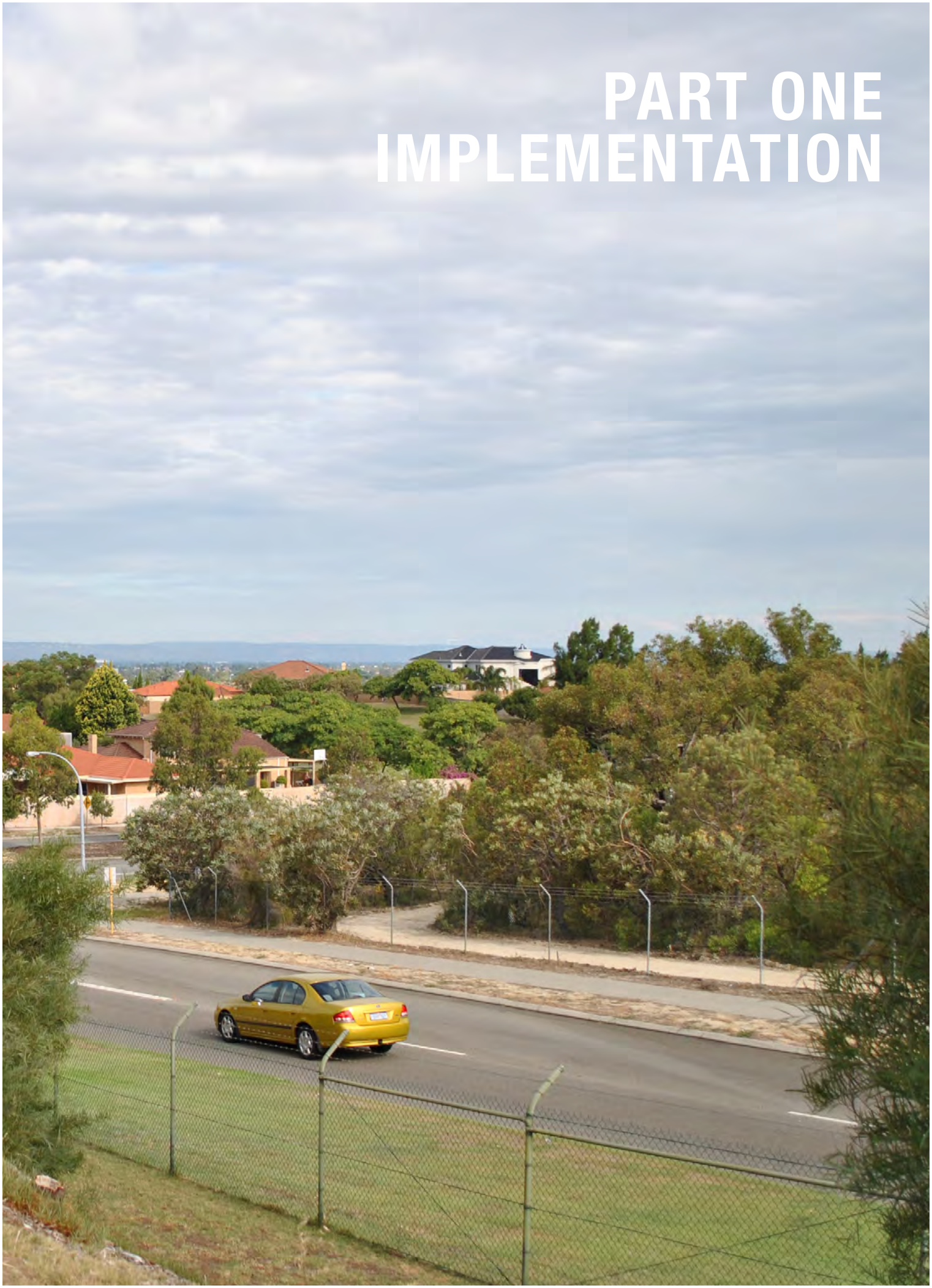
Appendix D: Bushfire Management Plan Strategen

Appendix E: Traffic Impact Assessment Report GTA

Appendix F: Department of Water Correspondence

Appendix G: Road Traffic Noise Assessment Herring Storer Acoustics

PART ONE
IMPLEMENTATION



PART ONE: IMPLEMENTATION

1.0 Structure Plan Area

This Structure Plan shall apply to Lots 55 and 56 Cottonwood Crescent, Dianella being the land contained within the inner edge of the line denoting the structure plan boundary on the structure plan map (Plan 1).

2.0 Operation

This structure plan shall come into operation on the date it is approved by the Western Australian Planning Commission (WAPC).

3.0 Staging

Staging of development will rely on key development parameters, primarily relating to the extension of available services from surrounding development.

4.0 Subdivision and Development Requirements

4.1 Land Use Zones and Reserves

Land Use permissibility within the Structure Plan area shall be 'Residential' be in accordance with the Structure Plan Map and corresponding Zones and Reserves under the Scheme.

4.2 Bushfire Response

All development within the Structure Plan area shall have due regard to the requirements of the prepared Bushfire Management Plan.

Residential lots within a bushfire prone area will be required to include a notification under section 70A of the Transfer of Land Act 1893 on the certificate of title giving notice of the bushfire hazard and/or protective measures required to be maintained at the landowner's cost.

4.3 Noise Response

Lots affected by noise from Dianella Drive, as spatially identified in the Road Traffic Noise Assessment, shall be built to specified fencing and Quiet House Design standards and shall contain a notification on Title.

4.4 Public Open Space

As required by Liveable Neighbourhoods, a minimum 10% Public Open Space provision shall be provided as shown on the Structure Plan Map.

4.5 Movement Network

Access shall be provided generally in accordance with Local Road Reserves shown on the Local Structure Plan Map.

5.0 Residential Density

5.1 Density Ranges

1. Residential densities applicable to the Structure Plan Area shall be generally in accordance with the residential densities shown on the Structure Plan Map (Plan 1).
2. Plan 1 defines the residential density ranges that apply to specific areas within the Structure Plan. Where a density range applies, specific residential densities are to be subsequently assigned in accordance with a Residential Density Code Plan approved by the WAPC.
3. A Residential Density Code Plan is to be submitted at the time of subdivision to the WAPC and shall indicate the Residential Density Coding applicable to each lot within the subdivision and shall be consistent with the Structure Plan, and the Residential Density Ranges identified on Plan 1 and locational criteria contained in Clause 5.2.
4. The Residential Density Code Plan is to include a summary of the proposed dwelling yield of the subdivision.
5. Approval of the Residential Density Code Plan shall be undertaken at the time of determination of the subdivision application by the WAPC. The approved Residential Density Code Plan shall then form part of the Structure Plan and shall be used for the determination of future development applications. Variations to the Residential Density Code Plan will require further approval of the WAPC.
6. Residential Density Code Plans are not required if the WAPC considers that the subdivision is for one or more of the following:
    - The amalgamation of lots;
    - The purposes of facilitating the provision of access, services or infrastructure; or
    - Land which by virtue of its zoning or reservation under the Structure Plan cannot be developed for residential purposes.

5.2 Locational Criteria

1. The allocation of residential densities on the Residential Density Code Plan shall be in accordance with the following locational criteria:

a. R10-25 Range

    i. R25 applies as the base code except where identified in clause (ii) below.

    ii. Densities below R25 may be applied to larger lots where consistent with minimum site area requirements.

b. R25-40 Range
    i. R25 applies as the base code except where identified in clause (ii) below
    ii. R40 may be provided to lots located within 200 meters of Public Open Space.
c. R40-60 Range
    i. R40 applies as the base code except where identified in clause (ii) below.
    ii. R60 may be provided to lots adjacent to Public Open Space.
d. R80-100 Range
    i. R80 applies as the base code except where identified in clause (ii) below.
    ii. R100 may be provided to lots adjoining or adjacent to Dianella Drive.

6.0 Local Development Plans

A Local Development Plan is to be prepared in accordance with Clause 47 of the Deemed Provisions for Local Planning Schemes for lots affected by the following considerations, prior to development:

i. Lots deemed to be affected by noise from Dianella Drive, as identified in the Road Traffic Noise Assessment at Appendix G.
ii. Lots with a site crossfall in excess of 1 metre or requiring retaining in excess of 500mm.
iii. lots abutting public open space.
iv. lots with a density code of R60 and above, addressing moderation of impact to abutting lower-density lots.
v. lots containing trees or vegetation worthy of retention, as identified in Figure 9 - Tree Retention Plan, to ensure retianed trees and vegetation can be accommodated in deep soil planning areas within private open space; or
vi. lots abutting pedestrian accessways.

7.0 Additional Information

The details of additional information required to be submitted with the structure plan and the stage at which it is to be submitted are summarised in Table 1.

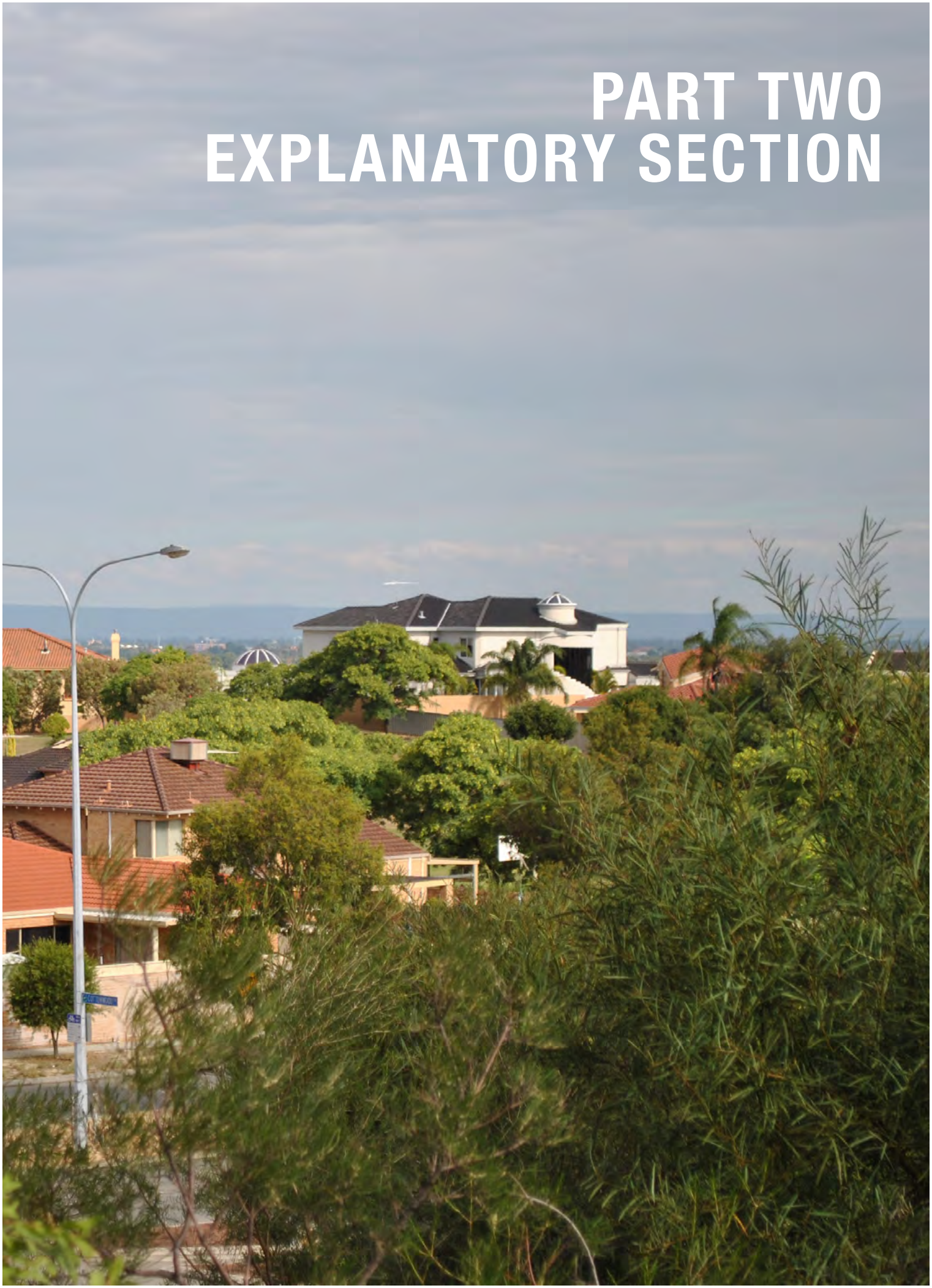
Table 1: Additional information.

Additional information	Approval stage	Consultation required
Bushfire Management Plan	Subdivision	City of Stirling

PART ONE: IMPLEMENTATION

Plan 1: Local Structure Plan Map

PART TWO
EXPLANATORY SECTION



PART TWO: EXPLANATORY SECTION

1.0 Planning Background

1.1 Introduction and purpose

The Structure Plan has been prepared by RobertsDay on behalf of Gay Street Property Holdings the registered proprietor proprietors of Lots 55 and 56 Cottonwood Crescent, Dianella ('subject site') respectively.

The Structure Plan design proposes the creation of 63 residential lots, with densities ranging from R10-20 through to R80-100. The design provides numerous areas of strategically located public open space, set within an interconnected road network linking the development to the adjoining residential estates and the surrounding district.

This section includes a description and analysis of the land, details about the development and confirmation that the proposal is consistent with the State's strategic objectives and the City of Stirling's planning framework for this locality.

The purpose of the Structure Plan is to provide an agreed planning framework and design response to facilitate subdivision and development. It has been prepared in accordance with the requirements and provisions of the Planning and Development (Local Planning Schemes) Regulations 2015 and the Western Australian Planning Commission's Structure Plan Framework, with due consideration to Clause 6A.6 of City of Stirling Local Planning Scheme No. 3 (LPS3).

1.2 Background

The subject site forms part of the Dianella Media Precinct which historically contained the television studios and broadcasting infrastructure for the Seven, Nine and Ten networks.

Since early 2008, there has been increased interest in the relocation of the media businesses and redevelopment of the sites for residential purposes. Recognising this at the 10 November 2009 Council Meeting, the City of Stirling Council endorsed the *Media Zones Development Procedure Statement*. The statement is an advisory note which identifies a number of conditions and prerequisites for the rezoning and redevelopment of the precinct. In 2010 the Dianella Media Zones Precinct Plan (Draft) was released by the City of Stirling to provide more detailed analysis of the change in land use and detailed guidance on the rezoning and preparation of plans to cater for residential development, and associated open space and protection of environmental amenities.

In August 2011 The City of Stirling adopted Amendment No.3 to LPS3 to rezone the Channel Seven site to 'Residential' zone and to introduce a 'Special Control Area' over the entire Media Precinct which requires future redevelopment within the Precinct to comply with the requirements of the *Dianella Media Zones Precinct Plan.* As outlined within this Plan, a prerequisite to the subdivision and development of the subject site was its rezoning to 'Development Zone' which was granted final approval by the Stirling Council at its meeting on 19 February 2013. The rezoning was gazetted on 26 May 2015.

1.3 Land description

1.3.1 Location

The subject site is situated within the municipality of the City of Stirling, approximately 11 kilometres north of central Perth and approximately 6 kilometres east of central Stirling.

The subject site is approximately 1 kilometre south of Mirrabooka Square Shopping Centre. Direct access to the subject site is provided from Cottonwood Crescent which extends along the southern and western boundaries of the site. Dianella Drive extends along the eastern boundary however no direct access from to the site is provided.

The Channel Seven and Nine sites, together with the Yokine Water Reservoir and a Bush Forever site are situated south of the subject lots. Surrounding residential development to the east and west comprise of low density single dwellings. The Mirrabooka Senior High School and primary school are approximately 200 metres west of the subject site.

A major bus route extends along Dianella Drive from the Mirrabooka regional centre to the Perth Central Business District. A regional cycling route also extends along Dianella Drive.

Refer Figure 1, context plan.

PART TWO: EXPLANATORY SECTION

Figure 1: Local Context Plan

PART TWO: EXPLANATORY SECTION

1.3.2 Area and land use

As outlined in Table 1, the site comprises approximately 7.0108 hectares.

Table 1: Land area

	Lot 55	Lot 56
House No.	55	23
Area	4.0028ha	3.008ha

Lot 55 is currently vacant, following demolition of the former Network Ten studio and administration complex and associated transmission infrastructure and car parking. Lot 56 to the north is void of any buildings. The eastern-most third is cleared whilst the remainder of the site contains remnant vegetation identified as Banksia woodland. All structures will be removed as development progresses, whilst the Banksia woodland will be partially retained as agreed following assessment of the Structure Plan under the Environment Protection and Biodiversity Act 1999 (EPBC Act).

Figure 2: Site Plan

PART TWO: EXPLANATORY SECTION

1.3.3 Legal description and ownership

Table 2 outlines the land details and ownership of lots subject of the Structure Plan. Refer to Appendix 1 for a copy of the Certificate of Title.

Table 2: Land details and ownership

Description	Street Address	CT Folio-Volume	Landowner/s
Lot 55 on Diagram 74500	55 Cottonwood Crescent, Dianella	1839-885	Gay Street Property Holdings
Lot 56 on Diagram 74500	23 Cottonwood Crescent, Dianella	1837-886	Gay Street Property Holdings

Figure 3: Metropolitan Region Scheme zoning

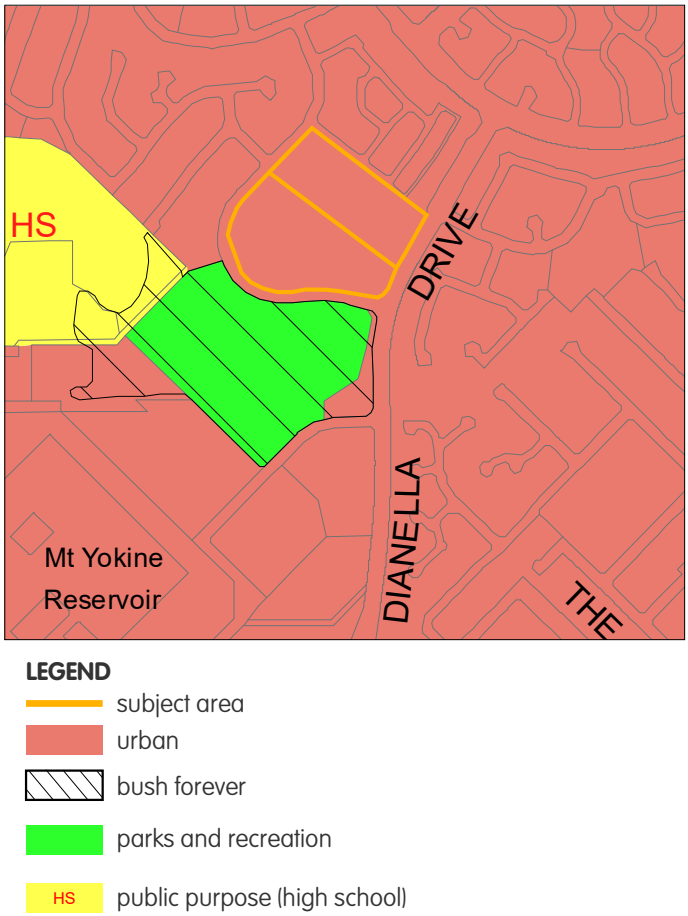


Figure 4: City of Stirling Town Planning Scheme No.3 zoning

1.4 Planning framework

1.4.1 Zoning and reservations

1.4.1.1 Metropolitan Region Scheme

In accordance with the provisions of the Metropolitan Region Scheme ('MRS') the subject site is zoned 'Urban.'

Refer Figure 3, MRS zoning.

1.4.1.2 Local Planning Scheme No. 3

In accordance with the City of Stirling Local Planning Scheme No.3 ('LPS3'), the subject site is zoned 'Development Zone.' The intent of the Development Zone is described as:

a. "To provide for coordinated development through the application of a comprehensive structure plan to guide subdivision and development;
b. To avoid the development of land for purposes likely to compromise its future development, or in a manner likely to detract from the amenity or integrity of the area."

Refer Figure 4, Scheme zoning.

1.4.2 Regional and sub-regional structure plans

1.4.2.1 Directions 2031 and Beyond

Directions 2031 and Beyond (Directions 2031) provides an overarching strategic framework for the detailed planning and delivery of housing, infrastructure and services for the Perth and Peel regions to support an estimated population of 3.5 million people in 2031. Directions 2031 seeks a 50 per cent increase from the current average residential density of 10 dwellings per gross urban zoned hectare to 15 dwellings per gross urban zoned hectare in new development areas.

The subject site is within the Central Sub-Region which is identified as requiring an additional 121,000 dwellings by 2031. Directions 2031 seeks a 50% increase in the current average residential density to 15 dwellings per gross urban hectare of land in new developments. The Structure Plan proposes a density of 36.7 dwellings per gross urban hectare and will contribute to meeting the forecast housing needs of the Central Sub-Region.

Development of the site will contribute to meeting the forecast housing needs of the region consistent with the sites zoning under the MRS.

1.4.2.2 Directions 2031 and Beyond and the Central Metropolitan Perth Sub-Regional Strategy

The Central Metropolitan Perth Sub-Regional Strategy ('CMPSRS') provides the strategic framework for the planning of urban growth consistent with Directions 2031. The City of Stirling is identified as requiring an additional 31,000 dwellings by 2031.

The strategy identifies the 'media precinct' as having a projected dwelling yield of 700 dwellings representing an 85% takeup rate. Dianella is recognised as having potential densities of 10 dwellings per hectare and 19 persons per hectare.

The Structure Plan will facilitate the redevelopment of the subject site for residential purposes consistent with the CMPSRS and the need to meet the anticipated demand for housing by 2031.

1.4.2.3 Perth and Peel @ 3.5 Million Central Metropolitan Sub-regional Planning Framework

The Central Metropolitan Sub-regional Planning Framework forms part of the strategic framework stipulated within the WAPC's Perth and Peel @ 3.5 Million report. The framework focuses on achieving increased infill and densities of residential and employment development within the existing built environment by making better use of established infrastructure.

It advocates for greater use of activity centres, transport corridors and station precincts to support a diversity of higher-density accommodation that is close to jobs and amenities, while ensuring urban development does not encroach on existing industrial centres and the green network.

The Sub-regional Framework outlines population and dwelling projections to 2050, with an infill target of 60,400 dwellings identified for the Stirling municipality. The structure planning of the site is consistent with the intent of the Sub-regional Planning Framework, and will assist the City to deliver the additional dwellings required to accommodate anticipated population growth.

1.4.2.4 Dianella Media Zones Precinct Plan and Redevelopment Procedure Statement

The Dianella Media Zones Precinct Plan ('Precinct Plan') was released in December 2010 to comply with the provisions of the Procedure Statement and provide guidance for the rezoning and planning for each site within the Precinct. The purpose of the Precinct Plan was to determine the extent and composition of urban development and outline bush protection areas, public open space, urban zones, development densities, built form guidelines and infrastructure provision.

The Precinct Plan comprises two discrete areas: the northern sub-precinct in which the subject site is located, and the southern sub-precinct. In relation to the future development of the subject site, the Precinct Plan states:

- The precinct is physically separated from the balance of the Media District and detailed planning of this land is to be progressed independently by the two owners;
- Provide 10% public open space (or cash in lieu); and
- Provide an overall density of 30 dwellings per (net) hectare with variation permitted depending on proximity to Mirrabooka centre and site conditions.

Although the Precinct Plan provides limited guidance on the future development of the northern sub-precinct, the Structure Plan is consistent with the intent of the Plan.

1.4.3 Planning Policies and Statements

1.4.3.1 State Planning Policy 3.1 – Residential Design Codes

The State Planning Policy 3.1 – Residential Design Codes (R-Codes) is the basis for the control of residential development throughout Western Australia. In accordance with conventional planning practice in Western Australia, the R-Codes are the agreed mechanism to control density within residential zones, through the application of R-Code densities on local planning scheme maps. The R-Code density (eg. R20, R30 etc.) primarily controls the allowable average and minimum lot size, with built form performance standards and 'deemed-to-comply' examples, specific to the stipulated density, outlined within Part 5 & 6 of the R-Codes.

The Structure Plan map designates R-Code densities, as a response to certain locational and design criteria. Development provisions within the R-Codes will be adopted to guide development at the subject site except where it is otherwise specified within a Local Development Plan.

1.4.3.2 Liveable Neighbourhoods

Liveable Neighbourhoods (LN) is the WAPC's operational policy guiding the design and approval of structure plans. The objective of LN is the delivery of new developments that provide high quality living, working and recreational environments, thereby contributing to the successful implementation of the State Planning Strategy and State Sustainability Strategy.

The Structure Plan meets the requirements of LN with a particular focus on the following key aims:

- An urban structure based on interconnected, safe and walkable neighbourhoods;
- Creating a sense of community, identity and a sense of place;
- Providing a variety of lot sizes and housing types to cater for the diverse housing needs of the community;
- Maximising land efficiency wherever possible; and
- Achieving a residential density of approximately 36.7 dwellings per gross urban hectare, which exceeds the Liveable Neighbourhoods target of 22 dwellings per residential site hectare.

1.4.3.3 City of Stirling Local Housing Strategy and Dianella Local Area Plan

The Local Housing Strategy acknowledges the growing shortage of both smaller and appropriately designed and priced dwellings within Perth and the City of Stirling. The Strategy identifies the need for statutory planning to facilitate the development of higher density dwellings in suitable locations close to activity centres and high frequency transit routes.

The Dianella Local Area Plan was prepared by the City of Stirling and notes the community vision for the area is a "green leafy character dominated by trees, parks and bushland."

Within the 'Dianella Local Area Future Opportunities' Plan the subject site is highlighted as 'Media Precinct: unique economic and conservation role.' Dianella Drive to the east of the subject site is shown as needing the installation of cycle lanes or dual use paths.

With regard to the subject site, it is identified as a desirable location for medium to high density residential development provided this is balanced with bushland conservation. The Plan notes that increased density would be desirable to allow more people access to community amenities, to meet sustainability objectives and to support larger commercial centres.

1.4.3.4 City of Stirling Public Open Space Strategy

The City's Public Open Space ('POS') Strategy provides guidance for the continued provision of POS to all residents within the City. It provides guidance for the location and accessibility of open space, recognising different categories of open space (passive, active, conservation). The objectives and principles of the POS Strategy have been considered during the design of the Structure Plan.

1.4.3.5 City of Stirling Integrated Transport Strategy

The City's Integrated Transport Strategy provides a strategic approach to transport by integrating land use and transport planning, pedestrian amenity, cyclist amenity, public transport, parking and demand management, policy and travel behaviour. The key objectives of the Strategy are:

- To encourage more sustainable transport of people and goods;
- To enable efficient movement of people and goods;
- To improve accessibility for pedestrians, cyclists and public transport users to a variety of destinations;
- To equitably provide for transport needs throughout the community; and
- To encourage public transport modes over private transport modes.

The Mirrabooka Regional Centre is identified as a future train station under the City's public transport wish list. The proposed Structure Plan will contribute to an increased number of housing stock, thus providing opportunities for increased public transport usage and resultant investment.

1.4.4 Other Policies and Statements

1.4.4.1 Statement of Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region

Statement of Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region (SPP2.8) provides a policy and implementation framework to ensure bushland protection and management is appropriately addressed and integrated with broader land use planning and decision-making.

The subject site is immediately north of a 'Bush Forever Reserve' as recognised within SPP 2.8. The proposed development of the subject site is not considered to have an adverse impact of the Bush Forever area.

1.4.4.2 Statement of Planning Policy 3 – Urban Growth and Settlement

SPP 3 establishes the principles for urban growth in Western Australia to ensure that future development is undertaken in a sustainable manner including the provision of a variety of housing types and infrastructure to service the urban growth.

The subject site is located within an existing urban area and is within close proximity to the Mirrabooka District Shopping Centre, an important employment node and the educational establishments of Mirrabooka primary and high schools. There is good access to public transport as well as local and regional recreation facilities. The development meets the criteria of this policy.

2.0 Site conditions and constraints

The following summary outlines the site's existing environmental conditions and is informed by the comprehensive environmental reporting provided at Appendix B to this report.

2.1 Biodiversity and natural area assets

Independent flora surveys have been completed within the Structure Plan area, as provided at Appendix B. The survey confirmed presence of Banksia woodland community and possible black cockatoo habitat within Lot 56, which represents the State and Federally listed Threatened Ecological Community SCP20a. The common conclusion of the investigations is that it is acceptable from an environmental viewpoint for this land to be partially developed for urban use with a suitable degree of vegetation conservation.

The proposed development design has been revised to increase the area of Public Open Space for future conservation. A POS conservation area is proposed within Lot 56 which contains 0.761ha of Jarrah/Banksia Woodland including 20 potential black cockatoo breeding trees. This revised design achieves an increase in conservation area relative to prior concept designs.

The revised POS design has been supported by the City of Stirling through consultation and has received EPBC approval with a determination that the proposed development does not constitute a controlled action.

A draft Conservation Area Management Plan (Refer Appendix B3) has been developed to support the proposed action and ensure the future protection and management of vegetation retained within POS.

2.2 Topography, landform and soils

The site survey indicates that the property slopes from approximately 80m AHD on the northwest boundary to approximately 60m AHD in the south east corner thus showing a 20m fall across the lots.

The 1:50000 Perth Geological Map Series indicates that the site is likely to consist of medium to coarse grained yellow sand.

A detailed geotechnical investigation would need to be undertaken by a certified geotechnical engineer prior to construction to confirm site conditions and geological development constraints.

The Department of Environment Regulation (DER) Contaminated Sites Database does not list any of the landholdings within the site.

The DER Acid Sulfate Soils (ASS) risk maps, available through Landgate's Shared Land Information Platform (SLIP), does not depict an ASS classification, suggesting the risk of the site containing ASS is relatively low.

Refer to Appendix C: Engineering Services Report.

2.3 Hydrology

The Perth Groundwater Atlas (2004) indicates that the water table is approximately 45-55m below ground level, and therefore groundwater is not anticipated to impact on the development or affect stormwater infiltration.

The Department of Water has advised that no monitoring would be required given the site conditions, namely; the small size of the site, the infill nature of the development and the significant separation distance to groundwater. Additionally, the Department has advised that there are no requirements for urban water management reporting (LWMS or UWMP) for the site.

For further information relating to site hydrology, refer to Appendix C: Engineering Services Report.

2.4 Bushfire hazard

Due to the proximity of the site to remnant native vegetation to the south and the associated bush fire risk to the site, a Bushfire Management Plan (BMP) was deemed necessary. The BMP, prepared by Strategen in November 2020, outlines how bush fire risk will be mitigated to achieve a suitable and effective bush fire management outcome for the site.

The following is a summary of key bush fire issues that have been considered as part of the FMP to inform development of specified bush fire risk treatment and mitigation measures:

- On-site vegetation within the proposed tree retention area and within the adjoining Cottonwood Crescent Conservation Reserve (Bush Forever Site 42) has been identified as being Class B.
- The effective slope of the site under the classified vegetation was deemed to range from approximately 61 m AHD (Australian Height Datum) in the southeast to approximately 80m AHD in the northwest. This equates to an effective slop of approximately 3 degrees under vegetation, with the bulk of classified vegetation downslope from proposed development.
- Investigation of bushfire history revealed no evidence of recent bushfire occurrence, whilst FireWatch indicates that no bushfire has occurred in the immediate locality for the past 20 years.
- Cottonwood Reserve was identified to contain a high fuel loads resulting from a lack of active and fuel hazard programs.

These findings informed subsequent bushfire hazard assessment, which identified existing and proposed POS areas as having a low bushfire hazard level, whilst Cottonwood Reserve has been assessed as extreme risk. In response to this, the BMP proposes the following bushfire management measures:

- Maintain a 25 metre wide Asset Protection Zone (APZ), wholly within the Cottonwood Crescent road reserve, with fuel loads maintained within 2 t/ha annually through grass cutting to a height of 100 mm in line with standard verge maintenance procedures.
- Provide a 3 metre firebreak around areas of Public Open Space in accordance with the provisions of the City of Stirling Annual Firebreak Notice.
- Provide at least 2 separate vehicle access points into the development from surrounding road network with all internal streets to comply with vehicular access technical requirements
- Provide a reticulated water supply system to all proposed lots, ensuring that a constant supply of water is available to meet minimum domestic and emergency water supply requirements.
- Provide of a network of fire hydrants along the internal road network at locations which meet relevant authority requirements.

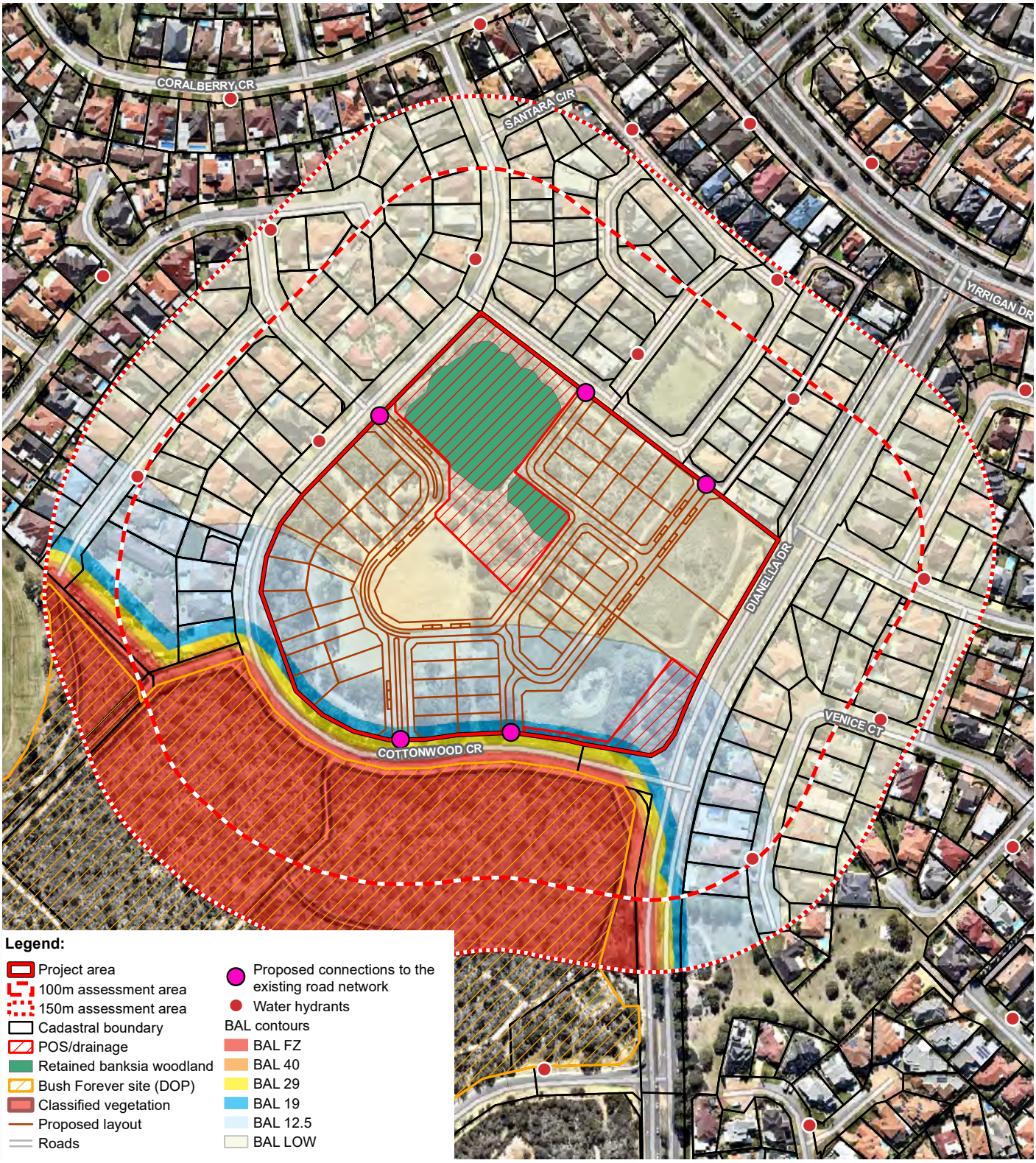
PART TWO: EXPLANATORY SECTION

Residential lots within a bushfire prone area will be required to include a notification under section 70A of the Transfer of Land Act 1893 on the certificate of title giving notice of the bushfire hazard and/or protective measures required to be maintained at the landowner's cost.

Implementation of the bushfire risk management and mitigation measures outlined in the BMP will ensure that should a bush fire occur within or adjacent to the residential development, fire intensity on-site will be minimised and life, property and environmental assets are expected to be protected, and that relevant objectives of SPP 3.7: Planning in Bushfire Prone Areas and the associated guidelines are achieved.

Refer to Appendix D – Bushfire Management Plan.

Figure 5: Bushfire Management Plan



2.5 Heritage

A search of the Department of Indigenous Affairs Heritage Register indicated that there are no known archaeological or ethnographic Aboriginal sites recorded on the site. Additionally, there are no areas of European Heritage recorded as being on, or within the vicinity of the site.

2.6 Summary of Issues and Opportunities

Integration	With existing residential development to the northeast and northwest through road network and lot design.
Public Transport	Serviced by Transperth bus routes 67, 68 and 69.
External Road Network	Regional connections provided by Dianella Drive, Accessed from Cottonwood Crescent. Five local connections service the Structure Plan area, providing access to Cottonwood Crescent, and Santara Circle.
Interface	With adjoining residential neighbourhood and Dianella Drive, with consideration given to noise, traffic, and amenity impact.
Existing Vegetation	Portion of site contains Banksia woodland ecological community. Significant portion of woodland identified as being of 'excellent' condition retained in dedicated POS.
Bushfire risk	Generally minimal across the site. External risks requiring a response include fuel loads and potential hazards in Bush Forever site to the south, adequately addressed through bushfire management.
Topography	20m cross fall across site, ranging from approximately 60m AHD in the south east corner to 80m AHD in the north west.
Low Points	South-east low point provides opportunity for the location of drainage within POS.
Services	Can be connected from the existing development to the north and west, including gas, power, water, sewer, telephone services.
Local employment and services	The subject site is 600m south of the Mirrabooka Square Shopping Centre which is classified as a 'Secondary Centre'.
Schools	Site located east of Mirrabooka Senior High School and playing fields and located in close proximity to other primary and secondary schools.

PART TWO: EXPLANATORY SECTION

3.0 Land use and subdivision requirements

3.1 Land use

As demonstrated by the Structure Plan map, it is proposed that the subject site be developed for predominantly residential purposes. A range of residential densities and housing typologies are proposed to meet market and affordability demands.

The proposed Structure Plan is consistent with the existing State and Local Government planning framework over the subject site and will contribute to meeting the forecast housing demand for the City of Stirling.

An overview of the Structure Plan and its key elements is provided in Table 3 below:

Table 3: Structure Plan Overview

Item	*Data*
Total area covered by the structure plan	7.011 ha
Area of each land use proposed: Residential Public Open Space/ Drainage	 4.082 ha 1.528 ha
Estimated lot yield	63 Lots
Estimated number of dwellings	201 Dwellings
Estimated residential site density	28.7 Dwellings per gross ha
Estimated population	502 people
Number of high schools	0
Number of primary schools	0
Estimated commercial floor space	0
Estimated number and % of public open space:	0.6522ha (10.7%)
Estimated number and area of natural area and biodiversity assets (conservation)	0.761ha

Figure 6: Structure Plan Indicative Concept Plan

Legend

1. Landscaped internal street network with reduced corner radii
2. Internal foothpaths set back from kerb aligned to property boundary
3. Retained conservation bushland with walking trails
4. POS incorporating drainage, central grassed area and planted buffer to conservation area
5. Landscaped Pedestrian Access Way
6. Multiple dwelling development with frontage to internal street and landscaped interface with Danella Drive

3.2 Open space

The proposed open space network has been strategically located to provide opportunities for passive and active recreation, drainage and banksia woodland retention. The primary POS area is located at the centre and north of the subject site, establishing a central 'village green' within which a range of activites may be accomodated. This POS also allows for the retention of 0.761 ha of Banksia woodland, with the extent of woodland to be cleared supported by EPBC assessment and below threshold levels. To the west, a pedestrian access way establishes a connection to the southern bushland reserve and the surrouding neighbourhood, including Mirrabooka Senior High School.

As amended, the SP provides for the retention of a 7607m^2 portion of remnant Banksia Woodland present within Lot 56, with a residual 1572m^2 portion to be cleared to accomodate roadworks and residential development. The proposed SP and extent of retained vegetation depicted on Plan 1 has been assessed by the Minister for Environment and Energy under the Environment Protection and Biodiversity Act 1999 (EPBC Act) and determined to not be a controlled action. As such, the proposed SP does not require further assessment and approval under the EPBC Act to proceed.

As demonstrated within the following POS schedule, a total area of 1.416 ha (20.8%) is proposed to be retained for POS/ Conservation. A POS area of 0.6552ha (10.7%) is proposed, which exceeds the minimum 10% POS provision as prescribed by Liveable Neighbourhoods. Management of the POS will be the responsibility of the City of Stirling following a two year monitoring period by the developer. Further detailed design of the POS will be undertaken at the subdivision stage.

Refer Table 4: POS Schedule and Figure 7: Public Open Space Concept Plan

Table 4: Public Open Space Schedule

Local Structure Plan Area		
Total Net Site Area		7.011 ha
Less Deductions		
Dedicated Drainage (1:1)	0.1178 ha	
Conservation	0.761 ha	
Gross Subdivisible Area (GSA)		6.13 ha
Public Open Space @ 10% of GSA		0.613 ha
May Comprise : Minimum 80% unrestricted public open space Maximum 20% restricted use public open space	 0.49 ha 0.123 ha	 0.613 ha
Public Open Space Provision		
POS 1 (Unrestricted) (Minus 1:1 Drainage) POS 1 (Restricted - 1:5 Drainage) POS 2 (Unrestricted) (Minus 1:1 Drainage) POS 2 (Restricted - 1:5 Draiange)	0.4662 ha – 0.183 ha 0.006 ha	
Total Open Space Provision		0.6552 ha (10.7%)

Figure 7: Public open space plan

3.3 Residential

The Structure Plan proposes four residential density ranges, R10-25, R25-40, R40-60 and R80-100, in order to accommodate a variety of demographics and household compositions. A total of 63 lots are proposed, including two grouped housing sites, three multiple dwelling lots and 58 single residential lots.

Single residential lots conform to two key typologies; larger lots fronting Cottonwood Crescent which reflect the character of adjecent residential dwellings and medium density lots fronting the internal road network. Grouped and Multiple Dwelling lots are located so as to capitalise on the amenity of POS as well as bushland and city views.

The Structure Plan proposes 36.7 dwellings per gross urban hectare, exceeding the Liveable Neighbourhoods density target of 22 dwellings per residential site hectare and the density target set by Directions 2031 of 15 dwellings per gross urban zoned hectare.

This range of residential densities reflects the site's proximity to the Mirrabooka Secondary Centre and Dianella Drive, which is well serviced by public transport.

Local Development Plans (LDPs) shall be used to provide specific and detailed guidance on site and development outcomes for specific areas, as detailed in Part 1 of this report. In particular, LDPs will manage the interface between proposed multiple dwelling sites and existing low dwelling lots, particularly where such lots share a common boundary. In these instances, impact of multiple dwelling development will be moderated by road interface design, site levels and setbacks, achieving a suitable transition from high to low density.

3.4 Movement network

The Structure Plan proposes a permeable internal street layout, with five primary access points at: a proposed roundabout at the intersection of Tecoma Way and Cottonwood Crescent; two street connections through to Santara Circle and; two T-junction intersections on Cottonwood Crescent. Proposed Multiple Dwelling sites will generally gain access from the internal road network, being the 15m Access Road B as shown at Figure 8.

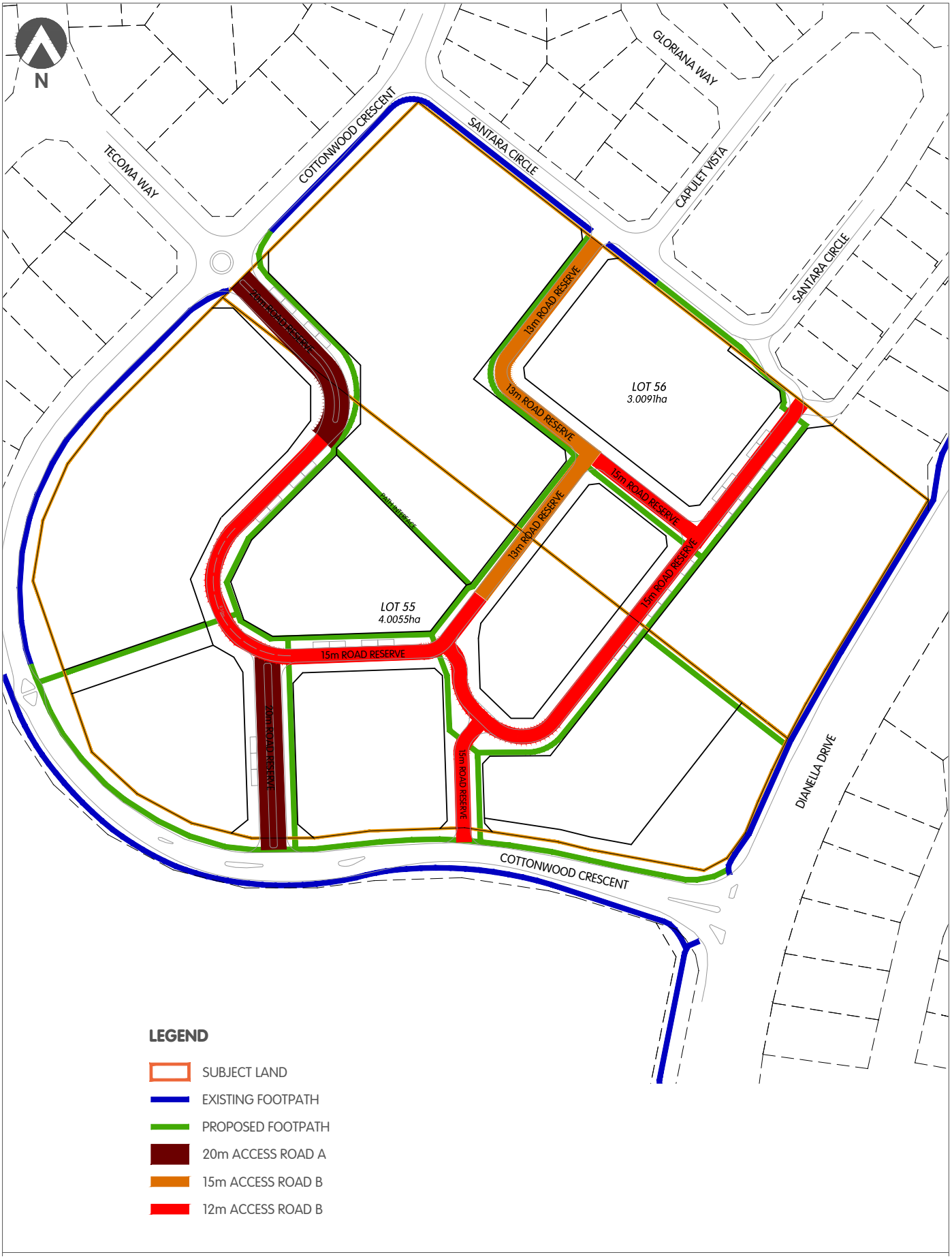
The City of Stirling previously provided in-principle support for access to Lot 55 from Cottonwood Crescent on the basis sufficient sight lines are provided. An approximate distance of 86m is provided which is greater than the current sight distances, and meets the required safe intersection sight distance for a speed of 50km/h. Preservation of this speed limit is to be maintained through the provision of a traffic calming treatment adjoining the Pedestrian Access Way.

The SP area is well-serviced by public transport, with bus routes 67, 68 and 69 servicing the site from the adjoining Dianella Drive. The SP also proposes a high quality and well connected pedestrian and cyclist network, with internal pedestrian access ways designed to facilitate connection with surrounding amenities, including Mirrabooka Shopping Centre of Mirrabooka Primary School and Mirrabooka Senior High School.

In support of the SP, a Transport Assessment Report prepared by GTA Consultants (October 2019) concluded that likely traffic generation associated with the proposed development (approximately 1,040 vehicular trips per weekday), its impact on the internal and external road network, and public transport, walking and cycling requirements are within acceptable paramaters.

For further information about Traffic Impact, Refer to Appendix E – Traffic Assessment Report.

Figure 8: Movement Network Plan



3.5 Water management

In November 2012, the Department of Water confirmed that neither a Local Water Management Strategy nor an Urban Water Management Plan would be required to form part of the Structure Plan or a condition of subdivision. Refer to Appendix F for a copy of the Department of Water correspondence.

As outlined within the Engineering Services Report prepared by Pritchard Francis in September 2019, the City requires the subdivision to be designed in accordance with the 'IPWEA Local Government Guidelines for Subdivisional Development.' In this regard, stormwater drainage is to be designed to cater for a 1 in 5 year ARI for road drainage and a 1 in 100 ARI for overland flow.

In accordance with the City's requirements, the road drainage network is designed to cater for a 1 in 5 year ARI event. Runoff is to be directed into a pit and pipe system directing the flow into infiltration areas, located in the designated public open spaces and PAWs . This arrangement responds to an identified lack of drainage capacity within the Dianella Drive road reserve.

For further information about Water Management, Refer to Appendix C – Engineering Services Report.

3.6 Noise Management

Herring Storer Acoustics undertook a Road Traffic Noise Assessment in July 2019 for the proposed development (refer to Appendix G). The purpose of the assessment was to assess noise received within the development from vehicles travelling along Dianella Drive and to establish the required attenuation measures to control noise if it exceeded noise limits.

The assessment found that noise received at the multiple dwelling lots along Dianella Drive would exceed the noise limits of State Planning Policy 5.4 (SPP5.4). In order to achieve compliance with SPP5.4, it is recommended to incorporate 'Quiet House' design to impacted residences and provide notifications on titles for those lots adjacent to Dianella Drive.

Refer to Appendix G - Noise Assessment.

3.7 Education Facilities

The subject site is situated to the east of the existing Mirrabooka Senior High School and playing fields. Other Schools and education establishments within close proximity to the site include (but are not limited to):

- Mirrabooka Primary School and Intensive English Centre;
- North Morley Primary School;
- Our Lady of Lourdes Primary School;
- West Coast Steiner School;
- St Gerard's Primary School; and
- St Andrew's Grammar School.

No education facilities are proposed on-site.

3.8 Activity Centres and Employment

The subject site is 600m south of the Mirrabooka Square Shopping Centre which is classified as a 'Secondary Centre' within Statement of Planning Policy 4.2: Activity Centres for Perth and Peel (SPP4.2). The existing centre will provide essential services, community facilities and employment opportunities for future residents within the Structure Plan area.

3.9 Infrastructure coordination, servicing, and staging

An Engineering Services Report was prepared by Pritchard Francis in September 2019. The report outlines the infrastructure likely to be required to develop the site and confirms it can be serviced with electrical, water, sewer, gas, stormwater drainage and communications infrastructure.

The report confirms that the land can be connected to all necessary services, either through connection to services which adjoin the site or through extension from neighbouring areas.

The Water Corporation has advised that water reticulation will require connections to both the diameter 100mm in Cottonwood Crescent and Santara Circle will be required, along with a new diameter 200mm extension along Cottonwood Crescent running parallel with the 700m main along the development boundary.

Western Power has advised there should be sufficient capacity in the existing electricity network to accommodate the proposed development with the point of connection located in Dianella Drive.

ATGO Gas Australia has advised that the existing 100mm PVC gas main has the capacity to service the proposed development and therefore no upgrades are required.

Refer to Appendix C – Engineering Services Report.

3.10 Tree Retention

Figure 9 depicts:

a. those existing trees to be retained within the Public Open Space.

b. those existing trees to be retained provided they are not impacted by subdivisional works.

Figure 9: Tree Retention Plan

4.0 Conclusion

The Lots 55 and 56 Cottonwood Crescent Local Structure Plan will facilitate residential development complemented by high quality and accessible public open space, consistent with the land use intention set by the local strategic planning context.

It is expected that the Structure Plan will accommodate approximately 201 dwellings, consisting of single, grouped and multiple dwellings accommodating approximately 502 people. Future residents will be well serviced by the internal public open space and road network, connectivity to the surrounding neighbourhood and the availability of public transport, retail, employment and education facilities within close proximity.

The Structure Plan accords with the strategic objectives of Perth and Peel @ 3.5 Million by facilitating the development of a key infill site which will contribute towards the delivery of additional dwellings needed to accomodate anticipated population growth within the City of Stirling.

Additionally, the Structure Plan achieves an appropriate level of residential density considering its context, with the proposed 36.7 dwellings per gross urban hectare exceeding relevant policy minima and facilitating medium density development at a key infill site.

Finally, the Structure Plan also achieves higher order strategic planning objectives outlined in the City of Stirling Media Zones Development Procedure Statement and Dianella Media Zones Draft Precinct Plan, in providing for residential development, and associated open space and protection of environmental amenities.

APPENDIX A
Certificates of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
55/D74500	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	4/8/2014

VOLUME 1839 FOLIO 885

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

LAND DESCRIPTION:

LOT 55 ON DIAGRAM 74500

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

GAY STREET PROPERTY HOLDINGS PTY LTD OF FORT DRUMMOND, TELEVISION AVENUE, MOUNT SAINT THOMAS, WOLLONGONG, NEW SOUTH WALES

(T M722778) REGISTERED 31/7/2014

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

1. THE RIGHT TO MINES OF COAL OR OTHER MINERALS BEING EXCLUDED FROM PORTION OF THE SAID LAND
2. T108/1886 EASEMENT BENEFIT AS TO PORTION ONLY SEE SKETCH ON VOL 1839 FOL 885. REGISTERED 8/1/1886.
3. T391/1893 EASEMENT BENEFIT AS TO PORTION ONLY SEE SKETCH ON VOL 1839 FOL 885. REGISTERED 1/1/1893.

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:	1839-885 (55/D74500)
PREVIOUS TITLE:	1839-884
PROPERTY STREET ADDRESS:	55 COTTONWOOD CR, DIANELLA.
LOCAL GOVERNMENT AUTHORITY:	CITY OF STIRLING

WESTERN AUSTRALIA

REGISTER NUMBER	
56/D74500	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	5/7/2016

VOLUME 1839 FOLIO 886

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 56 ON DIAGRAM 74500

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

GAY STREET PROPERTY HOLDINGS PTY LTD OF TELEVISION AVENUE MOUNT SAINT THOMAS NSW 2500
(T N373424) REGISTERED 1/7/2016

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

1. THE RIGHT TO MINES OF COAL OR OTHER MINERALS BEING EXCLUDED FROM PORTION OF THE SAID LAND
2. T108/1886 EASEMENT BENEFIT AS TO PORTION ONLY SEE SKETCH ON VOL 1839 FOL 886. REGISTERED 8/1/1886.
3. T551/1886 EASEMENT BENEFIT AS TO PORTION ONLY SEE SKETCH ON VOL 1839 FOL 886. REGISTERED 17/6/1886.
4. T391/1893 EASEMENT BENEFIT AS TO PORTION ONLY SEE SKETCH ON VOL 1839 FOL 886. REGISTERED 1/1/1893.
5. *N373616 CAVEAT BY HOUSING AUTHORITY LODGED 1/7/2016.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* 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:	1839-886 (56/D74500)
PREVIOUS TITLE:	1839-884
PROPERTY STREET ADDRESS:	23 COTTONWOOD CR, DIANELLA.
LOCAL GOVERNMENT AUTHORITY:	CITY OF STIRLING

APPENDIX B
Environmental Assessment

B1
Lot 55 Level 1 Flora and Vegetation Survey
RPS

B2
Lot 56 Level 2 Flora Survey
Ecoscape

B3
Lomandra and Graceful Sun Moth Survey
Ecoscape

LEVEL 1 SPRING FLORA SURVEY

Channel 10 Site, Cottonwood Crescent, Dianella

Prepared by:

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Report No: L08350
Version/Date: Rev 0, March 2009

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Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Draft A	Draft for Client Review	ClaDor	CarGil/AngMer/ KriBen	19.02.09	SN 24.02.09		
Rev 0	Final for Issue	ClaDor	D. Walsh (Satterley)	03.03.09	DC 03.03.09	K. Bennetts	04.03.09

Disclaimer

SUMMARY

The findings of the Level 1 Spring Flora and Vegetation Survey conducted in September 2008 of the Channel 10 Site, Cottonwood Crescent, Dianella can be summarised as follows:

- Botanists recorded eighty-seven plant taxa across the site. No Declared Rare Flora species, as listed under subsection (2) of Section 23F of the Western Australian *Wildlife Conservation Act 1950* or Priority Flora species as listed by the Department of Environment and Conservation (Atkins, 2008) were located within the study area. No species governed by the *Environment Protection and Biodiversity Conservation Act 1999* were located within the study area.

- No flora species of other conservation significance as stated in Guidance Statement 51 (EPA, 2004) or as listed in *Bush Forever* (Western Australian Planning Commission, 2000) were recorded within the study area.

- Thirty-three introduced flora (weeds) were recorded from the survey site, which is 38% of the total flora recorded. Nine of these are listed in The Environmental Weeds Strategy for WA (EWSWA) (CALM, 1999) as High or Moderate, according to their invasiveness, distribution and environmental impact.

- The vegetation of the study area was analysed and is inferred to represent the Floristic Community Type (FCT) 23a – Central *Banksia attenuata – B. menziesii* woodlands. This FCT is well reserved with a low conservation risk (Gibson et al. 1994).

- The vegetation on site ranged from Good – Degraded to Completely Degraded. The north-western end of the site is fringed with remnant native vegetation that is in Good – Degraded condition. The central and eastern portion of the site ranges from Degraded to Completely Degraded, consisting of landscaped lawns and gardens of predominantly exotic species with some scattered remnant bushland species. The south-western corner of the site is fringed with vegetation ranging in condition from Good – Degraded to Completely Degraded.

- The site is not identified as Regionally Significant Bushland.

- According to this assessment the survey area is a Locally Significant Natural Area, as it satisfies several ecological criteria. Del Marco et al. (2004) assert that although a natural area is confirmed as 'Locally Significant', this does not necessarily mean that it must and can be protected. Local governments, communities and developers must appreciate that *Bush Forever* excluded some sites of significance based on ecological value because of the social and economic constraints that existed at the time.

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FIGURES

(compiled at rear of report)

APPENDICES

1.0 BACKGROUND

In October 2008 RPS Environment and Planning was commissioned by Satterley Property Group to undertake a Level 1 Flora Survey. The study area consists of intact native vegetation and landscaped gardens or lawn containing scattered remnant bushland species. The location of the site is shown in Figure 1.

1.1 Report Objectives

This report presents the findings of the Level 1 Flora and Vegetation Survey conducted in October 2008, of Channel 10 Bushland, Cottonwood Crescent, Dianella, and is consistent with the requirements of the EPA for a Level 1 Flora and Vegetation Survey (EPA, 2004).

This report includes:

- A desktop review of available information.
- Vegetation mapping (inferred floristic community types and condition).
- A conservation significance assessment of flora and vegetation.

2.0 EXISTING INFORMATION

2.1 Declared Rare Flora and Priority Flora

2.1.1 State Legislation

Declared Rare Flora (DRF) are flora that have been adequately surveyed and are considered to be in danger of extinction, rare or otherwise in need of special protection within Western Australia. DRF are protected under the *Wildlife Conservation Act 1950* (as amended).

Additionally in Western Australia there are four categories of Priority Flora, which are not specifically covered under current legislation, but their conservation status warrants some protection. Three categories of Priority Flora are allocated to species that are poorly known (Priority 1 to 3). These require more information to be assessed for inclusion as DRF. The categories are arranged to give an indication of the priority for undertaking further surveys based on the number of known sites, and the degree of threat to those populations. A fourth category of priority (Priority 4) is included for those species that have been adequately surveyed and are considered to be rare but not currently threatened.

The Department of Environment and Conservation's (DEC) databases for Threatened (Declared Rare) Flora, the Western Australian Herbarium (WAH) Specimen and Declared Rare Flora were searched for known records within a 5 km radius of the project area. The search coordinates used were 310° 52' 50.13' S and 115° 51 22.82' E. There were seven conservation significant species recorded, one of which is DRF. The list of significant flora is provided in Table 1.

Table 1: Significant Flora Species within a 5 km Radius of Channel 10 Site, Dianella

Species	Conservation Code[1]
Epiblema grandiflorum var. *cyaneum*	R
Lepidium pseudohyssopifolium	P1
Aotus cordifolia	P3
Cyathochaeta teretifolia	P3
Hibbertia spicata subsp. *leptotheca*	P3
Isopogon drummondii	P3
Jacksonia sericea	P4

[1]R: Declared Rare Flora - Extant Taxa

Taxa **which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection,** and have been gazetted as such.

P1: Priority One - Poorly known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

P2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

P3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

P4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.[1]

2.1.2 Federal Legislation

Some flora species have additional protection under the *Environment Protection and Biodiversity Conservation Act (EPBC) 1999*. In Western Australia, this predominantly consists of DRF flora. These are defined as Threatened Flora Species under the *EPBC Act*. Penalties apply for any damage to individuals, populations or habitats of species protected.

2.1.3 Other Species of Conservation Significance

Environmental Protection Authority (EPA) Guidance Statement 51 (EPA, 2004) lists species other than DRF and Priority Flora as of conservation significance where a species has:

- A keystone role.
- Relictual status.

- Anomalous features indicating a potential new discovery.
- A representation of a species range (range extensions, extremes or an outlier population).
- Status as a restricted subspecies, variety, or naturally occurring hybrid.
- Poor reservation.
- Status as a local endemic or has a restricted distribution.

This document states that conservation significance includes these criteria, but is not limited to them. It may include flora that are poorly represented in WAH and short range endemic flora (those with a known range less than 200km).

2.2 Vegetation

2.2.1 Vegetation Complexes

Vegetation complexes are groups of vegetation types that occur in patterns relating to soil and geomorphology (and water availability) of the substrate. A large part of the Swan Coastal Plain has been mapped for vegetation complexes by Heddle et al., (1980) and is largely related to the Dune Systems (Quindalup, Spearwood, Bassendean, Pinjarra Plain) and north–south changes in climate.

Heddle et al., (1980) has mapped the vegetation within the study area as Karrakatta Complex – Central and South. A description of the complex is given below:

- **Karrakatta Complex – Central and South** is predominantly Open Forest of *Eucalyptus gomphocephala*, *E. marginata, Corymbia calophylla* and woodland of *E. marginata* and *Banksia* species.

The conservation status of the Karrakatta Complex – Central and South within the Interim Biogeographic Regionalisation of Australia (IBRA) subregion Swan Coastal Plain (SCP) between Moore River and Dunsborough occurring within the Perth Metropolitan Region (PMR) (Del Marco et al. 2004) is presented in Table 2. The remnant vegetation extent of the Karrakatta Complex – Central and South within the *Bush Forever* study area boundaries is presented in Table 3.

Table 2: Representation of Channel 10 Site, Dianella–Karrakatta Complex – Central and South, circa 1997 Remnant Vegetation Extent in the Swan Coastal Plain (Del Marco et al. 2004)

Vegetation Complex	Pre-European extent (ha)	Present Extent (ha) Remaining	% of Present Extent Remaining	% of Present Extent in Secure Tenure#
Karrakatta – Central and South	51 620	14 811	28.7*	2.4

* Equivalent to < = 30% in 2004 based on the limitations of these statistics
** Equivalent to < = 10% in 2004 based on the limitations of these statistics
# refers to National Parks, Nature Reserves, Conservation Parks and Reserves from CALM Managed Lands 2002 GIS database.

Table 3: Representation of Channel 10 Site, Dianella–Karrakatta – Central and South Complex, circa 1997 Remnant Vegetation Extent in *Bush Forever* Study Areas in the Swan Coastal Plain of the Perth Metropolitan Region (Del Marco et al. 2004)

Vegetation Complex	Pre-European extent (ha)	Present Extent (ha) Remaining	% of Present Extent Remaining	% of Complex Proposed for Protection Within *Bush Forever* areas
Karrakatta – Central and South	34 532	6 275	18	8*

* Equivalent to 400ha or 10% or less (whichever is the greater) in 2004 based on the limitations of these statistics

It is important to keep in mind that the statistics for the percentage remaining of vegetation complexes is derived from dated aerial photography circa 1997–1998 with limited ground-truthing. As a consequence the percentages of ecological communities remaining are generally an overestimate of the native vegetation remaining at present. The principal factors contributing to this overestimation are:

- The preferential mapping of treed landscapes, leading to some mapping of areas that are parkland cleared or completely degraded.
- The inclusion of areas that are approved for clearing through development approvals and/or clearing permits.
- Some areas have been cleared since the time of the aerial photography (Del Marco et al. 2004).

It is noteworthy that the figures provided in Table 2 and 3 do not address the condition of the remaining vegetation.

2.2.2 Floristic Community Types

Floristic Community Types (FCTs) are based on a survey of the vegetation of the Swan Coastal Plain from Seabird to Dunsborough, completed by Gibson et al. (1994). The purpose of the Gibson et al. (1994) survey was to determine the number and type of

vegetation communities present across the southern SCP and to then assess how much of each remained and whether they were protected within reserves. There were 509 survey plots surveyed using the same methodology outlined in this report. Each FCT defined as a result of Gibson et al. (1994) was given a Reservation Status and a Conservation Status (Tables 4 and 5).

Most of the Swan Coastal Plain Threatened Ecological Communities (TECs) and/or Priority Ecological Communities (PECs) protected under State and Federal legislation (Section 1.2.3 to 1.2.5) are defined by their Floristic Community Type in Gibson et al. (1994).

Table 4: Reservation Status Categories (Gibson et al. 1994)

Reservation Status	Description
Well Reserved	Known from two or more A class National Parks or Nature Reserves.
Poorly Reserved	Known from a single A class National Park or Nature Reserve.
Unreserved	Not known to occur in any A class National Park or Nature Reserve.

Table 5: Conservation Status Categories (Gibson et al. 1994)

Conservation Status	Description
Presumed Destroyed	A community that is totally destroyed or so extensively modified that it is unlikely to re-establish ecosystem processes in the foreseeable future.
Critical	A community with most or all of its known occurrences facing severe modification or destruction in the immediate future.
Endangered	A community in danger of severe modification or destruction throughout its range, if causal factors continue operating.
Vulnerable	A community likely to move into the endangered category in the near future if the causal factors continue operating.
Susceptible	A community of concern because there is evidence that it can be modified or destroyed by human activities or would be vulnerable to new threatening process.
Low Risk	A community that does not qualify for one of the above categories
Insufficiently Known	A community for which there is inadequate data to assign to one of the above categories.

2.2.3 Threatened Ecological Communities

Within Western Australia, Threatened Ecological Communities (TECs) are defined by DEC as those which are found to fit into one of the categories in Table 6. The categories 'Data Deficient' and 'Lower Risk' can be used to provide a list of communities not classified as threatened, but that require more information. Within Western Australia, TECs have limited protection under the *Wildlife Conservation Act 1950* and the *Environmental Protection Act 1986* (as amended). TECs will be protected by the proposed Biodiversity Conservation Act (in preparation).

The EPBC Act provides protection for TECs under federal legislation, which are defined as those communities which are:

- **Critically Endangered** (if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future).
- **Endangered** (if, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future).
- **Vulnerable** (if, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future).

Table 6: Threatened Ecological Communities Category of Threat (English and Blyth, 1997)

Category	Definition
Presumed Totally Destroyed (PD)	An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies: A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or B) All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria: A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and **either or both** of the following apply: ▪ geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years) ▪ modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and **one or more** of the following apply (i, ii or iii): ▪ geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years) ▪ there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes ▪ there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years).

Category	Definition
Endangered (EN)	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii): ▪ geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years) ▪ modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): ▪ geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years) ▪ there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes ▪ there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long-term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated. B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.
Data Deficient (DD)	An ecological community which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research).
Lower Risk (LR)	An ecological community that has been adequately surveyed and does not qualify for any of the above categories of threat and appears unlikely to be under threat of significant modification or destruction in the short to medium term future.

2.2.4 Threatened Ecological Communities Database

A search of the DEC Threatened Ecological Communities Database for known records of TECs and/or PECs within a 5 km radius of Channel 10 Site, Dianella is presented below in Table 7. One TEC and no PECs were identified from the search area.

Table 7: Threatened Ecological Communities within a 5 km Radius of Channel 10 Site, Dianella

Code	Description	Status
SCP 20a	Banksia attenuata woodland over species rich dense shrublands	Endangered

2.2.5 Other Vegetation of Conservation Significance

2.2.5.1 Priority Ecological Communities

Possible TECs that do not meet survey criteria or that are not adequately defined are added to DEC's Priority Ecological Community List under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as TECs. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened (P1, 2 or 3), or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5.

2.2.6 Regionally Significant Bushland

Within the Swan Coastal Plain portion of the Perth Metropolitan Region, bushland of regional significance is identified by the criteria in *Bush Forever* (Western Australian Planning Commission, 2000). Regionally significant bushland that is to be protected has been designated within *Bush Forever* sites or identified as any bushland of a vegetation complex with only 400 ha or 10% or less (whichever is the greater) remaining in the *Bush Forever* Study Area (Western Australian Planning Commission, 2000). Other natural areas of regional significance (e.g. wetlands, watercourses), have not yet been formally designated by the State Government within the *Bush Forever* Study Area (Western Australian Planning Commission, 2000).

2.2.7 Locally Significant Natural Areas

Locally Significant Natural Areas are Local Natural Areas that meet one or more ecological criteria of significance and have been verified in the field. The fact that a natural area is confirmed as 'locally significant' does not necessarily mean that it must and can be protected (Del Marco et al. 2004). Local Natural Areas refers to all natural areas, not just bushland, that exists outside of the DEC Managed Estates, regional parks and *Bush Forever* sites (Del Marco et al. 2004).

The ecological criteria for Locally Significant Natural Areas are listed in Table 8. Many of these criteria also have regional conservation value as they are directly based on the criteria for regional significance in *Bush Forever*. Del Marco et al. (2004) states that Local Governments, communities and developers must appreciate that *Bush Forever* excluded some sites of significance based on ecological value because of the social and economic constraints that existed at the time.

These ecological criteria were established by the 'Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region' (Del Marco et al. 2004) and are directly based on an extension of the State Government's *Bush Forever* strategy (Western Australian Planning Commission, 2000), along with the criteria proposed in the Urban Bushland Strategy (Government of Western Australia, 1995).

Table 8: Ecological Criteria for use in determining Locally Significant Natural Areas of the Swan Coastal Plain (Del Marco et al. 2004)

ECOLOGICAL CRITERIA
1. Representation
1a. Regional Representation
i. Any natural area with recognised International, National, State or Regional Conservation Value (outside *Bush Forever* Sites and Department of Conservation and Land Management [CALM] Managed Estate) that is not yet protected and/or managed for conservation (Essential)
ii. Natural areas of an ecological community with only 1500 ha or 30% or less (whichever is greater) of their pre-European extent remaining in the Interim Biogeographically Regionalisation of Australia (IBRA) subregion (Essential – Jarrah Forest, Desirable – Swan Coastal Plain).
iii. Large (greater than 20 ha), viable natural area in good or better condition of an ecological community with over 30% of its pre-European extent remaining in the IBRA subregion (Desirable).
iv. Natural area of an ecological community with only 400 ha or 10% or less (whichever is greater) protected for conservation in the *Bush Forever* Study Area (Essential).
1b. Local Representation
i. Natural area of an ecological community with 10% or less of its pre-European extent remaining within the Local Government area (Essential).
ii. Natural area of an ecological community with 30% or less of its pre-European extent remaining within the Local Government area (Essential – Jarrah Forest, Desirable SCP).
iii. Large (greater than 10 ha), viable natural areas in good or better condition of an ecological community with more than 30% of its pre-European extent remaining within the Local Government area (Desirable).
2. Diversity
i. Natural areas in good or better condition that contain both upland and wetland structural plant communities (Essential).

ECOLOGICAL CRITERIA
3. Rarity
i. Natural areas of an ecological community with only 1500 ha or 10% or less (whichever is the greater) of their pre-European extent remaining in the IBRA subregion (Essential).
ii. Natural areas of an ecological community with only 400 ha or 10% or less (whichever is the greater) of their pre- European extent remaining in the Bush Forever Study Area (Essential).
iii. Natural areas classified by CALM as containing Threatened Ecological Communities (TECs) (English & Blyth 1997, 1999; CALM TEC GIS database, undated) (Essential).
iv. Natural areas containing Declared Rare Flora (DRF), Specially Protected Fauna (SPF) or significant habitat for Specially Protected Fauna (Essential).
v. Natural areas containing Priority or other significant flora or fauna or significant habitat for these fauna (Essential).
4. Maintaining Ecological Processes or Natural Systems – Connectivity
i. Natural areas acting as stepping stones within a Regional Ecological Linkage (Essential).
ii. Natural areas acting as stepping stones within a within a local ecological linkage determined by a Local Government (Essential).
5. Protection of Wetland, Streamline and Estuarine Fringing Vegetation and Coastal Vegetation
i. Wetlands meeting the criteria for listing as Conservation Category or Resource Enhancement Wetlands plus an appropriate buffer (minimum 50 m) in addition to the wetland dependant vegetation (Essential).
ii. Wetlands listed under the Environmental Protection (Swan Coastal Plain Lakes) Policy (EPP Lakes) plus an appropriate buffer (Essential).
iii. Riparian vegetation along rivers, creeklines and other channel wetlands plus an appropriate buffer (minimum 50 m) in addition to the riparian (wetland dependant) vegetation (Essential).
iv. Floodplains delineated on the basis of ecological and geomorphic features plus an appropriate buffer (minimum 50 m) in addition to the floodplain area (Essential).
v. Estuarine fringing vegetation plus an appropriate buffer (minimum 50 m) of non-estuarine vegetation (Essential).
vi. Coastal vegetation on the foredunes and secondary dunes (Essential).

3.0 METHODS

3.1 Field Survey

In October 2008, two botanists from RPS conducted a Level 1 Spring Flora Survey at Channel 10 Site, Cottonwood Crescent Dianella (Figure 1). Survey methodology was based on a Level 1 Flora Survey as outlined in Guidance Statement 51 (EPA, 2004).

A Level 1 Survey comprises of:

Background Research or Desktop Study

I. Gather together background information on the target area.

Reconnaissance Survey

I. Verify accuracy of the Desktop Study.

II. Delineate and characterise the flora and range of vegetation units present in the target area.

III. Identify potential impacts.

This involves selective, low intensity sampling of flora and vegetation to produce maps of vegetation units and vegetation condition at an appropriate scale. Searches for significant flora (Table 1) were also performed within the study area.

A species list was complied using the latest nomenclature and taxonomic references (*Florabase*, 2009 and Atkins, 2008).

3.1.1 Vegetation Sampling

Mapping of each vegetation unit was completed using aerial photographs and on site surveying. Each vegetation unit was defined by the dominant plant species (>2% cover) throughout its extent, using the vegetation structure classes of the Western Australian Planning Commission (2000) (Table 9).

Table 9: Vegetation Structure Classes (Western Australian Planning Commission, 2000)

Life Form/ Height Class	Canopy Cover (percentage)			
	100–70%	**70–30%**	**30–10%**	**10–2%**
Trees 10–30 m Trees <10 m	Closed Forest Low Closed Forest	Open Forest Low Open Forest	Woodland Low Woodland	Open Woodland Low Open Woodland
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs >2 m Shrubs 1–2 m Shrubs <1 m	Closed Tall Scrub Closed Heath Closed Low Heath	Tall Open Scrub Open Heath Open Low Heath	Tall Shrubland Shrubland Low Shrubland	Tall Open Shrubland Open Shrubland Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

3.1.2 Vegetation Condition

The sites were traversed by vehicle and foot to assess the vegetation condition. The Vegetation Condition scale used was that of Keighery (1994) as used in *Bush Forever*, (Western Australian Planning Commission, 2000) (Table 10).

Table 10: Vegetation Condition Scale (Western Australian Planning Commission, 2000)

Condition		Definition
P	**Pristine**	No obvious signs of disturbance.
E	**Excellent**	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
V	**Very Good**	Vegetation structure altered; obvious signs of disturbance
G	**Good**	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	**Degraded**	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
C	**Completely Degraded**	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').

3.2 Floristic Community Types

An inferred Floristic Community Type (FCT) was assigned to each mapped vegetation unit of Channel 10 Site, Dianella. This was discerned by comparing the species recorded with the species list per community type in Gibson et al. (1994), and additional FCTs listed in *Bush Forever* (Western Australian Planning Commission, 2000). The species recorded by Gibson et al. (1994), which occur with frequencies of at least 50% in any one community type, were used for comparison with vegetation units at Dianella. Landforms on which each FCT occurs were also considered in the assignment.

The conservation significance of vegetation was assessed by consulting Gibson et al., (1994), EPA (2006), and the Threatened Ecological Community Database (2004). The Department of the Environment, Water, Heritage and the Art's Protected Matters database was searched for any local issues protected under the *EPBC Act* (DEWHA, 2007).

4.0 RESULTS AND DISSCUSSION

4.1 Flora

Botanists recorded eighty-seven taxa from thirty plant families across the site; thirty-three of these taxa are exotic species that are naturalised weeds or landscaping plants. The list of species recorded within the study area is presented in Appendix 1.

No Declared Rare Flora species, as listed under subsection (2) of Section 23F of the Western Australian *Wildlife Conservation Act 1950* or Priority Flora species as listed by the Department of Environment and Conservation (Atkins, 2008) were located within the study area. No species governed by the *Environment Protection and Biodiversity Conservation Act 1999* were located within the study area.

No other flora species of other conservation significance as stated in Guidance Statement 51 (EPA, 2004) or as listed in *Bush Forever* (Western Australian Planning Commission, 2000) were recorded within the study area.

4.1.1 Introduced Flora (Weeds)

Thirty-four introduced flora (weeds and landscaping plants) were recorded from the survey site, which is 38% of the total flora recorded.

The Environmental Weeds Strategy for WA (EWSWA) (CALM, 1999), rated all the weeds known for Western Australia at the time of publication, according to invasiveness, distribution and environmental impact (Table 11). Weeds were classified into four categories; High, Moderate, Mild and Low. High rated species are those that all three criteria apply to (Table 11) and Moderate to which two criteria apply. The High and Moderate category weeds recorded in the survey area that should be prioritised for control or eradication are listed in Table 12.

Table 11: Criteria for Environmental Weeds Strategy Rating

Criteria	Description
Invasiveness	Ability to invade bushland in good to excellent condition or ability to invade waterways.
Distribution	Wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.
Environmental Impacts	Ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

Table 12: The EWSWA (CALM, 1999) Rating of Weeds at Channel 10 Site, Cottonwood Crescent, Dianella

Weed		Rating	Weed		Rating
*	*Ehrharta calycina*	High	*	*Cynodon dactylon*	Moderate
*	*Leptospermum laevigatum*	High	*	*Eucalyptus citriodora*	Moderate
*	*Pelargonium capitatum*	High	*	*Gladiolus caryophyllaceus*	Moderate
*	*Briza maxima*	Moderate	*	*Vicia sativa*	Moderate
*	*Carpobrotus edulis*	Moderate			

4.2 Vegetation

4.2.1 Vegetation Units

Botanists defined and mapped 2 vegetation units across the study areas as shown in Figure 2. Photographs of each vegetation unit can be found in Appendix 2. Descriptions of the vegetation units for the study area are as follows:

1. **LaRem** – landscaped area (lawn or garden) with scattered remnant native bushland species.

2. **EmBa** – Low Woodland of *Eucalyptus marginata* over Low Open Woodland of *Banksia attenuata* over Open Shrubland of *Jacksonia sternbergiana, Xanthorrhoea brunonis* and *Xanthorrhoea preissii* over Open Heath including *Hibbertia hypericoides, Gompholobium tomentosum, Conostephium pendulum* over Open Sedgeland of *Mesomelaena pseudostygia* over Open Exotic Grassland.

4.2.2 Floristic Community Type

In a more detailed look at the ecological community on site, the mapped vegetation units can all be inferred to represent the Floristic Community Type 23a Central *Banksia attenuata – B. menziesii* woodlands. This community type is restricted to the Bassendean system and is located between Bullsbrook and Woodman Point area. This community type is considered to be well reserved, with low conservation risk (Gibson et al. 1994).

Level 1 vegetation surveys do not include plot based analysis which is required for definitive Floristic Community Type (FCT) and Threatened Ecological Community identification; therefore, the FCT for the study area has only be inferred for this report.

4.3 Vegetation Condition

The vegetation on site ranged from Good – Degraded to Completely Degraded. The north-western end of the site is fringed with remnant native vegetation that is in Good – Degraded condition. The central and eastern portion of the site ranges from Degraded to Completely Degraded, consisting of landscaped lawns and gardens of predominantly exotic species with some scattered remnant bushland species. The south-western corner of the site is fringed with vegetation ranging in condition from Good – Degraded to Completely Degraded. The condition of the vegetation is represented in Figure 2.

4.4 Regional Significant Bushland

The site is not identified as Regionally Significant Bushland. The vegetation complex present at the site is identified as having 18% of the complex remaining in the *Bush Forever* study areas in the Swan Coastal Plain portion of the Perth Metropolitan Area (Table 3). This does not satisfy the criteria stated in *Bush Forever* (Western Australian Planning Commission, 2000) for identification as Regionally Significant Bushland (400 ha or 10% or less remaining with basic structure intact), even taking into account an approximate overestimate of 5% in these figures (Western Australian Planning Commission, 2000). There are no DRF or TECs located within the survey area.

4.5 Locally Significant Natural Areas

The ecological criteria for determining locally significant natural areas of the Swan Coastal Plain (Table 8), in relation to the study area, have been addressed in Section 4.5.1 to 4.5.5. According to this assessment the survey area is a Locally Significant Natural Area on the basis of meeting the 'Essential' criteria detailed in Sections 4.5.1, 4.5.3 and 4.5.4. (Refer to Table 7 in Del Marco et al. 2004).

The fact that a natural area is identified as 'Locally Significant' does not necessarily mean that it must and can be protected (Del Marco et al. 2004). Del Marco et al. (2004) states that local governments, communities and developers must appreciate that *Bush Forever* excluded some sites of significance based on ecological value because of the social and economic constraints that existed at the time.

4.5.1 Representation

1a) i) Recognised for International, National, State or Regional conservation value

No

A desktop search of: The Australian Heritage Database, Protected Matters Database, Directory of Important Wetlands in Australia and RAMSAR Sites revealed the Channel 10, Dianella study area is not currently formally recognised for International, National, State, or Regional Conservation Significance. No threatened flora or Threatened Ecological Communities (TECs) as defined by the *EPBC Act 1999* were recorded within the study area.

1a) ii) Community with <30% remaining within IBRA region

Yes

According to Del Marco et al. (2004) 28.7% of the Karrakatta Complex – Central and South remains within the Swan Coastal Plain between Moore River and Dunsborough. Del Marco et al. (2004) states that there is an approximate over estimate of about 10% in these figures, which means that there may be as little as 18% remaining of the Karrakatta Complex – Central and South (Table 2).

1a) iii) Large viable (>20 ha) conservation areas regionally in good or better condition and 1b) iii) locally

No

The Channel 10 study area has less than 20 ha in good or better condition. The site is primarily landscaped with scattered remnant native bushland species. There are small pockets of Good – Degraded condition vegetation within the north-western and south-western corners of the site (Figure 3).

1a) v) Ecological Community with <10% in Bush Forever Conservation

Yes (Essential)

Approximately 8% of the pre-European Karrakatta – Central and South Complex is proposed for protection within *Bush Forever* areas. These are regionally significant bushland areas and not necessarily secure tenure (Table 3) (Del Marco et al. 2004).

1b) i) Community with <10% remaining within local government area

Yes (Essential)

This criterion requires a 10% minimum of pre-European extent remaining within the local government area. Approximately 5% of the pre-European Karrakatta Complex – Central and South remains within the City of Stirling Local Government area (Table 13).

Table 13: Representation of Karrakatta – Central and South Complex within the City of Stirling Local Government Area (Del Marco et al. 2004)

Community	Pre European (ha)	Remaining extent of Pre European as of 2001	
		ha	%
Karrakatta – Central and South Complex	5463	292	5

1b) ii) Community with <30% remaining within local government area.

Yes

This criterion requires a 30% minimum of pre-European extent remaining within the local government area. Approximately 5% of the pre-European Karrakatta – Central and South Complex remains within the City of Stirling Local Government area (Table 13).

4.5.2 Diversity

2) i) Natural area containing upland and wetland communities in good or better condition

No

One Floristic Community Type (FCT) was inferred for the site: FCT23a Central *Banksia attenuata – B. menziesii* woodlands. The vegetation condition ranged from Good to Degraded to Completely Degraded. This community type is considered well reserved a with low conservation risk (Gibson et al. 1994).

4.5.3 Rarity

3) i) Ecological community with <10% remaining within IBRA.

No

Approximately 28.7% of the pre-European extent of Karrakatta Complex – Central and South remains within the Swan Coastal Plain (Table 2). This figure may be reduced to 18% if an approximate 10% overestimate in the statistics is taken into account (Del Marco et al. 2004).

3) ii) Ecological community with <10% in Bush Forever Conservation

Yes (Essential)

Only 8% of the Karrakatta Complex – Central and South has been proposed for protection within *Bush Forever* areas (Table 3).

3) iii) Does the area contain TECs

No

No TECs as defined by the *Wildlife Conservation Act 1950* or the *EPBC Act 1999* were located within the study area.

3) iv) Does the area contain DRF

No

No Declared Rare Flora species, as listed under subsection (2) of Section 23F of the Western Australian *Wildlife Conservation Act 1950* as listed by the Department of Environment and Conservation (Atkins, 2008) were located within the study area. No Threatened Flora governed by the *EPBC Act 1999* were located within the study area.

3) v) Does the area contain Priority or significant flora

No

No Priority or significant flora species as listed by the Department of Environment and Conservation (Atkins, 2008) were located within the study area.

4.5.4 Maintaining Ecological Processes or Natural Systems – Connectivity

4) i) Is the area part of a Regionally Significant Ecological Linkage

No

The study area is not part of any Regionally Significant Ecological Linkages (Western Australian Planning Commission, 2000).

4) ii) Is the area part of a Locally Significant Ecological Linkage

Yes (Essential)

In the City of Stirling's *Green Plan 2* (2002), Dianella Drive (between Morley and Yirrigan Drives), bounding the eastern edge of the study area, has been identified as 'significant and strategic' in establishing ecological links. The *Green Plan* also identifies the bushland areas adjacent to the Channel 9 site as being significant bushland.

4.5.5 Protection of Wetland, Streamline and Estuarine Fringing Vegetation and Coastal Vegetation

5) i) Conservation or Resource Enhancement Category Wetlands

No

No Conservation Category or Resource Enhancement Wetlands were located within the study area.

5) ii) Environmental Protection Policy Lakes

No

No wetlands as listed under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes 1992) were located within the study area.

5) iii) Riparian Vegetation

No

There is no riparian vegetation within the study area. However, there is a man-made lake on site which includes one endemic species that has been planted at the site and is not representative of a riparian vegetation community.

5) iv) Floodplains

No

No floodplains exist within the study area.

5) v) Estuarine vegetation

No

No estuarine vegetation exists on site.

5) vi) Coastal vegetation on the foredunes and or secondary dunes

No

No coastal vegetation exists on site.

5.0 RECOMMENDATIONS

The weed species recorded within the study area, listed in Table 12, are known to be invasive and have a negative impact on the environment. Therefore, these weeds should be prioritised for control or eradication.

6.0 LIMITATIONS

As with any biological survey, additional flora species including potential rare, priority or other conservation significant species could be detected in subsequent surveys. For example, ephemeral species such as orchids are not always present in each year/season or at the particular time a single botanical survey is conducted. This is a common to limitation to all botanical surveys.

Approximately 10% of Western Australian flora species are undescribed, with new species found regularly. The flora identifications for this project were completed in line with the taxonomic resources and expertise available at the time.

The statistics for percentage of vegetation complexes is derived from dated aerial photography circa. 1997–1998 with limited ground-truthing. As a consequence the percentages of ecological communities remaining may be an overestimate of the native vegetation remaining at present. This limitation is common to all data analysis utilising regional vegetation complex information. Additionally, the percentage figures stated in Tables 2 and 3 as discussed throughout Sections 4.4 and 4.5, do not take into account the condition of the remaining vegetation.

TECs, FCTs or conservation significant plant communities on site can not be positively confirmed without conducting a plot based survey.

7.0 REFERENCES

Atkins, K.L. (2008). Declared *Rare and Priority Flora List for Western Australia, 6 October 2008.* Department of Environment and Conservation. Wildlife Branch, Como.

CALM. (1999). *Environmental Weeds Strategy for Western Australia*. Department of Conservation and Environment, Como.

City of Stirling. (2002). *City of Stirling Green Plan 2: A strategy for the Conservation of Urban Bushlands to Promote Biodiversity,* Department of Parks and Reserves, Perth.

Community. Wildflower Society of WA (Inc.), Nedlands.

Del Marco, A., Taylor, R., Clarke, K., Savage, K., Cullity, J. and Miles, C. (2004). *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region.* Perth Biodiversity Project, Western Australian Local Government Association. West Perth.

Department of Environment and Conservation. (2004). *List of Threatened Ecological Communities on the Department of Conservation and Land Management's Threatened Ecological Community (TEC) Database*. http://www.naturebase.net/content/view/273/1208/ accessed online, February 2009.

Department of Environment, Water, Heritage and the Arts. (2007). *EPBC Act Protected Matters Report*. http://www.environment.gov.au/erin/ert/epbc/index.html accessed online, February 2009.

English, V. and Blyth, J. (1997). Identifying *and Conserving Threatened Ecological Communities (TECs) in the South West Botanical Province.* ANCA National Reserves System Cooperative Program: Project Number N702. Department of Conservation and Land Management, Wanneroo.

EPA. (2006). *Guidance Statement 10. Guidance for the Assessment of Environmnetal Factors. Level of Assessment for Proposals Affecting Natural Areas within the System 6 region and Swan Coastal Plain Portion of the System 1 Region.* June 2006.

EPA. (2004). Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986) Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. Guidance No. 51, June 2004.

Florabase®. (2009). Department of Environment, Western Australian Herbarium http://florabase.calm.wa.gov.au/ accessed online, February 2009.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). *A Floristic survey of the southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Government of Western Australia. (1995). *Urban Bushland Strategy*. Ministry for Planning, Perth.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Land Management, Perth.

Keighery, B.J. (1994). *Bushland Plant Survey: a Guide to Plant Community Survey for the* Western Australian Planning Commission (2000). *Bush Forever: Volume 2 Directory of Bush Forever Sites*, Perth.

FIGURES

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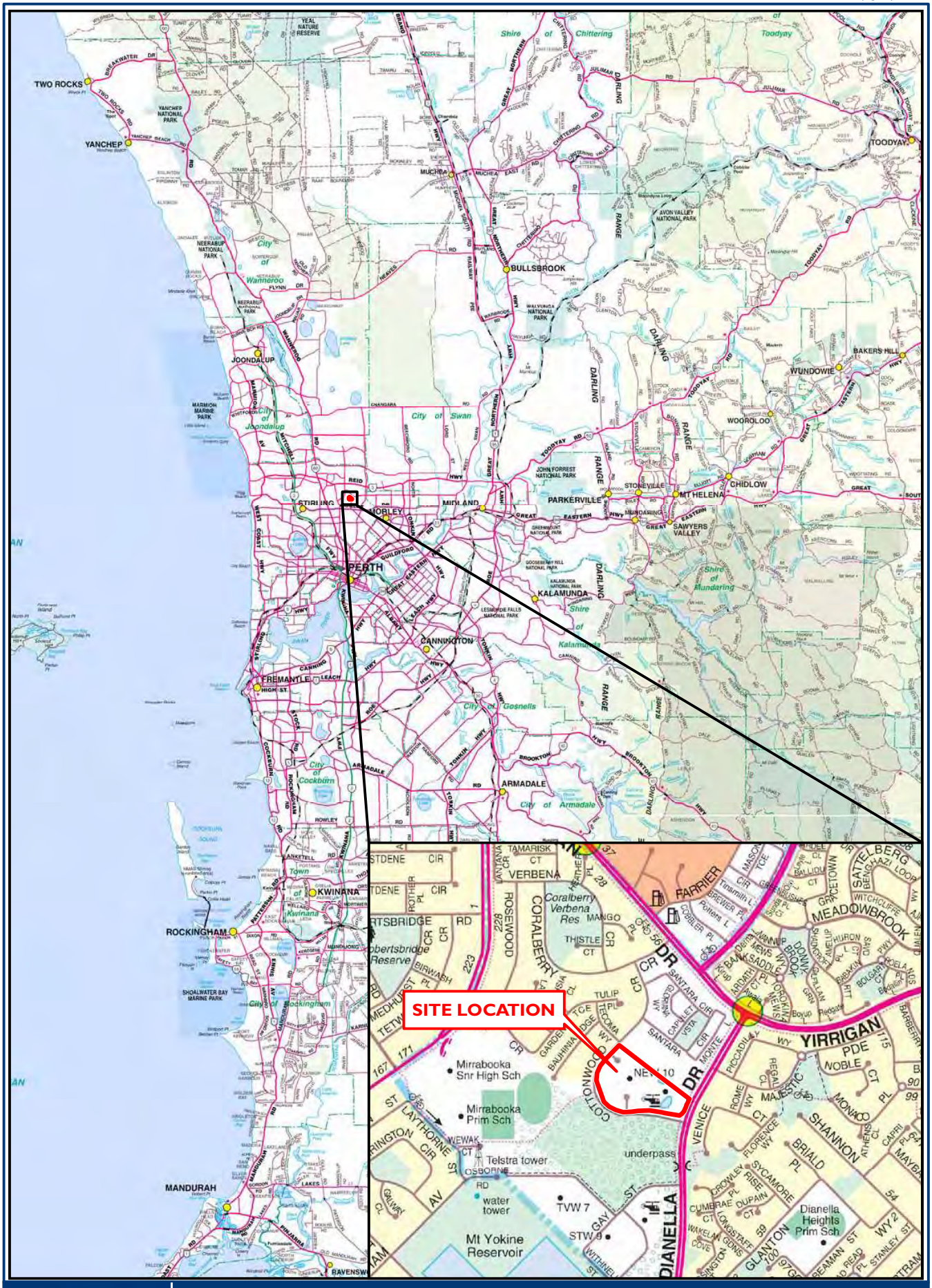

RPS

Job Number: L08350
Date: 16.02.09
Revision: A
Scale: 1:500000 @ A4
Drafted by: SF
Source: Landgate, 2008

Figure 1

Site Location

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RPS

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Revision: A
Scale: 1:1000 @ A3
Drafted by: SF
Source: Airphoto • Landgate, 2006

0 5 10 20 30 40 metres

Figure 2

Vegetation Units

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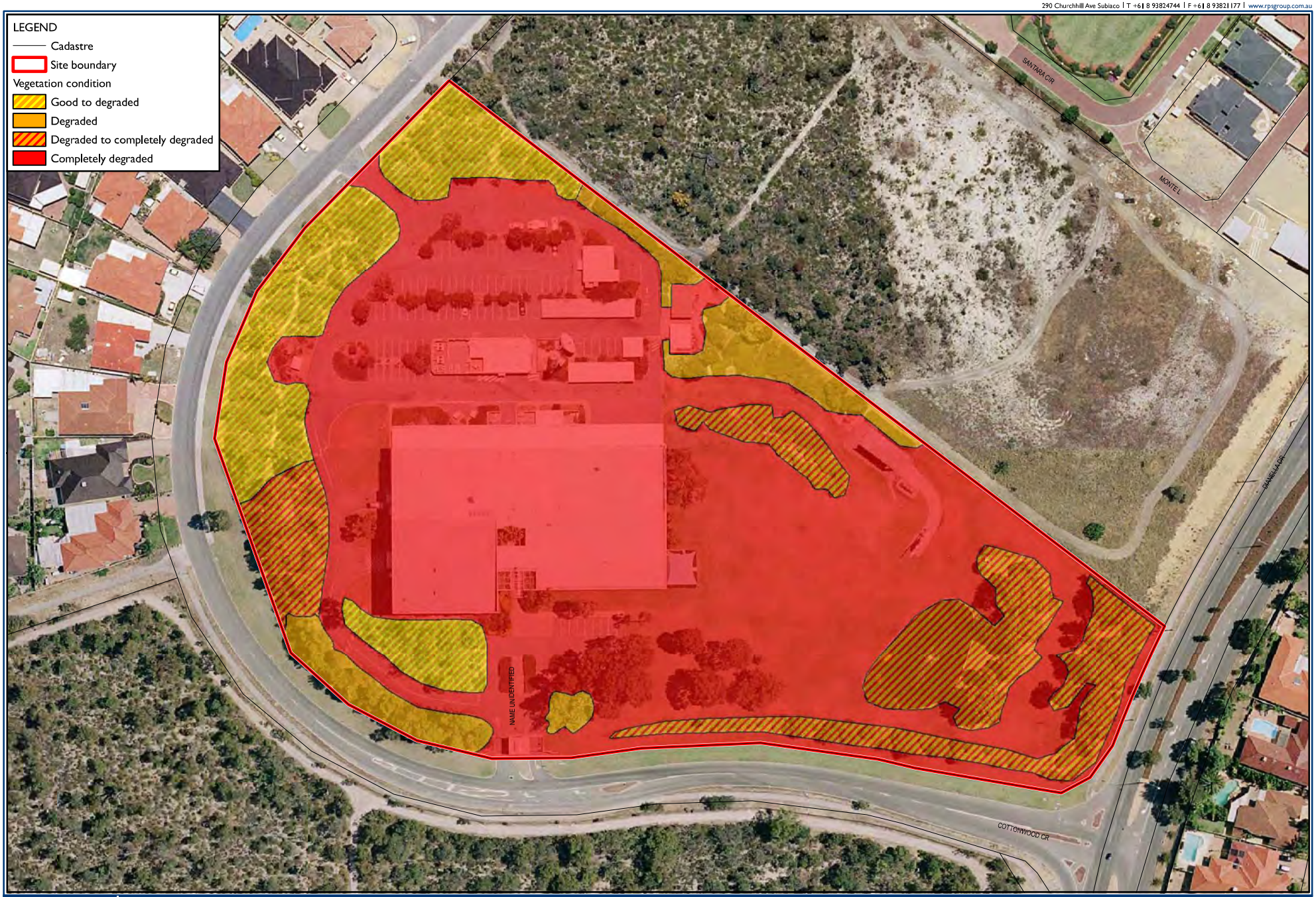

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Job Number: L08350
Date: 16.02.09
Revision: A
Scale: 1:1000 @ A3
Drafted by: SF
Source: Air photo - Landgate, 2006

0 5 10 20 30 40 metres

Figure 3

Vegetation Condition

RPS

APPENDIX I

Species List

APPENDIX 1: Species List

Family		Species
Aizoaceae (110)		
	*	*Carpobrotus edulis*
Anthericaceae (054F)		
		Corynotheca micrantha
		Sowerbaea laxiflora
Arecaceae (33)		
	P	*Exotic Palms*
Asteraceae (345)		
	*	*Gazania linearis*
	*	*Osteospermum calendulaceum*
	*	*Osteospermum sp.*
Colchicaceae (054J)		
		Burchardia congesta
Cyperaceae (32)		
		Mesomelaena pseudostygia
		Tetraria octandra
Dasypogonaceae (054C)		
		Calectasia narragara
		Dasypogon bromeliifolius
		Lomandra preissii
Dilleniaceae (226)		
		Hibbertia hypericoides
Epacridaceae (288)		
		Conostephium pendulum
		Leucopogon propinquus
Euphorbiaceae (185)		
		Ricinocarpos undulatus
Geraniaceae (167)		
	*	*Pelargonium capitatum*
Goodeniaceae (341)		
		Dampiera linearis
Haemodoraceae (55)		
		Conostylis candicans
		Haemodorum spicatum
		Phlebocarya ciliata
Iridaceae (60)		
	*	*Gladiolus caryophyllaceus*

		Patersonia occidentalis
Juncaceae (52)		
	P	*Juncus pallidus*
Lamiaceae (313)		
	*	*Lavandula dentata*
		Westringia rigida
Mimosaceae (165)		
		Acacia applanata
	P	*Acacia iteaphylla*
Myrtaceae (273)		
		Agonis flexuosa
	P	*Agonis flexuosa nana*
	*	*Angophora floribunda*
	P	*Astartea fascicularis*
	P	*Callistemon sp.*
	P	*Calothamnus sp.*
		Calytrix angulata
	P	*Chamelaucium uncinatum*
		Corymbia calophylla
	P	*Corymbia variegata*
	P	*Eucalyptus caesia subsp. caesia*
		Eucalyptus camaldulensis
	*	*Eucalyptus citriodora*
		Eucalyptus gomphocephala
		Eucalyptus marginata
	P	*Eucalyptus platypus*
		Hypocalymma robustum
	P	*Kunzea baxteri*
	*	*Leptospermum laevigatum*
		Melaleuca huegelii
	P	*Melaleuca pentagona*
		Scholtzia sp.
Orchidaceae (66)		
		Microtis media
		Thelymitra crinita
Papilionaceae (165)		
		Bossiaea eriocarpa
		Daviesia divaricata
		Gastrolobium capitatum
		Gompholobium tomentosum

		Hardenbergia comptoniana
		Jacksonia furcellata
		Jacksonia sternbergiana
		Kennedia prostrata
	*	*vicia sativa*
Pittosporaceae (152)		
		Sollya heterophylla
Poaceae (31)		
	*	*Briza maxima*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
Proteaceae (90)		
		Adenanthos cygnorum
		Banksia attenuata
		Grevillea bipinnatifida
	P	*Grevillea olivacea*
	P	*Grevillea sp.*
	P	*Hakea laurina*
		Petrophile linearis
		Stirlingia latifolia
		Synaphea spinulosa
Restionaceae (39)		
		Desmocladus fasciculatus
		Desmocladus flexuosus
		Hypolaena exsulca
		Lepyrodia glauca
Rutaceae (175)		
	*	*Coleonema pulchrum*
		Philotheca spicata
Stylidiaceae (343)		
		Stylidium brunonianum
		Stylidium calcaratum
Tremandraceae (182)		
		Tetratheca hirsuta
Xanthorrhoeaceae (054D)		
		Xanthorrhoea brunonis
		Xanthorrhoea preissii
Zamiaceae (016A)		
		Macrozamia fraseri

* Denotes a weed species.
P Denotes a planted species.

RPS

APPENDIX 2

Vegetation Unit Photographs

APPENDIX 2: Vegetation Unit Photographs

LaRem – Landscaped area (lawn or garden) with scattered remnant native bushland species

EmBa – Low Woodland of *Eucalyptus marginata* over Low Open Woodland of *Banksia attenuata* over Open Shrubland of *Jacksonia sternbergiana, Xanthorrhoea brunonis* and *Xanthorrhoea preissii* over Open Heath including *Hibbertia hypericoides, Gompholobium tomemtosum, Conostephium pendulum* over Open Sedgeland of *Mesomelaena pseudostygia* over Open Exotic Grassland.

APPENDIX C
Engineering Services Report
Pritchard Francis

Lots 55 & 56 Cottonwood Cres, Dianella

Engineering Services Report

Project No: 19-209

pritchard francis
civil and structural engineering consultants

Table of Contents

Revision	Description	Author	Date
0	Initial Report	Jamie De Palma	13 August 2019
1	Final Report	Jamie De Palma	9 September 2019

1 Introduction

At the request of Tim Trefry of Roberts Day, Pritchard Francis has prepared and updated this servicing report to identify existing services and upgrades required in order for the site to be subdivided to create a residential subdivision. Based on the latest plan, additional Local Authority requirements have been identified and addressed.

The report is based on the amended plan NET TEN RD1 011 rev 0 by Roberts Day received 27 July 2019, included within Appendix One. The amended plan has been amended since the previously received plan which has impacted the servicing and civil engineering design of the development.

The development site is located within the City of Stirling and is bounded by Cottonwood Crescent to the south and west, Dianella Drive to the south-east and Santara Circle to the north. Figure 1.1 shows an aerial photograph of the area, with the property outlined in red with the land area amounting to 7.0 hectares.

This report outlines the existing site conditions and expected water, sewer, electrical, gas infrastructure and local authority upgrades required to serve the proposed residential development.

Figure 1.1 – 2019 Aerial photograph of the site

2 Site Conditions

The site has been cleared of all original Channel Ten buildings and structures. The demolition and clearing work have been carried out since the previous report was prepared. It appears that no vegetation outside the building area has been removed or affect by the demolition works. As part of the new development plan, there is a proposed POS of 1.29ha in the northern corner bound by Cottonwood Crescent and Santara Circle that is shown to be retained.

2.1 Topography

The site survey indicates that the property slopes from approximately 80m AHD on the northwest boundary to approximately 60m AHD in the south east corner, thus creating a 20m fall across the lots. Typically, the lot grades evenly from the north-western boundary to the south-eastern boundary at Dianella Drive. There is approximately a 4m level difference between the levels along the eastern boundary of the lot to the pavement of Dianella Drive.

Refer to Appendix Two which contains the McMullen Nolan Group detailed survey plan dated 12 December 2012.

2.2 Geology

A geotechnical investigation of the site is yet to be completed and in lieu, Pritchard Francis have assessed the 1:50,000 Geological Map Series. The mapping indicates that the site is likely to consist of medium to coarse grained yellow sand of the Tamala Limestone formation. This soil type has medium permeability, can be easily excavated, low to medium bearing capacity and is suitable for urbanisation.

A detailed geotechnical investigation would need to be undertaken by a certified geotechnical engineer prior to construction to confirm site conditions and geological development constraints, if any at all. At completion of site work a final geotechnical inspection will be required and sign-off report produced in order for the local authority to provide clearances.

An extract of the Geological Map Series has been provided within Appendix Three.

2.3 Acid Sulphate Conditions

In lieu of a geotechnical investigation, Pritchard Francis has assessed the Planning Bulletin to determine the Acid Sulphate Soil risk of the site.

The mapping series indicates that the site has a low risk of Acid Sulphate Soils and Pritchard Francis do not anticipate that Acid Sulphates will impact the subdivisional works.

An extract of the Acid Sulphate Soils Risk Map is provided within Appendix Four.

2.4 Groundwater

The Perth Groundwater Atlas (2004) indicates that the water table is approximately 45m below ground level, and therefore it is not anticipated to impact on the development.

2.5 Survey

Whilst a full feature survey of the site has been completed by McMullen Nolan Group (refer Appendix Two), the survey was completed prior to the demolition of the Channel Ten studios, ancillary buildings and carparks. It is recommended that an updated feature survey be procured from McMullen Nolan Group to accurately represent the current site configuration and associated infrastructure surrounding the site.

2.6 Heritage Considerations

A search of the Aboriginal Heritage websites for this land did not reveal any heritage issues or ownership claims.

3 Infrastructure

3.1 Lot Levels and Retaining Walls

Pritchard Francis have prepared a lot level and retaining wall scheme to verify that the proposed structure plan can be successfully implemented. The design can be summarised as follows:

- The majority of the internal road network will grade towards the central POS for stormwater disposal.
- The road reserve adjacent to the Grouped Housing Sites and the existing Cottonwood Crescent will grade to the southern POS adjacent to Dianella Drive.
- The proposed residential lots abutting Cottonwood Crescent will match in smoothly with the existing road reserve levels.
- The proposed road reserves will match in smoothly with the proposed Recreation and Tree Retention area, as to protect and maintain as many trees as possible.
- The Grouped Housing Sites will not be provided with any retaining walls within the development sites. This will enable the subsequent developers and architects to determine the most appropriate housing layouts to suit the landform. Lots will be graded evenly and left sloping.
- The Grouped Housing Sites abutting Dianella Drive will be stepped in 3m elevation increments to accommodate the 10m level differential between the internal road reserve and Dianella Drive. 3m steps have been proposed as this will accommodate a multi-storey dwelling and minimise earthworks for the future developers.
- Some of the residential corner lots will require retaining walls on a particular boundary to accommodate the road reserve levels. In these cases, a DAP will be required that nominates the required crossover and garage location.
- Spine retaining walls will be required within all residential cells to accommodate the change in levels across the development.

A plan of the proposed lot levels and location of retaining walls has been provided within Appendix Five.

3.2 Sewer Reticulation

The Water Corporation Esinet data obtained on 29 July 2019 indicates that the site is located adjacent to the following sewer reticulation mains:

- Ø150mm sewer main within the north-eastern Monte Lane.
- Ø150mm sewer main within the western verge of Santara Circle, north-east of the site.
- Ø150mm sewer main within the western verge of Dianella Drive, east of the site.

The Water Corporation has provided advice with respect to the sewer servicing in 2012 and 2016, with the Water Corporation confirming on 8 August 2019 that the advice remains current. The Water Corporation has advised:

- 12 October 2012 – that the development falls within an existing sewer catchment and can be serviced from the existing network within Dianella Drive.
- 7 April 2016 – that the proposed development will result in downstream sewer capacity constraints, and a section of Water Corporation sewer within the eastern verge of Light Street, Dianella will need to be upgraded from a Ø150mm to a Ø225mm. Refer to Appendix Six which depicts the section of main to be upgraded, highlighted in yellow.

The revised structure plan will require that the Water Corporation sewer be extended south along Dianella Drive, before being extended west up Cottonwood Crescent and into the development. As the existing road reserve levels at the intersection of Cottonwood Crescent and Dianella Drive will not provide sufficient cover over the new Water Corporation sewer, the sewer will be laid through the southern POS on a 45 degree angle. This will ensure that the low point in the existing road is avoided, and sufficient cover achieved over the sewer. The Water Corporation confirmed on 8 August 2019 that the installation of the sewer via the POS would be acceptable. The City of Stirling have not provided comment on this design aspect, however the sewer will be protected via an easement through the POS and formal approval will be achieved with the Water Corporation land development process and engineering submission to the City of Stirling at the appropriate time.

The new development would be serviced by new Ø150mm PVC reticulation pipes.

Refer to Appendix Six which contains a plan of the existing sewer infrastructure, proposed sewer infrastructure and Water Corporation correspondence.

3.3 Water Reticulation

The Water Corporation Esinet data obtained on 29 July 2019 indicates that the site is surrounded by the following water reticulation mains:

- Ø100mm water main within the south verge of Santara Circle.
- Ø100mm water main within the western verge of Cottonwood Crescent, north-west of the site.
- Ø220mm water main within the western verge of Cottonwood Crescent, west of the site.
- Ø700mm water main within the northern verge of Cottonwood Crescent, south of the site.
- Ø500mm water main within the median of Dianella Drive, east of the site.

The Water Corporation has provided advice with respect to the water servicing in 2012 and 2016, with the Water Corporation confirming on 8 August 2019 that the advice remains current. The Water Corporation has advised:

- 12 October 2012 – that the development can be serviced by the existing infrastructure without any upgrading of the existing system required.
- 13 April 2016 – that the development can be still serviced by the existing infrastructure without any upgrading of the existing system required. Water Corporation indicated that connections to both the Ø100mm in Cottonwood Crescent and Santara Circle would be required, along with a new Ø200mm extension along Cottonwood Crescent running parallel with the 700m steel main, and into the development.

The new development would be serviced via a series of Ø100mm, Ø150mm and Ø200mm PVC pipes, similar to the concept undertaken by Pritchard Francis. A plan of the existing infrastructure and an indicative sketch for the water supply to service the development is provided in Appendix Seven.

3.4 Stormwater Drainage Strategy

3.4.1 City of Stirling Drainage Requirements

The City of Stirling has previously advised that the collection and detention of stormwater drainage must comply with the IPWEA Local Government Guidelines for Subdivisional Development, and the City of Stirling requirements. This shall include:

- The road drainage network shall be designed for a 20% AEP (5 ARI) event.
- The road drainage network shall direct the stormwater to the designated Public Open Space stormwater basin for detention and infiltration.
- Provide an overland flow path to direct a 1% AEP (100 ARI) storm event to the designated Public Open Space stormwater basin for detention and infiltration.
- Ensure that the post development annual discharge volumes and peak flows are maintained relative to pre-development conditions, in addition to protecting the built environment from flooding and water logging, and minimising public risk to the community.

3.4.2 City of Stirling Drainage Infrastructure

A Dial Before You Dig investigation has indicated that there are existing City of Stirling Drainage assets within the vicinity of the proposed development. The following drainage assets are located around the development site:

- Ø225mm and Ø375mm stormwater pipes within the eastern verge of Cottonwood Crescent, west of the site.
- Ø225mm and Ø300mm stormwater pipes within the southern verge of Cottonwood Crescent, north of the site.
- Ø375mm stormwater pipes within the southern verge of Cottonwood Crescent, south of the site.
- Ø300mm stormwater pipe within the eastern verge of Santara Circus, east of the site.
- Ø225mm stormwater pipe within the median island of Dianella Drive, east of the site.

3.4.3 Stormwater Drainage Plan

As noted within Lot Levels and Retaining Walls, the internal road network will generally grade to the central POS, whilst the road reserve adjacent to the Grouped Housing Sites and the existing Cottonwood Crescent will grade to the southern POS adjacent to Dianella Drive.

In line with the City of Stirling requirements, the road drainage network will be designed to cater for a 20% AEP (5 ARI) storm event. The runoff will be directed into a pit and pipe system directing the flow into infiltration areas, located in the POS. An overland flow path will be implemented to ensure that the roads grade to the stormwater basin for events which exceed the 20% AEP (5 ARI). At least 300mm freeboard is required between the finished floor heights and the 1% AEP peak flood level which can be achieved in the proposed civil earthworks scheme. This is in accordance with the requirements of Liveable Neighbourhoods and the Local Government Guidelines for Subdivisional Development.

Each POS will contain a stormwater basin to detain and infiltrate stormwater flows up to the 1% AEP (100 ARI) storm event. The exact dimensions and storage volume of the basins will be determined in due course once a Hydrologist has been appointed to the project to complete the Urban Water Management Plan. A preliminary concept and design volumes would be issued to the City of Stirling for their review and comment during the development of the UWMP.

The R40 lots of less than 300m^2 shall be provided with stormwater lot connection pits. The lot connection pits shall discharge the stormwater into the road reserve network, where the stormwater will be directed to either one of the two stormwater basins for detention and infiltration.

During the detailed design phase, the stormwater drainage design philosophy implemented for the proposed development has been completed in accordance with:

- Australian Rainfall and Runoff 2001.
- Better Urban Water Management 2008.
- Liveable Neighbourhoods.
- Local Government Guidelines for Subdivisional Development.
- City of Stirling requirements.

Please refer to Appendix Eight which contains a stormwater scheme depicting the anticipated drainage solution.

3.5 Pavements

The expected standard requirements for road networks will need to include the following:

- 6m wide pavement seal (kerbed).
- Entry road being the exception, to consist of 2 x 5m wide pavements with a 3m wide median island.
- Maximum longitudinal grade of 10% and an absolute minimum of 0.6%.
- One-way crossfall at 3% implemented throughout.
- Verge grading should be +2% from the top of kerb to the property boundary, and access within lots should have a maximum grade of 10%.
- Minimum road sweep radii in residential areas is 6m, for lane ways and 12m other roads including those that connect to district distributor roads with no requirement for channelization.
- Intersection upgrades, islands and other traffic control measures may be required to suit traffic conditions.
- Regulatory signs and pavement marking should be in accordance with Main Roads Western Australia standard requirements should they be required.
- All intersections should comply with Austroads – Guide to Traffic Engineering Practice Part 5 June 2005, Intersections at Grade".

All roads should be kerbed as per the following:

- Flush kerbing should be installed adjacent to Public Open Spaces (if accepted by the City of Stirling) where water is to drain directly to the POS, on the edges of through carriageways abutting eyebrow and battle-axe driveway treatments, car parks between the through road and parking bay, access streets and laneways, median islands where WSUD is used.
- Mountable kerbing should be installed on all residential streets and neighbourhood connector roads. All mountable kerbing is to be keyed where radiuses are less than 40m.
- Semi-mountable kerbing should be installed on median islands in dual carriageways and intersection sweeps.
- Barrier kerbing should be installed on roads abutting Public Open Space (unless flush kerbing is installed for WSUD purposes), and roads in which future paths will be constructed adjacent to the kerb line.

Pavement thickness should be designed in accordance with the Local Government Guidelines for Subdivisional Development and City of Stirling requirements, with consideration to the following requirements:

- Granular pavement to have a minimum design life of 40 years, with a longer life attainable through maintenance of the wearing course.
- The minimum pavement for urban residential roads in sandy soil conditions similar to this site should comprise of:
  - 150mm limestone sub base course
  - 100mm rockbase base course
  - 5mm primer seal
  - 30mm (AC10) asphalt wearing coarse

In addition to the above requirements, all parking within the development are recommended to conform with:

- AS2890.1 2004 – Off street car parking.
- AS2890.2 2002 – Off street commercial vehicle facilities.
- AS2890.5 1993 – On street parking.
- AS2890.6 2009 – Off street parking for people with disabilities.

3.6 Gas Supply

A Dial Before You Dig investigation has indicated that there is existing gas infrastructure within the vicinity of the proposed development. The following gas mains are located around the development site:

- Ø100mm Medium Pressure gas main within the western verge of Cottonwood Crescent, west of the site.
- Ø100mm Medium Pressure gas main within the northern verge of Cottonwood Crescent, south of the site.
- Ø80mm Medium Pressure gas main within the southern verge of Santara Circle.
- Ø100mm Medium Pressure gas main within the northern and southern verge of Dianella Drive.

Correspondence with the Asset Management Team at ATCO Gas Australia previously confirmed in 2012 that the existing gas mains have the capacity to service the proposed development and therefore no upgrades were required. Pritchard Francis lodged a new enquiry with ATCO Gas Australia on 29 July 2019 to verify that the previous advice remains current. A response was received on 30 July 2019, which confirms that the proposed development can be supported from the existing infrastructure.

Under current agreements if the developer provides a suitable trench, the gas provider will supply and install the required gas mains to service this development at their cost.

A copy of the 2012 and 2019 correspondence and Dial Before You Dig information has been provided within Appendix Nine.

3.7 Electrical Reticulation

A Dial Before You Dig investigation has indicated that there is existing Western Power infrastructure within the vicinity of the proposed development. The following Western Power assets are located around the development site:

- Existing High Voltage overhead cables within the northern verge of Dianella Drive.
- Existing High Voltage underground cables within the western verge of Cottonwood Crescent, west of the site.
- Western Power fibre network within the northern verge of Cottonwood Crescent, south of the site.

The Dial Before You Dig data has been provided within Appendix Ten.

Pritchard Francis engaged with 3E Electrical to seek further electrical advice, with the following comments received:

Background

Based on Roberts Day Dwg. No. RD1011, we understand that the development consists of a green title subdivision development over a 7Ha land parcel, creating 58 residential lots, 5 group housing sites (totalling 143 units) and 2 public open space (POS).

Existing Power Infrastructure

Three phase HV and LV underground distribution infrastructure currently exists adjacent to the site with HV overhead aerials underground HV feeder cables located on the northern side of Dianella Drive. The existing supply to the site appears to have been disconnected/removed as part of the demolition works.

Information on the capacity of the local zone substation can be determined from Western Power's public Network Capacity Mapping Tool (NCMT). The zone substation that appears to supply the HV network adjacent to the subject site is the Malaga zone substation, which is located along Weir Road, Malaga (4km Northeast as the crow flies). The NCMT currently shows there is 30MVA spare capacity at the zone substation indicating minimal risk for network capacity constraints at the zone substation. The spare capacity in the adjacent network however can only be confirmed via an official application to Western Power such as the Design Information Package request.

Proposed Power Networks

Based on the lot yield of 58 residential lots, 5 group housing sites (totalling 143 units) and 2 POS lots, at Western Power's standard load allocation, the development total's power load will be in the order of 730kVA. Given this, the proposed development will require new Western Power infrastructure to be installed as existing transformer sites in the area will not be able to service the entire load.

To service the proposed development would require tapping off the existing HV network along Dianella Drive and extending through development site via a new HV switchgear which will supply two new transformers to service the newly created residential lots. The transformer site would likely be placed in the POS and/or group housing sites to minimise impact to the size of the newly created lots and to be in a strategic location central to the larger power loads (i.e. Group Housing sites) to provide a more efficient power reticulation design. The infrastructure arrangement will be subject to the final lot layout with HV sites subject to an earthing study/assessment. It should be specifically noted that a number of metallic pipeline exists in the vicinity of the site which may dictate the placement of the transformer site. The assumption has been made that the group housing lots consists of typical residential units with no special loads and that the POS is not further developed with electrical communal services.

The existing HV network on Dianella Drive currently consists of a spur arrangement. The new development is likely to push the network load on the spur feeder over 1MVA and therefore as per Western Power Technical Rules, a HV ring network is to be created to provide reliability and redundancy to the network. This will involve running a new HV feeder cable to Yirrigan Drive via Dianella Drive to create the HV ring arrangement. With a steel water pipe also running along Dianella Drive, a low frequency induction study will be required to ensure no hazardous risks is introduced along the pipeline.

Overhead Removal/Undergrounding

The requirement to remove/underground the existing aerials will be subject to the WAPC conditions, Western Power requirements and Development Approval conditions of the Group Housing Sites. Western Power generally requires adjacent overhead aerial network to be removed/undergrounded where existing poles are situated on lot frontages less than 30m and where a number of relocations would be required to realign these poles to a common lot boundary. With only three overhead aerial bays remaining, we have assumed that all adjacent aerials will be undergrounded for aesthetic purposes.

3.8 Communications

A Dial Before You Dig investigation has indicated that there is existing communication infrastructure within the vicinity of the proposed development. The following communication assets are located around the development site:

- NBN Co assets located within the western verge of Cottonwood Crescent, west of the site.
- NextGen assets located within the northern verge of Cottonwood Crescent, south of the site.
- Telstra assets located within the western verge of Cottonwood Crescent, west of the site.
- Telstra assets located within the site servicing the previous structures.
- Telstra assets located within the northern verge of Cottonwood Crescent, south of the site.
- Vocus assets located within the western and eastern verge of Cottonwood Crescent, west of the site.
- Superloop assets located within the eastern verge of Dianella Drive.

NextGen Network, NBN Co, Telstra and Vocus cables are located within the Channel Ten site (Lot 55) and these will need to be removed in order to facilitate the proposed development. Liaison with each of the service authorities to remove these redundant assets will be required, however the design documentation and site works is typically managed by Telstra.

The communications Dial Before You Dig data has been provided within Appendix Eleven.

Pritchard Francis engaged with 3E Electrical to seek further communication advice, with the following comments received:

3E Communications Advice

Existing Telstra and NBN Co conduits are currently located on Cottonwood Cres, near Tecoma Way and Dianella Place. The Telstra network contains surplus conduits and underutilised capacity, which should avoid the need for any headworks civil works to service the new development. NBN Co fibre is understood to be located at its FTTN node located on Cottonwood Cres, near Tecoma Way and should have sufficient capacity to service the proposed development. If not NBN Co is likely to have capacity within 1 km of the development, which should obviate the need for a Developer contribution to backhaul fibre or conduit. A number of other carriers have networks in the vicinity, ie Nextgen, Vocus and Superloop along with Western Power who have pipe and fibre. The presence of these carriers/utilities is of no consequence for the provision of residential telecommunications services but would be of interest if business services were required in the new development.

The proposed development falls within the NBN Co Fixed Line Footprint and within a surrounding area that has already been converted to NBN Co broadband under the Brownfields Rollout, therefore NBN Co must accept Infrastructure Provider of Last Resort (IPoLR) responsibility, should the Developer wish to engage NBN Co. If not, the Developer could engage an alternative provider but costs of doing so are likely to be similar to an NBN Co solution, without the ubiquity of the NBN Co network. Given the yield of the development, NBN Co would most likely deliver FTTP technology to the development, despite the existing homes in the area being serviced by FTTN.

Telstra and Optus mobile networks currently provide 4G coverage of the proposed development.

Developers of new developments have two obligations in relation to telecommunications:

- To provide Fibre Ready pit and pipe – a legal obligation under the Telecommunications Act 1997.
- The provide telecommunications infrastructure (cable) to all lots/premises, where the purpose is for the sale or lease of lots – an obligation under the Federal governments Telecommunications in New Developments policy.

Pit and pipe can be constructed at industry rates and by Third Party contractors, whilst NBN Co fibre is constructed by NBN Co at $600/SDU premise and $400/MDU premise. Over 160 Retail Service Providers have access to the NBN Co wholesale network.

Six telecommunications carriers/utilities have communications networks on road reserve, adjacent to the proposed development, which generally should not be affected unless there are level changes on the existing road verge – see DBYD attached. To minimise relocations, we recommend that existing road verge levels be maintained and not be cut. However, new entry roads and the roundabout could affect communications assets as indicated below:

- Telstra - relocation required due to intersection of Telstra network with new entry road – likely to be a small relocation since existing network should be dead
- NBN Co – an NBN Co pit may be affected by the new roundabout design at the Tecoma Way intersection but a Feature Survey may show that the location is acceptable. Further investigation required
- Superloop - not expected to be affected
- Nextgen – located in WP duct and WP cable on road verge and not expected to be affected
- Vocus – intersection at Tecoma Way would most likely affect Vocus network and therefore would require relocation unless roundabout can be shifted north east slightly, which is not recommended - likely to be a small relocation since existing network should be dead
- WP Optical Fibre – not expected to be affected

4 Conclusion

This report outlines the infrastructure likely to be required to serve the amended plan for the proposed development of Lots 55 and 56 Cottonwood Crescent, Dianella, confirming that the site is accessible and can be served with roads, electrical, water, sewer, gas, stormwater drainage and communications infrastructure.

We have also carried out a preliminary design that illustrates that the levels can be managed provided retaining walls are installed and lots graded accordingly.

Appendices

Appendix One:	Roberts Day Concept
Appendix Two:	McMullen Nolan Group Survey
Appendix Three:	Geology
Appendix Four:	Acid Sulphate Soils Risk Map
Appendix Five:	Site Levels and Retaining Walls
Appendix Six:	Sewer Reticulation Infrastructure
Appendix Seven:	Water Reticulation Infrastructure
Appendix Eight:	Stormwater Infrastructure
Appendix Nine:	Existing Gas Infrastructure
Appendix Ten:	Existing Electrical Infrastructure
Appendix Eleven:	Existing Communication Infrastructure

Appendix One: Roberts Day Concept

POS BREAKDOWN	
POS 1	1.2920ha
POS 2	0.2359ha
TOTAL	**1.5279ha**

LEGEND

- SUBJECT LAND
- POS/DRAINAGE
- RETAINED BANKSIA WOODLAND
- CLEARED BANKSIA WOODLAND

N

POS PLAN

Lot 55 and 56 Cottonwood Cresent, Dianella

City of Stirling

SIZE A4

1:2000

0 metres 20 40 60 80 100

REF NO.	DRAW NO.	REV.
NET TEN	**RD1 011**	**O**

Appendix Two: McMullen Nolan Group Survey

LEGEND

- Survey Control
- Natural Surface
- Bus Stop
- Electrical Cable Box
- Light Pole
- Earth Pit
- Electrical Pole
- Power Dome
- Fire Hydrant
- Sign on Pole
- Steel Wire Anchor
- Stay Pole
- Bollard
- Flag
- Camera
- Tap
- Drainage Manhole
- Ground Floodlight
- Stop Valve
- Water Meter
- Reticulation Control Valve
- Telstra Marker
- Telstra Pit
- Sewer Inspection Shaft
- Sewer Line Marker
- Guide Post
- Drainage Gully/Manhole
- Electrical Pit/Structure/Stairs
- Telstra Manhole
- Tank
- Sign On Multiple Poles/Handrail/Columns
- Bank Top
- Bank Bottom
- Line Of Levels
- Brick Paving
- Edge Of Concrete
- Fence
- Footpath
- Gate
- Wall
- Awning
- Building
- Bottom Of Gate Rail
- Guardrail
- Retaining Wall
- Bushline
- Road Centreline
- Kerb
- Shed
- Drain
- Edge of Water

robertsday
perth | sydney | melbourne
Level 1 | 130 Royal Street East Perth
Western Australia 6004 AUSTRALIA
T: 08 9218 8700 | F: 08 9218 8701
www.robertsday.com.au

CADASTRAL INFORMATION:
Source: McMullen Nolen
Date: 6th Nov 2012
Projection: PCG94/AHD
Drawing Ref: 97667-003A

CLIENT
Network Ten

PROJECT
Network Ten

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY.

SURVEY PLAN WITH CONCEPT OVERLAY
Lot 55 and 56 Cottonwood Cresent, Dianella
City of Stirling

DRAFT

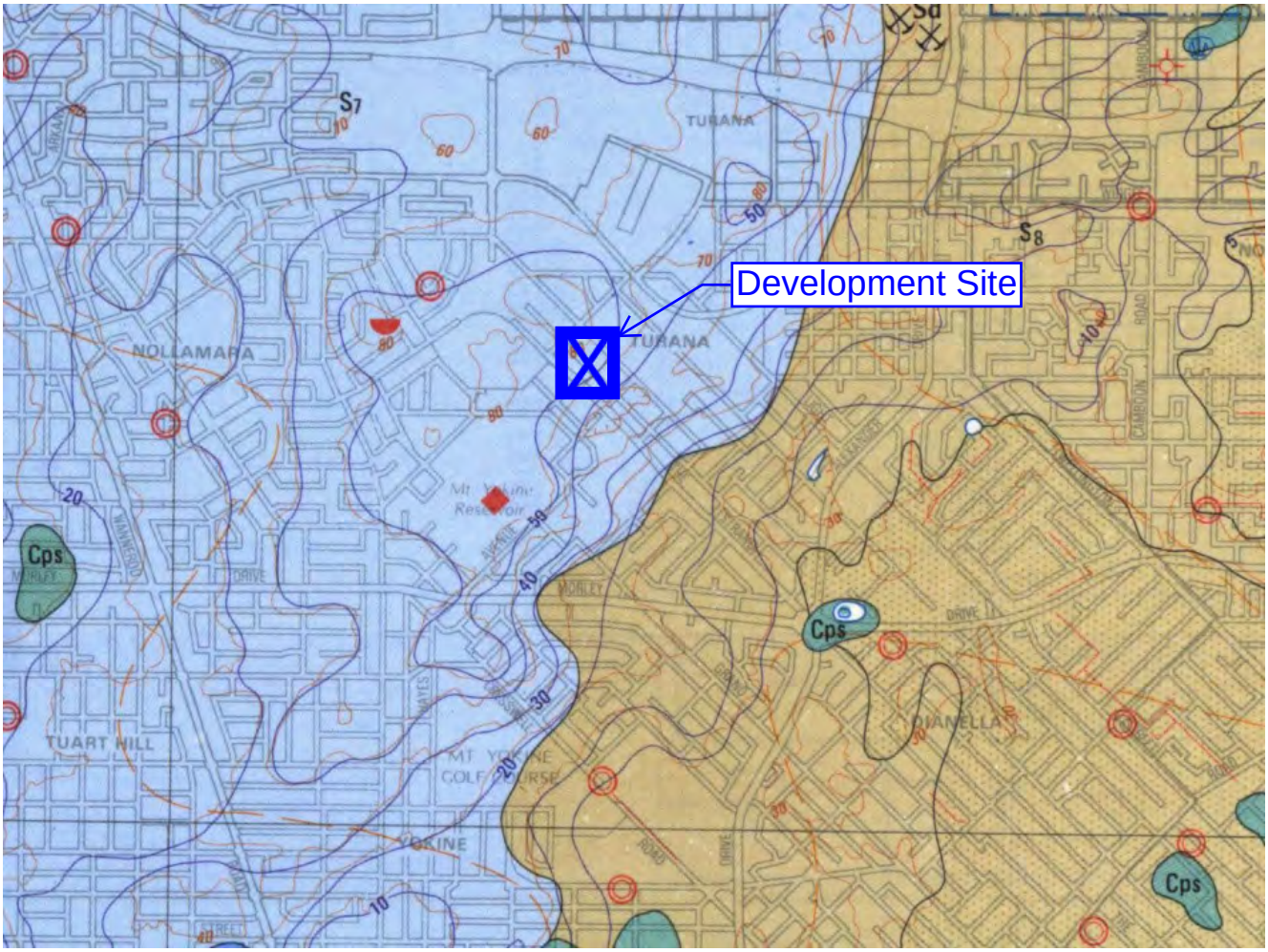
REFERENCE NUMBER	DRAWING NUMBER	ISSUE
NET TEN	RD1 002	E

SCALE 1:1000 SHEET A2

Appendix Three: Geology

PERTH

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA



SHEET 2034 II AND PART OF 2034 III AND 2134 III

Map Unit: Unconsolidated Material	Map Unit: Rock	Description	Equivalent Unit on geological maps	Relief; Slope	Rock-Mineral Resources	PHYSICAL PROPERTIES: Permeability	Corrosion potential	Slope stability	Ease of excavation	Shrink swell potential	Bearing capacity	USCS	CURRENT PROCESSES	SUITABILITY FOR SPECIFIED LAND USES: waste disposal Solid	waste disposal Liquid	Septic tanks	Roads	Urban extension	Excavation	NOTES
Cwh		PEATY CLAY – dark grey and black[2] with variable sand content of lacustrine origin	Swamp deposits (Qhw)	20–60 m;F	Peat, diatomite	L	M–H	L	H	M–H	L	OH–CH	Flooding	×	×	×	⊗	◆	×	High water table, prone to flooding, organic and clayey soils of low bearing capacity
M_2		SILT – grey mottled yellowish brown, blocky, firm, variable clay content		20 m;F	Plastic clay for brick, pipe and tile manufacture	L	L–M	L–M	H	L–M	L–M	ML MH	Flooding	×	×	×	×	◆	○	High water table, prone to flooding, variable bearing capacity, differential settlement of foundations may occur
P		PEAT – black, clayey in part, saturated fibrous organic soil		15 m;F	Peat	H	H	L	H	H	L	Pt	Flooding	×	×	×	×	×	◆	High water table, prone to flooding, low bearing capacity, differential settlement will occur, high compressibility
Sp		PEATY SAND – greyish brown, medium-grained quartz, moderately well sorted, variable organic content, of lacustrine origin		20–25 m;F	Sand, diatomite	M–H	L–M	L	H	L	L	SP–SW	Flooding	×	×	×	⊗	×	×	High water table, prone to flooding, variable under foundations
Spc		PEATY SAND – dark grey and black quartz sands with variable organic content and common peat lenses, variable clay content		10–15 m;F	Peat	H	M–H	L	H	L–M	L–M	SC, Pt		×	×	×	○	×	◆	High water table, may be prone to flooding, variable bearing capacity, differential settlement of foundations could occur
S_1		CALCAREOUS SAND – white, fine to medium-grained, sub-rounded quartz and shell debris, of aolian origin	Safety Bay Sand (Qhs)	0–20 m;M	Limesand	H	L–M	L	H	N/A	L	SP–SW	Wind transportation	×	●	◆	×	×	●	Active blowouts, and sand sheets, unvegetated, high lime content gives it considerable potential for fixing certain kinds of waste, and neutralising acids, low bearing capacity, settlement can be uneven
S_2		CALCAREOUS SAND – as S_1		0–60 m;M–S	Limesand	H	L–M	L	H	N/A	L	SP–SW	Wind transportation	◆	●	◆	⊗	×	×	Prone to remobilisation where the sparse vegetation is removed, high lime content gives it potential for fixing certain kinds of waste, and neutralising acids, low bearing capacity, settlement can be uneven
LS_{Es}		LIMESTONE – pale yellowish brown, weakly cemented, friable, medium-grained, sub-rounded quartz and shell debris, of aolian origin		40–55 m;M–S	Limesand	H	L–M	M	H	N/A	L–M	SP–SW	Wind transportation	×	●	◆	⊗	×	×	Generally linear features with moderate to steep slopes, susceptible to remobilisation, low bearing capacity
C		CLAY – mid to dark grey, soft, saturated, prominent 0.2 m thick oyster shell bed near surface of alluvial origin	Alluvium (Qha)	0–4 m;F		L	M–H	L–M	H	L	L	CL	Flooding, stream flow, sediment transport	×	×	×	○	×	* *	Confined to Swan River floodplain, prone to flooding, differential settlement of foundations may occur, high water table
Cmz		CLAY – dark strong brown, hard when dry, soft when moist, variable silt content, no sand, of alluvial origin		2–10 m;F	Clays for brick pipe and tile manufacture	L	L	M	H	L	L–M	CL	Flooding, stream flow, sediment transport	●	×	×	◆	×	◆	Confined to Helena River floodplain and Jane Brook, high water table, prone to flooding, bearing capacity dependent on clay mineralogy
Mr_1		CLAYEY SILT – yellow brown to strong brown, blocky, mottled, soft, with variable clay content, dispersive in part, of alluvial origin		2–10 m;F	Clays for brick pipe and tile manufacture	L	L	L–M	H	L	L–M	ML	Flooding, stream flow, sediment transport	×	×	×	◆	×	◆	Confined to Swan River floodplain and some tributaries, prone to flooding, high water table, some settlement under load can be expected
Ms_1		SANDY SILT – light yellow brown, blocky, mottled, some fine to medium-grained sand, soft when moist, variable clay content		1–5 m;F	Silts and clays for brick pipe and tile manufacture	L	L	M	H	L	M	ML	Flooding	○	×	×	◆	×	◆	Confined to Swan River floodplain, high water table, prone to flooding, some settlement of foundations may occur
S_{14}		SAND – pale grey to white, medium-grained sub-angular, quartz and feldspar, well sorted, abundant whole and broken bivalves and gastropod shells, of alluvial origin		0–5 m;F		H	L	L–M	H	N/A	L–M	SP	Potential for flooding	×	×	×	○	◆	* *	Confined to Swan River estuary high water table, prone to flooding, some settlement of foundations may occur, bearing capacity is dependent on degree of consolidation of the material
Sm_1		SILTY SAND – strong brown, leached at surface, fine to medium-grained, quartz, variable silt content		5–10 m;F		M	L	L–M	H	L	M	SF silty		●	×	●	◆	◆	◆	Confined to Swan River floodplain, high water table, variable thickness, bearing capacity is dependent on the amount of silt in the material
M_2		SILT – strong brown, tough, hard, variable fine-grained quartz sand in matrix	Alluvium (Qa)	200–290 m;G		L	L	M	H	L	M	ML	Some solifluction, occasional, stream flow	○	×	●	◆	○	◆	Confined to valleys on the Darling Scarp, variable thickness, may become saturated during periods of water flow
Mgr_2		GRAVELLY SILT – strong brown, tough with common pebbles of fine to coarse-grained, sub-rounded granite, some dolerite and rare sandstone (SS) variable sand content	Colluvium (Qc)	40–100 m;G	Gravel, possibility of silts and clays for brick pipe and tile manufacture	L–M	L	M–H	H	L	M–H	ML	Some solifluction, some stream flow	◆	×	×	◆	○	◆	Variable value as a foundation, permanent cuts are unstable
Ms_2		SANDY SILT – strong brown, firm, friable, occasional pebbly horizons with little matrix containing quartzite, granite, laterite, of colluvial origin		20–50 m;G	Used in brick manufacture to impart body	L	L	M–H	H	L–M	M	ML–M	Stream flow, some mass movement	◆	×	×	◆	○	◆	Variable value as a foundation, permanent cuts are unstable, dispersive in part
Mr_2		SANDY SILT – yellowish brown, tough, with variable sand content of fine to medium-grained quartz sand, some gravel in places.		20–75 m;G	Potential for gravel in part	L–M	L	L–M	H	L	M	ML	Stream flow, some mass movement	◆	×	×	◆	○	◆	Variable value as a foundation, permanent cuts are unstable
Smg		SILTY SAND – dark yellowish brown, tough silty, medium to coarse quartz sand, in places is abundant medium to coarse-grained plastic laterite (G_2) pebbles.		30 m;F	Gravel	M–H	L	L	H	L	L–M	SF silty		◆	×	◯	◆	◆	◆	Restricted occurrence
S_7		SAND – pale and olive yellow, medium to coarse-grained, sub-angular to sub-rounded quartz, trace of feldspar, moderately sorted, of residual origin.	Sand derived from Tamala Limestone (Qts)	0–100 m;G	Specification sand	M	L	L–M	H	N/A	L–M	SP–SW	Groundwater recharge	●	×	●	◆	◆	◆	Few limitations, some settlement under foundations can be expected, some ability to attenuate pollutants due to small clay content, usually considerable depth to water table due to topography
LS_3		LIMESTONE – light, yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of aolian origin.	Tamala Limestone (Qtl)	0–65 m;F–G	Dimension stone, metallurgical, agricultural and construction grade limestone	H	L	M–H	M–H	N/A	V		Groundwater recharge	×	×	●	◆	◆	◆	Variable bearing capacity dependent on degree of cementation, solution cavities and fissures could lead to settlement under load and offer an easy path for pollutants down to the water table
LS_{3r}		LIMESTONE – as LS_3, abundant karstic phenomena including caves, swallows, dolines		30–40 m;G	As LS_3	H	L	M–H	M–H	N/A	V_r		Groundwater recharge	×	◆	●	⊗	⊗	◆	As LS_3, high water table in places, extensive cave systems and other large scale karstic phenomena known
S_8		SAND – very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of aolian origin	Bassendean Sand (Qpb)	15–80 m;F–G	Construction and glass sand	H	L	L	H	N/A	M–H	SP–SW	Groundwater recharge, some wind transportation	●	×	●	◆	◆	◆	Well drained, when dry and vegetation free it could be remobilised, drainage disposal is only a problem in areas of high water table
S_{10}		SAND – as S_8	Thin Bassendean Sand over Guildford formation (Qpb/Qpa)	10–55 m;F	Construction and glass sand	H	L	L	H	N/A	M–H	SP–SW	Groundwater recharge, some wind transportation	×	×	×	◆	◆	◆	Of variable thickness, the sands physical properties are modified by the underlying material, generally high water table.
Mpr_1		PEBBLY SILT – strong brown silt with common, fine to occasionally coarse-grained, sub-rounded laterite quartz, heavily weathered granite pebble, some fine to medium-grained quartz sand, of alluvial origin	Guildford Formation (Qpa)	5–30 m;F	Plastic clays for brick, pipe and tile manufacture	L	L	M–H	H	L	M–H	ML	Stream flow, flooding	×	◆	×	◆	○	◆	Near surface water table, prone to flooding, differential settlement of foundations may occur unless built on columns or concrete rafts above 1 m of compacted sand, dispersive in places
Ms_3		SANDY SILT – strong brown to mid grey, mottled, blocky, disseminated fine sand, hard when dry, variable clay content of alluvial origin.		2–5 m;F	Clays for brick, pipe and tile manufacture	L	L	M–L	H	L	M–H	ML	Flooding	×	⊗	×	◆	○	◆	Confined to Swan River floodplain, susceptible to flooding, some settlement of foundations may occur, dispersive in places
S_{11}		SAND – light grey, medium-grained, sub-angular to rounded quartz and feldspar, moderately sorted of alluvial origin		5–15 m;F		H	L	L–M	H	N/A	L	SW	Stream flow, sediment transport	×	×	×	×	×	×	Restricted to fluvial channel with seasonal flow
S_{12}		SAND – yellow, fine to medium-grained, sub-angular to rounded quartz, with some feldspar, well sorted, variable silt content, of colluvial origin	Yoganup Formation (Qpc)	25–75 m;F–G	Construction sand	M–H	L	L–M	H	N/A	L–M	SW		◆	×	◆	◆	◆	◆	Settlement could occur under load, requires protection against erosion when exposed
SS		SANDSTONE – light grey, hard, compact, moderately weathered, fine-grained silty sandstone, lateritisation has affected the rock in places	Ridge Hill Sandstone (Cph)	75–100 m;G		M	L	M–H	L–M	L	L–M			×	×	○	◆	◆	◆	Areally restricted, variable foundations
LA_1		LATERITE – massive and cemented, occasionally vesicular, up to c. 4 m in thickness, overlies a zone of mottled and/or pallid clays and saprolite	Laterite (Ql)	235–335 m;F–G		L	L	M–H	L	L	H		Stream flow, sediment transport	×	×	○	◆	◆	◆	Can only be excavated by blasting, variable foundations and sub-surface drainage is a problem
G_2		GRAVEL–strong brown, coarse, sub-rounded to rounded lateritised granite pebbles in clay-silt mixture, moderately sorted, of colluvial origin		220–335 m;G	Gravel	H	L	L	H	L	L	GW	Stream flow, sediment transport	×	×	×	◆	◆	◆	Very loose, though occasionally weakly consolidated, needs protection against water erosion and fluctuations in moisture content, when compacted can withstand heavy loads
DO		DOLERITE – quartz rich, fine-grained, melanocratic, 2 to 20 m wide dykes	Dolerite (d)	25–250 m;G–M	Crushed rock aggregate when fresh, soils may contain plastic clays	L		M	L	L	H			×	×	×	◆	◆	◆	Can be a good foundation when fresh but soils developed on dolerite (plastic clays) give poor foundations unless moisture content kept constant
M_3		SILT – yellowish brown mottled, overlying kaolinitic horizon, firm and tough when dry, soft when wet, very variable sand content	Even-grained Granite (Aa and Aea)	30–270 m;G		L	L	L–M	H	L–M	L–M	ML–M	Solifluction, stream flow	×	×	×	×	○	◆	Foundation conditions variable and can be good providing requisite preparation conditions are carried out, tendency to be unstable on steep slopes, seepage is common
GR		GRANITE – mesocratic, fine to coarse-grained, ranges in composition from granodiorite to granite, adamellite being commonest variety		20–270 m;G–S	Crushed rock aggregate, dimension stone	L	L	H	L	L	H		Stream flow	●	×	×	◆	◆	◆	Foundation conditions generally good, even when weathered providing requisite preparation conditions are carried out
GR+DO		GRANITES and GNEISSES – intimate association of coarse-grained granites (GR) and gneisses and fine-grained dolerites (DO)	Migmatite (Am)	20–180 m;M–S		L	L	M–H	L	L	M–H		Stream flow	●	×	×	◆	◆	◆	Heterogeneous material, adequate foundations providing requisite preparations are followed for clayey soils, where present, unstable on steep slopes, sheet zones are common

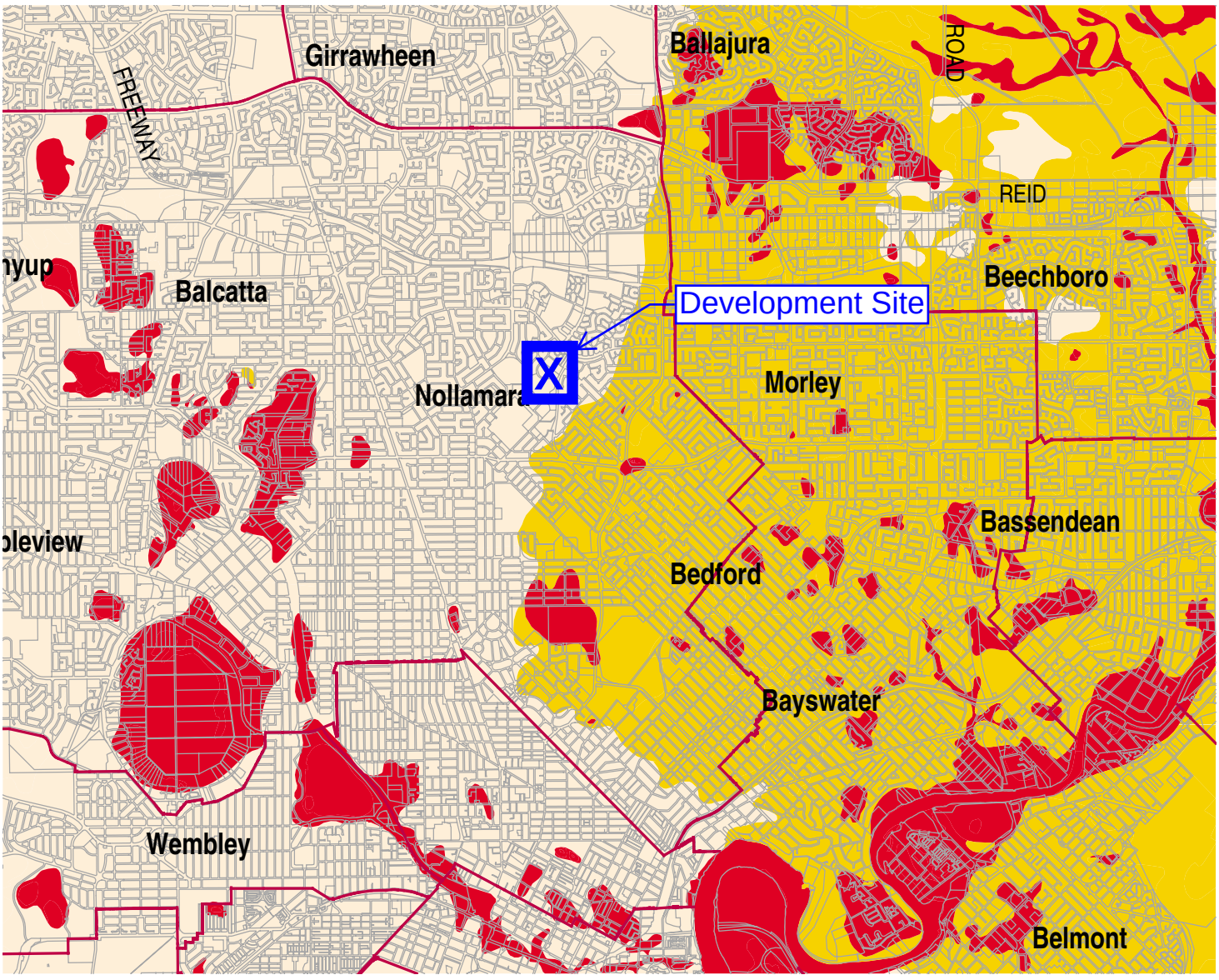
REFERENCES

1. See Lithological Classification
2. The terms unconsolidated material and rocks are used in the sense of the engineering terms "soil" and "rock".
3. Colours were derived from Standard Soil Colour Charts, notation omitted.
4. Maximum and minimum elevation of the unit with respect to Australian Height Datum.
5. Slopes expressed qualitatively in four terms, F–flat, G–gentle, M–moderate, S–steep, which correspond to < 3°, 3°–10°, 10°–20°, > 20°. The dominant slope of each unit is given.
6. H . . . . . high
   M . . . . . moderate
   L . . . . . low
   V . . . . . variable
   N/A . . . . . not applicable
   Properties vary with degree of weathering
7. Low over sinkholes and collapse features
8. Snowy Mountains Engineering Corporation Soil Classification which describes soils in terms of grain size, grading characteristics and compressibility. For rocks the symbols refer to the weathered products.
9. × activity undesirable for the environment
   ○ possible problems for the activity
   * * environment unsuitable or hazardous for the activity
   ◆ activity compatible with unit
   ● possible problems for the environment

The data contained on this sheet are provided for preliminary studies and are not intended as a substitute for detailed on-site investigation

Appendix Four: Acid Sulphate Soils Risk Map

Figure 3: Central Metropolitan Region Scheme Acid Sulfate Soils



Appendix Five: Site Levels and Retaining Walls

E 64.00 Existing Level

D 73.50 Proposed Level

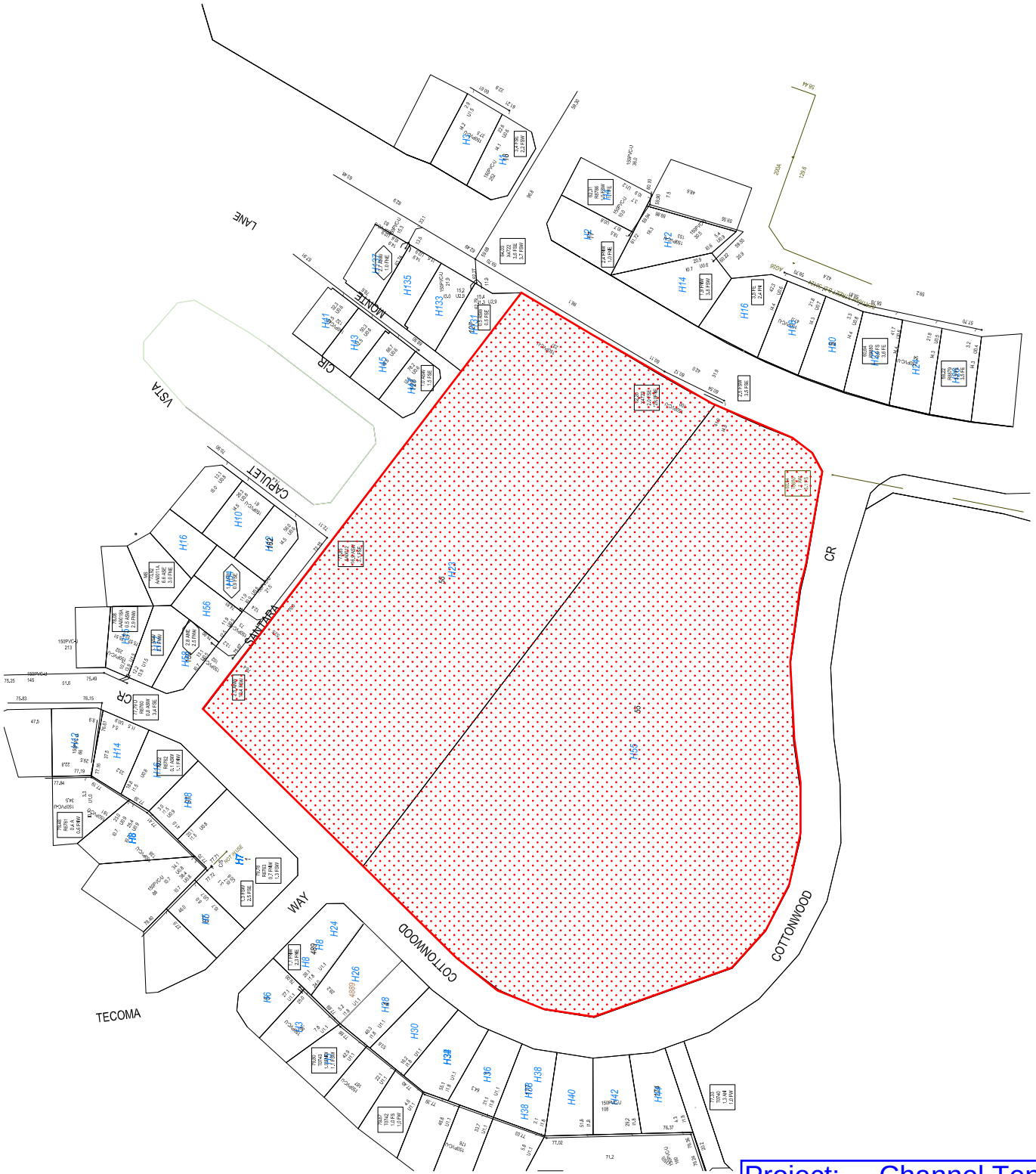
65.00 Proposed Lot Level

Retaining Wall

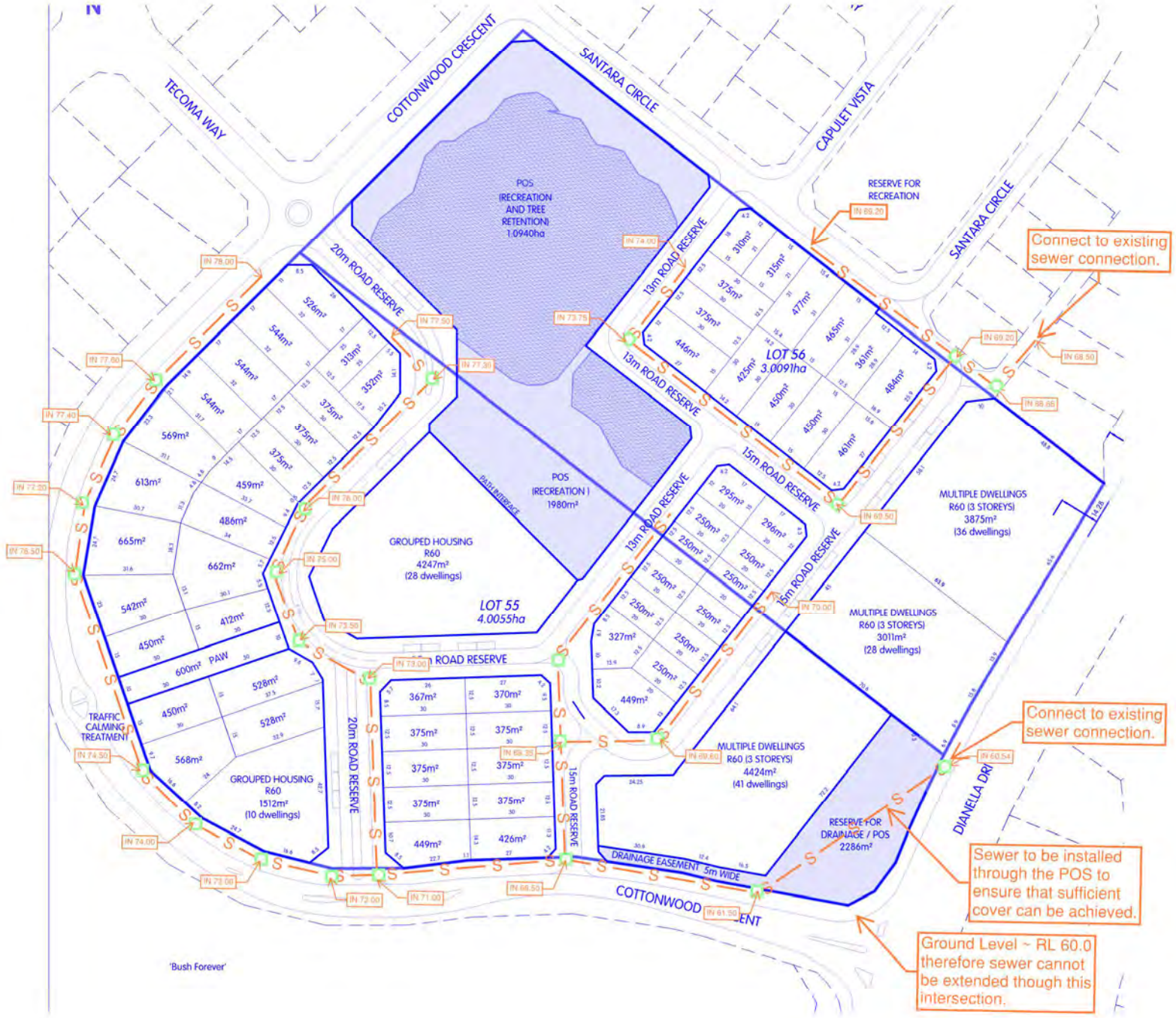
Earthwork Step

Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Site Levels and Retaining Walls
Scale:	1:2000 @ A4
Engineer:	Jamie De Palma
Date:	13 August 2019

Appendix Six: Sewer Reticulation Infrastructure



Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Existing Sewer
Scale:	NTS
Engineer:	Jamie De Palma
Date:	13 August 2019



Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Proposed Sewer
Scale:	1:2000 @ A4
Engineer:	Jamie De Palma
Date:	13 August 2019

Jamie De Palma

From: Rick Harrison <Rick.Harrison@watercorporation.com.au>
Sent: Thursday, 8 August 2019 2:39 PM
To: Jamie De Palma
Subject: FW: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella
Attachments: sd053.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Channel Nine/Ten

Kind Regards

Rick Harrison
TL - Land Servicing
Development Services

T (08) 9420 2076

From: Rick Harrison
Sent: Friday, 8 April 2016 11:43 AM
To: Denise Hare (denise.h@pfeng.com.au)
Subject: FW: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise,

Information below from our wastewater planners.

Regards,
Rick Harrison
A/ Team Leader, Land Servicing
Water Corporation
T: (08) 9420 2076

From: Luke Gabriel
Sent: Thursday, 7 April 2016 1:59 PM
To: Rick Harrison
Cc: Tina Zheng
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Rick,

I ran the model and added the structure plan you sent us, however I noticed that further downstream there some capacity issues. I noticed that the pipe between access chamber Y2527 and Y2511 is a 150, with the previous model had shown this pipe was at 80% capacity however when we added the development proposal to the model this pipe was shown as overflowing, as such this pipe will have to be upgraded to a 225 before we can approve the development proposal.

Attached is a plan of the pipe I'm referring to.

Regards,

Luke Gabriel
Asset Investment Planning Analyst
Asset Investment Planning Metro
Water Corporation
T: (08) 9420 3966

www.watercorporation.com.au

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Monday, 28 March 2016 7:36 AM
To: Rick Harrison
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Rick,

As a rough guess, I'd say about 2 L/s:

Yield	GSDF L/s/Net Ha	Area (m2)	GSDF L/s
R60/80 Multiple/Grouped Dwellings	0.625	16659	1.041188
R50	0.469	2397	0.112419
R40	0.375	14130	0.529875
R30	0.328	3232	0.10601
R20	0.219	10190	0.223161
Total			2.012652

Denise Hare
Project Leader - Civil
Pritchard Francis | T (08) 9382 5111

From: Rick Harrison [mailto:Rick.Harrison@watercorporation.com.au]
Sent: Thursday, 24 March 2016 2:45 PM
To: Denise Hare
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise,

Can you please advise what the total GSDF will be from this redevelopment?

Thanks

Regards,
Rick Harrison
A/ Team Leader, Land Servicing

Water Corporation
T: (08) 9420 2076

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Tuesday, 22 March 2016 2:15 PM
To: Mark Busher
Cc: Graham Hayward
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Mark,

I hope you are well. We've been asked to update our engineering services report for the above project, both because of the elapsed time and an updated plan. I've attached the updated plan with my thoughts on the sewer and water, and I just wanted to check that this is still acceptable to the Water Corporation and the planning hasn't changed?

Denise Hare
Project Leader - Civil
Pritchard Francis | T (08) 9382 5111

From: Mark Busher [mailto:Mark.Busher@watercorporation.com.au]
Sent: Friday, 12 October 2012 3:03 PM
To: Denise Hare
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Denise,

Planning attached,

Regards,

Mark Busher
Team Leader
Development Services
Planning and Capability
Water Corporation
T: (08) 9420 2076

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Friday, 12 October 2012 8:13 AM
To: Mark Busher
Subject: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Mark,

My name is Denise Hare and I am a civil engineer working on the subdivision of Lots 55 & 56 Cottonwood Crescent Dianella. As part of the works, we have been engaged to undertake a feasibility study into the proposed subdivision. Please find attached a proposed plan for the subdivision.

I have submitted a Dial before You Dig request for the region and have attached this for your information. Could you please advise whether the water infrastructure in the vicinity of the proposed development is capable of providing reticulated water supply to the proposed subdivision and where the closest sewer connection capable of serving the proposed development is located?

Thank you for your assistance.

Please don't hesitate to call me if you have any queries.

Regards

Denise Hare
Civil Engineer
Pritchard Francis
Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
Email: denise.h@pfeng.com.au
Website: www.pfeng.com.au
Level 1, 430 Roberts Road,
PO Box 2150, Subiaco 6904

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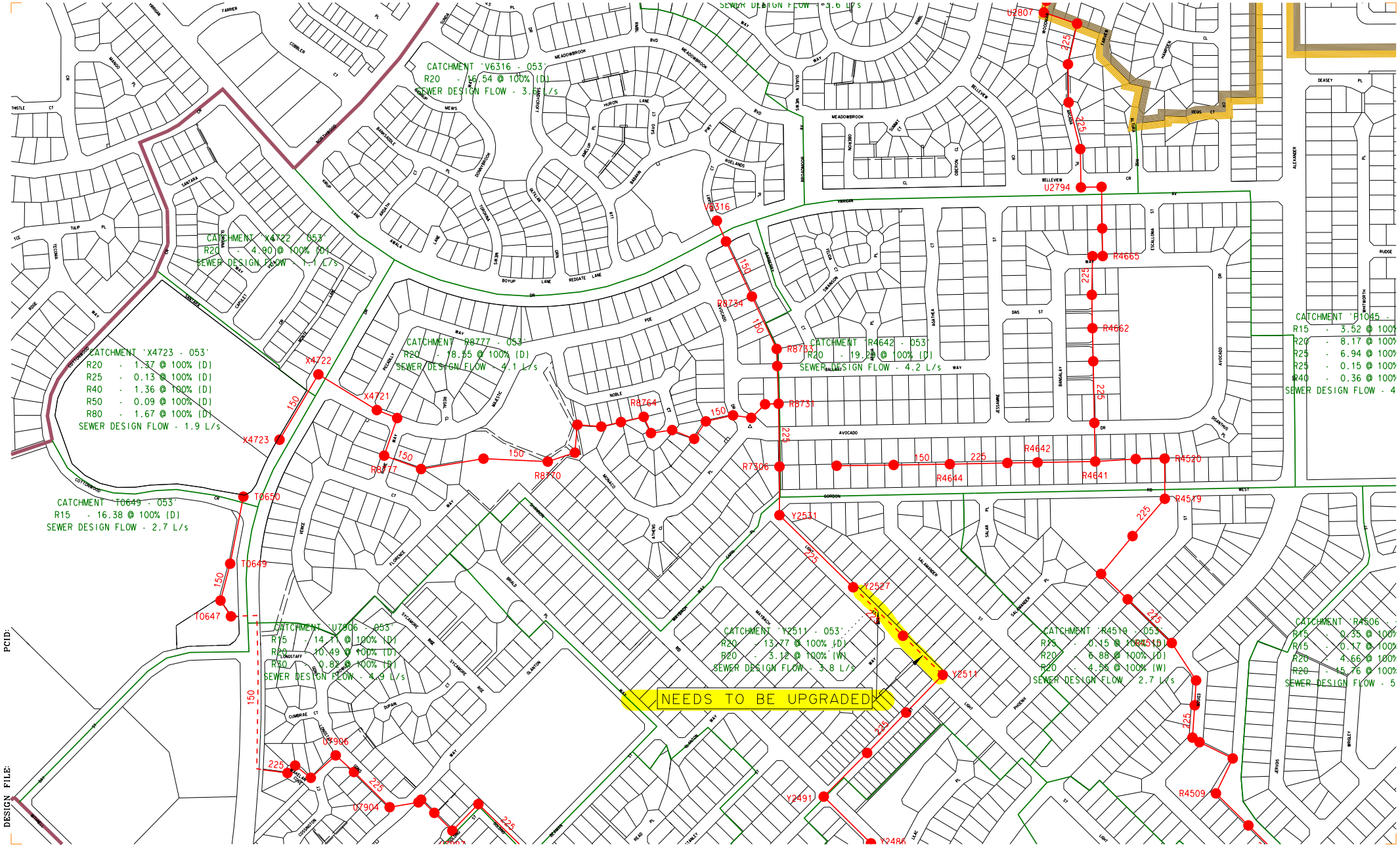


THE INFORMATION ON THIS PLAN IS BASED ON THE BEST DATA AVAILABLE AT DATE OF PRINTING AND IS SUBJECT TO ONGOING REVIEW AND AMENDMENT. NO RESPONSIBILITY IS ACCEPTED BY THE WATER CORPORATION FOR ACCURACY OF DATA SUPPLIED BY EXTERNAL AGENCIES.

LEGEND

- EXISTING PUMPING STATION
- EXISTING PRESSURE MAIN
- EXISTING GRAVITY SEWER
- PROPOSED PUMPING STATION
- PROPOSED PRESSURE MAIN
- PROPOSED GRAVITY SEWER
- PARKS AND PUBLIC OPEN SPACE
- EXISTING SEWERED AREAS
- SEWERED BY PRIVATE PS
- NODE CATCHMENT
- PS AND SEWER CATCHMENTS
- SEWER DISTRICT CATCHMENT
- WWTP CATCHMENT

NOTATION

SEWER DISTRICT NUMBER
CATCHMENT NODE
CATCHMENT 'T001 - 121'
R15 - 108.4 @75% (W)
GROSS AREA (ha)
'R' CODE ZONING
% OF LAND DEVELOPMENT
(W) - WET CONDITIONS
(D) - DRY CONDITIONS

SEWER DESIGN FLOW - 1.5 x AVERAGE DAILY FLOW RATE

AQUA NO.

AQUA VERSION

WATER CORPORATION

ISSUED WITH THE AUTHORITY OF THE MANAGER
INFRASTRUCTURE PLANNING BRANCH
629 NEWCASTLE STREET, LEEDERVILLE 6007
WESTERN AUSTRALIA.
TELEPHONE (08) 9420 2420, FAX (08) 9420 3179

WASTEWATER SCHEME PLANNING SERIES

MORLEY - SD053
CONCEPTUAL PLANNING

PLANNING BY	COMPILED BY	ACCEPTED BY
	L. GABRIEL	
SCALE 1: 5,000	FULL REVIEW	FILE NO. A3

Jamie De Palma

From: Rick Harrison <Rick.Harrison@watercorporation.com.au>
Sent: Thursday, 8 August 2019 1:44 PM
To: Jamie De Palma
Subject: RE: Lots 55, 56 Cottonwood Cres Dianella

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Channel Nine/Ten

Hi Jamie,

I can't see any major issues with your proposal to skew a section of sewer through the proposed POS, subject to council approval and required clearances to any drainage infrastructure in the POS.

Kind Regards

Rick Harrison
TL - Land Servicing
Development Services

T (08) 9420 2076

From: Mark Busher
Sent: Thursday, 8 August 2019 12:29 PM
To: Rick Harrison
Subject: FW: Lots 55, 56 Cottonwood Cres Dianella

Can you or one of your team advise Pritchard Francis
thanks

Mark Busher
Mgr - Land Servicing
Development Services

T (08) 9420 2092
M 0472 806 027

From: Land Servicing
Sent: Thursday, 8 August 2019 9:33 AM
To: Mark Busher
Cc: Land Planning
Subject: FW: Lots 55, 56 Cottonwood Cres Dianella

Jan Pryce
Sup Off - Business Services
Development Services

E Jan.Pryce@watercorporation.com.au
T (08) 9420 2099

watercorporation.com.au

From: Jamie De Palma [mailto:jamie.d@pfeng.com.au]
Sent: Thursday, 8 August 2019 9:27 AM
To: Land Servicing
Subject: FW: Lots 55, 56 Cottonwood Cres Dianella

From: Jamie De Palma
Sent: Tuesday, 30 July 2019 10:45 AM
To: Mark.Busher@watercorporation.com.au
Cc: land.planning@watercorporation.com.au
Subject: Lots 55, 56 Cottonwood Cres Dianella

Morning Mark,

Pritchard Francis have been engaged by Roberts Day to complete the engineering service review for the proposed development of Lot 55 and 56 Cottonwood Crescent Dianella, being the former Channel Ten studio site. Pritchard Francis had previously undertaken a similar report back in 2012, with some correspondence from the Water Corporation attached.

For the most part, the site is easily serviced with power, comms, water and gas. However servicing the development by sewer is somewhat constrained due to the natural levels of the Dianella Drive / Cottonwood Cres intersection.

The development needs to discharge into an existing Water Corporation sewer, located at the mid-eastern boundary along Dianella Drive. The existing invert of the sewer is RL 60.54, with the road level at the correspondence location at RL 61.22. Typically the Water Corporation sewer would be extended down Dianella Drive to the intersection of Cottonwood Cres, and then west along Cottonwood Cres.

Unfortunately this solution is not achievable due to the intersection levels of Dianella Drive and Cottonwood Cres reducing down to RL 60.40. Effectively the sewer would be about 1m about natural surface levels and servicing the proposed development would not be possible.

We propose that the Water Corporation sewer be installed on the 45 degree angle from Dianella Drive to Cottonwood Cres through the POS as shown in the attached. By installing the sewer through the POS, we are able to avoid the low levels at the intersection, and therefore achieve the necessary cover on the sewer pipe.

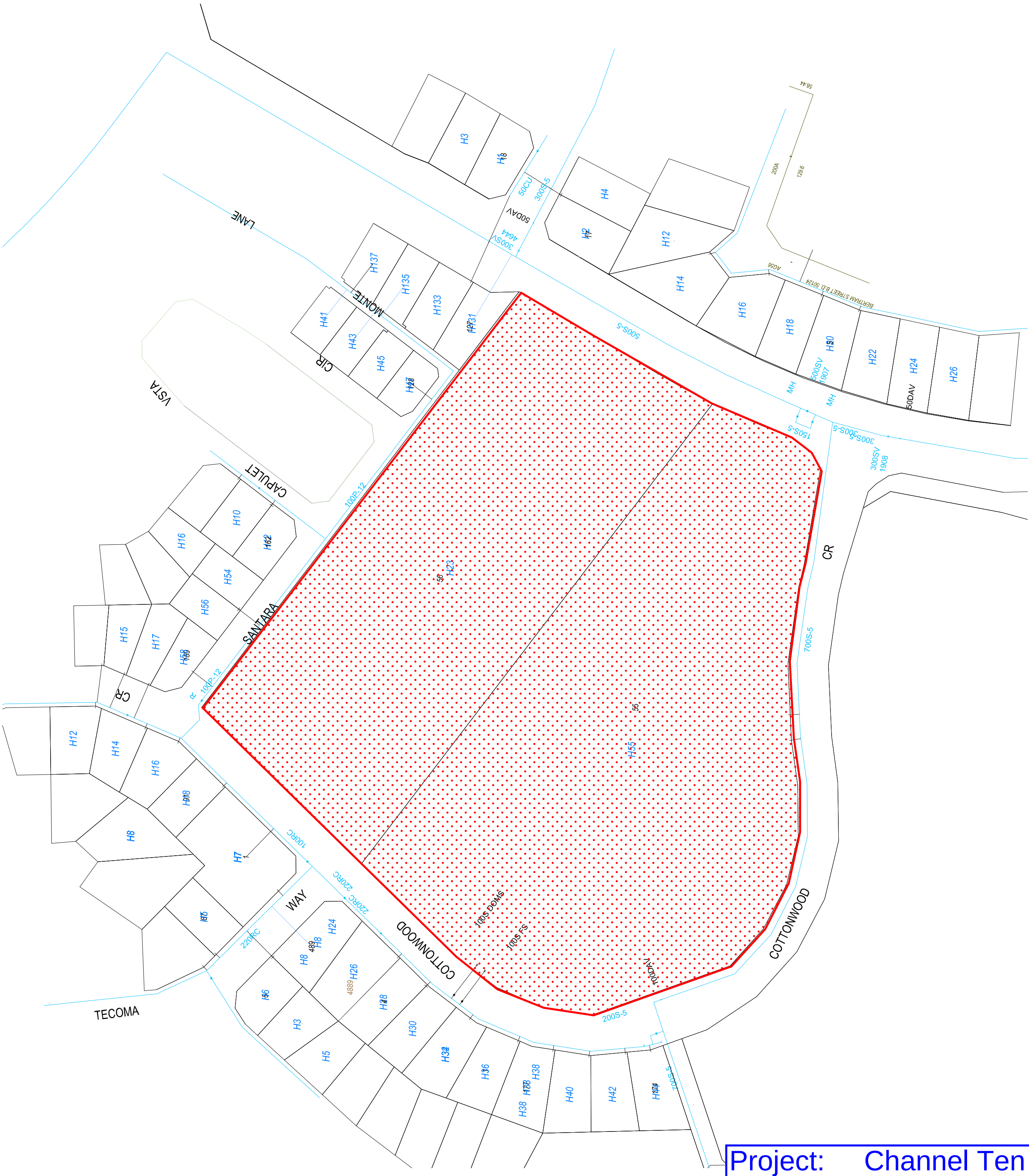
Can the Water Corporation advise whether this would be an acceptable solution? Pritchard Francis are also in discussion with the City of Stirling seeking their approval to build a sewer within a POS.

Please call me should you wish to discuss alternatives.

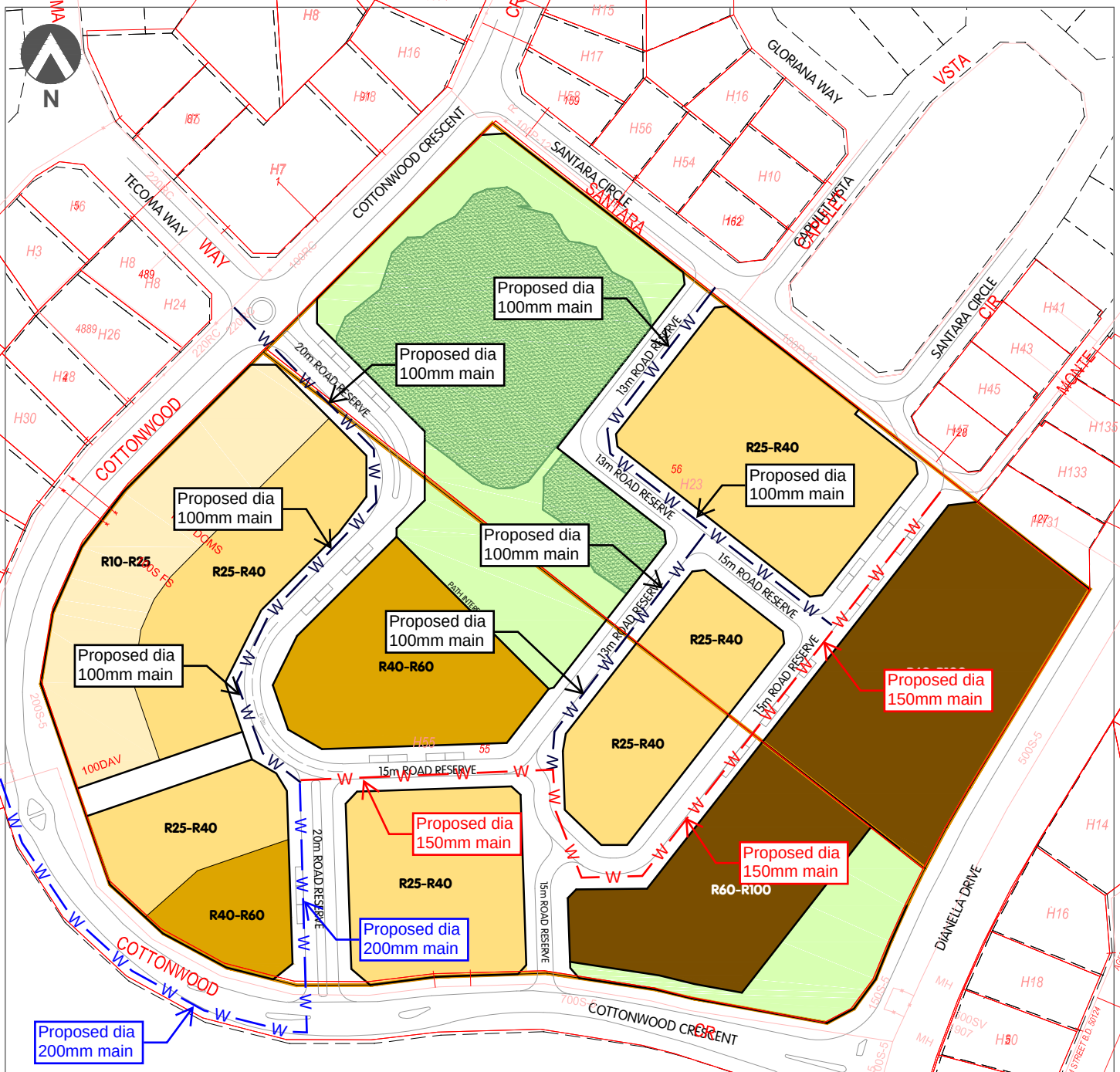
Jamie De Palma
Associate - Civil
BE (Hons) MIEAust CPEng NER

T (08) 9382 5111
E jamie.d@pfeng.com.au | W www.pfeng.com.au
430 Roberts Road, Subiaco WA 6008 | PO Box 2150 Subiaco WA 6904

Appendix Seven: Water Reticulation Infrastructure



Project: Channel Ten
Client: Roberts Day
Job No: 19-209
Drawing:
Title: Existing Water
Scale: 1:2000 @ A4
Engineer: Jamie De Palma
Date: 13 August 2019



LEGEND

- SUBJECT LAND
- POS/DRAINAGE
- RETAINED BANKSIA WOODLAND

R-CODE DENSITY

- R 10-25
- R 25-40
- R 40-60
- R 60-100

- W — Proposed 100mm Water Infrastructure
- W — Proposed 150mm Water Infrastructure
- W — Proposed 200mm Water Infrastructure

NORTH

DIAL BEFORE YOU DIG www.1100.com.au The Essential First Step.

Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Proposed Water
Scale:	1:2000 @ A4
Engineer:	Jamie De Palma
Date:	13 August 2019

DENSITY PLAN

Lot 55 and 56 Cottonwood Cresent, Dianella

City of Stirling

SIZE A4

1:2000 0 metres 20 40 60 80 100

REF NO.	DRAW NO.	REV.
NET TEN	**RD1 011**	**O**

Jamie De Palma

From: Rick Harrison <Rick.Harrison@watercorporation.com.au>
Sent: Thursday, 8 August 2019 2:39 PM
To: Jamie De Palma
Subject: FW: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella
Attachments: 20160413083735730.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Channel Nine/Ten

Kind Regards

Rick Harrison
TL - Land Servicing
Development Services

T (08) 9420 2076

From: Rick Harrison
Sent: Wednesday, 13 April 2016 10:22 AM
To: 'Denise Hare'
Cc: Simon Ridgewell
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise,

Attached water retic planning.

Regards,
Rick Harrison
A/ Team Leader, Land Servicing
Water Corporation
T: (08) 9420 2076

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Monday, 11 April 2016 9:46 AM
To: Rick Harrison
Cc: Simon Ridgewell
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Thanks Rick

Denise Hare
Project Leader - Civil
Pritchard Francis | T (08) 9382 5111

From: Rick Harrison [mailto:Rick.Harrison@watercorporation.com.au]
Sent: Monday, 11 April 2016 9:44 AM

To: Denise Hare
Cc: Simon Ridgewell
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise,

I don't think any retic upgrades are required. I'll check with our water retic planner and get back to you by the end of this week.

Regards,
Rick Harrison
A/ Team Leader, Land Servicing
Water Corporation
T: (08) 9420 2076

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Friday, 8 April 2016 11:52 AM
To: Rick Harrison
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Rick,

Thanks for sending that through, is the water capacity still ok?

Denise Hare
Project Leader - Civil
Pritchard Francis | T (08) 9382 5111

From: Rick Harrison [mailto:Rick.Harrison@watercorporation.com.au]
Sent: Friday, 8 April 2016 11:43 AM
To: Denise Hare
Subject: FW: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise,

Information below from our wastewater planners.

Regards,
Rick Harrison
A/ Team Leader, Land Servicing
Water Corporation
T: (08) 9420 2076

From: Luke Gabriel
Sent: Thursday, 7 April 2016 1:59 PM
To: Rick Harrison
Cc: Tina Zheng
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Rick,

I ran the model and added the structure plan you sent us, however I noticed that further downstream there some capacity issues. I noticed that the pipe between access chamber Y2527 and Y2511 is a 150, with the previous model had shown this pipe was at 80% capacity however when we added the development proposal to the model this pipe was shown as overflowing, as such this pipe will have to be upgraded to a 225 before we can approve the development proposal.

Attached is a plan of the pipe I'm referring to.

Regards,

Luke Gabriel
Asset Investment Planning Analyst
Asset Investment Planning Metro
Water Corporation
T: (08) 9420 3966

www.watercorporation.com.au

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Monday, 28 March 2016 7:36 AM
To: Rick Harrison
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Rick,

As a rough guess, I'd say about 2 L/s:

Yield	GSDF L/s/Net Ha	Area (m2)	GSDF L/s
R60/80 Multiple/Grouped Dwellings	0.625	16659	1.041188
R50	0.469	2397	0.112419
R40	0.375	14130	0.529875
R30	0.328	3232	0.10601
R20	0.219	10190	0.223161
Total			2.012652

Denise Hare
Project Leader - Civil
Pritchard Francis | T (08) 9382 5111

From: Rick Harrison [mailto:Rick.Harrison@watercorporation.com.au]
Sent: Thursday, 24 March 2016 2:45 PM
To: Denise Hare
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise,

Can you please advise what the total GSDF will be from this redevelopment?

Thanks

Regards,
Rick Harrison
A/ Team Leader, Land Servicing

Water Corporation
T: (08) 9420 2076

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Tuesday, 22 March 2016 2:15 PM
To: Mark Busher
Cc: Graham Hayward
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Mark,

I hope you are well. We've been asked to update our engineering services report for the above project, both because of the elapsed time and an updated plan. I've attached the updated plan with my thoughts on the sewer and water, and I just wanted to check that this is still acceptable to the Water Corporation and the planning hasn't changed?

Denise Hare
Project Leader - Civil
Pritchard Francis | T (08) 9382 5111

From: Mark Busher [mailto:Mark.Busher@watercorporation.com.au]
Sent: Friday, 12 October 2012 3:03 PM
To: Denise Hare
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Denise,

Planning attached,

Regards,

Mark Busher
Team Leader
Development Services
Planning and Capability
Water Corporation
T: (08) 9420 2076

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Friday, 12 October 2012 8:13 AM
To: Mark Busher
Subject: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Mark,

My name is Denise Hare and I am a civil engineer working on the subdivision of Lots 55 & 56 Cottonwood Crescent Dianella. As part of the works, we have been engaged to undertake a feasibility study into the proposed subdivision. Please find attached a proposed plan for the subdivision.

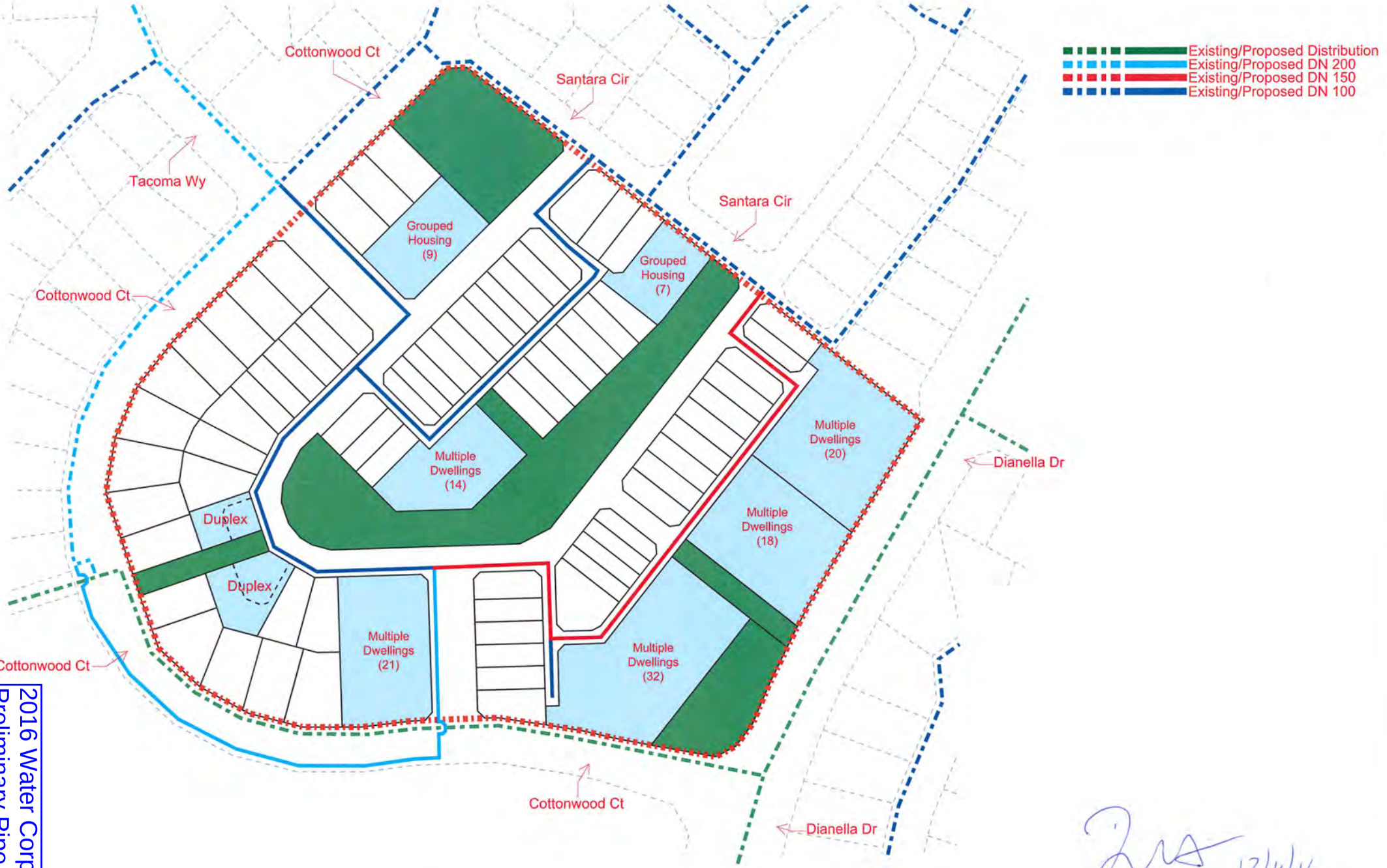
I have submitted a Dial before You Dig request for the region and have attached this for your information. Could you please advise whether the water infrastructure in the vicinity of the proposed development is capable of providing reticulated water supply to the proposed subdivision and where the closest sewer connection capable of serving the proposed development is located?

Thank you for your assistance.

Please don't hesitate to call me if you have any queries.

Regards

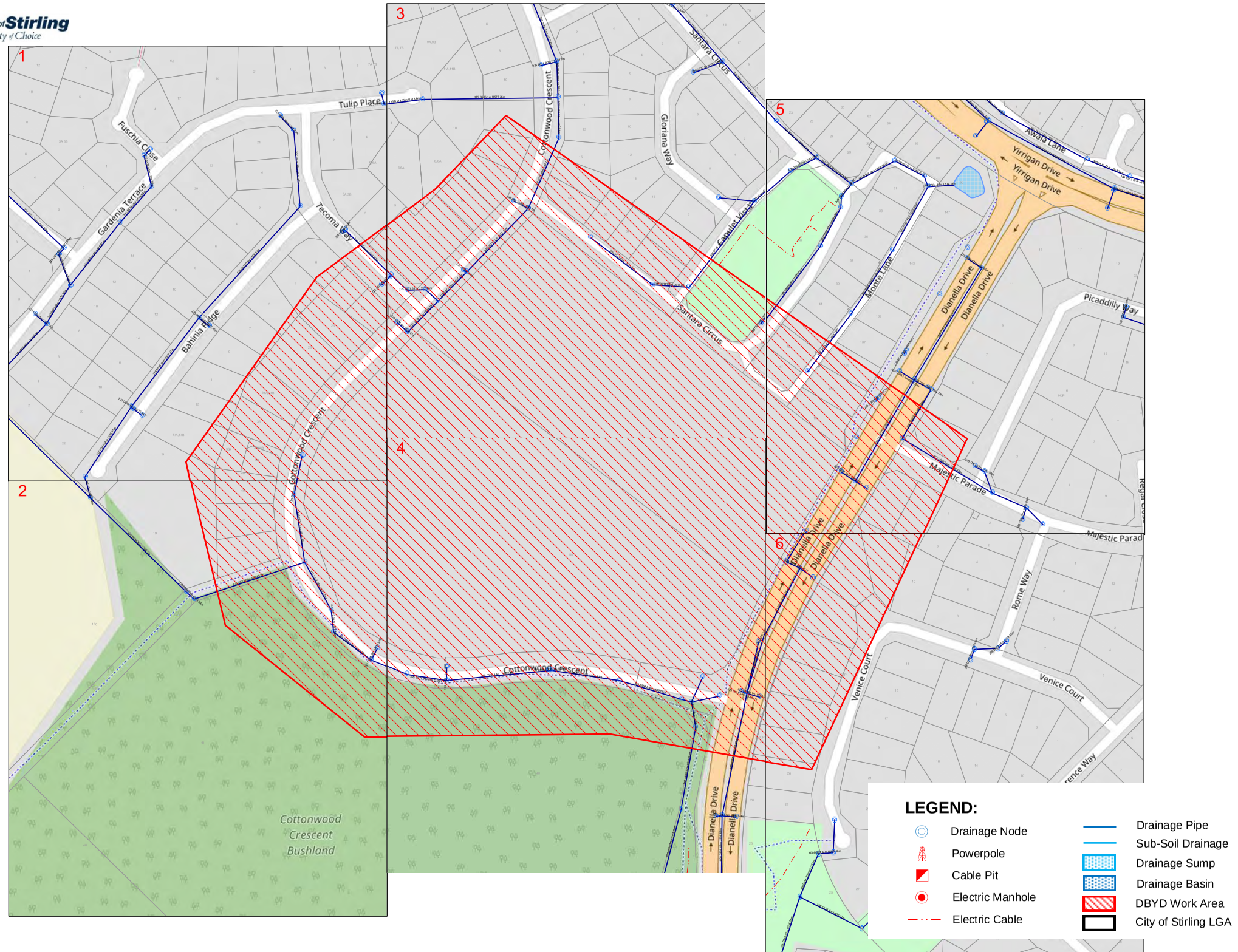
Denise Hare
Civil Engineer
Pritchard Francis
Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
Email: denise.h@pfeng.com.au
Website: www.pfeng.com.au
Level 1, 430 Roberts Road,
PO Box 2150, Subiaco 6904


Existing/Proposed Distribution
Existing/Proposed DN 200
Existing/Proposed DN 150
Existing/Proposed DN 100
Cottonwood Ct
Santara Cir
Tacoma Wy
Santara Cir
Grouped Housing (9)
Grouped Housing (7)
Cottonwood Ct
Multiple Dwellings (14)
Multiple Dwellings (20)
Dianella Dr
Duplex
Multiple Dwellings (18)
Duplex
Multiple Dwellings (21)
Multiple Dwellings (32)
Cottonwood Ct
Cottonwood Ct
Dianella Dr
2016 Water Corporation
Preliminary Pipe Layout.
13/4/16.

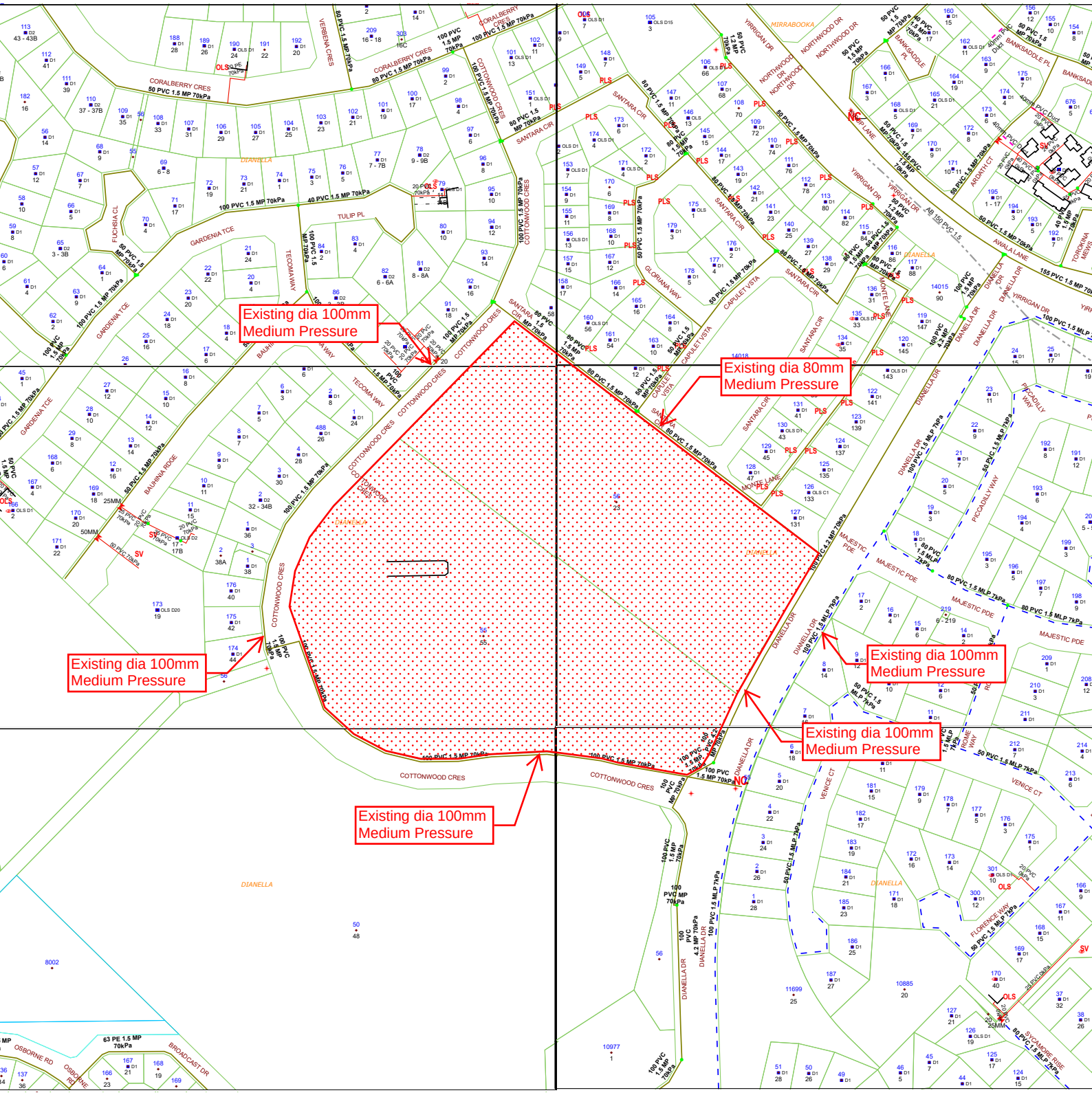
Appendix Eight: Stormwater Infrastructure

E 64.00 Existing Level
D 73.50 Proposed Level
65.00 Proposed Lot Level
Retaining Wall
Earthwork Step
Existing / Proposed Drainage
Existing / Proposed SEP
Existing / Proposed Gully Pit
Existing / Proposed Manhole

Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Proposed Stormwater
Scale:	1:2000 @ A4
Engineer:	Jamie De Palma
Date:	13 August 2019


1
2
3
4
5
6
Tulip Place
Fuschia Chase
Gardenia Terrace
Bahnia Ridge
Tecoma Way
Cottonwood Crescent
Gloriana Way
Santara Circus
Capulet Vista
Monte Lane
Awala Lane
Yirrigan Drive
Yirrigan Drive
Dianella Drive
Dianella Drive
Picaddilly Way
Majestic Parade
Majestic Parade
Rome Way
Venice Court
Venice Court
Cottonwood Crescent
Cottonwood Crescent Bushland
Dianella Drive
Dianella Drive
LEGEND:
Drainage Node
Powerpole
Cable Pit
Electric Manhole
Electric Cable
Drainage Pipe
Sub-Soil Drainage
Drainage Sump
Drainage Basin
DBYD Work Area
City of Stirling LGA

Appendix Nine: Existing Gas Infrastructure



NORTH

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Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Existing Gas
Scale:	NTS
Engineer:	Jamie De Palma
Date:	13 August 2019

Jamie De Palma

From: See, Mabel <Mabel.See@atco.com>
Sent: Tuesday, 30 July 2019 10:02 AM
To: ATCO Gas AU – Land Development; Maher, Lester
Cc: Elsheikh, Sam
Subject: RE: Lot 55 and 56 Cottonwood Crescent, Dianella

Hi Lester and Lewis,

I've received the email below from Jamie at Pritchard Francis. This is in response to their enquiry about ATCO's capability to provide for their 250 proposed residential dwellings at Lot 55 and 56 Cottonwood Crescent, Dianella.

Modelling for this proposed residential development was based on the following assumptions:

- 100% connection achieved by 2021
- Connection is via DN100 PVC MP main along Cottonwood Crescent and DN80PVC MP main along Santara Cir.
- This enquiry also takes into account previous development enquiry along Lots 1 & 2 Gay St, DIANELLA.
- The number of connections for this development is as shown below:
    - 250 x AL8 meters

Results
The MP network has the capacity to supply the proposed development from existing DN100PVC MP along Cottonwood Crescent and DN80PVC MP main along Santara Circuit. However a pressure adjustment for HN046 to 65KPa will be required. (There is no cost associated with the pressure change)

Please let me know if you require any additional information or have any questions.

Regards,

Mabel See
Asset Planning Engineer
Gas, Australia

E. mabel.see@atco.com
T. +61 8 6163 5042
A. 81 Prinsep Road, Jandakot WA 6164
W. atcogas.com.au

From: Jamie De Palma <jamie.d@pfeng.com.au>
Sent: Monday, 29 July 2019 2:04 PM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Cc: Maher, Lester <Lester.Maher@atco.com>; Pemberton, Chris <Chris.Pemberton@atco.com>; Asset Services <Asset.Services@atco.com>; See, Mabel <Mabel.See@atco.com>; Elsheikh, Sam <Sam.Elsheikh@atco.com>
Subject: Lot 55 and 56 Cottonwood Crescent, Dianella

Good afternoon,

Pritchard Francis have been engaged by Roberts Day to prepare an engineering services report for the residential development of Lot 55 and 56 Cottonwood Crescent Dianella, being the former Channel Ten studios site.

The proposed subdivision concept plan has been attached, which based on the proposed R-coding, will yield in the order of 250 dwellings.

Can ATCO Gas please advise whether the existing gas infrastructure (dia 100mm within Cottonwood Crescent, dia 80mm within Santara Crescent and dia 100mm within Daniella Drive) are adequately sized to cater for the proposed Structure Plan?

Jamie De Palma
Associate - Civil
BE (Hons) MIEAust CPEng NER

pritchard francis

T (08) 9382 5111
E jamie.d@pfeng.com.au | **W** www.pfeng.com.au
430 Roberts Road, Subiaco WA 6008 | PO Box 2150 Subiaco WA 6904

Jamie De Palma

From: Stubbs, Marc <Marc.Stubbs@atcogas.com.au>
Sent: Tuesday, 30 October 2012 3:28 PM
To: Denise Hare
Cc: Searle, Lewis; Lim, Sin Wei
Subject: FW: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella
Attachments: image005.jpg; image006.jpg

Hi Denise

Please see the message below that confirms that the existing medium pressure network abutting your development site has the capacity to service a subdivision of 161 dwellings.

I hope this is helpful, please contact me if you require further information.

Regards
Marc

Marc Stubbs
Business Development Representative
Telephone: (08) 6218 1746 Mobile: 0418 901 700

From: Lim, Sin Wei
Sent: Tuesday, 30 October 2012 3:21 PM
To: Stubbs, Marc; Searle, Lewis
Cc: Drawing Office
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Marc,

Sorry for the delay.

The existing medium pressure 100 PVC main will be able to supply gas to LOT 55 & 56 Cottonwood Cres, Dianella.

The modelling was based on a total 161 residential dwellings.

Regards,
Sin Wei

Sin Wei Lim
Asset Planning Engineer

Telephone: (08) 9499 7243

From: Stubbs, Marc
Sent: Tuesday, 30 October 2012 8:31 AM

To: Denise Hare; Searle, Lewis
Cc: Lim, Sin Wei; Drawing Office
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Denise

Our Asset Services Team are still assessing the best way of servicing this project. I will contact you as soon as I receive the results of their evaluation.

Regards
Marc

Marc Stubbs
Business Development Representative
Telephone: (08) 6218 1746 Mobile: 0418 901 700

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Monday, 29 October 2012 8:26 AM
To: Searle, Lewis
Cc: Stubbs, Marc; Lim, Sin Wei; Drawing Office
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Marc,

Could you please advise on the query below?

Regards

Denise Hare
Engineer - Civil
Pritchard Francis
Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
Email: denise.h@pfeng.com.au
Website: www.pfeng.com.au
Level 1, 430 Roberts Road,
PO Box 2150, Subiaco 6904

From: Searle, Lewis [mailto:Lewis.Searle@atcogas.com.au]
Sent: Monday, 22 October 2012 1:28 PM
To: Denise Hare
Cc: Stubbs, Marc; Lim, Sin Wei; Drawing Office
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella
Importance: High

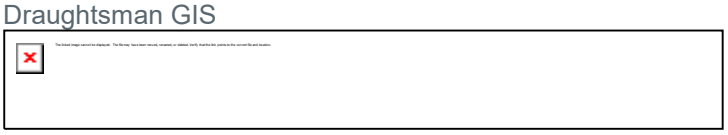
Hi Denise, apologies for the delay.

Please see attached .pdf of the project and it's vicinity within the Medium Pressure Netowrk. It is also roughly 1.2km from the High Pressure Network and I will have to ask our engineers here to decide which pressure will be appropriate to support this project.

Mark/Sin Wei, please can you let Denise know what ATCO's intentions will be in terms of which pressure we select and whether or not a capital contribution will be necessary ?

Thanks team, apologies again for the imposition.

Lewis Searle
Draughtsman GIS



Telephone: (08) 9499 7239 | Facsimile: (08) 6218 1705|

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Monday, 22 October 2012 8:59 AM
To: Searle, Lewis
Cc: Stubbs, Marc
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Lewis,

Can you please advise how you are progressing with this?

Regards

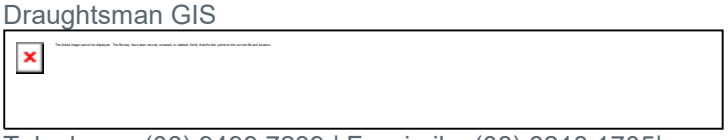
Denise Hare
Engineer - Civil
Pritchard Francis
Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
Email: denise.h@pfeng.com.au
Website: www.pfeng.com.au
Level 1, 430 Roberts Road,
PO Box 2150, Subiaco 6904

From: Searle, Lewis [mailto:Lewis.Searle@atcogas.com.au]
Sent: Wednesday, 17 October 2012 11:29 AM
To: Denise Hare
Cc: Stubbs, Marc
Subject: RE: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

HI Denise, we are extremely at the moment and have been inundated with requests, so apologies for not getting back to you sooner. I'll do my best to get to this by the end of the week.

Thanks very much

Lewis Searle
Draughtsman GIS



Telephone: (08) 9499 7239 | Facsimile: (08) 6218 1705|

From: Denise Hare [mailto:denise.h@pfeng.com.au]
Sent: Wednesday, 17 October 2012 11:11 AM
To: Searle, Lewis
Cc: Stubbs, Marc
Subject: FW: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Lewis,

Can you please advise how you are progressing with this?

Regards

Denise Hare
Civil Engineer
Pritchard Francis

Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
Email: denise.h@pfeng.com.au
Website: www.pfeng.com.au
Level 1, 430 Roberts Road,
PO Box 2150, Subiaco 6904

From: Denise Hare
Sent: Friday, 12 October 2012 8:14 AM
To: lewis.searle@atcogas.com.au
Subject: Subdivision of Lots 55 & 56 Cottonwood Crescent Dianella

Hi Lewis,

I am working on the subdivision of Lots 55 & 56 Cottonwood Crescent Dianella. As part of the works, we have been engaged to undertake a feasibility study into the proposed subdivision. Please find attached a proposed plan for the subdivision.

I have submitted a Dial before You Dig request for the region and have attached this for your information. Could you please advise whether the gas infrastructure in the vicinity of the proposed development is capable of providing reticulated water supply to the proposed subdivision and where the closest sewer connection capable of serving the proposed development is located?

Thank you for your assistance.

Please don't hesitate to call me if you have any queries.

Regards

Denise Hare
Civil Engineer
Pritchard Francis
Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
Email: denise.h@pfeng.com.au
Website: www.pfeng.com.au
Level 1, 430 Roberts Road,
PO Box 2150, Subiaco 6904

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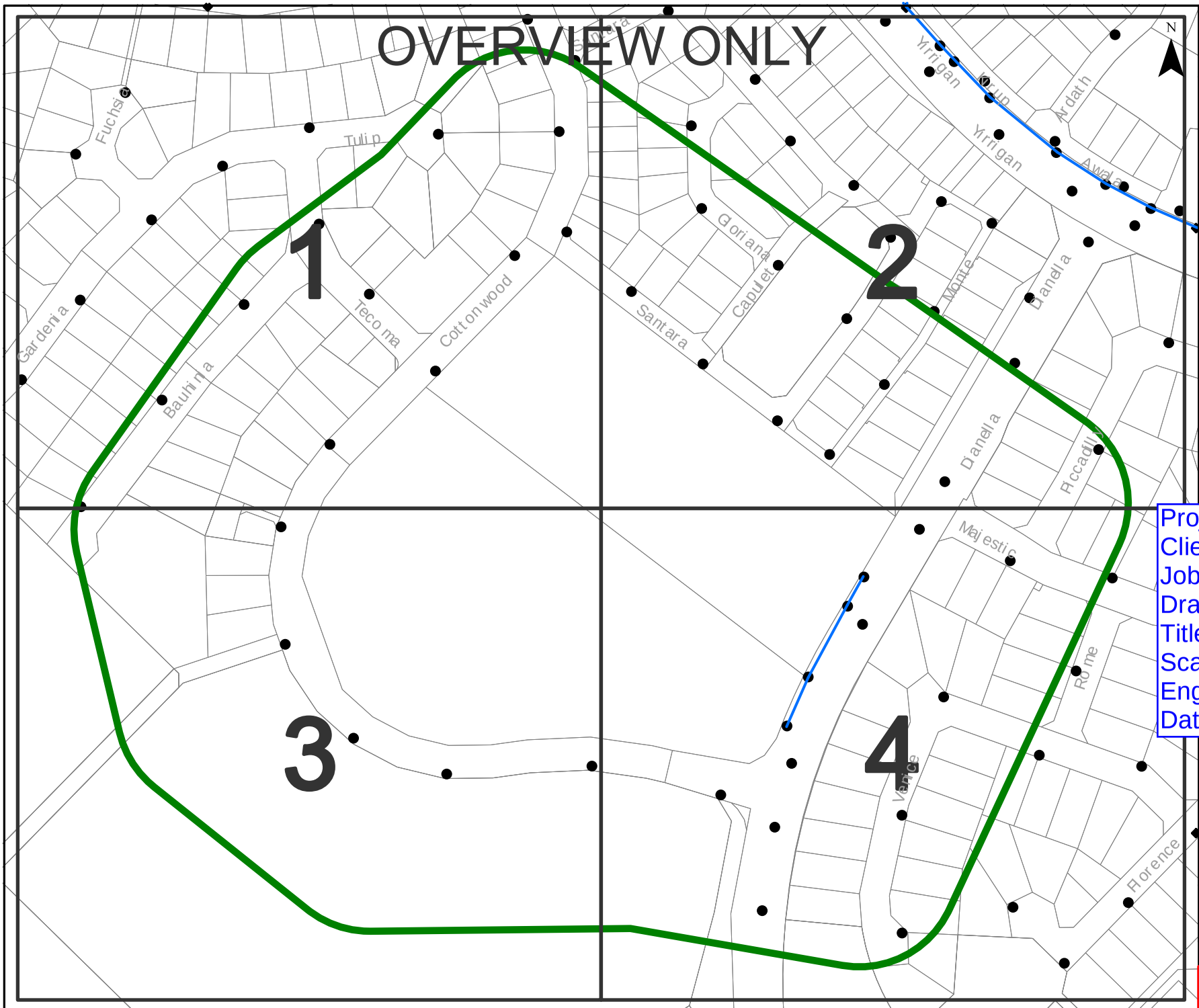
Appendix Ten: Existing Electrical Infrastructure



westernpower

OVERHEAD LEGEND

Structures

- Power Pole
- Transmission Poles

Transmission Overhead Powerline

- Transmission (33kV - 330kV)

Distribution Overhead Powerline

- High Voltage (1kV - 33kV)
- Low Voltage (< 1kV)

Proposed Construction Assets

- Design Area *
- High Voltage Overhead Powerline
- Low Voltage Overhead Powerline
- Power Pole

Communications Assets

- Overhead Pilot Cable

Feature

- Area of Interest

Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Existing Power
Scale:	NTS
Engineer:	Jamie De Palma
Date:	13 August 2019

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Check that you have enough clearance from the DANGER ZONES near overhead powerlines.

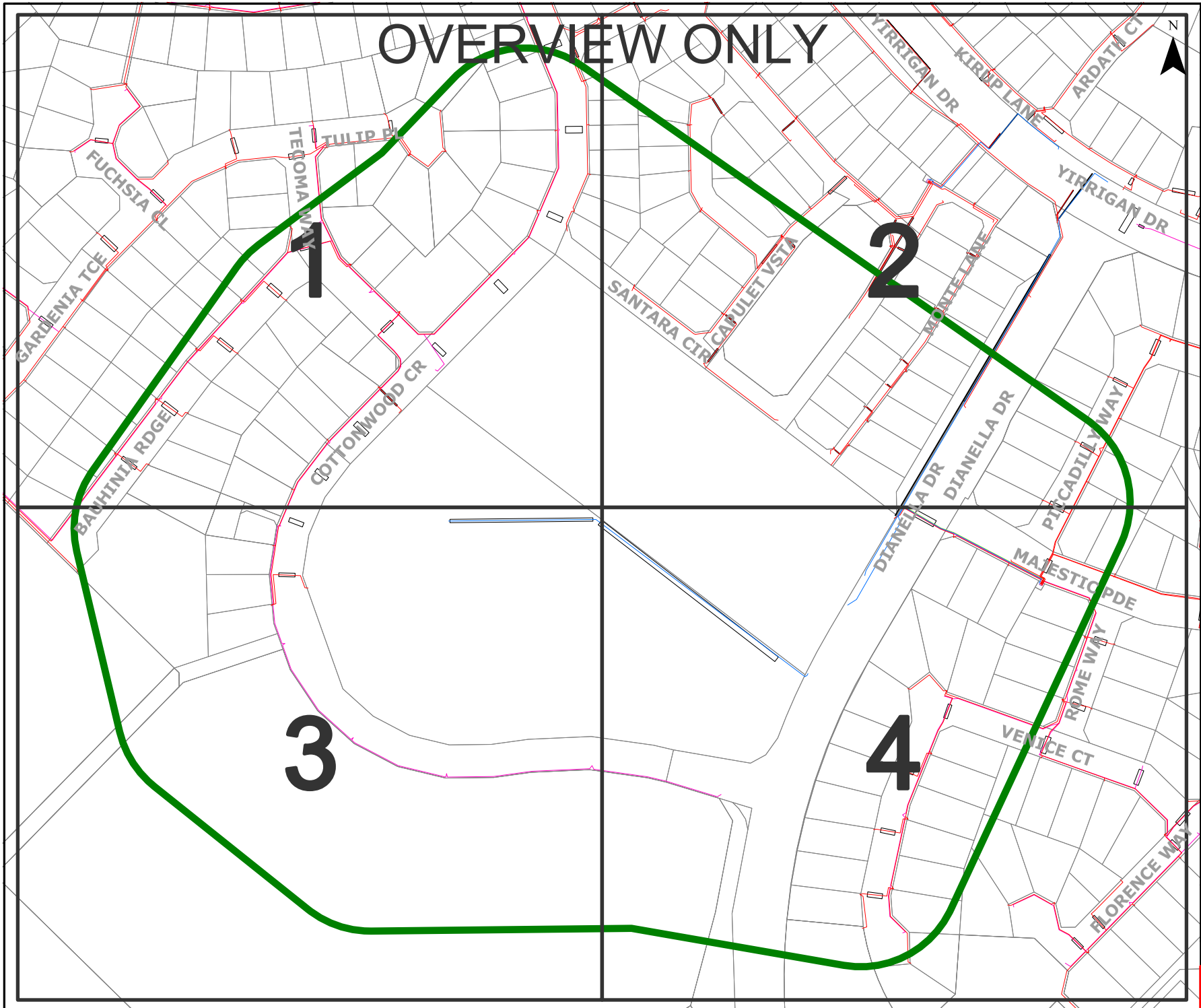
Telephone Support: 1300 769 345
Mon to Fri - 08:00 to 16:30

Information valid for 30 days from date of issue

A4 | Scale : 1:3075

WARNING! Look out for overhead power lines

Sequence Number: 86098463 | Date of Issue: 29/07/2019



westernpower

UNDERGROUND LEGEND

Structures

- Pillar
- Metal Pole
- Transformer Site
- UG Crossing *
- Ring Main Unit
- LV Distribution Frame

Distribution Cables

- High Voltage Cable (1kV - 33kV)
- Low Voltage Cable (< 1kV)
- Street Light Circuit (< 1kV)
- Street Light Pilot (< 1kV)
- Earth Wire

Cable Pole Terminations

- HV Termination
- LV Termination

Proposed Construction Assets

- Design Area *
- High Voltage Underground Cable
- Low Voltage Underground Cable
- Metal Pole
- Pillar
- Transformer site
- HV Termination
- LV Termination

State Underground Power Project

- CURRENT Work Area *
- COMPLETED Area *

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.

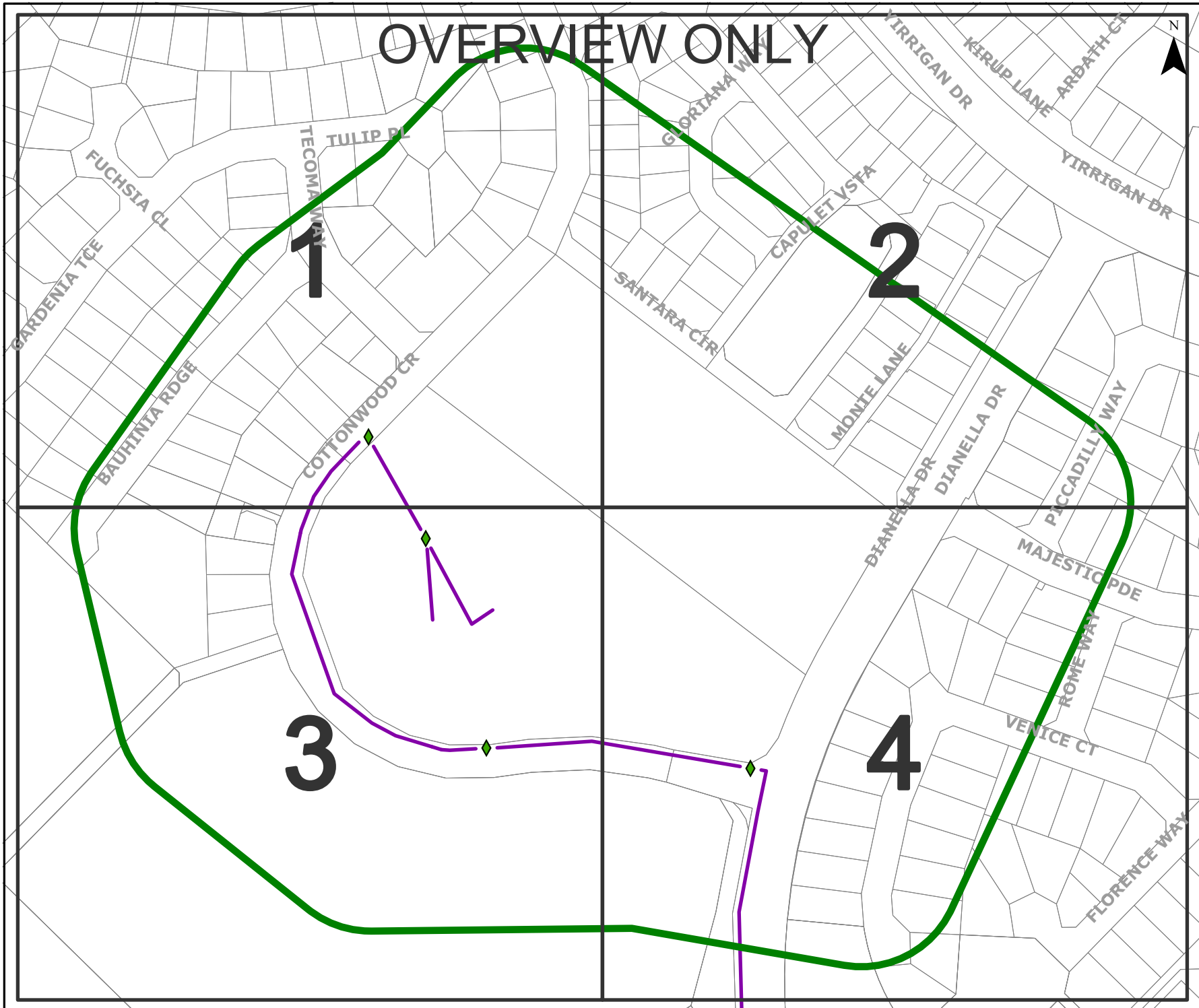
Telephone Support: 1300 769 345
Mon to Fri - 08:00 to 16:30

Information valid for 30 days from date of issue

A4 | Scale : 1:3075

WARNING! Look out for overhead power lines

Sequence Number: 86098463 | Date of Issue: 29/07/2019



westernpower

FIBRE NETWORK LEGEND

Communications Assets

- Fibre Network Pits
- 32mm Conduit
- 50mm Conduit
- 63mm Conduit
- 80mm Conduit
- 90mm Conduit
- 100mm Conduit
- 110mm Conduit
- Direct Buried (Bare Cables)
- Cable in Unused Gas Main

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.

Network Management Centre
Telephone: 1800 752 075
Mon to Fri - 08:00 to 16:30

Information valid for 30 days from date of issue

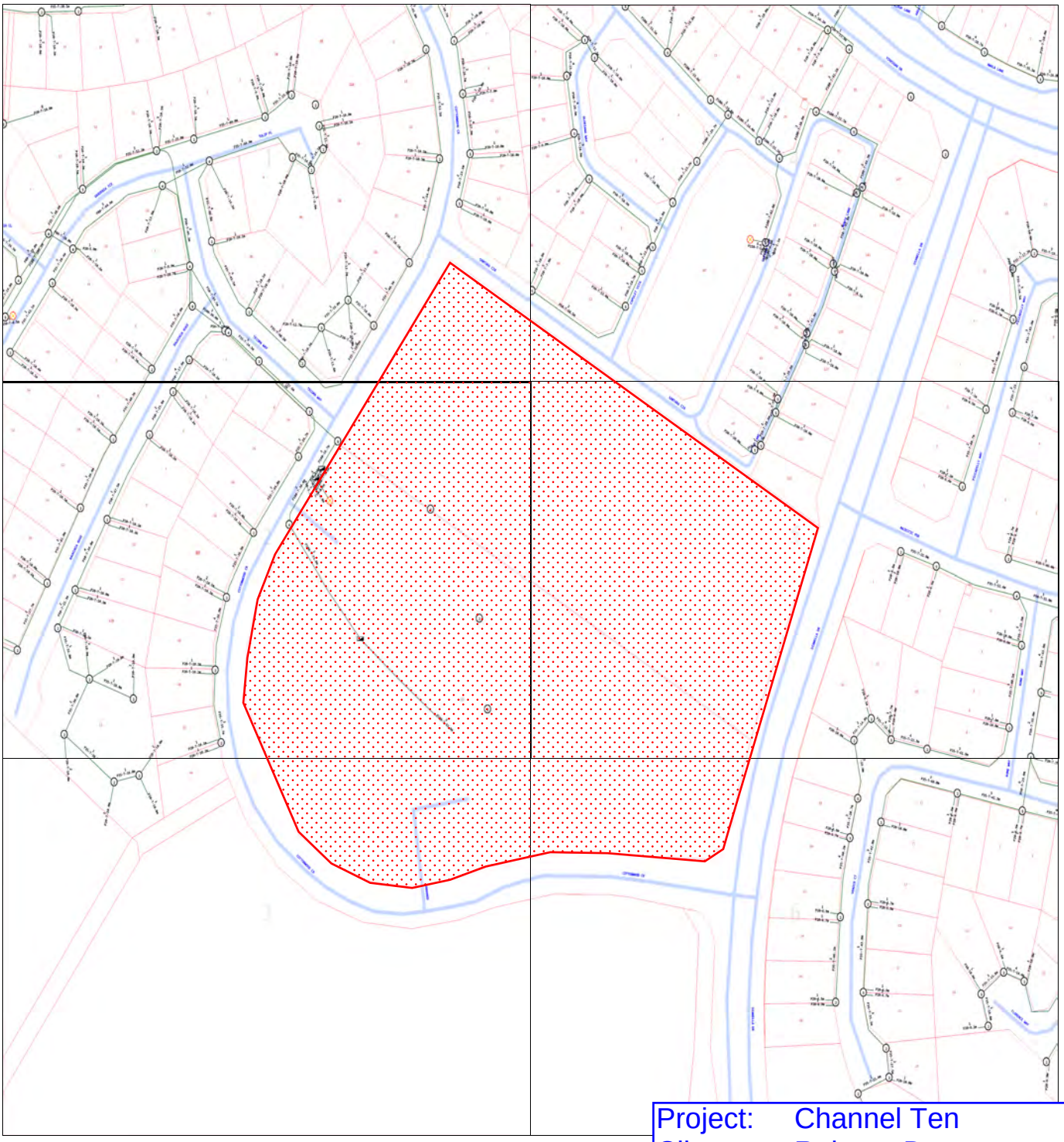
A4	Scale : 1:3075

WARNING! Look out for overhead power lines

Sequence Number: 86098463

Date of Issue: 29/07/2019

Appendix Eleven: Existing Communication Infrastructure



Project:	Channel Ten
Client:	Roberts Day
Job No:	19-209
Drawing:	
Title:	Existing Communications
Scale:	NTS
Engineer:	Jamie De Palma
Date:	13 August 2019

NORTH

DIAL BEFORE YOU DIG
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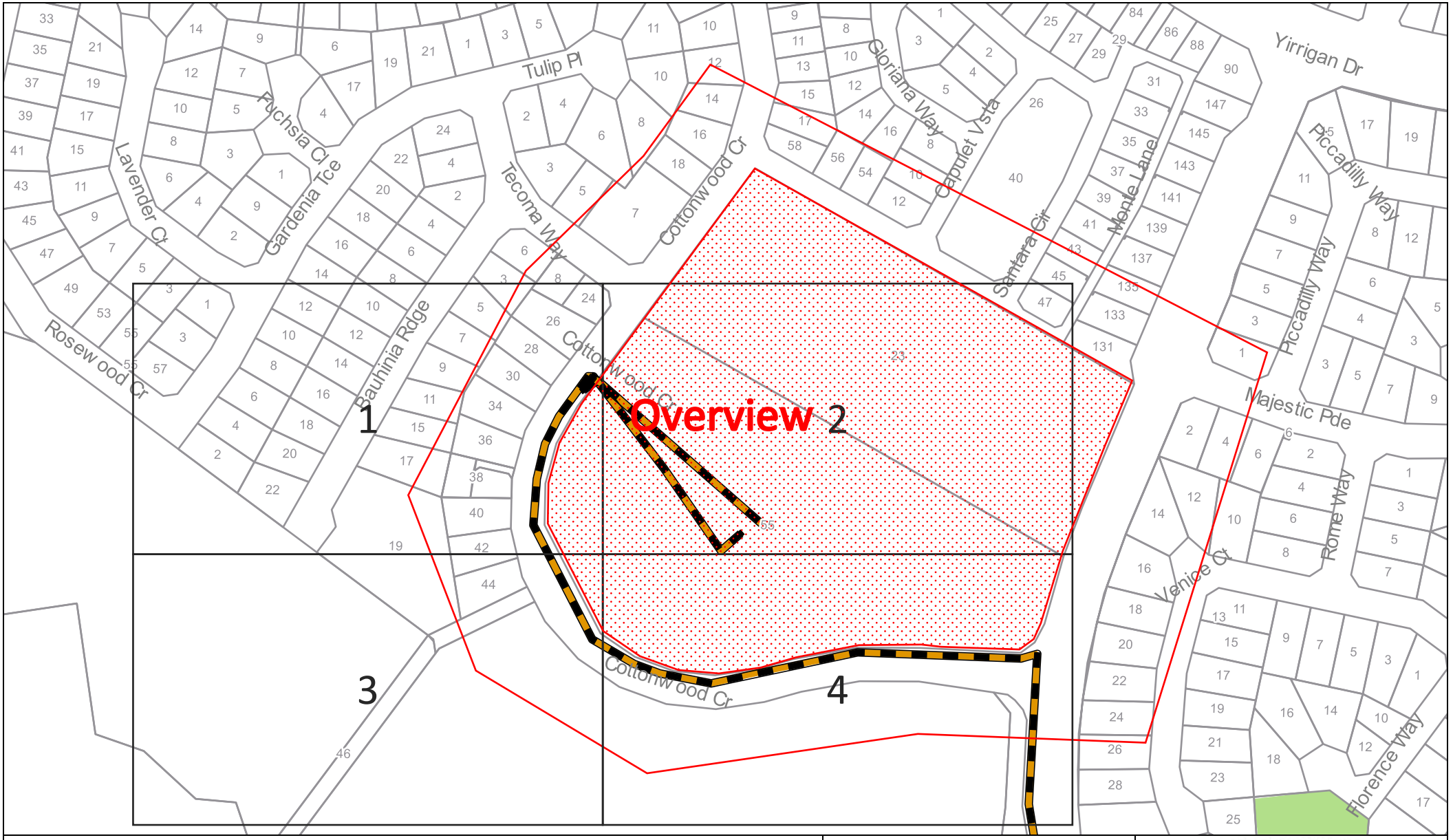


Sequence Number: 86098470

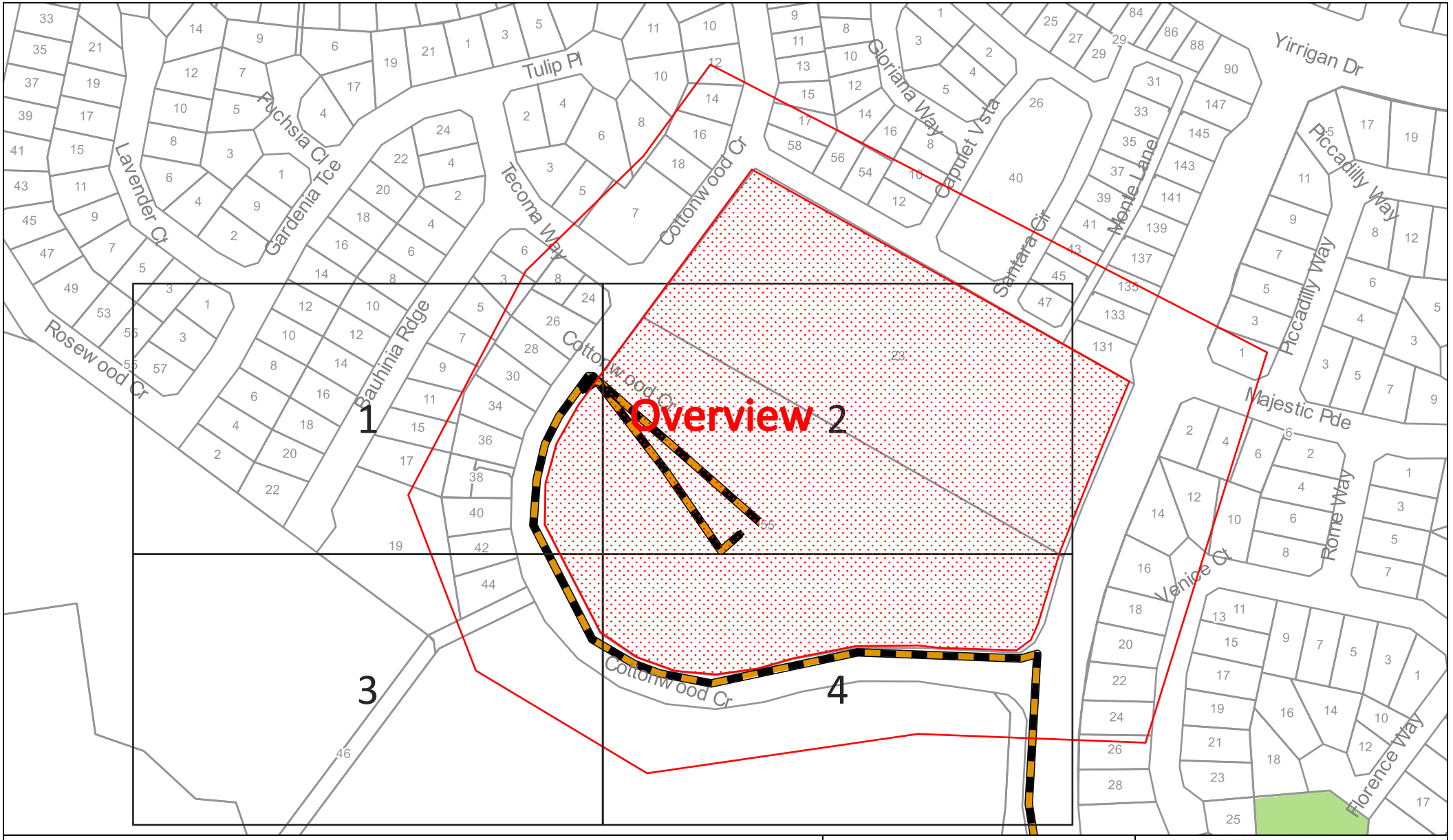
Date: 29/07/2019

DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.

nextgen GROUP

LEGEND

Digsite	Assets
Area	Cable
	3rd Party Duct
	Marker Post



Sequence Number: 86098470

Date: 29/07/2019

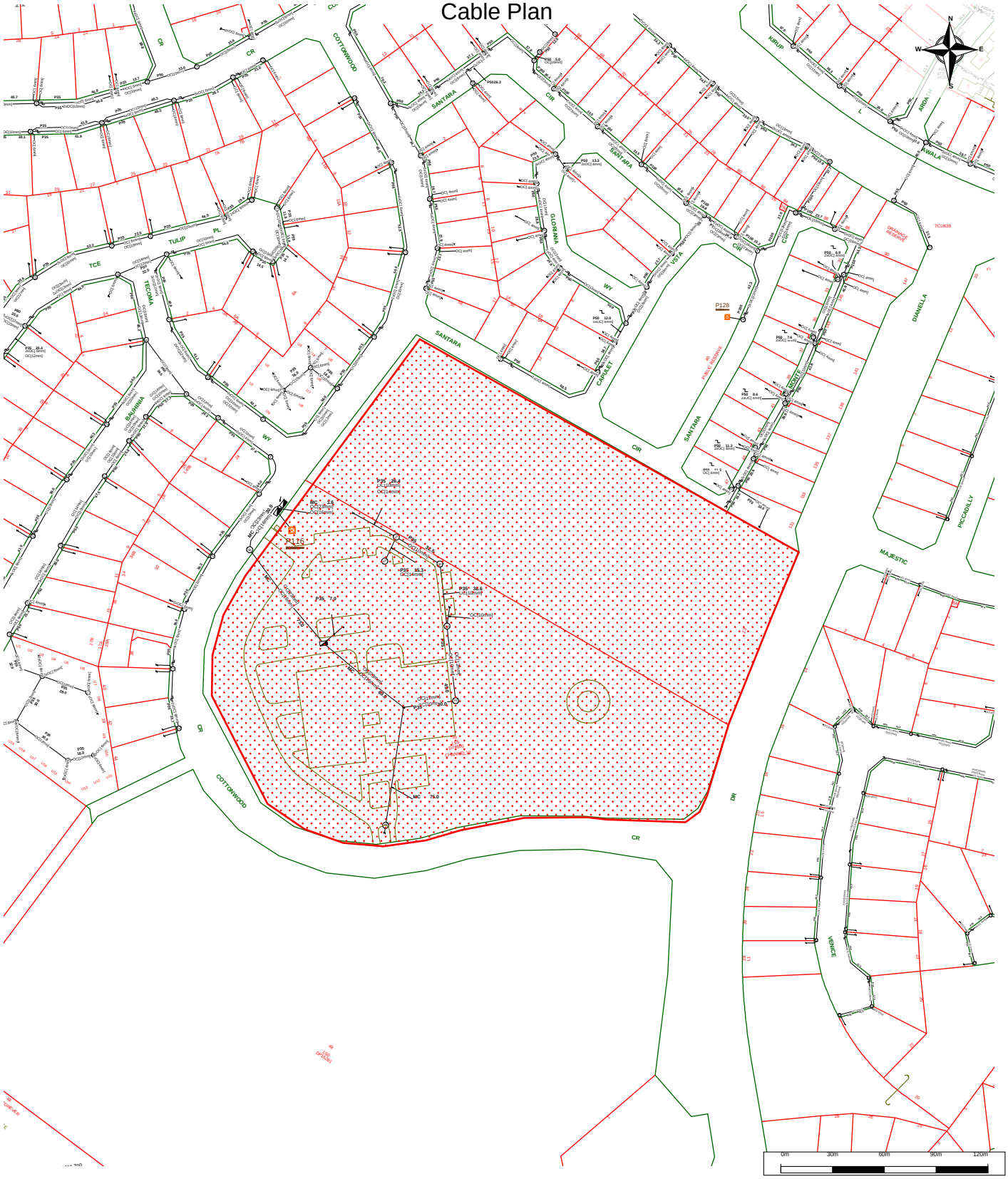
DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.

nextgen GROUP

LEGEND

Digsite	Assets
Area	Cable
	3rd Party Duct
	Marker Post

Cable Plan



For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)	Sequence Number: 86098466
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.
Generated On 29/07/2019 15:12:48	

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

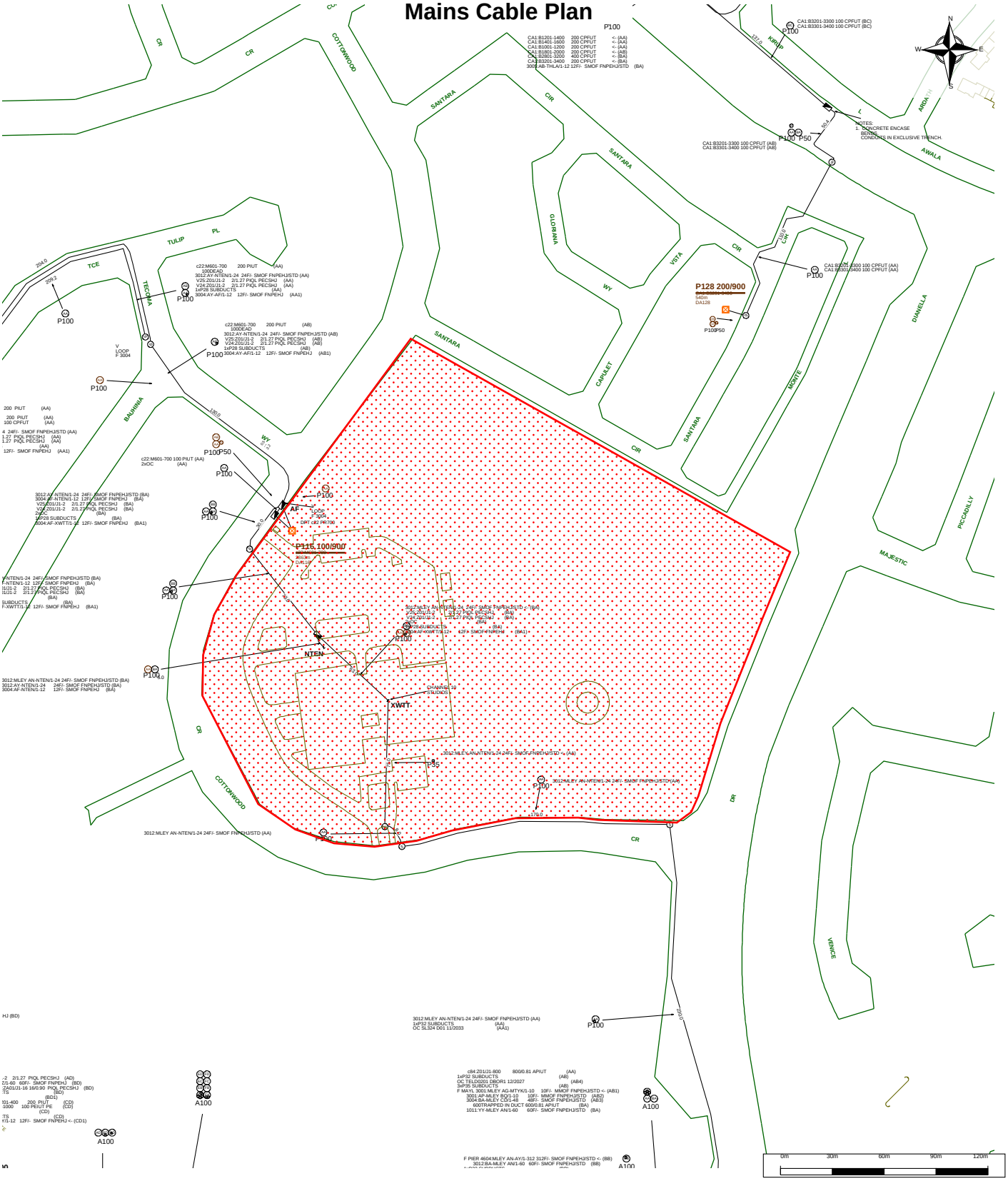
WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

Mains Cable Plan



Telstra	For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	
Generated On 29/07/2019 15:12:50	Sequence Number: 86098466
	CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

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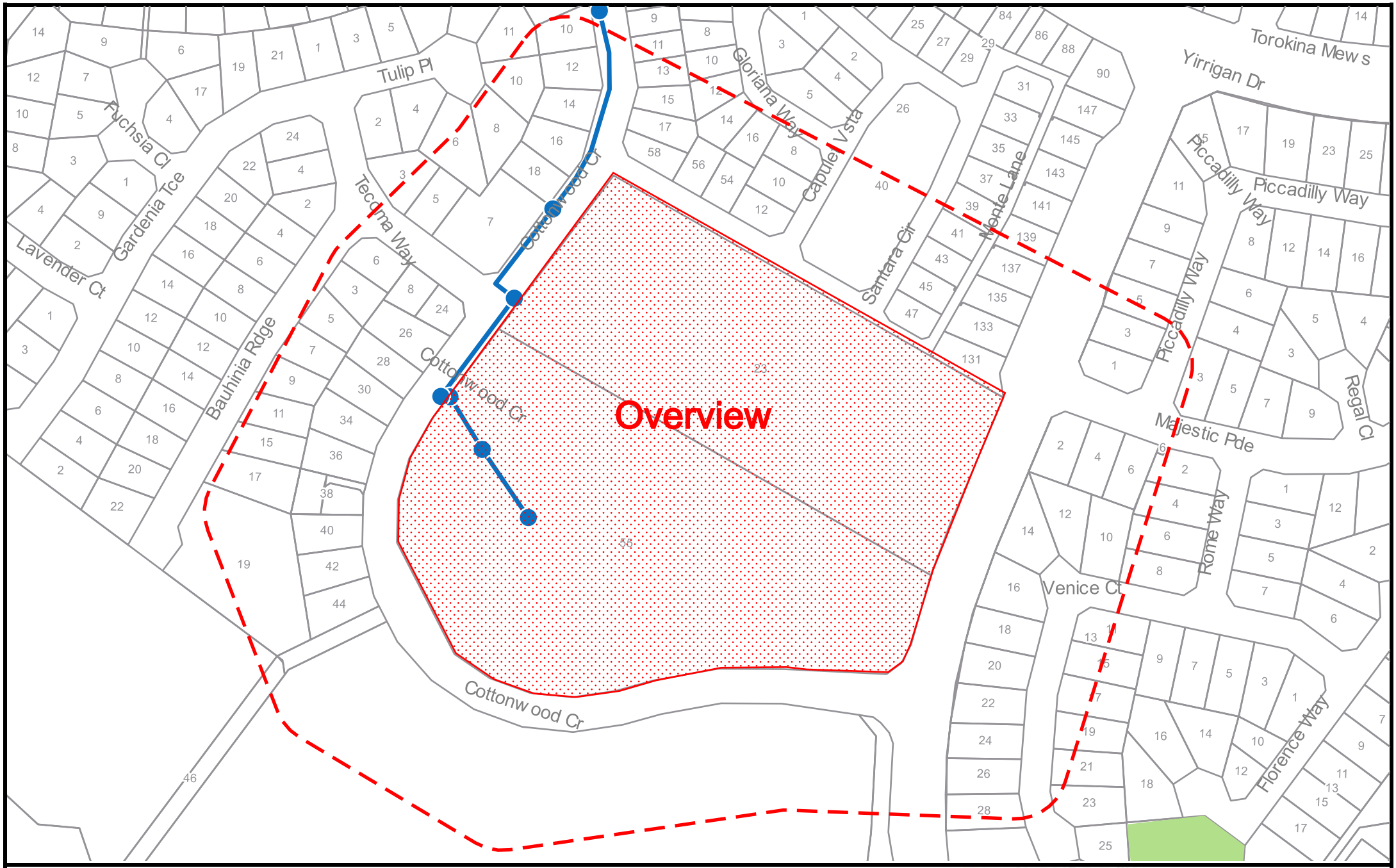


SEQUENCE NUMBER: 86098469
JOB NUMBER: 16736034
ADDRESS: Cottonwood Cres, Dianella, WA 6059

LEGEND
Vocus Group Pit
Vocus Group Conduit

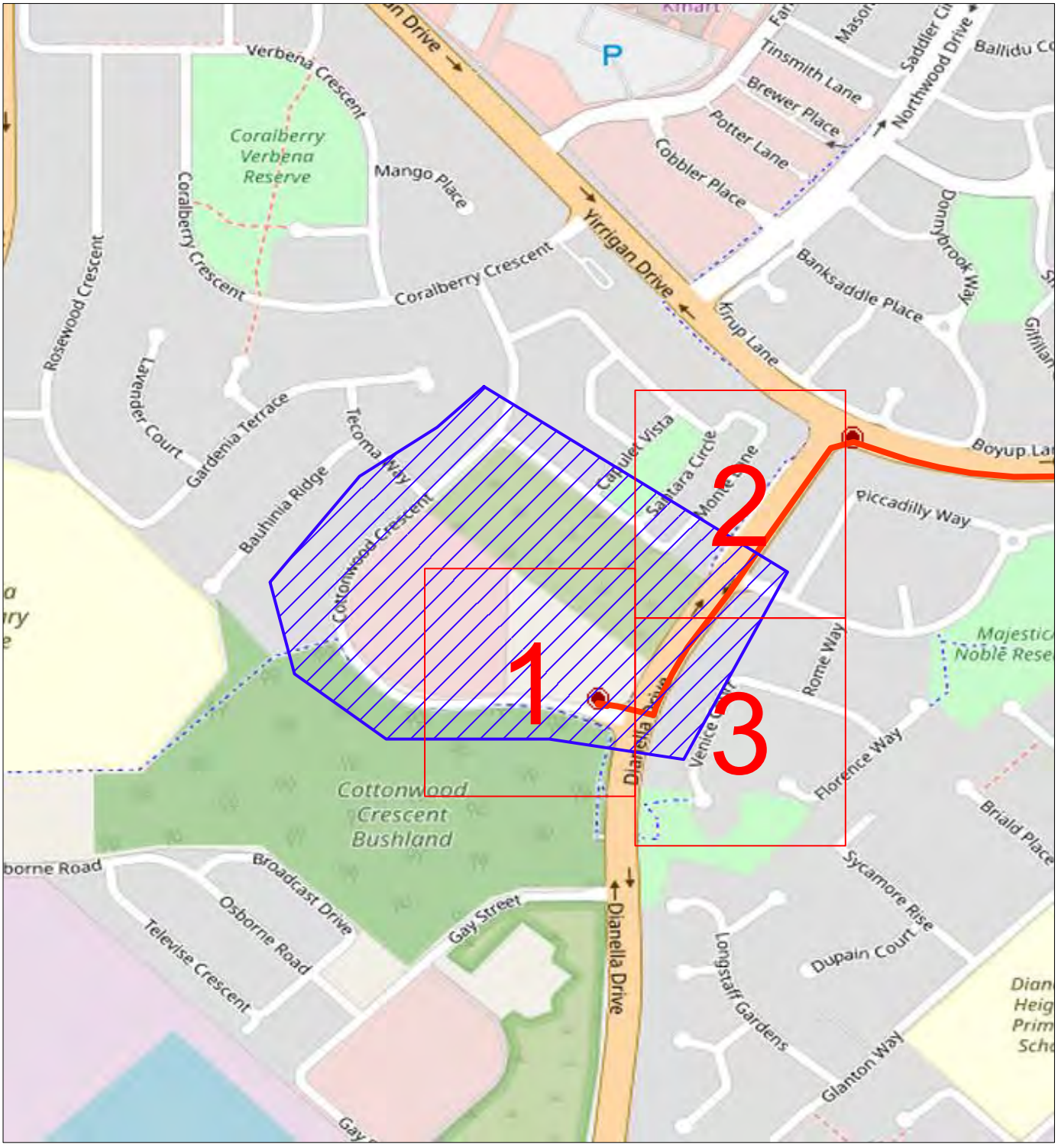
SCALE: 1:2779

Date: 29/07/2019

Overview Map

Sequence No: 86098472

Cottonwood Cres Dianella



N

0 0.06km

LEGEND:

Superloop Asset

Property Boundary

Affected DBYD Work Area

1 Detail Map

Background layer sourced from Open Street Maps

APPENDIX D
Bushfire Management Plan
Strategen

FPA AUSTRALIA | Fire Protection Association Australia | Life. Property. Environment.

BPAD Bushfire Planning & Design

Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference: Lots 55 and 56 Cottonwood Crescent

Suburb: Dianella **State:** WA **P/code:** 6059

Local government area: City of Stirling

Description of the planning proposal: Local Structure Plan

BMP Plan / Reference Number: RDP16001.01 **Version:** R001 Rev 3 **Date of Issue:** 5/11/2020

Client / Business Name: RobertsDay

Reason for referral to DFES	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 BPC elements)?	☐	☑
Is the proposal any of the following special development types (see SPP 3.7 for definitions)?		
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	☐	☑

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?
The Local Structure Plan submission is a strategic planning proposal

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Zac Cockerill	Level 2	37803	31/08/2021
Company		**Contact No.**	
Strategen-JBS&G		9792 4797	

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner  Date 5/11/2020

Bushfire Management Plan

Lots 55 & 56 Cottonwood Crescent, Dianella

Prepared for
Roberts Day
by Strategen-JBS&G

November 2020

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

www.jbsg.com.au

Bushfire Management Plan

Lots 55 & 56 Cottonwood Crescent, Dianella

Strategen-JBS&G is a trading name of
JBS&G Australia Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ABN: 62 100 220 479

November 2020

Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose. Strategen-JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by Strategen-JBS&G, and should not be relied upon by other parties, who should make their own enquiries.

Client: Roberts Day

Report Version	Revision No.	Purpose	Strategen-JBS&G author/reviewer	Submitted to Client	
				Form	Date
Draft Report	Rev A	For review by client	Z Cockerill / R Banks	Electronic (email)	23/03/2016
Final Report	Rev 0	Issued for use: to accompany LSP submission	Z Cockerill	Electronic (email)	24/05/2016
Final Report	Rev 1	Issued for use: to accompany revised LSP submission	Z Cockerill (BPAD 37803)	Electronic (email)	14/10/2016
Final Report	Rev 2	Issued for use: to accompany revised LSP submission	B Mastrangelo (BPAD 45985) / Z Cockerill (BPAD 37803)	Electronic (email)	25/10/2019
Final Report	**Rev 3**	**Issued for use: to address WAPC Schedule of Modifications**	**Z Cockerill (BPAD 37803)**	**Electronic (email)**	**5/11/2020**

Table of contents

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1. Introduction

1.1 Background

Roberts Day has prepared a Local Structure Plan (LSP) for Lots 55 and 56 Cottonwood Crescent, Dianella, hereon referred to as the project area, located in the City of Stirling. The LSP outlines proposed areas of residential development, Public Open Space (POS) and proposed internal roads. Figure 1 presents the proposed Local Structure Plan design, revised to address comments from Department of Environment (DoE) in relation to retention of on-site vegetation.

Due to the current extent of on-site and adjacent vegetation, the project area is designated as bushfire prone on the WA *Map of Bush Fire Prone Areas* (DFES 2019, see Plate 1). As a result, Strategen-JBS&G has prepared this Bushfire Management Plan (BMP) to inform strategic planning and fulfil the following key objective:

1. Accompany the proposed LSP submission to WAPC in order to meet planning requirements triggered under *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2017).

The following information is required to accompany the LSP as required under SPP 3.7 Policy Measure 6.3:

- where the lot layout of the proposal is known, a Bushfire Attack Level (BAL) contour map to determine the indicative acceptable BAL ratings across the subject site, in accordance with the Guidelines – refer to Section 3.3 and Figure 4.Figure 4
- identification of any bushfire hazard issues arising from the BAL contour map – refer to Section 3.4
- clear demonstration that compliance with the bushfire protection criteria in the Guidelines can be achieved in subsequent planning stages – refer to Section 5 and Table 3.

This BMP has been prepared in accordance with the Guidelines and addresses all of the above information requirements to satisfy SPP 3.7.

1.2 Purpose and application of the plan

The purpose of this BMP is to provide guidance on how to plan for and manage the bushfire risk to future assets of the project area through implementation of a range of bushfire management measures. The BMP outlines how future on-site assets can be protected from potential bushfire threat.

Plate 1: Bush Fire Prone Areas Map (DFES 2019)

Source: RobertsDay 2019

Figure 1: Revised Local Structure Plan design

2. Environmental considerations

2.1 Native vegetation – modification and clearing

A portion of the project area contains remnant vegetation, which will be partially cleared to facilitate the proposed urban residential land use. Lot 55 is highly degraded and already largely cleared from previous land uses/development. Lot 56 contains approximately 9182 m^2 of remnant Banksia woodland in excellent condition, of which approximately 7610 m^2 will be retained within POS 1 and 1572 m^2 will be cleared as per the approved POS plan contained in Appendix 1.

Table 1 provides a summary of a search of publicly available environmental data.

Table 1: Summary of environmental values

Environmental value	Not Mapped as occurring within or adjacent to project area	Mapped as occurring within or adjacent to the project area		Description
		Within	Adjacent	
Environmentally Sensitive Area			✓	An Environmentally Sensitive Area occurs immediately to the south of the project area, associated with Cottonwood Reserve.
Swan Bioplan Regionally Significant Natural Area	✓			N/A
Ecological linkages		✓	✓	A Perth Regional Ecological Linkage occurs both within, and adjacent to the project area.
Wetlands	✓			N/A
Waterways	✓			N/A
Threatened Ecological Communities listed under the EPBC Act		✓	✓	A Threatened Ecological Community is mapped as occurring within and adjacent to the project area, this being the Banksia Woodlands of the Swan Coastal Plain, which is mapped as likely to occur within and adjacent to the project area.
Threatened and priority flora	✓			N/A
Fauna habitat listed under the EPBC Act		✓	✓	Potential Quenda habitat is mapped as occurring in the northern portion of the project area as well as immediately to the south as part of Cottonwood Reserve. A pocket of potential Quenda habitat is mapped as occurring 400 m to the northeast of the project area. With respect to Carnaby's Black Cockatoo, the project area is mapped as containing: 1. Possible breeding areas 2. Confirmed roosting areas (buffered) 3. Potential feeding areas (northern portion).
Threatened and priority fauna			✓	A Threatened Fauna species is mapped as occurring 200 m to the south of the project area.
Bush Forever Site			✓	Cottonwood Reserve located immediately south of the project area is mapped as Bush Forever Reserve No. 43.

Environmental value	Not Mapped as occurring within or adjacent to project area	Mapped as occurring within or adjacent to the project area		Description
		Within	Adjacent	
DBCA managed lands and waters (includes legislated lands and waters and lands of interest)	✓			N/A
Conservation covenants	✓			N/A

Strategen-JBS&G understands that agreement with DoE on a final design, as per Figure 1, has resulted in a 'Not a controlled action' decision. All other relevant environmental approvals for clearing of native vegetation will be sought as part of future planning stages.

2.2 Revegetation / landscaping plans

No revegetation is proposed as part of the proposal; however, approximately 7610m^2 of Banksia woodland will be retained within POS 1 as per Appendix 1. This vegetation retention will not trigger BAL impacts due to being excludable under Clause 2.2.3.2 (b) of AS 3959 as being less than 1 ha in size and greater than 100 m from any other vegetation being classified vegetation.

POS 1 will also contain approximately 5310 m^2 of low threat managed (non-conservation) open space. POS 2 will contain approximately 2359 m^2 of low threat managed vegetation for drainage purposes. These spaces will be established as low threat vegetation and non-vegetated areas under Clauses 2.2.3.2 (e) and (f) of AS 3959 and maintained in this state initially by the developer, then by the City (refer to City agreement in Appendix 6). These exclusions will need to be reflected as part of detailed landscape design and engineering plans.

3. Spatial consideration of bushfire threat

3.1 Existing site characteristics

3.1.1 Location

The project area comprises approximately 7.01 ha consisting of Lots 55 and 56 Cottonwood Crescent, Dianella, located in the City of Stirling (Figure 2). The project area is bound by existing urban residential development to the north, east and west. Cottonwood Crescent Conservation Reserve (Bush Forever Site 43) is located to the south opposite Cottonwood Crescent (Figure 2).

3.1.2 Zoning and land use

The project area is currently zoned 'Residential Development' under provisions of the City of Stirling Local Planning Scheme No 3 (LPS No. 3). Lot 55 was the location of previous Network 10 operations but is currently vacant land and Lot 56 is undeveloped.

3.1.3 Assets

Lot 56 contains remnant Banksia woodland vegetation, of which approximately 9182 m^2 was assessed to be in excellent condition. There are no existing life or property assets present throughout the project area given the undeveloped nature of the site.

3.1.4 Access

The project area is currently accessed via Cottonwood Crescent in the south and west. Existing firebreaks and access trails occur throughout the Lot 56 bushland component.

3.1.5 Water and power supply

Reticulated water and underground power supply infrastructure and services are available to the site from adjacent areas of residential development.

Legend:

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- Bush Forever site
- Roads

Scale 1:3,750 at A4 — 0 50 100 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57209

Client: Roberts Day

Version: A | Date: 25-Oct-2019

Drawn By: cthatcher | Checked By: CT

Channel 10 Dianella

SITE OVERVIEW

FIGURE 2

strategen JBS&G

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Roberts Day\57209 Channel 10 Dianella BMP update (RDP16001.01)\GIS\Maps\R01 Rev A\57209_02_SiteOverview.mxd
Image Reference: www.nearmap.com© - Imagery Date: 16 July 2019.

3.2 Post-development fire environment

3.2.1 Vegetation classifications

Strategen-JBS&G assessed vegetation classifications within the project area and adjacent 150 m through on-ground assessment on 1 September 2014 and reassessment on 28 September 2016 in accordance with methodology outlined in *AS 3959–2018 Construction of Buildings in Bushfire-Prone Areas* (AS 3959–2018; SA 2018). Upon analysis of the latest available aerial imagery (dated 17 July 2019), on-site and adjacent conditions have not materially changed and are consistent with previous assessment results.

A vegetation classification map has been developed on the basis of the latest assessment (refer to Figure 3), which includes identification of the post-development vegetation extent, identification of any exclusions under AS 3959 and the location and direction of site photographs.

Given the level of proposed clearing within the project area required to accommodate residential development, only one area of post-development vegetation was classified as follows (refer also to Figure 3):

- Class B woodland within Cottonwood Crescent Conservation Reserve (Bush Forever Site 43) to the south (refer to Plate 2, Plate 4, Plate 7 and Plate 8).

All remaining areas within the project area and adjacent 150 m will, following development of the site, be excluded under Clause 2.2.3.2 of AS 3959. These areas are summarised as follows:

- proposed retention of approximately 7610 m^2 of vegetation within POS 1 (as per Appendix 1) will be excluded from classification in accordance with Clause 2.2.3.2 (b) of AS 3959, as it will be a single area of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified (Plate 10)
- remaining areas throughout POS 1 (non-conservation, approximately 5310 m^2) and the entirety of POS 2 (approximately 2359 m^2), as shown in Appendix 1, will be excluded from classification in accordance with Clauses 2.2.3.2 (e) and (f) of AS 3959 (refer to Appendix 6 for City agreement to maintain POS 2 in a low threat state following handover)
- road verges and streetscaping will be excluded from classification in accordance with Clauses 2.2.3.2 (e) and (f) of AS 3959, as they are currently, or will be prior to development, maintained public reserves and parklands predominantly cleared of vegetation and regularly managed in a low threat state (Plate 3, Plate 5, Plate 6, Plate 14)
- the proposed residential built footprint, roads and paths will be excluded from classification in accordance with Clause 2.2.3.2 (e) of AS 3959, as this land is either currently devoid of vegetation or proposed to be cleared in whole prior to building construction and will be a non-vegetated area (Plate 9, Plate 11, Plate 12 and Plate 13).

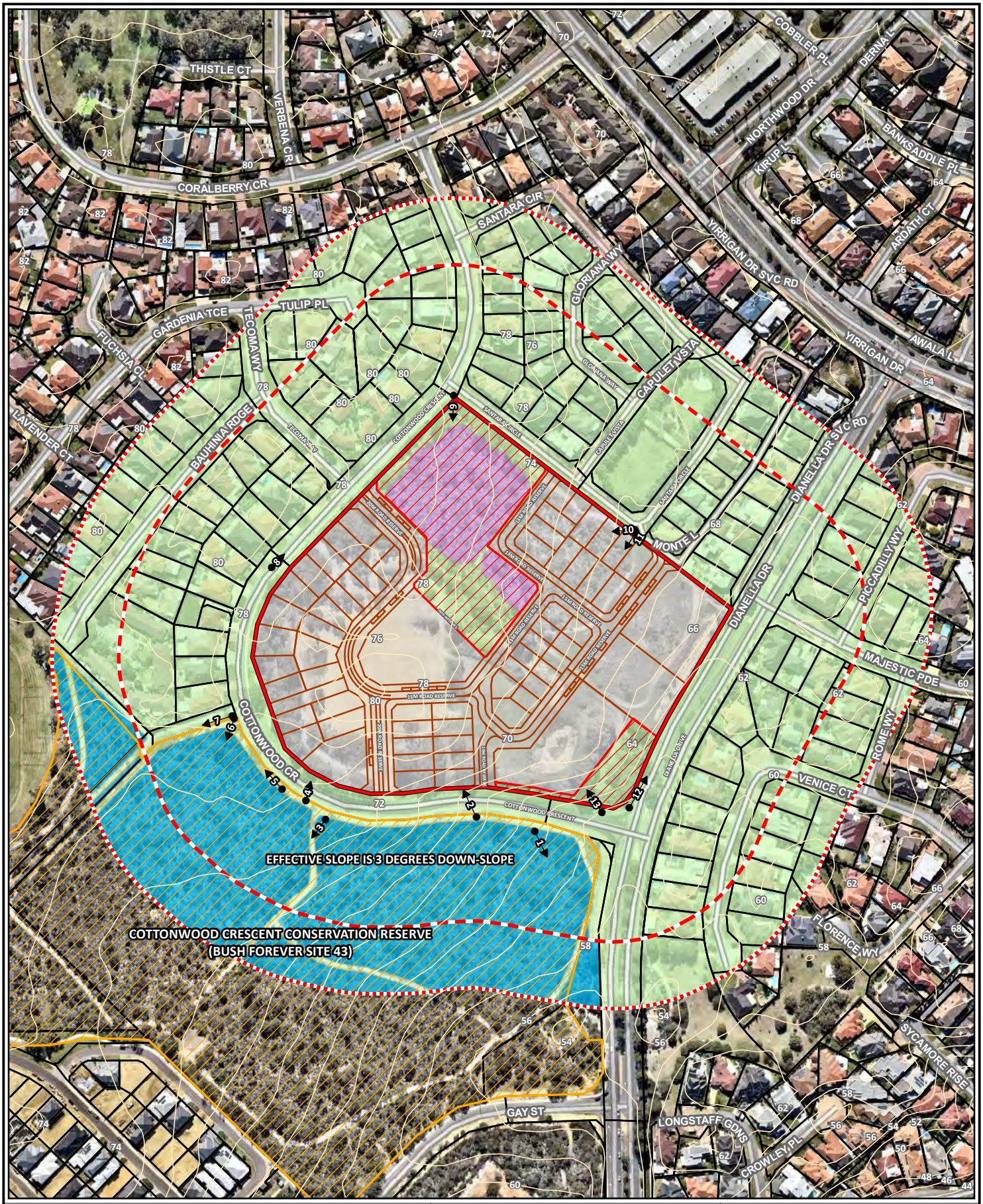
This information has been used to inform a BAL contour assessment for the project area (refer to Section 3.3).

3.2.2 Effective slope

Strategen-JBS&G assessed effective slope under the abovementioned classified vegetation through on-ground assessment on 1 September 2014 and reassessment on 28 September 2016 in accordance with methodology outlined in AS 3959.

Topographic elevation throughout areas of Class B woodland within Cottonwood Crescent Conservation Reserve to the south ranges from approximately 59 mAHD in the southeast to approximately 77 mAHD in the northwest. This equates to a slope of approximately 3 degrees under vegetation, which attracts an effective slope designation of 0–5 degrees and the vegetation is down-slope. Assessment results are depicted in Figure 3 and supported by topographic contours of the site and adjacent land.

This information has been used to inform a BAL contour assessment for the project area (refer to Section 3.3).



Legend:

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- POS/drainage
- Bush Forever site (DOP)

Vegetation class

- Class B Woodland
- Clause 2.2.3.2 (b)
- Clause 2.2.3.2 (e) & (f)
- Area to be modified to low threat
- Proposed layout
- Photo point directions
- Roads

Scale 1:3,750 at A4

0 25 50 75 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57209

Client: Roberts Day

Version: A | Date: 25-Oct-2019

Drawn By: cthatcher | Checked By: BM

Channel 10 Dianella

POST-DEVELOPMENT VEGETATION CLASSIFICATION AND EFFECTIVE SLOPE

FIGURE 3

strategen JBS&G

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Roberts Day\57209 Channel 10 Dianella BMP update (RDP16001.01)\GIS\Maps\R01 Rev A\57209_03_PostVegSlope.mxd
Image Reference: www.nearmap.com© - Imagery Date: 17 July 2019.

Plate 2: Photo Point 1: Class B woodland adjacent south of project area within Cottonwood Crescent Conservation Reserve (background) and interfacing limestone access (foreground)

Plate 3: Photo Point 2: Low threat vegetation (managed road verge) in foreground excluded under Clause 2.2.3.2 (f) within Cottonwood Crescent road reserve and future development site in background to be cleared

Plate 4: Photo Point 3: Class B woodland adjacent south of project area within Cottonwood Crescent Conservation Reserve either side of limestone access

Plate 5: Photo Point 4: Low threat vegetation (managed road verge) in foreground excluded under Clause 2.2.3.2 (f) within Cottonwood Crescent road reserve and future development site in background to be cleared

Plate 6: Photo Point 5: Low threat vegetation (managed road verge) excluded under Clause 2.2.3.2 (f) within Cottonwood Crescent road reserve

Plate 7: Photo Point 6: Class B woodland adjacent south of project area within Cottonwood Crescent Conservation Reserve (background) and interfacing limestone access and concrete path (foreground)

Plate 8: Photo Point 7: Class B woodland adjacent south of project area within Cottonwood Crescent Conservation Reserve (left of shot) and interfacing limestone access and concrete path (right of shot)

Plate 9: Photo Point 8: Non-vegetated area (sealed road) excluded under Clause 2.2.3.2 (e) within Cottonwood Crescent road reserve and future development site (right of shot) to be cleared

Plate 10: Photo Point 9: Proposed POS reserve with tree retention in northwest portion of site excluded under Clause 2.2.3.2 (b)

Plate 11: Photo Point 10: Future development site to be cleared

Plate 12: Photo Point 11: Future development site to be cleared

Plate 13: Photo Point 12: Non-vegetated area (sealed road) excluded under Clause 2.2.3.2 (e) within Dianella Drive road reserve and future development site (left of shot) to be cleared

Plate 14: Photo Point 13: Proposed POS drainage reserve in southeast portion of site excluded under Clause 2.2.3.2 (f)

3.3 BAL contour assessment

Strategen-JBS&G has undertaken a BAL contour assessment in accordance with the Method 1 procedure outlined in AS 3959 to identify the indicative BAL impact over the project area. The BAL contour assessment is based on post-development conditions in line with indicative lot layout.

The Method 1 procedure for calculating BAL contours incorporates assessment of the following parameters, as outlined in the following subsections.

- state-adopted FDI rating
- vegetation classification
- effective slope
- distance maintained between proposed development areas and the classified vegetation.

3.3.1 Fire Danger Index

A blanket rating of FDI 80 is adopted for Western Australian environments, as outlined in AS 3959 and endorsed by Australasian Fire and Emergency Service Authorities Council.

3.3.2 Vegetation classification

Vegetation classification is described in Section 3.2.1 (Figure 3) and consists of Class B woodland.

3.3.3 Effective slope

Effective slope under classified vegetation is described in Section 3.2.2 (Figure 3). Effective slope is 0–5 degrees and the vegetation is down-slope.

3.3.4 Distance between proposed development areas and the classified vegetation

Strategen-JBS&G has assessed the minimum separation distance between proposed development areas and the classified vegetation extent to the south to be 25 m, consisting of 20 m wide Cottonwood Crescent road reserve and 5 m wide limestone access/firebreak within Cottonwood Crescent Conservation Reserve.

3.3.5 Method 1 BAL calculation

A Method 1 BAL calculation has been completed for this site in accordance with AS 3959 (Table 2). The resulting BAL contours give an indication of the levels of bushfire attack (i.e. the radiant heat flux) that may be received by proposed development areas and this can inform the standard of building construction required for proposed dwellings to potentially withstand such impacts.

The assessed BAL contours for the site are depicted in Figure 4. All proposed lots situated beyond 100 m from classified vegetation are considered to be BAL–Low, where there is insufficient risk to warrant specific building construction requirements.

Table 2: Method 1 BAL calculation

Classified vegetation	Effective slope	Hazard separation distance	BAL rating	Comment
Class B woodland	Down-slope >0–5 degrees	<13 m	BAL–FZ	No development is proposed in this area
		13–<17	BAL–40	No development is proposed in this area
		17–<25	BAL–29	No development is proposed in this area
		25–<35	BAL–19	Proposed development may occur in this area
		35–<100	BAL–12.5	Proposed development will occur in this area

3.4 Bushfire context and identification of bushfire hazard issues

There is no evidence of recent bushfire occurrence within or adjacent to the project area. In the absence of bushfire or any active fuel hazard reduction, the resulting fuel loads throughout vegetated areas (i.e. within Cottonwood Crescent Conservation Reserve to the south) is generally high due to vegetation density and ongoing accumulation of litter, trash and scrub fuels at ground level (i.e. surface and near surface fuels).

The City is vulnerable to a range of ignition sources each year, most notably as a result of deliberately lit fire (i.e. arson) and accidental causes (e.g. vehicle accidents, sparks from vehicle exhausts/industrial work, incorrect disposal of cigarette butts, etc).

Since most bushfires in the Perth Metropolitan Area are ignited by humans, the current ignition risk is estimated to be moderate to high due to the existing high levels of residency, public access and visitation at the bushland interface. However, Strategen-JBS&G considers that the ignition risk will increase following development intensification and increased levels of public access and resident occupancy at the bushland interface.

Due to the location of high density urban residential land to the north, east and west, a fire front approaching the project area from the south within Cottonwood Crescent Conservation Reserve is the most likely source of bushfire attack. The fire run in this direction is limited (200–300 m) through long unburnt woodland fuels situated down-slope from the site. Bushfire impacts are likely to be greatest under predominant afternoon summer weather conditions, where the likely prevailing winds from the south or southwest have the potential to direct a bushfire towards the site and the resulting fire behaviour is likely to escalate over this time and contribute moderate to elevated levels of radiant heat and ember attack on the proposed development. Therefore, the bushfire response at the southern interface should incorporate sufficient levels of defendable space, vehicular access water supply to address this bushfire risk.

Local volunteer and career Bush Fire Brigades stationed throughout the City of Stirling and surrounding municipalities are expected to provide a prompt emergency suppression response should a bushfire threaten lives or homes on or adjacent to the project area.

Strategen-JBS&G considers the abovementioned bushfire hazards and associated bushfire risk are readily manageable through implementation of standard management responses outlined under Guideline acceptable solutions and AS 3959. These responses will be factored in to proposed development early in the planning process to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life and property assets.

4. Bushfire management measures

Strategen-JBS&G has identified a range of bushfire management measures that on implementation will enable all proposed lots to be developed with a manageable level of bushfire risk and full compliance with the Guidelines. The bushfire management measures are depicted in Figure 4 (where applicable) and discussed in the following subsections.

4.1 Separation distances and fuel management

A 25 m wide Asset Protection Zone (APZ) already exists at the development-bushland interface in the form of Cottonwood Crescent road reserve and the adjacent south compacted limestone access around the perimeter of Cottonwood Crescent Conservation Reserve, both of which are well established and exceed standard APZ specifications. This in-situ and accessible defendable space is crucial to ensure future life and property assets are defendable from potential bushfire occurrence to the south.

Since the APZ already consists of long term low fuel tenure in the form of an established sealed road and limestone base access (compliant with Schedule 1 of the Guidelines as per Appendix 2), no additional fuel management will be required to maintain the APZ in a low fuel state outside of that already being undertaken as per the existing management regime for these areas, which consists of slashing and weed control.

Proposed development areas of the site will be cleared in whole prior to building construction. On-site road reserves/verges, the non-conservation component of POS 1 and POS 2 will all be maintained in a low fuel state (at or less than 2 t/ha) on a regular and ongoing basis all year round through mechanical slashing and weed control, which will deliver compliance with Schedule 1 of the Guidelines, as outlined in Appendix 2. Should development be staged, then 100 m wide on-site low threat staging buffers may have to be considered to mitigate any temporary BAL impact from adjacent development stages.

4.2 Increased building construction standards

The BAL contour map indicates that BAL-19 and BAL-12.5 are likely to affect future development areas, as depicted in Figure 4. The BAL contours have been assigned in accordance with AS 3959, as described in the Method 1 calculation (Section 3.3). The BAL contour map also demonstrates that future development will be avoided within BAL–FZ and BAL–40 areas. All proposed lots situated further than 100 m from post-development classified vegetation are considered to be BAL–Low, where there is insufficient risk to warrant specific construction requirements. Future landowners/builders will need to ensure buildings are constructed to the assessed BAL ratings where applicable.

4.3 Vehicular access

Five different public vehicular access connections will be provided to the surrounding public road network in Cottonwood Crescent (three) and Santara Circle (two) to ensure that at least two different public access routes are available for the development at all times. The proposed LSP design does not contain any cul-de-sacs, dead-ends or battle-axe lots.

All public roads constructed as part of the development will comply with technical requirements of the Guidelines, as outlined in Appendix 3.

Firebreak provisions will not be triggered for the proposed development given the lot sizes proposed, perimeter road provisions and conservation status of the retained vegetation.

4.4 Reticulated water supply

All proposed lots will be provided a reticulated water supply through extension of existing services from surrounding residential areas. The reticulated system will ensure an all year-round supply of water is provided for each lot to meet minimum domestic and emergency water supply requirements, as per Appendix 4.

A network of hydrants will also be provided along the internal road network at locations which meet relevant water supply authority and DFES requirements, in particular the Water Corporation Design Standard DS 63 'Water Reticulation Standard Design and Construction Requirements for Water Reticulation Systems up to DN250'. This standard will guide construction of the internal reticulated water supply system and fire hydrant network, including spacing and positioning of fire hydrants so that the maximum distance between a hydrant and the rear of a building envelope (or in the absence of a building envelope, the rear of the lot) shall be 120 m and the hydrants shall be no more than 200 m apart.

4.5 Additional measures

Strategen-JBS&G makes the following additional recommendations to inform ongoing planning stages of the development:

1. Notification on Title: notification is to be placed on the Title of all proposed lots situated in a designated bushfire prone area at creation of title as a condition of subdivision to ensure all landowners/proponents and prospective purchasers are aware that their lot is currently in a designated bushfire prone area and that increased building construction standards may apply to future buildings as determined by this BMP or through reassessment of the BAL at building permit.
2. BMP compliance reporting: a BMP compliance report will be prepared for each stage of subdivision clearance to provide a post-subdivisional works audit against provisions of the approved BMP to ensure all relevant bushfire management measures and commitments have been implemented as intended. This will include audit against the BAL contour map in Figure 4.
3. Compliance with current City of Stirling annual firebreak notice: the developer/land manager and prospective land purchasers are to comply with the current City of Stirling annual firebreak notice (Appendix 5), which specifies the following for proposed residential lots:
   (a) slash/mow all grass to a height of no more than five centimetres and remove all flammable vegetation.

Legend:

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- POS/drainage
- Retained banksia woodland
- Bush Forever site (DOP)
- Classified vegetation
- Proposed layout
- Roads
- Proposed connections to the existing road network
- Water hydrants

BAL contours

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

Scale 1:3,750 at A4

0 50 100
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57209

Client: Roberts Day

Version: A | Date: 25-Oct-2019

Drawn By: cthatcher | Checked By: CT

Channel 10 Dianella

BAL CONTOUR MAP AND BUSHFIRE MANAGEMENT MEASURES

FIGURE 4

strategen JBS&G

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Roberts Day\57209 Channel 10 Dianella BMP update (RDP16001.01)\GIS\Maps\R01 Rev A\57209_04_BALsMgtMeasure.mxd
Image Reference: www.nearmap.com© - Imagery Date: 16 July 2019.

5. Proposal compliance and justification

Proposed development within the project area is required to comply with SPP 3.7 under the following policy measures:

6.2 Strategic planning proposals, subdivision and development applications

a) Strategic planning proposals, subdivision and development applications within designated bushfire prone areas relating to land that has or will have a Bushfire Hazard Level (BHL) above low and/or where a Bushfire Attack Level (BAL) rating above BAL-LOW apply, are to comply with these policy measures.

b) Any strategic planning proposal, subdivision or development application in an area to which policy measure 6.2 a) applies, that has or will, on completion, have a moderate BHL and/or where BAL-12.5 to BAL-29 applies, may be considered for approval where it can be undertaken in accordance with policy measures 6.3, 6.4 or 6.5.

c) This policy also applies where an area is not yet designated as a bushfire prone area but is proposed to be developed in a way that introduces a bushfire hazard, as outlined in the Guidelines.

6.3 Information to accompany strategic planning proposals

Any strategic planning proposal to which policy measure 6.2 applies is to be accompanied by the following information prepared in accordance with the Guidelines:

a) (i) the results of a BHL assessment determining the applicable hazard level(s) across the subject land, in accordance with the methodology set out in the Guidelines. BHL assessments should be prepared by an accredited Bushfire Planning Practitioner; or

a) (ii) where the lot layout of the proposal is known, a BAL Contour Map to determine the indicative acceptable BAL ratings across the subject site, in accordance with the Guidelines. The BAL Contour Map should be prepared by an accredited Bushfire Planning Practitioner; and

b) the identification of any bushfire hazard issues arising from the relevant assessment; and

c) clear demonstration that compliance with the bushfire protection criteria in the Guidelines can be achieved in subsequent planning stages.

This information can be provided in the form of a Bushfire Management Plan or an amended Bushfire Management Plan where one has been previously endorsed.

Implementation of this BMP is expected to meet the following objectives of SPP 3.7:

5.1 Avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.

5.2 Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.

5.3 Ensure that higher order strategic planning documents, strategic planning proposals, subdivision and development applications take into account bushfire protection requirements and include specified bushfire protection measures.

5.4 Achieve an appropriate balance between bushfire risk management measures and, biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration of the potential impacts of climate change.

In response to the above requirements of SPP 3.7, bushfire management measures, as outlined in Section 4, have been devised for the proposed development in accordance with acceptable solutions of the Guidelines to meet compliance with bushfire protection criteria. An ‘acceptable solutions’ assessment is provided in Table 3 to assess the proposed bushfire management measures against each bushfire protection criteria in accordance with the Guidelines and demonstrate that the measures proposed meet the intent of each element of the bushfire protection criteria.

Table 3: Acceptable solutions assessment against bushfire protection criteria

Bushfire protection criteria	Intent	Acceptable solutions	Proposed bushfire management measures	Compliance statement
Element 1: Location	To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure	A1.1 Development location The strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL–29 or below.	Refer to Section 3.3 and Figure 4, which demonstrate that development will not occur in BAL–FZ or BAL–40 areas. BAL contours indicate that BAL–19 and BAL–12.5 affect the project area.	The measures proposed are considered to comply and meet the intent of Element 1 Location.
Element 2: Siting and design of development	To ensure that the siting and design of development minimises the level of bushfire impact	A2.1 Asset Protection Zone Every building is surrounded by an APZ, depicted on submitted plans, which meets detailed requirements (refer to the Guidelines for detailed APZ requirements in Appendix 2).	Refer to Section 4.1, which demonstrates that a 25 m wide APZ is already established at the development-bushland interface and is suitable to address Element 2 Siting and design of development.	The measures proposed are considered to comply and meet the intent of Element 2 Siting and design of development
Element 3: Vehicular access	To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event	A3.1 Two access routes Two different vehicular access routes are provided, both of which connect to the public road network, provide safe access and egress to two different destinations and are available to all residents/the public at all times and under all weather conditions.	Refer to Section 4.3, which demonstrates that at least two different vehicular access routes will be provided for the proposed development via multiple links to the surrounding public road network.	The measures proposed are considered to comply and meet the intent of Element 3 Vehicular access
		A3.2 Public road A public road is to meet the Guidelines requirements in Appendix 3.	Refer to Section 4.3, which demonstrates that all proposed public roads will meet requirements of the Guidelines, as per Appendix 3.	
		A3.3 Cul-de-sac (including a dead-end-road) A cul-de-sac and/or a dead end road should be avoided in bushfire prone areas. Where no alternative exists (i.e. the lot layout already exists and/or will need to be demonstrated by the proponent), detailed Guidelines requirements will need to be achieved as per Appendix 3.	N/A No cul-de-sacs are proposed as part of the development.	
		A3.4 Battle-axe Battle-axe access legs should be avoided in bushfire prone areas. Where no alternative exists, (this will need to be demonstrated by the proponent) detailed Guidelines requirements will need to be achieved as per Appendix 3.	N/A No battle-axe lots are proposed as part of the development.	
		A3.5 Private driveway longer than 50 m A private driveway is to meet detailed Guidelines requirements as per Appendix 3.	N/A No private driveways longer than 50 m are proposed as part of the development.	

		A3.6 Emergency access way An access way that does not provide through access to a public road is to be avoided in bushfire prone areas. Where no alternative exists (this will need to be demonstrated by the proponent), an emergency access way is to be provided as an alternative link to a public road during emergencies. An emergency access way is to meet detailed Guidelines requirements as per Appendix 3.	N/A No emergency access ways are required as part of the development.	
		A3.7 Fire service access routes (perimeter roads) Fire service access routes are to be established to provide access within and around the edge of the subdivision and related development to provide direct access to bushfire prone areas for fire fighters and link between public road networks for firefighting purposes. Fire service access routes are to meet detailed Guidelines requirements as per Appendix 3.	N/A No fire service access routes are required as part of the development.	
		A3.8 Firebreak width Lots greater than 0.5 hectares must have an internal perimeter firebreak of a minimum width of three metres or to the level as prescribed in the local firebreak notice issued by the local government	N/A Formal firebreak requirements will not be triggered for the proposed development.	
Element 4: Water	To ensure that water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.	A4.1 Reticulated areas The subdivision, development or land use is provided with a reticulated water supply in accordance with the Guidelines specifications (see Appendix 4).	Refer to Section 4.4, which demonstrates that all proposed lots will be provided a reticulated water supply and network of hydrants.	The measures proposed are considered to comply and meet the intent of Element 4 Water
		A4.2 Non-reticulated areas Water tanks for firefighting purposes with a hydrant or standpipe are provided and meet detailed requirements (refer to the Guidelines for detailed requirements for non-reticulated areas)	N/A The proposed development will not occur within a non-reticulated area.	
		A4.3 Individual lots within non-reticulated areas (only for use if creating 1 additional lot and cannot be applied cumulatively) Single lots above 500 square metres need a dedicated static water supply on the lot that has the effective capacity of 10 000 litres.	N/A The proposed development will not occur within a non-reticulated area.	

6. Implementation and enforcement

Implementation of the BMP applies to the developer, prospective landowners and the City to ensure bushfire management measures are adopted and implemented on an ongoing basis. A summary of the bushfire management measures described in Section 4, as well as a works program, is provided in Table 4. These measures will be implemented to ensure the ongoing protection of proposed life and property assets is achieved. Timing and responsibilities are also defined to assist with implementation of each measure.

Table 4: Proposed works program

Bushfire management measure	Timing for application	Responsibility
Clearing of proposed development footprint throughout the site	During subdivisional works	Developer
Establishment of low threat road verges, POS and recreation and drainage reserves at or less than 2 t/ha all year round (not including on-site conservation vegetation)	On a regular and ongoing basis via mechanical slashing and weed control	Developer until completion of development and the City thereafter
Establishment and maintenance of low threat staging buffers (if required)	During subdivisional works for individual stages	Developer
Implementation of increased building construction standards as required	During construction of proposed dwellings	Builder, prospective landowners
Construction of public roads (in advance if required during development staging to establish two different vehicular access routes for each development stage)	During subdivisional works	Developer
Provision of reticulated water supply and network of hydrants	During subdivisional works	Developer
Notification on Title	As part of subdivision clearance and lot Title	Developer
BMP compliance report	As part of subdivision clearance and lot Title	Developer
Compliance with current City of Stirling annual firebreak notice	All year round as specified in the firebreak notice, as amended (Appendix 5)	All parties

7. References

Department of Fire and Emergency Services (DFES) 2019, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: *http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx*, [22/10/2019].

Standards Australia (SA) 2018, *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.

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

Western Australian Planning Commission (WAPC) 2017, *Guidelines for Planning in Bushfire-Prone Areas V1.3*, Western Australian Planning Commission, Perth.

Appendix 1
POS plan

POS BREAKDOWN	
POS 1	1.2920ha
POS 2	0.2359ha
TOTAL	**1.5279ha**

LEGEND

- SUBJECT LAND
- POS/DRAINAGE
- RETAINED BANKSIA WOODLAND
- CLEARED BANKSIA WOODLAND

POS PLAN

Lot 55 and 56 Cottonwood Cresent, Dianella

City of Stirling

SIZE A4

1:2000 0 metres 20 40 60 80 100

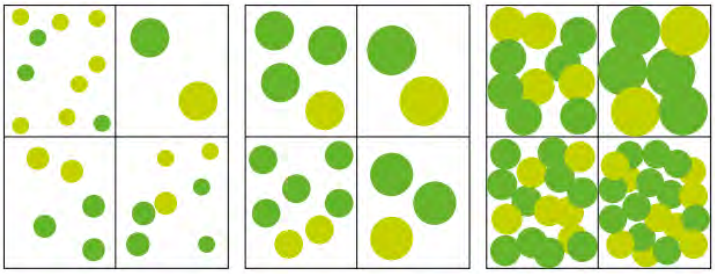
REF NO.	DRAW NO.	REV.
NET TEN	**RD1 011**	**O**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

Appendix 2
APZ standards (Schedule 1 of the Guidelines)

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.



- **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 5m^2 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.

Appendix 3
Vehicular access technical standards of the Guidelines

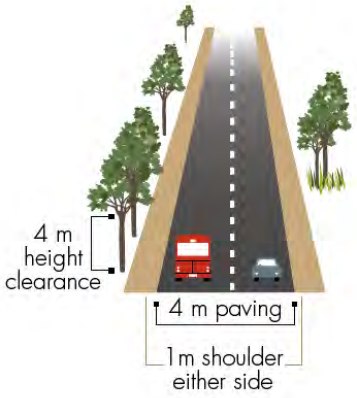
Public roads	
Acceptable solution A3.2	A public road is to meet the requirements in Table 1, Column 1.
Explanatory note E3.2	Trafficable surface: Widths quoted for access routes refer to the width of the trafficable surface. A six metre trafficable surface does not necessarily mean paving width. It could, for example, include four metre wide paving one metre wide constructed road shoulders. In special circumstances, where eight lots or less are being serviced, a public road with a minimum trafficable surface of four metres for a maximum distance of 90 metres may be provided subject to the approval of both the local government and Department of Fire and Emergency Services. Public road design: All roads should allow for two-way traffic to allow conventional two-wheel drive vehicles and fire appliances to travel safely on them. 

Table 1: Vehicular access technical requirements

Technical requirement	1	2	3	4	5
	Public road	Cul-de-sac	Private driveway longer than 50 m	Emergency access way	Fire service access routes
Minimum trafficable surface (m)	**6***	6	4	6*	6*
Horizontal distance (m)	**6**	6	6	6	6
Vertical clearance (m)	**4.5**	N/A	4.5	4.5	4.5
Maximum grade <50 m	**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	**8.5**	8.5	8.5	8.5	8.5

* Refer to E3.2 Public roads: Trafficable surface

Appendix 4
Water technical standards of the Guidelines

Reticulated areas	
Acceptable solution A4.1	The subdivision, development or land use is provided with a reticulated water supply in accordance with the specifications of the relevant water supply authority and Department of Fire and Emergency Services.
Explanatory note E4.1	Water supply authorities in Western Australia include the Water Corporation, Aqwest and the Busselton Water Board. The Water Corporation's 'No. 63 Water Reticulation Standard' is deemed to be the baseline criterion for developments and should be applied unless local water supply authorities' conditions apply.

Appendix 5
City of Stirling annual firebreak notice

City of Stirling
City of Choice

Public Notice

BUSH FIRES ACT 1954
FIREBREAK NOTICE 2020 - 2021

City of Stirling
Notice to all property owners and occupiers within the City of Stirling.
Pursuant to Section 33 of the Bush Fires Act 1954, you are hereby required, on or before 30 November 2020 or within 14 days of becoming the owner or occupier after 30 November 2020, to remove from the land owned or occupied by you, all flammable material and/or clear firebreaks in accordance with the following land areas and thereafter to maintain that land or firebreaks up to and including 31 March 2021:

Where the area of the land is less than 2,000 square metres -

Slash/mow all grass to a height no greater than five (5) centimetres and remove all slashed matter and other flammable material from the land.

Where the area of the land is greater than 2,000 square metres-

Install a continuous firebreak of three (3) metres wide and a minimum of four (4) metres vertical, clear of all bush and flammable material, around all structures and along all external boundaries of the land.

Prune trees and shrubs and remove dead flammable material from around all structures. Ensure the roofs, gutters and walls of all buildings on the land are free of flammable material.

These standards must be maintained until 31 March 2021.

'Flammable material' is defined for the purpose of the notice to include any mineral, vegetable, substance, object, thing or matter that may, or is likely to, catch fire and burn, or any other thing deemed by an authorised officer to be capable of combustion. It does not include green standing trees, growing bushes, and plants in gardens and/or lawns - unless deemed otherwise.

If it is considered impracticable to clear a firebreak or to remove flammable material from the land as required by this notice, an application to the City of Stirling in writing may be made prior to 14 November 2020 for permission to take alternative action to mitigate the fire hazard. Until written permission is received from the City, compliance with this notice is required.

Burning off without written authorisation is strictly prohibited within the City of Stirling.

The penalty for failing to comply with this notice is a fine of up to $5,000. If the works are not carried out by the date required in this notice, the owner of the land is liable, whether prosecuted or not, to pay all costs for performing the works directed in this notice.

19/8/20

STUART JARDINE PSM
Chief Executive Officer
City of Stirling

Appendix 6
Confirmation of low threat POS management from City of Stirling

From: "Drew.Manning@stirling.wa.gov.au" <Drew.Manning@stirling.wa.gov.au>
Date: Monday, 26 October 2020 at 4:31 PM
To: Tim Trefry <tim.trefry@robertsday.com.au>, Gareth Glanville <Gareth.Glanville@stirling.wa.gov.au>
Subject: RE: Network 10 Structure Plan

Hi Tim,

I feel as though we've been down this worm hole before!

Who confirms that the design of the drainage/POS area conforms to a "low threat state"?

And pending that question is the following of any use,

Once the proposed design for the POS drainage area has been confirmed as a low fire threat by xxxx and the City has approved the design within this limitation, the City will continue to maintain the area as a low fire threat aera.

Regards,

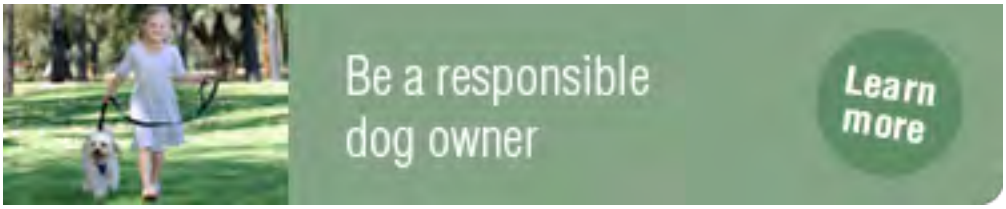
Drew Manning
Coordinator Project Management and Landscape Architecture
Parks and Sustainability

City of Stirling
City of Choice

Administration Centre 25 Cedric Street Stirling 6021 WA
Phone (08) 9205 8661 **| Mobile** 0417 185 434 **| Facsimile** (08) 9205 8822
Email Drew.Manning@stirling.wa.gov.au

City of Stirling kaadatj Noongar moort Noongar boodja-k Wadjak boodja-k. Ngalak kaadatj Noongar nedingar wer birdiya koora koora wer yeyi. Baalabang koondarm, malayin wer nakolak baalap yang ngalany-al. Ngalak dandjoo barn wer kaaratj bandang boodja-k.

The City of Stirling acknowledges the traditional custodians of this land, the Wadjak people of the Nyoongar nation, and pays respect to the Elders past, present and future for they hold the memories, the traditions, the culture and hopes of Aboriginal Australia.



From: Tim Trefry <Tim.Trefry@robertsday.com.au>
Sent: Wednesday, 21 October 2020 5:16 PM
To: Gareth Glanville <Gareth.Glanville@stirling.wa.gov.au>; Drew Manning <Drew.Manning@stirling.wa.gov.au>
Subject: Network 10 Structure Plan

Hello Gareth / Drew

We are at the final hurdle for the Network 10 Structure Plan – the WAPC schedule of modifications.

I am seeking your assistance one last time. Modification 5 (2) for the Bushfire Management Plan requires confirmation the small POS / Drainage area will be maintained in a low threat state. (Refer attachments)

We will prepare and lodge a landscape plan for this area that will only propose limited tree planting to provide an aesthetic for the drainage area. This POS / drainage area will then be maintained by the landowner for two summers before being handed over to the City.

On this basis, are you able to confirm this POS / drainage area will be maintained in a low threat state once handed over to the City?

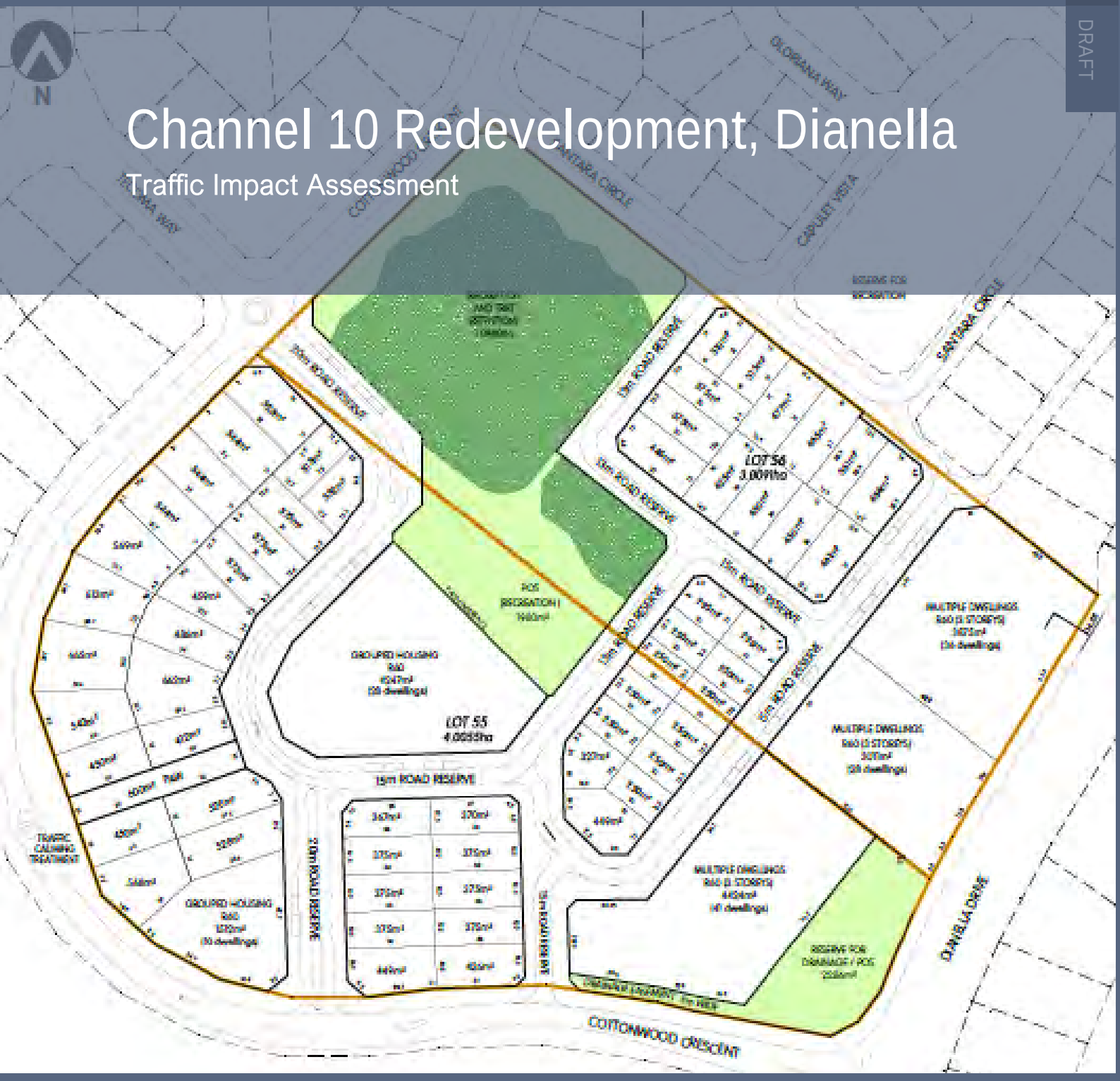
Regards
Tim Trefry partner
m +61 412 221 440 **d** +61 8 9213 7333 **t** +61 8 9213 7300
HATCH | RobertsDay
perth brisbane canberra melbourne sydney
level two 442 murray street perth wa australia 6000

APPENDIX E
Traffic Impact Assessment Report
TARSC

DRAFT

Channel 10 Redevelopment, Dianella

Traffic Impact Assessment



Prepared by: GTA Consultants (WA) Pty Ltd for Channel 10 c/o RobertsDay

on 23/09/19

Reference: W178230

Issue #: A-Dr

GTAconsultants

Channel 10 Redevelopment, Dianella

Traffic Impact Assessment

Client: Channel 10 c/o RobertsDay

on 23/09/19

Reference: W178230

Issue #: A-Dr

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A-Dr	19/09/19	Draft	RD	RD	TM	

GTAconsultants

Melbourne | Sydney | Brisbane

CONTENTS

Appendices

Tables

1. INTRODUCTION

1.1. Purpose of this Report

This Traffic Impact Assessment (TIA) report has been prepared for a development proposal, prepared by Roberts Day for the Channel 10 site in Dianella, in the City of Stirling.

The report documents the review and advice previously provided by Spiire (Property and Infrastructure Consultants) and subsequently Tarsc (Traffic Consultant) on the likely generation of traffic associated with the development proposal, the impact of this traffic on the internal and external road network, and requirements for public transport, walking and cycling.

1.2. Background

The Channel 10 precinct comprises two lots; Lot 55 (Channel 10), which is 4.0 hectares and Lot 56 (Channel 10), which is 3.0 hectares. Lot 55 is presently used as a television studio (Channel 10) and Lot 56 is vacant with some remnant bushland. A large area of the Channel 10 site when operating at the site was surface car parking. The Channel 10 site is now to be developed into residential dwellings of single, grouped and multiple dwelling sites and some public open space. Located in an inner ring suburb, the Channel 10 precinct is within comfortable walking distance of the Mirrabooka Shopping Centre and the Mirrabooka High School and Mirrabooka Primary School.

The precinct is not within the walkable catchment of any current rail services with the nearest station around five kilometres away, although it is within walking distance of fairly frequent bus services along Dianella and along Cottonwood Crescent to/from the Mirrabooka Bus Station. Consequently, traffic generated by the development is likely to reflect conventional estimates rather than estimates applicable to transit-oriented development (TOD) should there be any future light rail developed in the vicinity of the site.

2. STREET NETWORK LAYOUT

A permeable internal street layout has been proposed for the area, assuming a residential yield of 201 dwellings incorporating 143 grouped dwellings and 58 single lot dwellings. This is shown in Appendix A. Under the present proposal, there will be three main points of ingress/egress from the proposed development:

- via a proposed roundabout at the intersection of Tecoma Way and Cottonwood Crescent;
- via two street connections through to Santara Circle and then Cottonwood Crescent;
- via a T-junction located approximately at the disused Channel 10 main entry on Cottonwood Crescent; and,
- Via a new T-junction located approximately 70-75m east of the above junction.

The access near the Channel 10 site has been discussed and agreed to "in-principle" with the City of Stirling as long as sufficient sight distance is provided, this being approximately 86m in this instance. This is greater than the current sight distance available of approximately 75m from the current Channel 10 crossover. This proposed sight distance also meets the required safe intersection sight distance (SISD) of 86m for a speed of 50km/h, 4.5 second decision time, on a 4.5% downgrade and a coefficient of deceleration of 0.46.

Cottonwood Crescent is a two-lane local access road, which intersects with Dianella Drive at an unsignalised T-junction. It carries approximately 1,250 vehicles per day (vpd) near Dianella Drive and 910vpd near Tecoma Way and has a speed limit of 50km/h as a built-up area. Refer to Appendix B for traffic flow data from the City of Stirling. The 85th percentile speed of vehicles has been measured at approximately 59km/h near Dianella Drive and approximately 53km/h near Tecoma Way.

Dianella Drive is a four-lane divided road and is classed by Main Roads Western Australia (MRWA) as a District Distributor (A). Based on traffic counts conducted in 2017/18 by MRWA, Dianella Drive carried 17,833 vehicles per day north of Morley Drive, refer to Appendix C (2017/18 data has shown that traffic volumes have been increasing at a rate of approximately 1.0% per annum since 2001). The Cottonwood Crescent/Dianella Drive intersection is presently configured to allow all turning movements as there is a broken median in Dianella Drive, however it is not signalised. The broken median width is sufficient for vehicles to conduct a right turn out of Cottonwood Crescent onto Dianella Drive in two movements.

The internal road layout proposed for the development includes 6.0m wide roads in combination with 6.0m wide laneways that service some lots in generally 13-15m wide reservations. The main east-west road connecting with Tecoma Way and the entrance near the current Channel 10 entrance are proposed to be 20m wide reserves allowing tree lined avenues/boulevards with 3.5m wide carriageways either side of a 3.0m wide median. All intersections are T-junctions with right of way predetermined under the *Road Traffic Code*.

All roads within the development are to have footpaths installed in line with Liveable Neighbourhoods, being footpaths on one side of roadway (except laneways). These footpaths are to connect with a shared path on the southern side of Cottonwood Crescent at the main entrance west of Dianella Drive.

There is proposed to be direct access for lots fronting Cottonwood Crescent with sight distances being approximately 70m from each lot along Cottonwood Crescent to the north. For a residential property, Australian Standards AS/NZS 2890.1:2004 requires a sight distance of 40m for a domestic property access onto a road subject to a 50km/h speed limit.

3. TRAFFIC GENERATION, DISTRIBUTION AND IMPACTS

3.1. Trip Generation Rate

The proposed development is to be a residential development consisting of single residential and grouped dwellings. The traffic generation for the site based on the publication *Land Use Traffic Generation Guidelines (Director General of Transport, SA, 1987)* for a single residential dwelling suggests 8 trips per dwelling. Grouped dwellings would have a generation rate somewhat less than this (in the order of 3 to 5 trips per dwelling), but the higher rate of 8 trips per day per dwelling has been assumed to allow for a more robust assessment.

3.2. Trip Generation of Site

As discussed previously, the development is proposed to consist of 201 dwellings (consisting of 58 single residential and 143 grouped dwelling type dwellings).

Using the above higher generation rate for 201 dwellings there should be in the order of 1,040 trips per day generated by the proposed development. However, previous assessment (undertaken by Spiire and Tarsc) of the impact of the proposed development had assumed a higher generation rate and total traffic generation of the proposed development of 1,750vpd (compared to approximately 1,040 based on the above rates) by the proposed development with 875 entering and 875 exiting per day. Further, it has been assumed that 7.5% (130 trips) of this traffic flow occurs in the AM peak hour (25% entering and 75% exiting the development) and 10% (175 trips) in the PM peak hour (67% entering and 33% exiting the development).

This traffic generation of the site conservatively assumes that there is no traffic generated from the previous land-uses on the site with the site now being vacant.

3.3. Trip Distribution

With the site bordering Cottonwood Crescent, the proposed distribution of trips are as summarised below:

- Cottonwood Crescent to the north – 10%;
- Tecoma Way to the west – 10%; and,
- Cottonwood Crescent to the east – 80%.

Further to this distribution, the traffic distributed onto Cottonwood Crescent to the east has been assumed to be further distributed:

- Dianella Drive to the north – 16% of total development flow; and,
- Dianella Drive to the south – 64% of total development flow.

The flows on the internal roads are shown in Appendix D.

Table 3.1 summarises the expected traffic flows on roads within the vicinity due to the development and the current flows on those roads and the above assumed directional flows to and from the proposed development.

Table 3.1: Trip Distribution from Development (Current Flows)

Road	Current Traffic Volume (vpd, two-way)	Expected Development Traffic (vpd, two-way)
Cottonwood Crescent North	910	+150
Tecoma Way	500 (est)	+150
Santara Circle	250 (est)	+150
Cottonwood Crescent East	1,250	+700
Dianella Drive North	17,833	+150
Dianella Drive South	17,833	+450

3.4. Traffic Impact Development

In general terms the roads surrounding the development will have traffic volumes that should not exceed their maximum traffic flows for similar roads of their type. The comparisons to maximum flows that these roads should carry are shown below in Tables 3.2 and 3.3. The maximum hourly flows are expected to be approximately 10% to 65% of the midblock carrying capacity of the roads, whilst the daily flows are expected to within similar acceptable limits.

Table 3.2: Expected Daily Flows (two-way)

Road	Current Traffic Volume (vpd, two-way)	Expected Development Traffic (vpd, two-way)
Cottonwood Crescent North	3,0001	1,060
Tecoma Way	1,0002	650
Santara Circle	1,000	400
Cottonwood Crescent East	3,000	1,950
Dianella Drive North	25,0003	17,980
Dianella Drive South	25,000	18,280

Table 3.3: Expected Hourly Flows (one-way)

Road	Current Traffic Volume (vpd, one-way)	Expected Development Traffic (vpd, one-way)
Cottonwood Crescent North	600	55
Tecoma Way	600	60
Santara Circle	600	25
Cottonwood Crescent East	600	195
Dianella Drive North	1,900	1,060
Dianella Drive South	1,900	1,260

[1] Based on Access St C, Liveable Neighbourhoods, 2009
[2] Based on Access St D, Liveable Neighbourhoods, 2009
[3] Based on Integrator A – Centres – 60km/h, Liveable Neighbourhoods, 2009

It can be seen that the traffic flows are not expected to exceed the indicative maximum acceptable daily flow rates on any of the roads bordering the proposed development. The critical factor is the peak hour flows and the intersection performance at the intersections of Dianella Drive / Cottonwood Crescent and the main entry to the development near the current Channel 10 entry. Table 3.4 and the subsequent intersection analysis confirm that the maximum flows are not exceeded. In this instance most roads are considerably less than the capacity.

With regards to intersections, *Austroads Guide to Traffic Engineering Practice Part 5 – Intersections at Grade* provides advice as to intersection performance in peak flow conditions with regards to possible further analysis. This is summarised in Table 3.4.

Table 3.4: Austroads Guidelines

Major Road Type	Major Road Flow (vph, two-way)	Minor Road Flow (vph, two-way)
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Examining the expected traffic flows at each of the intersections around the proposed development Table 3.5 is derived.

Table 3.5: Comparison to Austroads Guidelines

Road	Current Traffic Volume (vpd, one-way)	Expected Development Traffic (vpd, one-way)
Dianella Drive/Cottonwood Crescent	2,010	228
Cottonwood Crescent/"Channel 10 Entry"	228	109
Cottonwood Crescent/Tecoma Way	97	60

From the above it can be seen that the subject intersection highlighted red will exceed the values given in Table 3.4. Thus, this intersection should be examined in further detail.

3.5. SIDRA Assessments

To further assess the performance of the intersection of Dianella Drive / Cottonwood Crescent, a computer program called *Sidra Intersection (Version 6.1)* was utilised.

3.6. Intersection of Dianella Drive/Cottonwood Crescent

This intersection was assessed using the AM and PM peak flows of the development. The results are shown below in Tables 3.6 to 3.9. Overall, the intersection should perform satisfactorily during both the AM and PM peaks with levels of service in the A to D range, with similar operation during both peak periods and little difference between the expected operation and the current operation of the intersection under peak flows. The queues on the Cottonwood Crescent approach are expected to be 10m at worst in the AM peak and queuing in the median to be wholly contained therein.

Table 3.6: Current AM Peak Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Dianella Dr																
Lane 1	32	0	0	32	0.0	1270 1	0.025	100	7.6	LOS A	0.1	0.7	90	Turn Bay	0.0	0.0
Lane 2	0	359	0	359	5.0	1889	0.190	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	359	0	359	5.0	1889	0.190	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	32	718	0	749	4.8		0.190		0.3	NA	0.1	0.7				
North: Dianella Dr																
Lane 1	0	623	0	623	5.0	1889	0.330	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	623	0	623	5.0	1889	0.330	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	8	8	0.0	658	0.013	100	11.7	LOS B	0.0	0.3	100	Turn Bay	0.0	0.0
Approach	0	1245	8	1254	5.0		0.330		0.1	NA	0.0	0.3				
North West: Median RT																
Lane 1	0	0	79	79	0.0	267	0.296	100	21.1	LOS C	1.1	7.6	500	–	0.0	0.0
Approach	0	0	79	79	0.0		0.296		21.1	LOS C	1.1	7.6				
West: Cottonwood Crs																
Lane 1	19	0	0	19	0.0	526	0.036	100	12.4	LOS B	0.1	0.9	50	Turn Bay	0.0	0.0
Lane 2	0	0	79	79	0.0	521	0.152	100	13.2	LOS B	0.5	3.8	500	–	0.0	0.0
Approach	19	0	79	98	0.0		0.152		13.0	LOS B	0.5	3.8				
Intersection				2180	4.5		0.330		1.5	NA	1.1	7.6				

Table 3.7: Current PM Peak Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Dianella Dr																
Lane 1	57	0	0	57	0.0	1270 1	0.045	100	7.6	LOS A	0.2	1.2	90	Turn Bay	0.0	0.0
Lane 2	0	521	0	521	5.0	1889	0.276	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	521	0	521	5.0	1889	0.276	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	57	1042	0	1099	4.7		0.276		0.4	NA	0.2	1.2				
North: Dianella Dr																
Lane 1	0	322	0	322	5.0	1889	0.171	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	322	0	322	5.0	1889	0.171	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	15	15	0.0	414	0.036	100	15.5	LOS C	0.1	0.7	100	Turn Bay	0.0	0.0
Approach	0	644	15	659	4.9		0.171		0.3	NA	0.1	0.7				
North West: Median RT																
Lane 1	0	0	49	49	0.0	621	0.080	100	9.8	LOS A	0.3	2.0	500	–	0.0	0.0
Approach	0	0	49	49	0.0		0.080		9.8	LOS A	0.3	2.0				
West: Cottonwood Crs																
Lane 1	13	0	0	13	0.0	332	0.038	100	16.7	LOS C	0.1	0.9	50	Turn Bay	0.0	0.0
Lane 2	0	0	49	49	0.0	326	0.152	100	17.9	LOS C	0.5	3.5	500	–	0.0	0.0
Approach	13	0	49	62	0.0		0.152		17.7	LOS C	0.5	3.5				
Intersection				1869	4.5		0.276		1.2	NA	0.5	3.5				

Table 3.8: Expected AM Peak Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Dianella Dr																
Lane 1	53	0	0	53	0.0	1270 1	0.041	100	7.6	LOS A	0.2	1.1	90	Turn Bay	0.0	0.0
Lane 2	0	359	0	359	5.0	1889	0.190	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	359	0	359	5.0	1889	0.190	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	53	718	0	771	4.7		0.190		0.5	NA	0.2	1.1				
North: Dianella Dr																
Lane 1	0	623	0	623	5.0	1889	0.330	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	623	0	623	5.0	1889	0.330	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	13	13	0.0	658	0.019	100	11.7	LOS B	0.1	0.4	100	Turn Bay	0.0	0.0
Approach	0	1245	13	1258	4.9		0.330		0.1	NA	0.1	0.4				
North West: Median RT																
Lane 1	0	0	141	141	0.0	267	0.529	100	25.6	LOS D	2.4	16.5	500	–	0.0	0.0
Approach	0	0	141	141	0.0		0.529		25.6	LOS D	2.4	16.5				
West: Cottonwood Crs																
Lane 1	32	0	0	32	0.0	519	0.061	100	12.6	LOS B	0.2	1.5	50	Turn Bay	0.0	0.0
Lane 2	0	0	141	141	0.0	511	0.276	100	14.2	LOS B	1.1	7.8	500	–	0.0	0.0
Approach	32	0	141	173	0.0		0.276		13.9	LOS B	1.1	7.8				
Intersection				2342	4.2		0.529		2.8	NA	2.4	16.5				

Table 3.9: Expected PM Peak Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Dianella Dr																
Lane 1	132	0	0	132	0.0	1269 1	0.104	100	7.7	LOS A	0.4	3.0	90	Turn Bay	0.0	0.0
Lane 2	0	521	0	521	5.0	1889	0.276	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	521	0	521	5.0	1889	0.276	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	132	1042	0	1174	4.4		0.276		0.9	NA	0.4	3.0				
North: Dianella Dr																
Lane 1	0	322	0	322	5.0	1889	0.171	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	322	0	322	5.0	1889	0.171	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	29	29	0.0	414	0.071	100	15.7	LOS C	0.2	1.5	100	Turn Bay	0.0	0.0
Approach	0	644	29	674	4.8		0.171		0.7	NA	0.2	1.5				
North West: Median RT																
Lane 1	0	0	88	88	0.0	621	0.142	100	10.0	LOS B	0.5	3.7	500	–	0.0	0.0
Approach	0	0	88	88	0.0		0.142		10.0	LOS B	0.5	3.7				
West: Cottonwood Crs																
Lane 1	21	0	0	21	0.0	315	0.067	100	17.6	LOS C	0.2	1.5	50	Turn Bay	0.0	0.0
Lane 2	0	0	88	88	0.0	303	0.291	100	20.6	LOS C	1.1	7.6	500	–	0.0	0.0
Approach	21	0	88	109	0.0		0.291		20.0	LOS C	1.1	7.6				
Intersection				2045	4.1		0.291		2.2	NA	1.1	7.6				

3.7. Performance Assessment Concept Parameters

The level of service concept describes the quality of traffic service in terms of six levels, designated A to F, with level of service A (LOS A) representing the best operating condition (i.e. at or close to free flow), and level of service F (LOS F) the worst (i.e. forced flow). More specifically:

- LOS A: Primarily free flow operations at average travel speeds, usually about 90% of the FFS (free flow speed) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is less than 10 seconds. At non-signalised movements at intersections the average control delay is less than 10 seconds;
- LOS B: Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted, and control delays at signalised intersections are between 10 and 20 seconds. At non-signalised movements at intersections the average control delay is between 10 and 15 seconds;
- LOS C: Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50% of the FFS for the street class. Signalised intersection delays are between 20 and 35 seconds. At non-signalised movements at intersections the average control delay is between 15 and 25 seconds;
- LOS D: A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40% of FFS. Signalised intersection delays are between 35 and 55 seconds. At non-signalised movements at intersections the average control delay is between 25 and 35 seconds;
- LOS E: Characterised by significant delays and average travel speeds of 33% of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections (between 55 and 80 seconds), and inappropriate signal timing. At non-signalised movements at intersections the average control delay is between 35 and 50 seconds; and,
- LOS F: Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays (in excess of 80 seconds), high volumes, and extensive queuing. At non-signalised movements at intersections the average control delay is greater than 50 seconds.

In addition to the above:

- Average Delay: is the average of all travel time delays for vehicles through the intersection; and,
- Queue: is the queue length below which 95% of all observed queue lengths fall.

3.8. Impact of Development on Local Area

Based on the above assessment it is concluded that the development will have an acceptable impact on the surrounding roads and intersections.

4. PROVISION FOR PUBLIC TRANSPORT

The proposed development is presently outside of the rail corridor and is in an area serviced by buses. There are a number of bus services that operate in the vicinity of the precinct. These include Routes 67, 68 and 69 along Dianella Drive (with the 67 diverting along Cottonwood Crescent). Route 67 has bus stops near the current PAW south of 44 Cottonwood Crescent.

During peak hours, services towards the Perth CBD along Dianella Drive operate about every 5 minutes at a high frequency. These services give regional access by public transport, to the north and south.

Footpaths on both sides of Cottonwood Crescent are recommended to ensure walking access to bus services is of a high standard. There is presently a shared path on the southern/western side of Cottonwood Crescent, thus there should be provision of a footpath on the northern/eastern side of Cottonwood Crescent.

5. PROVISION FOR WALKING & CYCLING

5.1. The Walking Environment

The preliminary plan for internal streets shows a connected pedestrian movement network.

The current proposal makes provision for shade trees, which will contribute to pedestrian amenity. The following features should apply when detail is added to the plan:

- Provision of a footpath on one side of internal streets as a minimum: footpaths on both sides of Cottonwood Crescent should be provided;
- Clearly marked and evenly spaced street crossing points;
- Tactile paving and dropped kerbs at crossing points to facilitate universal access;
- Sufficient pavement widths to accommodate wheelchairs; and,
- Appropriate street lighting to create a sense of safety at night.

Internal pedestrian infrastructure will be linked with adequate existing infrastructure along streets that frame the precinct, including Mirrabooka Shopping Centre of Mirrabooka Primary School and Mirrabooka Senior High School.

There is a PAW proposed to connect from the internal road network, across Cottonwood Crescent at a combined slow-point/pedestrian crossing to a PAW on the western side of Cottonwood Crescent that connects to Mirrabooka Senior High School.

5.2. Cycling

It is predicted that both traffic volumes and traffic speeds will be low for the internal street network with volumes slightly higher than 1,000vpd for the main access/egress road connecting with Cottonwood Crescent near the current Channel 10 entry/exit. Other roads are expected to have traffic volumes less than 300vpd. Accordingly, when development is completed, cyclists will be able to safely navigate through the precinct via the planned street network assuming a high degree of connectedness is achieved - without specific off or on-street facilities. In particular, there will be sufficient safe linkages to Mirrabooka Primary School and Mirrabooka Senior High School via the shared path that connects with the western extremity of Cottonwood Crescent.

There are several regional cycle routes in the surrounding environment with two Perth Bicycle Network (PBN) continuously signed routes in the vicinity:

- NE4 along Dianella Drive; and,
- NW7 to the south, along Cottonwood Crescent. Also, there is a shared path along the south side of Cottonwood Crescent.

6. SUMMARY

As a result of the analysis undertaken for the proposed development at Lots 55 and 56 Cottonwood Crescent, Dianella, the following findings were made:

- The proposed development will generate approximately 1,040 vehicular trips on a weekday;
- There are good pedestrian footpaths currently and being proposed on all sides of the proposed development with access to high frequency public transport and nearby trips attractors/generators; and,
- The impact of the traffic volumes associated with the development is considered acceptable with little impact on roads in the vicinity with the road network with an equivalent 1,750 trip per day from the proposed development used to stress test the road network with no deleterious effects.

A. PROPOSED DEVELOPMENT

REVISED LOCAL STRUCTURE PLAN DESIGN

Lot 55 and 56 Cottonwood Cresent, Dianella

City of Stirling

SIZE A4

1:2000

0 metres 20 40 60 80 100

REF NO.	DRAW NO.	REV.
NET TEN	**RD1 011**	**N**

B. COTTONWOOD CRESCENT TRAFFIC DATA

B

Road Name	Location	Suburb	Class	NB/EB	SB/WB	Total AWT	85% Speed	% CV	Peak Hr %	Date	Position	Speed Limit	Site No
Cottonwood Crescent	S of Santara Circle N	Dianella	LA	433	474	907	52.6	3.8	9.2	Sep 15	No 11	50	29-025
Cottonwood Crescent	W of Dianella Drive	Dianella	LA	643	609	1252	59.4	4.3	10.4	Sep 15	50m West	50	29-026
Coralberry Crescent	W of Cottonwood Crescent	Dianella	LA	511	496	1006	47.5	4.7	10.6	Sep 15	No 18	50	29-023
Rosewood Crescent	S of Verbena Crescent	Dianella	LA	325	317	641	58.0	3.7	10.0	Sep 15	No 12	50	29-080
Rosewood Crescent	S of Poinsettia Way	Dianella	LA	287	289	576	36.4	6.4	8.3	Sep 15	No 53	50	29-081
Poinsettia Way	E of Nollamara Avenue	Dianella	LA	568	582	1150	42.5	3.5	9.4	Sep 15	No 3	50	29-079

C. DIANELLA DRIVE TRAFFIC DATA

C

SITE 5721

Hourly Volume

Dianella Dr (1251827)

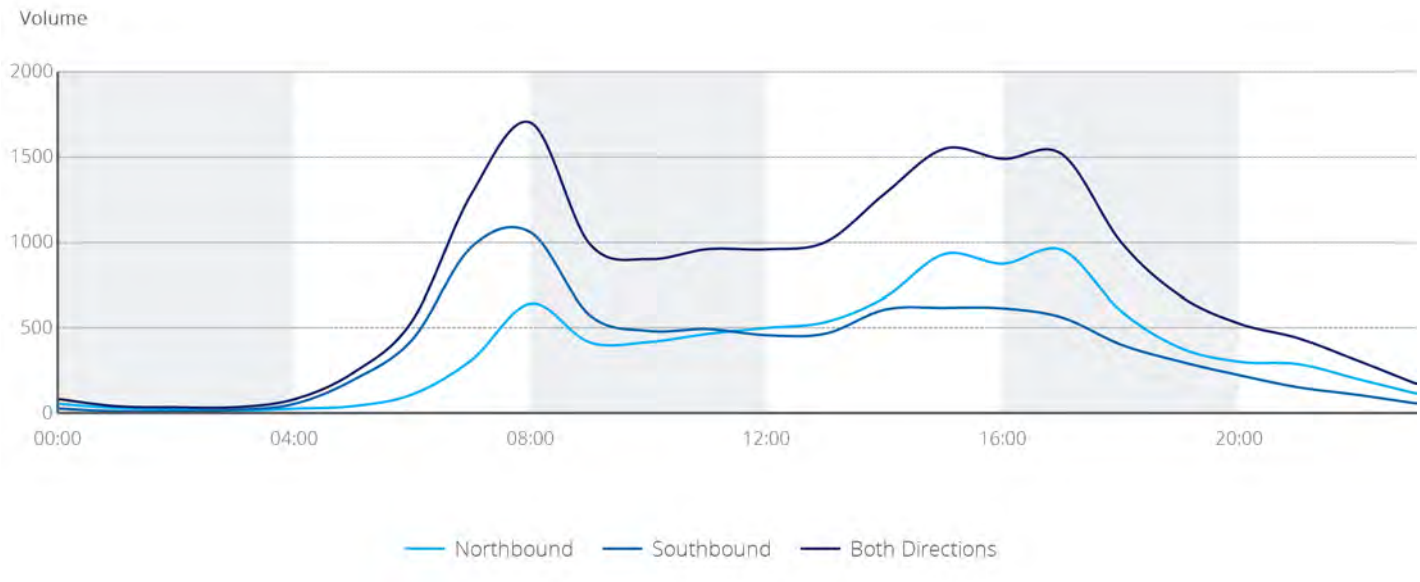
North of Morley Dr (SLK 0.49)

2017/18
Monday to Friday

	All Vehicles			Heavy Vehicles			
	NB	SB	Both	NB	SB	Both	%
00:00	56	28	84	2	2	4	4.8
01:00	30	11	41	2	0	2	4.9
02:00	24	11	35	0	0	0	0.0
03:00	15	20	35	2	1	3	8.6
04:00	27	55	82	4	2	6	7.3
05:00	42	196	238	1	23	24	10.1
06:00	111	433	544	14	51	65	11.9
07:00	312	973	1285	21	55	76	5.9
08:00	643	1059	1702	30	44	74	4.3
09:00	416	575	991	30	34	64	6.5
10:00	418	483	901	29	35	64	7.1
11:00	466	494	960	29	38	67	7.0
12:00	501	458	959	29	29	58	6.0
13:00	535	468	1003	30	31	61	6.1
14:00	679	608	1287	30	34	64	5.0
15:00	931	618	1549	48	34	82	5.3
16:00	875	615	1490	33	31	64	4.3
17:00	955	561	1516	35	26	61	4.0
18:00	597	402	999	18	22	40	4.0
19:00	383	303	686	13	10	23	3.4
20:00	302	223	525	8	12	20	3.8
21:00	288	152	440	6	4	10	2.3
22:00	201	108	309	5	5	10	3.2
23:00	115	57	172	2	2	4	2.3
TOTAL	8922	8911	17833	421	525	946	5.3

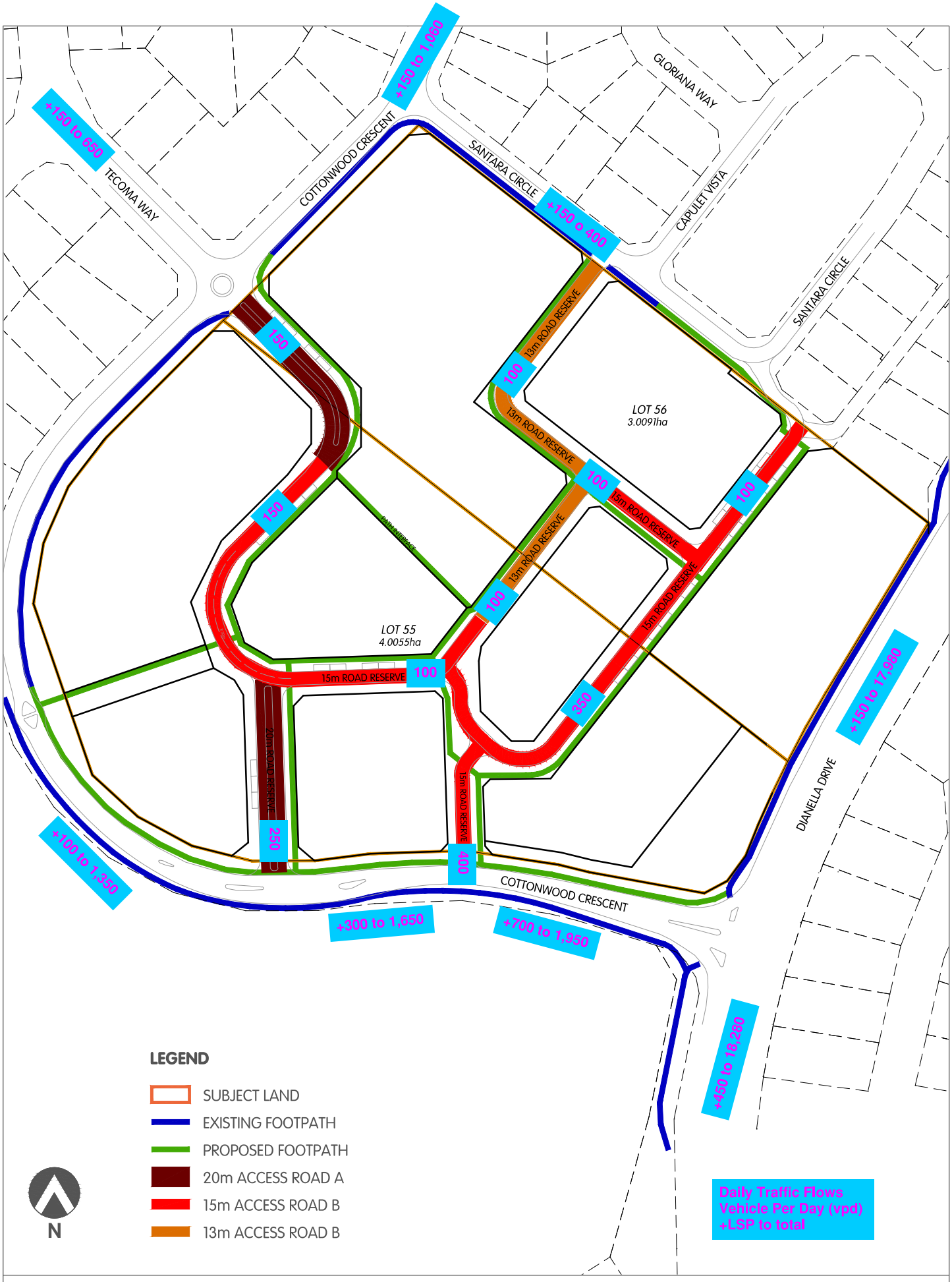
Peak Statistics

AM	TIME	08:00	07:30	07:45	09:15	06:30	06:45
	VOL	643	1156	1732	36	62	81
PM	TIME	16:45	14:30	14:45	15:00	14:30	15:00
	VOL	958	655	1551	48	41	82



D. EXPECTED INTERNAL TRAFFIC FLOWS

D



MOVEMENT NETWORK PLAN

Lot 55 and 56 Cottonwood Cresent, Dianella

City of Stirling

SIZE A4

1:2000 0 metres 20 40 60 80 100

REF NO.	DRAW NO.	REV.
NET TEN	**RD1 011**	**O**

GTAconsultants

www.gta.com.au

APPENDIX F
Department of Water Correspondence

From:	Rebecca Epworth
To:	Tracy McQue
Subject:	FW: Lots 55 and 56 Cottonwood Crescent, Dianella
Date:	Wednesday, 7 November 2012 12:51:01 PM
Attachments:	image001.png

Tracy – Confirmation from DoW below that no groundwater monitoring is required for Lots 55 and 56 Cottonwood Cresent.

Cheers, Bec

Rebecca Epworth
Director

Ph: 9381 5513 | Fax: 9381 5514 | Mobile: 0437 707 472
2/460 Roberts Road, SUBIACO WA 6008 | www.coterra.com.au

From: STOCKER Celine [mailto:Celine.Stocker@water.wa.gov.au]
Sent: Wednesday, 7 November 2012 11:58 AM
To: Liz Coulson; Rebecca Epworth
Subject: Lots 55 and 56 Cottonwood Crescent, Dianella

Hi Liz/Bec,

Thanks for the information regarding groundwater monitoring on Lots 55 and 56 Cottonwood Crescent, Dianella. The Department of Water can confirm that no groundwater monitoring for the site is required.

Please do not hesitate to contact me should you have any further queries.

Cheers,

Celine Stocker
Natural Resource Management Officer
Land Use Planning
Department of Water
6250 8045

APPENDIX G
Road Traffic Noise Assessment
Herring Storer Acoustics

HERRING STORER ACOUSTICS

PROPOSED RESIDENTIAL DEVELOPMENT

LOTS 55 AND 56 COTTONWOOD CRESCENT DIANELLA

STATE PLANNING POLICY 5.4 NOISE MANAGEMENT PLAN

NOVEMBER 2020

OUR REFERENCE: 26917-1-12181

DOCUMENT CONTROL PAGE

NOISE ASSESSMENT

LOTS 55 & 56 COTTONWOOD CRESCENT
DIANELLA

Job No: 12181

Document Reference: 26917-1-12181

FOR

HATCH ROBERTS DAY

DOCUMENT INFORMATION			
Author:	Tim Reynolds	**Checked By:**	Paul Daly
Date of Issue :	26 November 2020		

REVISION HISTORY				
Revision	**Description**	**Date**	**Author**	**Checked**

DOCUMENT DISTRIBUTION				
Copy No.	**Version No.**	**Destination**	**Hard Copy**	**Electronic Copy**
1	1	Hatch Roberts Day Attn : Tim Trefry Email : Tim.Trefry@robertsday.com.au		✓

CONTENTS

APPENDICES

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Hatch Roberts Day to undertake a road traffic noise assessment for the proposed development located at Lots 55 and 56 Cottonwood Crescent, Dianella.

The purpose of this assessment was to assess noise received within the development from vehicles travelling along Dianella Drive and if exceedance with the stated criteria were determined, establish the required attenuation measures to control noise intrusion to acceptable levels. The traffic noise assessment has been carried out in accordance with the WAPC State Planning Policy 5.4 *"Road and Rail Noise"*.

As part of the study, the following was carried out:

- Monitor existing noise received from vehicles travelling along Dianella Drive.
- For future traffic flows, determine noise that would be received at residences within the development from vehicles travelling on Dianella Drive.
- Assess the predicted noise levels for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

It is noted that with regard to State Planning Policy 5.4, that this forms a specialist acoustic assessment, taking into account the provided building design and as of such is more specific than a "Quiet House Design Package" typically recommended with State Planning Policy.

For information, the development plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *"Road and Rail Noise"* (SPP5.4), the appropriate criteria for assessment for this development are as listed below for "Noise Limits".

EXTERNAL

$L_{Aeq(Day)}$ of 55 dB(A); and
$L_{Aeq(Night)}$ of 50 dB(A).

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
$L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

Noise received at an outdoor area should also be reduced as far as practicable, with an aim of achieving an L_{Aeq} (night) of 50 dB(A). The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".

Noise received at some of the first row of residential Lots along Dianella Drive would, as shown by the noise contour plot attached in Appendix C exceed the Policies "Noise Target". Given that multiple residential Lots (i.e R60 and R80 Lots) Dianella Drive for the length of the sub-division and that these residences would be developed on top of an embankment, to comply with the requirements of SPP 5.4, “Quiet House” design needs to be incorporated into the development of the multiple residential developments, as indicated on Figure D1 in Appendix D.

For information, a summary of the “Quiet House” Design Packages are attached in Appendix E. It is noted that “Quiet House” Design Packages attached in Appendix E are “Deemed to Satisfy” constructions, hence, alternative constructions would be acceptable, provided they are supported by an acoustic report prepared by a suitably qualified acoustic consultant.

Finally, Notification on Titles would be required for those residence which receive a noise level that exceeds the “Noise Target”. Lots requiring notifications are also shown on Figure D1 in Appendix D.

3. ACOUSTIC CRITERIA

3.1 WAPC PLANNING POLICY

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *“Road and Rail Noise”.* The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

a) *noise-sensitive land-use within the policy’s trigger distance of a transport corridor as specified in **Table 1**;*

b) *New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

c) *New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State’s transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent.”*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	***Trigger distance***	***Distance measured from***
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

***Table 2** sets out noise targets that are to be achieved by proposals under which the policy applies. Where exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.*

In the application of the noise targets the objective is to achieve:

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

TABLE 2: NOISE TARGETS

Proposals	***New/Upgrade***	***Noise Targets***		
		Outdoor		***Indoor***
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	***Night (L_{Aeq}(Night)dB) (10 pm-6 am)***	***(L_{Aeq} dB)***
Noise-sensitive land-use and/or development	*New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor*	*55*	*50*	*L_{Aeq} (Day) 40(Living and work areas)* *L_{Aeq} (Night) 35 (bedrooms)*
Roads	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*
Railways	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*
- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*
- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*
- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

Noise Exposure Forecast (Section 6.2)

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*
- *noise-sensitive land-use and/or development is acceptable subject to deemed-to-comply mitigation measures; or*
- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

4. MEASUREMENTS AND OBSERVATIONS

To determine the existing acoustic environment at the proposed development, noise data loggers were located adjacent to Dianella Drive, with data collected from Monday 16 November 2020 to Monday 23 November 2020. The noise data logger was located, as shown on Figure 4.1.

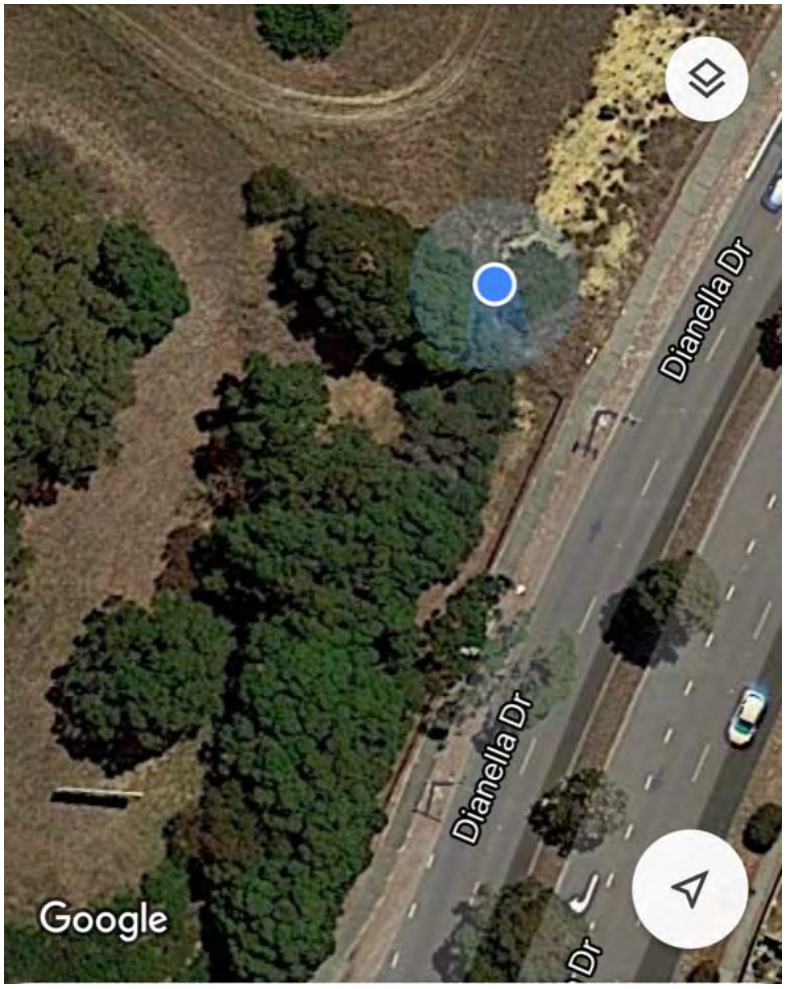


FIGURE 4.1 – LOGGER LOCATION

The automatic noise data logger records sound pressure levels in accordance with Australian Standard 2702-1984: *Acoustics - Method For Measurement of Road Traffic Noise.* The logger used records statistical noise level data, of which the L_{A10}, L_{Aeq} and L_{A90} levels are reported. These are defined below:

L_{A10} The noise level exceeded for 10% of the time (in this instance, the noise level exceeded for 6 minutes in each 1-hour period).

L_{Aeq} The energy equivalent noise level for the 1-hour period. A single number value that expresses the time-varying sound level for the 1-hour period as though it were a constant sound level with the same total sound energy as the time-varying level.

L_{A90} The noise level exceeded for 90% of the time (in this instance, the noise level exceeded for 54 minutes in each 1-hour period).

The logger was calibrated before and after the measurement period and have been subject to a laboratory calibration within the last 24 months.

The results of the noise logging are summarised in Table 4.1. The results are also shown graphically on Figure B1, attached in Appendix B.

TABLE 4.1 - SUMMARY OF MEASURED NOISE LEVELS (DIANELLA DRIVE)

Parameter	Measured Level dB(A)*
$L_{A10\ (18\ hour)}$	65.1
$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	62.4
$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	54.1

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

Based on the above measured noise levels, the relationships between the L_{A10} noise level and the $L_{Aeq(Day)}$; and $L_{Aeq(Night)}$ were determined, as listed in Table 4.2.

TABLE 4.2 – RELATIONSHIP BETWEEN MEASURED NOISE LEVELS

$L_{A10(18\ hour)} - L_{Aeq,Day}$	$L_{A10(18\ hour)} - L_{Aeq,Night}$	$L_{Aeq,Day} - L_{Aeq,Night}$
2.7	11	8.3

Note : It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

5. MODELLING

Modelling of noise received within the subdivision from Dianella Drive was carried out using SoundPlan, using the Calculation of Road Traffic Noise (CoRTN) algorithms. The input data for the model included:

- Increased traffic volume, assuming 2% growth over 20 years.
- Other traffic data as listed in Table 4.1.
- A +2.5 dB adjustment to allow for façade reflection.

The traffic data currently available on the Main Roads web site are as listed in Table 5.1. Table 5.1 also lists the percentage heavy vehicles and the calculated future traffic flows.

TABLE 5.1 - SUMMARY OF TRAFFIC DATA

Parameter	Dianella Drive
Current Traffic Flow (vpd)	17833
Future Traffic Flow (vpd)	27029
Percentage Heavy Vehicles (%)	5.3
Speed (km/hr)	70

For the noise modeling for future traffic it has been assumed that the percentage of future heavy vehicles remains the same as for the current traffic flows. In this case, we believe that this is a conservative approach, as we believe that the percentage of heavy vehicles would fall over time.

We note that with the difference between the $L_{Aeq,8hr}$ and the $L_{Aeq,16hr}$ being greater than 5 dB(A), achieving compliance with the day period criteria will also result in achieving compliance with the night period criteria. Therefore, to simplify the analysis, only modelling for the night period has been undertaken.

Noise modelling was undertaken for the 2040 traffic flows, with the multiple residential developments (i.e R60 and R80) fronting Dianella Drive for both noise received at ground and first floors.

The noise contour plots for the day period are attached in Appendix C, as Figures C1 to C2.

6. ASSESSMENT

In accordance with the WAPC Planning Policy 5.4, an assessment of the noise that would be received within the development located at Lots 55 and 56 Cottonwood Crescent, Dianella, from vehicles travelling on Dianella Drive has been undertaken.

Under the WAPC State Planning Policy 5.4, for this development, the "Noise Target" as listed in Table 1 are the appropriate noise levels for to be achieved for this development. Under SPP 5.4, the "Noise Target" criteria which are applicable external to a residence are:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the outdoor criteria apply to the ground floor level only, however, it also states that noise mitigation measures should be implemented with a view to achieving the “Noise Target” levels in least one outdoor living area. The Policy states the following acceptable internal noise levels:

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

Noise received at some of the first row of residential Lots along Dianella Drive would, as shown by the noise contour plot attached in Appendix C exceed the Policies "Noise Target". Given that R60 and R80 multiple residential Lots front Dianella Drive for the length of the sub-division and that these residences would be developed on top of an embankment, to comply with the requirements of SPP 5.4, “Quiet House” design needs to be incorporated into the development of the multiple residential developments, as indicated on Figure D1 in Appendix D.

For information, lots requiring “Quiet House” design are shown on Figure D1 attached in Appendix D. Also for information, a summary of the Quiet House Design Packages are attached in Appendix E. It is noted that “Quiet House” Design Packages attached in Appendix E are “Deemed to Satisfy” constructions and alternative constructions would be acceptable, provided they are supported by an acoustic report prepared by a suitably qualified acoustic consultant.

Finally, Notification on Titles would be required for those residence which receive a noise level that exceeds the “Noise Target”. Lots requiring notifications are also shown on Figure D1 in Appendix D.

APPENDIX A

DEVELOPMENT PLAN

LEGEND

- SUBJECT LAND
- PUBLIC OPEN SPACE SITES
- RETAINED BANKSIA WOODLAND

ZONING

- RESIDENTIAL

ten

RD great places

REVISED LOCAL STRUCTURE PLAN DESIGN

Lot 55 and 56 Cottonwood Cresent, Dianella

City of Stirling

SIZE A4

1:2000

0 metres 20 40 60 80 100

REF NO.	DRAW NO.	REV.
NET TEN	**RD1 011**	**S**

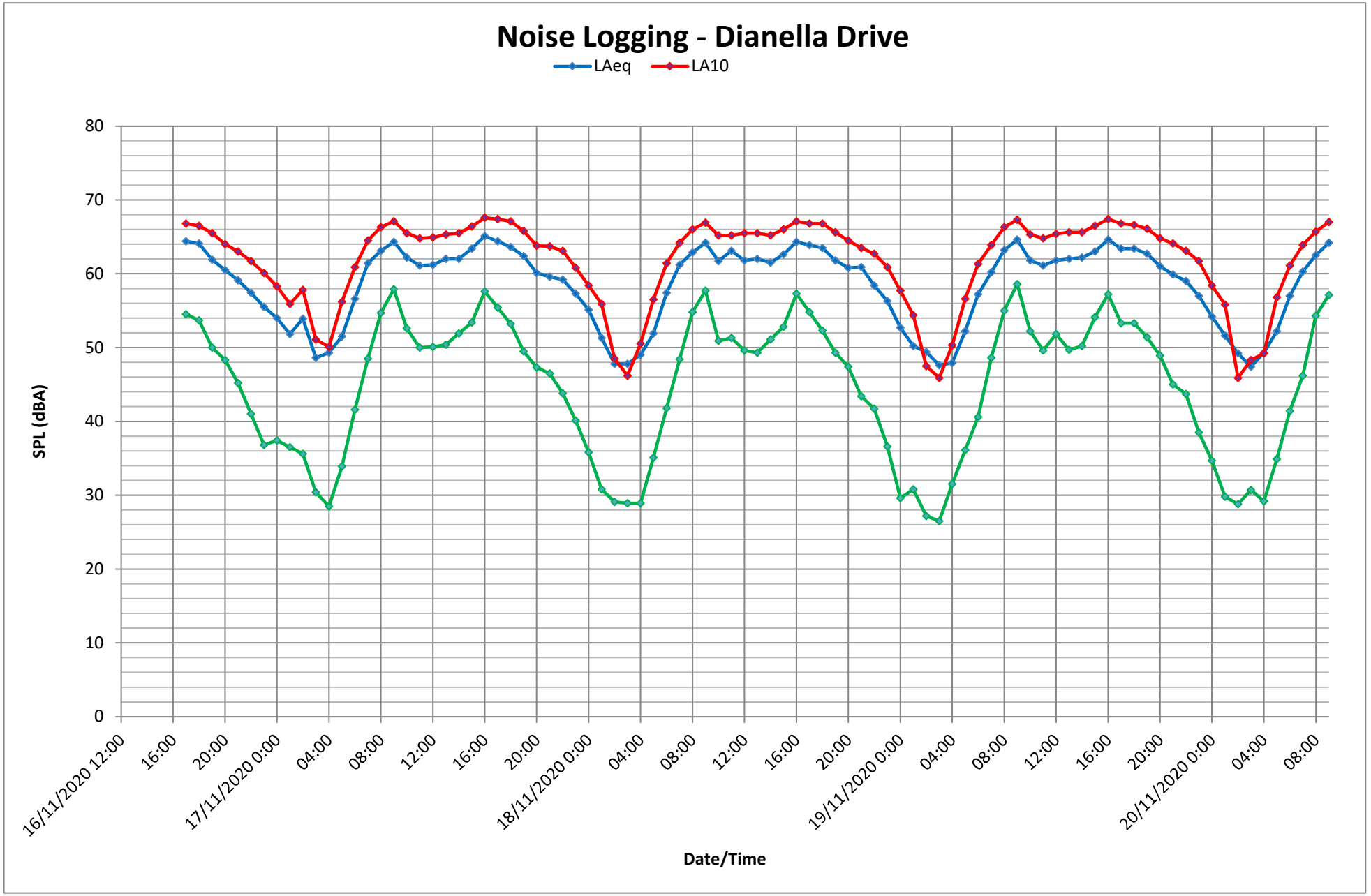
Figure 5: Structure Plan Indicative Concept Plan

Legend

1. Landscaped internal street network with reduced corner radii
2. Internal foothpaths set back from kerb aligned to property boundary
3. Retained conservation bushland with walking trails
4. POS incorporating drainage, central grassed area and planted buffer to conservation area
5. Landscaped Pedestrian Access Way
6. Multiple dwelling development with frontage to internal street and landscaped interface with Danella Drive

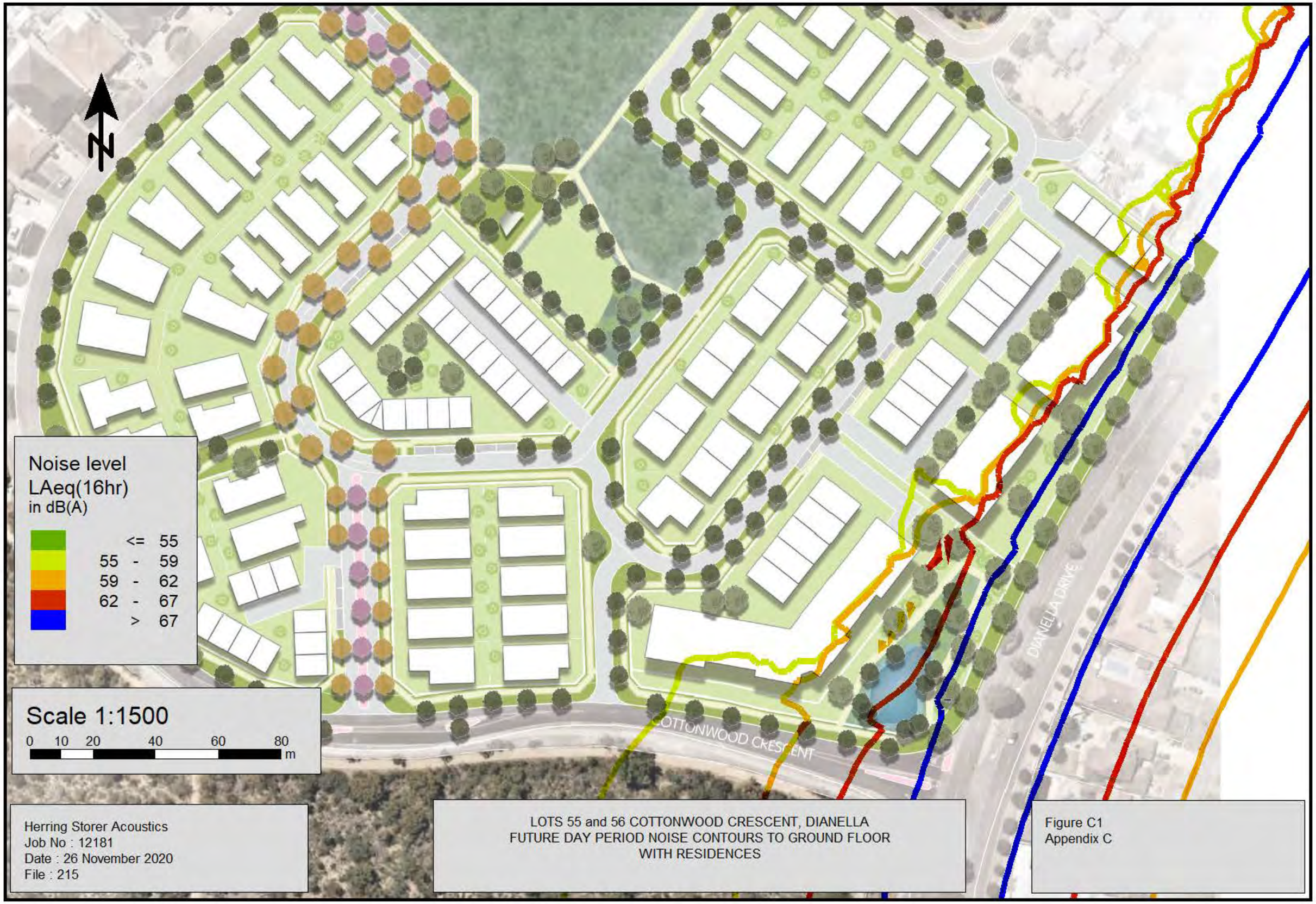
APPENDIX B

NOISE MONITORING


Noise Logging - Dianella Drive
LAeq
LA10
SPL (dBA)
80
70
60
50
40
30
20
10
0
16/11/2020 12:00
16:00
20:00
17/11/2020 0:00
04:00
08:00
12:00
16:00
20:00
18/11/2020 0:00
04:00
08:00
12:00
16:00
20:00
19/11/2020 0:00
04:00
08:00
12:00
16:00
20:00
20/11/2020 0:00
04:00
08:00
Date/Time

APPENDIX C

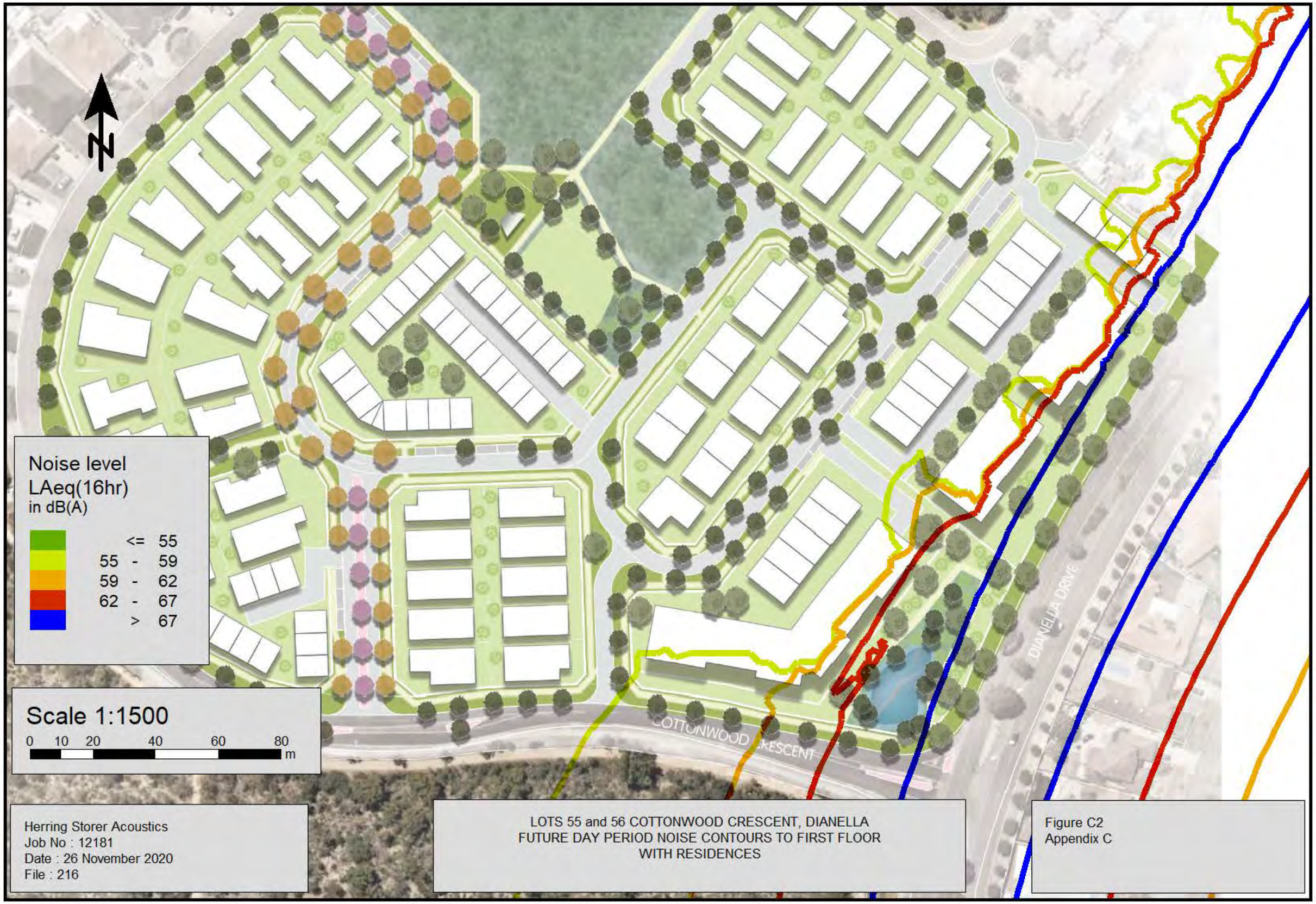
NOISE CONTOUR PLOTS



Herring Storer Acoustics
Job No : 12181
Date : 26 November 2020
File : 215

LOTS 55 and 56 COTTONWOOD CRESCENT, DIANELLA
FUTURE DAY PERIOD NOISE CONTOURS TO GROUND FLOOR
WITH RESIDENCES

Figure C1
Appendix C



Herring Storer Acoustics
Job No : 12181
Date : 26 November 2020
File : 216

LOTS 55 and 56 COTTONWOOD CRESCENT, DIANELLA
FUTURE DAY PERIOD NOISE CONTOURS TO FIRST FLOOR
WITH RESIDENCES

Figure C2
Appendix C

APPENDIX D

LOTS REQUIRING “QUIET HOUSE” DESIGN AND NOTIFICATIONS

NOTE :
Alternative constructions are acceptable provided they are supported by a noise ingress report prepared by a suitably qualified acoustic consultant.

LOTS 55 and 56 COTTONWOOD CRESCENT
LOTS REQUIRING
QUIET HOUSE DESIGN AND
NOTIFICATIONS ON TITLES

Herring Storer Acoustics
Date : 26 November 2020
Job No : 12181

Figure D1
Appendix D

APPENDIX E

SPP 5.4 “QUIET HOUSE” PACKAGES

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A **Quiet House A**	**Facing**	**Bedroom and Indoor Living and work areas to Rw + Ctr 45dB** **Stud Frame Walls** ➢ One row of 92mm studs at 60mm centres with: ➢ Resilient steel channels fixed to the outside of the studs; and ➢ 9.5mm hardboard or 9mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and ➢ 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and ➢ -Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. **Brick Walls** ➢ Single leaf of 150mm brick masonry with 13mm cement render on each face: **OR** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**)**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side On		As per "Facing" above, except R_w+C_{tr} values may be 3dB less, e.g. glazed sliding door with 10 mm glass and weather seals for bedrooms	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			
	Opposite		No specific requirements	No specific requirements			

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B **Quiet House B**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face ➢ Single leaf of 220mm brick masonry with 13mm cement render on each face ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor areas: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**Rw+Ctr 31dB**). ➢ Up to 60% floor area: as per above but must be minimum10mm single or 6mm-12mm-10mm double insulated glazing (**Rw+Ctr 34dB**) **Indoor Living and work areas** ➢ Up to 40% floor area; Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (R_w+C_{tr} 28dB). Sealed awning or casement windows may use 6mm glazing instead. **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**R_w+C_{tr} 31dB**). **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34dB).**	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile sarking and at least 10mm plasterboard ceiling, R3.0+ insulation **OR** ➢ Metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-On		**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead. **: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			
	Opposite		As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C **Quiet House C**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves	**Bedrooms** ➢ External doors to bedrooms facing the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB): OR** ➢ Up to 40% floor area; as per above but must be minimum 10mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 34dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (**R_w+C_{tr} 31dB**). Sealed awning or casement windows may use 6mm glazing instead**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr 34dB)**	**To R_w+C_{tr} 40dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.
	Side-on	**Single leaf of 220mm brick masonry with 13mm cement render on each face** ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals				
	Opposite	**Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB): OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			

Note: The above treatments are a deemed to satisfy construction. Alternative designs are acceptable, provided they are certified by a suitable qualified acoustic consultant.

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