PLANNING SOLUTIONS

URBAN & REGIONAL PLANNING

Structure Plan

Lot 1 (303) Corfield Street, Gosnells

Prepared for
Powerstar Pty Ltd atf Aveling Family Trust
and Zeditave Pty Ltd JV
C/- Viridian Property Group

June 2017

Direct all inquiries to:

Planning Solutions
Level 1, 251 St Georges Terrace
Perth, WA 6000

All correspondence to:
GPO Box 2709
Cloisters Square PO 6850

Phone: 08 9227 7970
Fax: 08 9227 7971
Email: admin@planningsolutions.com.au
Web: www.planningsolutions.com.au

Endorsement page

This structure plan is prepared under the provisions of the City of Gosnells Town Planning Scheme No. 6.

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

7 July 2017 ..... Date

Signed for and on behalf of the Western Australian Planning Commission

.....

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

..... Witness

7 July 2017 ..... Date

7 July 2027 ..... Date of Expiry

Records of amendments made to structure plan

Amendment no.	Summary of the amendment	Amendment type	Date approved by WAPC

Executive Summary

This structure plan applies to Lot 1 (303) Corfield Street, Gosnells (**subject site**), located within the municipality of the City of Gosnells. It forms part of a larger urban development precinct that was rezoned Development by Amendment No. 130 to the City of Gosnells Town Planning Scheme No. 6, and is the first structure plan within that precinct.

The proposed structure plan is intended to facilitate the subdivision of the subject site for residential and/or commercial purposes.

Table (i) below provides for a summary of the proposed development of the subject site.

Table (i) – Structure Plan summary

Item	Data		Report reference (section no.)
Total area covered by the structure plan	3.4663ha		Part Two, Section 1.2
Area of each land use proposed: • Residential • Office	Hectares 1.1700ha 0.3462ha	Lot yield 36 lots 1 Office lot or 11 residential lots	 Part Two, Section 3.3 Part Two, Section 3.4
Total estimated lot yield	36 lots		Part Two, Section 3.3
Estimated number of dwellings	36 dwellings		Part Two, Section 3.3
Estimated residential site density	30.8 dwellings per site hectare		Part One, Section 4.6
Estimated population	97 people (assumes 2.7 avg household size)		Part Two, Section 3.3
Number of high schools	0 high schools		N/A
Number of primary schools	0 primary schools		N/A
Estimated commercial floor space	Approx. 1,600m^2 floor area		Part Two, Section 3.4
Employment self-sufficiency targets	60%		Part Two, Section 3.4
Estimated number and area of public open space: • Local parks	1 park 0.8247ha (includes wetland core)		Part Two, Section 3.2
Estimated percentage of natural area	0.4252 ha 1 site		Part Two, Section 3.2

Table of contents

Part One

1 Structure plan area 1
2 Operation 1
3 Staging 1
4 Subdivision and development requirements 1
4.1 Land use zones and reserves 1
4.2 Protection of environmental features 1
4.3 Bushfire hazard 2
4.4 Transportation noise 2
4.5 Staging 2
4.6 Interface to adjoining land 2
4.7 Density targets 2
4.8 Water Corporation water main 2
5 Local Development Plans 3
6 Other requirements 3
6.1 Infrastructure upgrades 3
6.2 Developer contributions 3
7 Additional information 3

Part Two

1 Planning background 6
1.1 Introduction and purpose 6
1.2 Land description 6
1.3 Planning framework 7
2 Site conditions and constraints 16
2.1 Biodiversity and natural area assets 16
2.2 Landform and soils 17
2.3 Groundwater and surface water 18
2.4 Bushfire hazard 18
2.5 Transport noise 19
2.6 Heritage 19
2.7 Context and other land use constraints 19
3 Structure Plan 22
3.1 Land use 22
3.2 Open space 22
3.3 Residential 24
3.4 Office 26
3.6 Movement networks 29
3.7 Water management 33
3.8 Education facilities 34
3.9 Activity centres and employment 34
3.10 Infrastructure coordination, servicing and staging 34
3.11 Developer contribution arrangements 35

Plans

Plan 01 Structure Plan

Figures

Figure 01 Aerial photograph
Figure 02 Zoning map
Figure 03 Context and constraints
Figure 04 Concept plan
Figure 05 Office site indicative layout plan
Figure 06 Movement network

Technical appendices index

Appendix No.	Document title	Approval required OR supporting document only	Approval status	Approval agency
1	Certificate of Title	Supporting document	N/A	N/A
2	Environmental Assessment	Supporting document	N/A	N/A
3	Bushfire Management Plan	Supporting document	Not yet approved	City of Gosnells
4	Transportation Noise Assessment	Supporting document	N/A	N/A
5	Landscape Concept Plan	Supporting document	N/A	N/A
6	Traffic Report	Supporting document	N/A	N/A
7	Local Water Management Strategy	Approval required	Not yet approved	Department of Water
8	Engineering Report	Supporting document	N/A	N/A

Project details		
Job number	4001	
Client	Viridian Property Group	
Prepared by	Planning Solutions	
Consultant Team	Statutory Planning and Urban Design Environmental Engineering Water Management Traffic Engineering Surveyor Geotechnical Acoustic Landscaping Bushfire	Planning Solutions Aurora Environmental Wood & Grieve Engineers JDA Hydrology Riley Consulting MNG Golder Associates Lloyd George Acoustics Plan E Strategen

Planning Solutions Document Control		
Revision number	File name	Document date
Rev 0	160120 4001 Structure Plan Report	20 January 2016
Rev 1	160420 4001 Structure Plan Report (Rev 1)	20 April 2016
Rev 2	160614 4001 Structure Plan Report (Rev 2)	15 June 2016
Rev 3	160824 4001 Structure Plan Report (Rev 3)	24 August 2016
Rev 4	170406 4001 Structure Plan Report (Rev 4)	6 April 2017
Rev 5	170615 4001 Structure Plan Report (Rev 5)	15 June 2017

Lot 1 (303) Corfield Street, Gosnells
Part One – Implementation

1 Structure plan area

This Structure Plan shall apply to Lot 1 (303) Corfield Street, Gosnells (**Structure Plan area**), being the land contained within the inner edge of the line denoting the structure plan boundary on the Structure Plan Map (**Plan 1**).

2 Operation

This Structure Plan commences operation on the date it is approved by the Western Australian Planning Commission (WAPC).

3 Staging

This Structure Plan can be implemented once it is approved by the WAPC.

4 Subdivision and development requirements

4.1 Land use zones and reserves

The Structure Plan Map (**Plan 1**) outlines land use, zones and reserves applicable within the Structure Plan area. Decisions relating to the future subdivision and development of the land within the Structure Plan area shall have due regard to the detail contained within this Structure Plan including the technical appendices.

The Structure Plan consists of the following zones and reserves:

- Residential (R30)
- Office
- Local Open Space

Land use permissibility within the Structure Plan area shall be in accordance with the corresponding zone or reserve under the City of Gosnells Town Planning Scheme No. 6 (**the Scheme**).

4.2 Protection of environmental features

The portion of the existing Resource Enhancement Wetland (REW) UFI 15842 that contains vegetation mapped as 'Good' condition is to be retained in public open space. A buffer of variable width around the wetland will be maintained within the public open space. The treatment of the buffer and wetland, including any proposed rehabilitation and on-going management will be addressed in a Wetland and Public Open Space Management Plan to be prepared at subdivision stage.

4.3 Bushfire hazard

Based on the proximity of 'Extreme' and 'Moderate' rated hazardous vegetation and the Department of Fire and Emergency Services Map of Bushfire Prone Areas 2015, the Structure Plan area is considered to be within a Bushfire Prone Area. The layout of the Structure Plan with roads abutting hazardous vegetation ensures future dwellings will be located in areas with an appropriate Bushfire Attack Level rating. A bushfire management plan (BMP) has been prepared in support of the Structure Plan and identifies the bushfire management measures required to be implemented by the developer in the initial stages of subdivision to ensure the relevant standards and performance criteria are met.

4.4 Transportation noise

The Office zoned site is affected by transportation noise emanating from Corfield Street. Any development proposal for noise-sensitive uses (e.g. residential, education, child care, etc.) within this site must be accompanied by a site specific noise assessment undertaken by a qualified acoustic consultant consistent with *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning.*

4.5 Staging

Subdivision is likely to occur in a single stage, progressing from the new neighbourhood connector road extending from Corfield Street.

Servicing of the Structure Plan area is capable through the extension of existing services.

4.6 Interface to adjoining land

The Structure Plan provides for a neighbourhood connector road providing access from Corfield Street along the south-eastern boundary of the land. It is anticipated that this road will be extended further south through the adjoining Lot 1272 as development of the surrounding land is progressed.

A road along portion of the interface between the Structure Plan area and adjoining school site is provided to maximise accessibility around the school.

4.7 Density targets

Strategy / Policy Document	Density Target	Provided (based on 36 lots)
Directions 2031 and Beyond	15 dwellings per gross hectare	13.6 dwellings per gross hectare
Perth and Peel @ 3.5 million	26 dwellings per residential site hectare	30.8 dwellings per site hectare
Liveable Neighbourhoods	22 dwellings per site hectare	

4.8 Water Corporation water main

The Water Corporation's Serpentine-Canning water main travels along the northern and eastern boundaries of the subject site, within the adjoining primary school site and Corfield Street road reserve. A 5m wide building exclusion area, measured from the centre of the pipe, is required to protect the water main, as illustrated on the Structure Plan Map (Plan 1).

A condition of subdivision approval will be applied to create an easement or restrictive covenant to prevent building works occurring within the building exclusion area. The building exclusion area may be used for minor infrastructure, including at-grade car parking, access and minor underground mains infrastructure. Non-destructive construction methods such as static rolling must be used where construction activities are undertaken within 20m of the water main.

5 Local Development Plans

Local Development Plans are to be prepared in accordance with clause 7.6 of the Scheme, prior to any subdivision and/or development of the Office zoned site. The main issues to be addressed include:

- Building orientation to local open space and primary school.
- Vehicular access arrangements.
- Street and lot boundary setbacks.
- Private open space for residential development.

6 Other requirements

6.1 Infrastructure upgrades

The Structure Plan area is capable of being serviced through the extension of existing services in the vicinity. No infrastructure upgrades are required to support the subdivision of the land.

6.2 Developer contributions

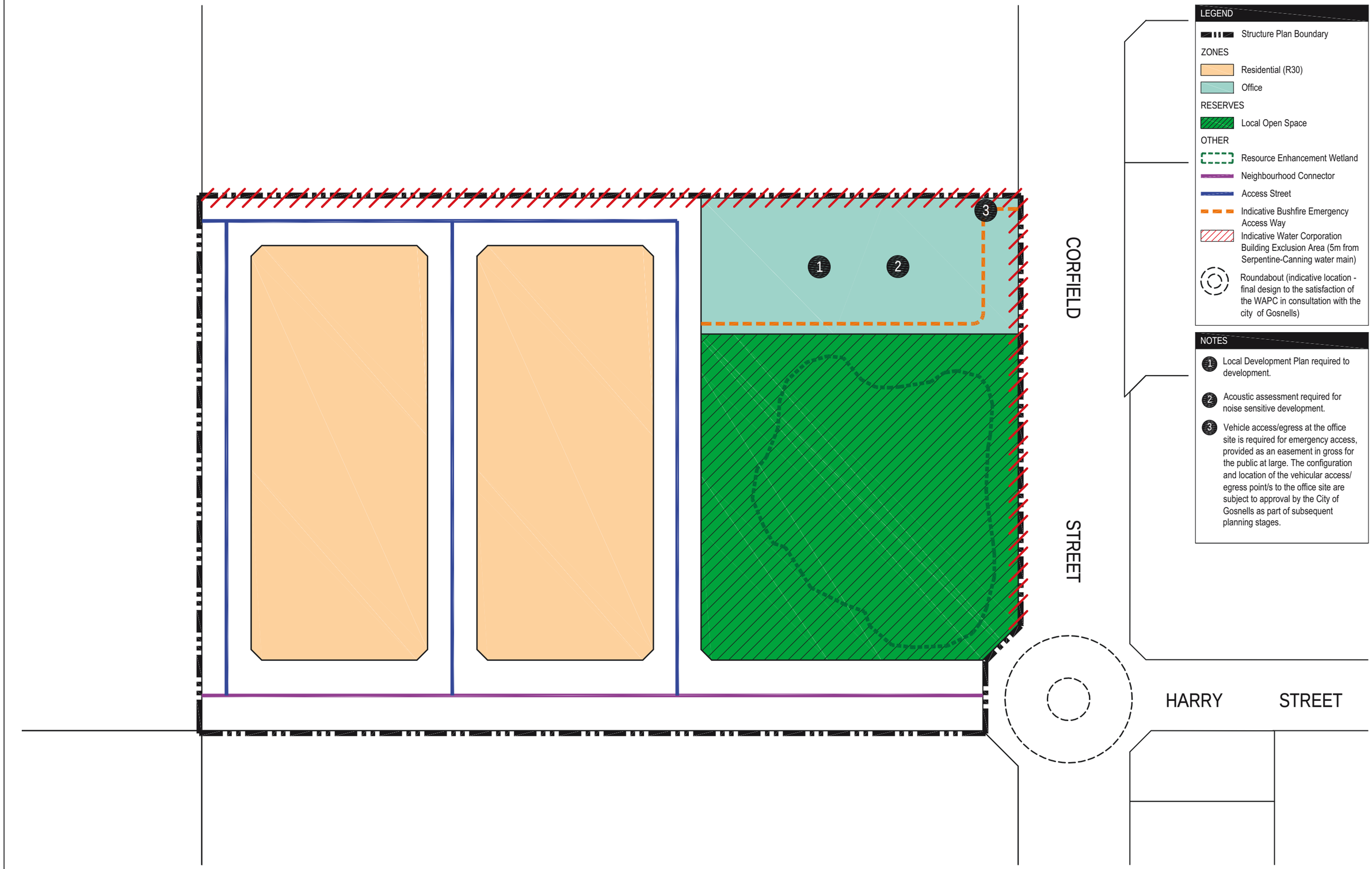
As the land is under single ownership and is intended on being developed in a single stage, the requirement for a development contribution arrangement is unnecessary in this instance.

The Structure Plan area is not subject to any developer contributions under the Scheme.

7 Additional information

The following additional information is required to be submitted at the subdivision or development stage.

Additional information	Approval stage	Consultation required
Urban Water Management Plan	Subdivision (condition)	City of Gosnells
Acid Sulphate Soils Management Plan (if required)	Subdivision (condition)	City of Gosnells
Mosquito and Midge Management Plan	Subdivision (condition)	City of Gosnells
Wetland and Public Open Space Management Plan	Subdivision (condition)	City of Gosnells
Environmental Construction and Works Management Plan	Subdivision and/or Development (condition)	City of Gosnells



LEGEND

- Structure Plan Boundary

ZONES

- Residential (R30)
- Office

RESERVES

- Local Open Space

OTHER

- Resource Enhancement Wetland
- Neighbourhood Connector
- Access Street
- Indicative Bushfire Emergency Access Way
- Indicative Water Corporation Building Exclusion Area (5m from Serpentine-Canning water main)
- Roundabout (indicative location - final design to the satisfaction of the WAPC in consultation with the city of Gosnells)

NOTES

1. Local Development Plan required to development.
2. Acoustic assessment required for noise sensitive development.
3. Vehicle access/egress at the office site is required for emergency access, provided as an easement in gross for the public at large. The configuration and location of the vehicular access/ egress point/s to the office site are subject to approval by the City of Gosnells as part of subsequent planning stages.

PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING

SCALE	1:1,000 @ A3
DATE	14 June 2017
FILE	170221 4001 Structure Plan Map.dwg
REVISION	4/DR/Rev/21.02.201 7 3/EF/Rev/14.06.2016 2/EF/Rev/18.04.2016

Scale Bar (m) 0 10 20 30

STRUCTURE PLAN MAP

LOT 1 (303) CORFIELD STREET
GOSNELLS, WESTERN AUSTRALIA

PLAN 01

BASEPLAN SOURCE: NEARMAPS & WA ATLAS

Lot 1 (303) Corfield Street, Gosnells
Part Two – Explanatory Section

1 Planning background

1.1 Introduction and purpose

Structure plans are forward planning documents that provide a guiding framework for subdivision and development. Structure plans coordinate the provision of land use, road networks, public open space, community facilities, schools and centres of activity, services and infrastructure.

This Structure Plan has been prepared in accordance with the City of Gosnells (City) Town Planning Scheme No. 6 (TPS6) and the relevant 'deemed provisions' of the *Planning and Development (Local Planning Scheme) Regulations 2015* (Planning Regulations). The purpose of the Structure Plan is to facilitate the urban development of Lot 1 (303) Corfield Street, Gosnells (subject site).

With the support of the technical data, the proposed Structure Plan provides for the following:

- Pattern of land use.
- Network and hierarchy of roads.
- Public open space.
- Bushfire management.
- Water management.
- Servicing strategy.

Once endorsed, the proposed Structure Plan will guide the subdivision, land use and residential density for the subject site. In accordance with the Planning Regulations, the proposed Structure Plan does not seek to provide detailed development standards, nor does it seek to vary the requirements of the Residential Design Codes (R-Codes). Local Development Plans are able to fulfil this role if required.

As required by the Department of Planning, the proposed structure plan has been prepared in accordance with the requirements of *Liveable Neighbourhoods* (LN), and has been structured in accordance with the requirements of TPS6 and the WAPC's *Structure Plan Framework (August 2015)*.

1.2 Land description

1.2.1 Location

The subject site is located approximately 22 kilometres southeast of the Perth City Centre and 11 kilometres southeast of the Cannington Strategic Metropolitan Centre. Tonkin Highway is located approximately 1 kilometre from the subject site. Abutting the subject site to the northwest is the Seaforth Primary School site, and the surrounding land to the south and west comprises the landholding owned by the Della-Vedova family.

1.2.2 Area and land use

The subject site comprises a single lot, with an area of approximately 3.5 hectares and frontage of 150m to Corfield Street. The land is currently used for rural residential purposes, with an existing single dwelling located in the northern corner of the lot. The land is surrounded by predominantly rural residential and residential land uses. The eastern side of Corfield Street generally comprises medium density residential development, with local shops located directly opposite the subject site.

The subject site is generally undulating, and slopes slightly towards the wetland in the eastern portion of the lot. The highest point is approximately 24.53 metres Australian Height Datum (AHD) at the northern corner of the lot and the lowest point being 21.70 metres AHD within the area identified as wetlands at the front of the lot.

Refer Figure 1, aerial photograph.

1.2.3 Legal description and ownership

The subject site is currently held in single land ownership. The lot details are outlined in Table 1.

Table 1 – Lot details

Lot	Plan/Diagram	Volume	Folio	Area (hectares)
1	71840	1777	791	3.4663

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

1.3 Planning framework

1.3.1 Zoning and reserves

1.3.1.1 Metropolitan Region Scheme

Under the provisions of the Metropolitan Region Scheme (MRS) the subject site is zoned Urban. The subject site fronts Corfield Street, which is reserved for Other Regional Roads under the MRS. The land remains unaffected by the reservation.

The proposed structure plan is consistent with the provisions of the MRS and may be approved accordingly.

Refer Figure 2, zoning map.

PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING

SCALE	1: 2,000 @ A4
DATE	04 January 2016
FILE	01 160104 4001 Aerial Photo.dwg
REVISION	1/EF/First Draft/04.01.2016

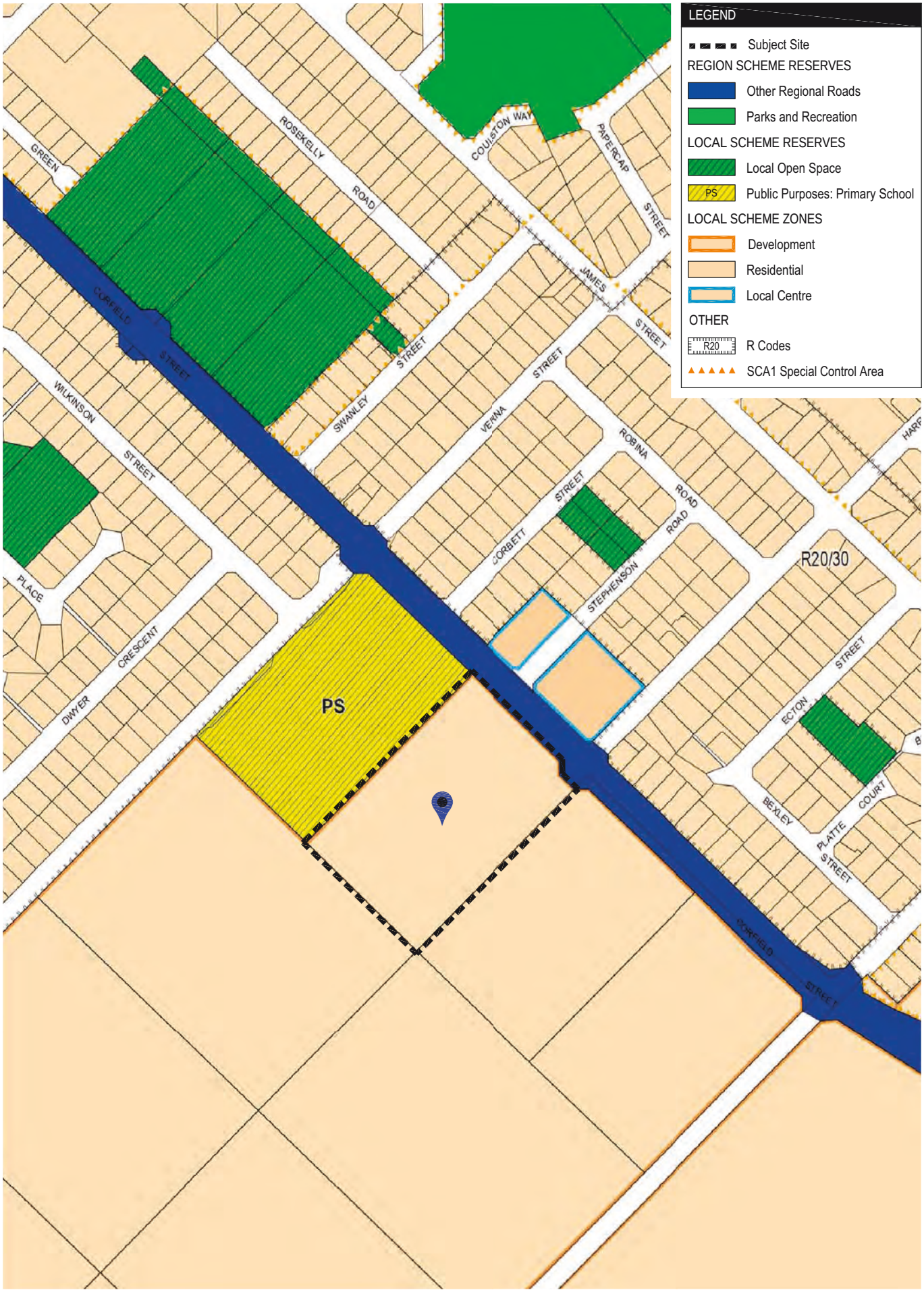
Scale Bar (m) 0 50

AERIAL PHOTOGRAPH

LOT 1 (303) CORFIELD STREET, GOSNELLS, WESTERN AUSTRALIA

FIGURE 01

 BASEPLAN SOURCE: NEARMAPS



PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING

SCALE	1: 5,000 @ A4
DATE	04 January 2016
FILE	02 160104 4001 Zoning Map.dwg
REVISION	1/EF/First Draft/04.01.2016

Scale Bar(m) 0 50 100

ZONING MAP

LOT 1 (303) CORFIELD STREET, GOSNELLS, WESTERN AUSTRALIA

FIGURE 02

1.3.1.2 City of Gosnells Town Planning Scheme No. 6

The subject site is zoned Development under the provisions of TPS6. Refer Figure 2, zoning map. Clause 4.2 states the objective of the Development zone is:

> *To provide for the progressive and planned development of land for a variety of uses including, residential, commercial, industrial, recreational and community generally in accordance with an Outline Development Plan adopted pursuant to clause 7.4.*

The proposed Structure Plan (previously referred to as an Outline Development Plan) facilitates the coordinated development of the subject site for a mix of residential and commercial purposes. It takes into consideration future development and the existing land uses surrounding the subject site. The proposed Structure Plan has been prepared with due regard to the amenity of the existing locality and will demonstrate how an integration with the surrounding land has been achieved. As such, the proposed Structure Plan is consistent with the objectives of the Development zone.

The new Planning Regulations came into effect on 19 October 2015 and introduced a set of deemed provisions which automatically form part of every local planning scheme in the State. Clause 27 of the deemed provisions relates to the effect of a structure plan, with clause 27 (1) stating:

> *A decision-maker for an application for development approval or subdivision approval in an area that is covered by a structure plan that has been approved by the Commission is to have due regard to, but is not bound by, the structure plan when deciding the application.*

Consistent with the provisions of the Planning Regulations, the proposed Structure Plan will guide the future subdivision and development of the subject site.

1.3.2 Planning strategies

1.3.2.1 Directions 2031

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

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

Directions 2031 sets a target of 15 dwellings per gross urban zoned hectare of land in new development areas. The residential portion of the proposed Structure Plan comprises approximately 36 single lots, equating to a density of 13.6 dwellings per gross urban zoned hectare for the subject site. This equates to a shortfall of 1.4 dwellings per hectare, or 4 single residential lots. The density target shortfall is considered appropriate in this instance, as the subject site is highly constrained by natural features, including the REW within the subject site and surrounding vegetation acting as a bushfire hazard to future dwellings and requiring sufficient hazard separation distances in the form of additional roads around the perimeter of the site. The proposed Office site further reduces the land solely available for residential purposes.

Due to the size and complexity of strategic planning for the metropolitan area, sub-regional strategies are prepared to provide guidance at the local level. The subject site falls within the south-east sub-region, which is forecast to increase its population levels by 34 per cent, requiring an additional 35,000 dwellings by 2031.

1.3.2.2 Draft Outer Metropolitan Perth and Peel Sub-regional Strategy

The Draft Outer Metropolitan Perth and Peel Sub-Regional Strategy (Sub-Regional Strategy) is a strategic planning document intended to guide the delivery of objectives of Directions 2031. In order to progress urban growth in a coordinated manner, the Sub-Regional Strategy suggests the development of land zoned Urban and Urban Deferred be prioritised to accommodate urban expansion.

The subject site is located within a wider 'urban zoned undeveloped' area under the Sub-Regional Strategy, generally comprising the surrounding undeveloped landholdings along Tonkin Highway. This area is expected to yield 3,000 new dwellings under the connected city model.

1.3.2.3 City of Gosnells Local Housing Strategy

The City of Gosnells Local Housing Strategy (LHS) has been prepared to identify the capacity for increasing residential densities within the City to cater for population growth and change, whilst contributing to a more sustainable form of residential settlement. Although dated (having been endorsed in 2003), the LHS outlines the importance of determining residential densities based on accessibility to public transport services, local shops, community facilities and public open space. The residential densities proposed as part of this structure plan are considered appropriate in the context of the subject site, which is identified as being in an area of high accessibility on the Access Indicator Map appended to the LHS.

1.3.2.4 City of Gosnells Activity Centres Planning Strategy

The City of Gosnells Activity Centres Planning Strategy (ACPS) outlines the broad planning requirements for the development of new activity centres and redevelopment and renewal of existing centres within the City. The subject site is located opposite the Corfield Shopping Centre, which is identified as a Neighbourhood Centre under the ACPS. The ACPS states:

> *The centre has relatively low amenity and could benefit from renovation or refurbishment to improve the visual appeal of the centre and attract new tenants. The anchor tenant is an IGA supermarket with 1176m² floor space. The Corfield Tavern is the second largest tenant at 385m².*

The ACPS, in relation to older centres, provides:

> *The general strategic approach in relation to older, well-established centres should be to encourage and facilitate any development at all which would result in some improvement to a centre, even though it may not represent an "ideal" outcome. Whilst high standards of urban design and development should always be encouraged and preferred over more "ordinary" development, this strategy envisages specifically foregoing higher standards, if necessary, in order to facilitate some physical and/ or social improvement over an existing situation.*

In relation to Neighbourhood Centres, the ACPS states:

> *All to be a maximum of 4,500m² without a RSA.*
>
> *Mix of land use requirements do not apply to neighbourhood centres, but local offices, community services, and adjacent or integrated higher density residential development should be encouraged wherever practicable.* [emphasis added]

The proposed Structure Plan provides for residential development, increasing the number of households within the catchment of the Neighbourhood Centre. Additionally, the proposed Office site provides an opportunity to broaden the range of commercial facilities adjunct to the Neighbourhood Centre, consistent with the ACPS.

1.3.3 Policies

1.3.3.1 State Planning Policies

SPP 3 – Urban Growth and Settlement

State Planning Policy 3 – Urban Growth and Settlement (SPP 3) applies to all development throughout Western Australia. SPP 3 notes orderly planning of urban growth and settlement should be facilitated by structure plans, which should take into account the strategic and physical context of the locality, provide for the development of safe, convenient and attractive neighbourhoods which meet the diverse needs of the community, and facilitate logical and timely provision of infrastructure and services. The proposed Structure Plan is consistent with the intent of SPP 3 in terms of attaining the policy's stated objectives. Accordingly, the proposed Structure Plan for the subject site warrants the support and endorsement of the determining authorities.

SPP 3.1 – Residential Design Codes

State Planning Policy 3.1 - Residential Design Codes (R-Codes) applies to residential development in Western Australia. Clause 5.2.2 of TPS6 requires the development of land for residential purposes to conform to the provisions of the R-Codes.

The R30 density identified on the proposed Structure Plan is interpreted by the R-Codes. Future subdivision and residential development across the subject site is to comply with the requirements of the R-Codes relevant to the R30 density code.

SPP 3.4 – Natural Hazards and Disasters

State Planning Policy 3.4 – Natural Hazards and Disasters (SPP 3.4) applies to the preparation of structure plans throughout Western Australia. It requires consideration to be given to potential hazards such as floods, severe storms and cyclones, storm surges and tsunamis, coastal erosion, bushfires, landslides and other land movements and earthquakes. Relevant to the subject site is bushfire hazard – refer to Section 2.4 of this report.

SPP 3.6 – Development Contributions for Infrastructure

State Planning Policy 3.6 – Development Contributions for Infrastructure (SPP3.6) outlines the relevant considerations and principles for developer contributions for infrastructure, and the preparation of development contribution plans. Refer to Section 3.10 of this report.

SPP 3.7 – Planning for Bushfire Prone Areas

State Planning Policy 3.7 – Planning for Bushfire Prone Area (SPP 3.7) was gazetted on 7 December 2015, and published along with the revised Guidelines for Planning in Bushfire Prone Areas. The policy introduces new requirements for development in bushfire prone areas. The policy contains objectives and policy measures, which apply to all land-use development proposals at varying stages of the development process. Refer to Section 2.4 of this report for further detail in relation to bushfire risk management.

SPP 4.2 – Activity Centres for Perth and Peel

State Planning Policy 4.2 – Activity Centres for Perth and Peel (SPP 4.2) specifies the broad planning requirements for the planning of new activity centres and the redevelopment and renewal of existing centres in Perth and Peel. SPP 4.2 includes objectives for a range of activity centres, including Perth capital city, strategic metropolitan, secondary, specialised, district and neighbourhood centres.

SPP 4.2 describes the role and function of a neighbourhood centre as follows:

> *The main role and function of neighbourhood and local centres is to provide for the daily and weekly household shopping needs, community facilities and a small range of other convenience services.*

Clause 5.2.3 of SPP4.2 relates to employment, and provides the following:

> *(3) Planning decision-making should facilitate: …*
>
> - *smaller-scale offices and commercial tenancies, particularly in neighbourhood and district centres, to facilitate the transition of home-based businesses and the growth of small business; …*

The Office site proposed as part of the Structure Plan will expand upon and complement the existing commercial uses within the Neighbourhood Centre, consistent with SPP4.2.

SPP 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning

State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning (SPP 5.4) aims to promote a system in which sustainable land use and transport and mutually compatible. Corfield Street currently carries around 17,000 vehicles per day and is expected to increase to around 25,000 vehicles per day in the future. A Transport Noise Assessment has been prepared; refer to Section 2.5 of this report for further detail.

1.3.3.2 Other relevant State policies and guidelines

Liveable Neighbourhoods

The proposed Structure Plan has been prepared in accordance with the current (January 2009) version of LN as outlined in Section 3.3 of this report.

An updated version of LN was released by the DoP for the purposes of public review in October 2015. Section 3.3 of this report only refers to the draft LN where necessary.

Development Control Policy 5.1 Regional Roads (Vehicular Access)

The WAPC's Development Control Policy 5.1 Regional Roads (Vehicular Access) (DC5.1) sets out the principles to be applied when considering proposals for vehicle access to or from developments abutting regional roads. DC5.1 includes the following considerations:

> *3.3.1 In considering applications for access on regional roads, the effects of the proposals on traffic flow and road safety will be the primary consideration. The more important the regional road, the greater the importance attached to these factors. In general, the Commission will seek to minimise the creation of new driveways on regional roads and rationalise existing access arrangements.*
>
> *3.3.5 In determining applications for development involving the formation, laying out or alteration of a means of access to regional roads, the following must be considered:*
>
> *i) the effects of the development on traffic flow and safety, the character and function of the road, the volume and speed of traffic, the width of the carriageway and visibility; and*
>
> *ii) the volume and type of traffic generated by the development.*

Direct vehicular access between the proposed Office site and Corfield Street is proposed, with right-out access restricted. This is considered appropriate as it allows the Office site to operate in conjunction with the Corfield Shopping Centre, and removes commercial traffic from residential streets. Refer to the Structure Plan Traffic Report attached as Appendix 6 to this report for consideration of the above factors.

Transport Assessment Guidelines for Developments

The proposed Structure Plan has been prepared in accordance with the Department of Planning's *Transport Assessment Guidelines for Developments*, as outlined in Section 3.5 of this report, and addressed in the Structure Plan Traffic Report attached as Appendix 6 to this report.

Better Urban Water Management Guidelines

The proposed Structure Plan has been prepared in accordance with the *Better Urban Water Management Guidelines*, as discussed in Section 3.6 of this report, as well as in the Local Water Management Strategy (LWMS) attached as Appendix 7 to this report.

Acid Sulphate Soils Planning Guidelines

The WAPC's *Acid Sulphate Soils Planning Guidelines* (ASS Guidelines) specify that structure plans wholly or partially within areas of high to moderate acid sulphate soils should be prepared with consultation to the ASS Guidelines. Guidance Statement B3 of the ASS Guidelines suggests that the pattern and distribution of proposed land uses within structure plans should avoid disturbance of acid sulphate soils where practicable. Refer to Section 2.2.3 of this report for further detail on the impact of acid sulphate soils on the subject site.

Structure Plan Framework

The WAPC's *Structure Plan Framework* has been prepared to guide landowners and their representatives, decision-making authorities, advisory agencies and local government on the preparation of structure plans. It includes guidance on the content of structure plans and structure plan maps. The proposed Structure Plan has been prepared in accordance with this Framework.

Guidelines for Planning in Bushfire Prone Areas

The Guidelines for Planning in Bushfire Prone Areas was finalised and released in December 2015. The Guidelines is designed to supplement the objectives and policy measures established in SPP 3.7, to assist in its interpretation and provide advice on how bushfire risk is to be addressed when designing or assessing a proposal within a bushfire-prone area. The proposed Structure Plan has been designed with input from a qualified bushfire consultant, and a BMP has been prepared in accordance with the requirements of the Guidelines. Refer to Section 2.4 of this report for further detail on the BMP for the subject site.

1.3.3.3 Local Planning Policies

The City's planning framework comprises a suite of local planning policies pertaining to various matters and planning considerations. Relevant are the following local planning policies, which have been paid due regard in the preparation of the proposed Structure Plan:

- Local Planning Policy 3.1 – Outline Development Plans
- Local Planning Policy 3.2 – Coordination of Infill Development
- Local Planning Policy 4.7 – Planning and Development of Public Open Space and Streetscapes.
- Local Planning Policy 4.10 – Subdivision and Development Abutting Public Open Space

1.3.3.4 Pre-lodgement consultation

Department of Planning

A pre-lodgement meeting was held with the Department of Planning (DoP) on 13 April 2015, where in-principle support was provided for the proposed sub-precinct Structure Plan to be progressed, subject to the Structure Plan demonstrating that it will not prejudice adjacent landholdings and the coordinated planning of the broader development area. The DoP outlined a number of key planning considerations to be addressed in the Structure Plan, including access arrangements, noise from Corfield Street, design integration with neighbouring properties, wetland management and classification, density targets and bushfire hazard. These matters have been in addressed and discussed in detail throughout this report.

City of Gosnells

On 3 November 2015 a pre-lodgement meeting was held with the City, where a range of matters were discussed in relation to the proposed Structure Plan. The City agreed it would support the lodgement and processing of a structure plan for the subject site, without undergoing structure planning over the entire surrounding development area. The proposed Structure Plan has been prepared accordingly.

Department of Education

As the subject site immediately abuts the Seaforth Primary School to the northwest, a pre-lodgement meeting was held with the Department of Education (DoE) on 9 July 2015 to discuss the proposed Structure Plan. The DoE provided comments and feedback on key planning and development considerations for the subject site, which have been noted and considered in the preparation of the Structure Plan. This includes consideration of design interface issues between the subject site and school, vehicle movement considerations and wider catchment planning.

2 Site conditions and constraints

2.1 Biodiversity and natural area assets

2.1.1 Vegetation

A site visit conducted by Aurora Environmental identified the vegetation on the subject site to consist of:

- Low Open Woodland of *Melaleuca rhaphiophylla* over pasture grasses;
- Low Forest of *Melaleuca rhaphiophylla* over pasture grasses;
- Low Open Woodland of *Eucalyptus marginata* over *Banksia* spp., *Nuytsia floribunda* and *Xylomelum occidentale* over weedy understorey.

Majority of the vegetation on the subject site is considered to be Completely Degraded, with the areas Banksia Woodland being in a Degraded condition. The area associated with the *Melaleuca spp*. wetland were mapped as either in Good condition or Good to Degraded. The vegetation condition has been severely compromised through historical clearing and previous agricultural activities including grazing. This has led to the removal of most of the understorey vegetation on the site and the establishment of weeds.

2.1.2 Fauna

Information about the potential conservation significant fauna in the vicinity of the subject site has been obtained by conducting a search of Department of Parks and Wildlife's (DPaW) NatureMap database and Department of Environment's Protected Matters Search Tool. The majority of species are unlikely to use the site. The species which may occasionally use the site are summarised in Table 2 below.

Table 2 – Threatened fauna

Species	Class	State	Commonwealth	Notes
Baudin's Black-Cockatoo *Calyptorhynchus baudinii*	Bird	Threatened	Vulnerable	This species may occasionally use habitat on the site. Limited foraging habitat is present on the site.
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Bird	Threatened	Endangered	This species may occasionally use habitat on the site. Limited foraging habitat is present on the site.
Forest Red-Tailed Black Cockatoo *Calyptorhynchus banksii naso*	Bird	Threatened	Vulnerable	This species may occasionally use habitat on the site. Limited foraging habitat is present on the site.

All habitat types have been degraded through past clearing, grazing and weed infestation. As a result, they lack structure and niche habitats that would support a diverse fauna assemblage. The wetland habitat has no understorey species and therefore is unlikely to support conservation significant fauna such as Quenda, which prefer a dense understorey to provide refuge from predators. The Eucalypt / Banksia Woodland is degraded, providing limited foraging value. Breeding and roosting is unlikely to be supported on the site due to an absence of suitable habitat trees.

Refer Appendix 2, Environmental Assessment.

2.2 Landform and soils

2.2.1 Topography

The subject site is generally undulating, and slopes slightly towards the wetland in the eastern portion of the lot. The highest point is approximately 24.53 metres Australian Height Datum (AHD) at the northern corner of the lot and the lowest point being 21.70 metres AHD within the area identified as wetlands at the front of the lot.

2.2.2 Soils

Based on the results of the geotechnical investigation, the subsurface conditions encountered across the subject site are summarised as follows:

- Topsoil – Sand: fine to coarse grained, pale grey to grey, trace silt, containing roots, very loose to loose, moist, extending from the surface to depths of between about 0.85m to 0.2m, overlying.
- Sand: fine to coarse grained, grey/white to yellow, with less than about 5% fines however with about 12% clay/silt at TP01 at a depth of 1.7m, generally medium dense to dense however loose to medium dense at test pit location TP04 and very loose at test pit location TP14, moist, extending to depths of between about 0.7m and the maximum investigated depth of about 2.5m.
- Cemented Sand (Coffee Rock): only encountered at locations TP03 to TP05 at depths of between about 0.7m and 1.0m, fine to coarse grained sand in an iron cemented matrix, red brown, medium to high strength, with some low strength zones, causing refusal of the excavator at depths of between 0.8m and 1.2m.

Refer to the Geotechnical Investigation and Preliminary Acid Sulfate Soils Assessment contained in Appendix 1 of the Environmental Assessment attached as Appendix 2.

2.2.3 Acid sulfate soils

A preliminary acid sulfate soils assessment was undertaken by Golder Associates, and is documented in the Geotechnical Investigation and Preliminary Acid Sulfate Soils Assessment.

The shallow sandy soils above the groundwater table at the site generally did not have recorded measurable levels of sulphide, however two samples of sandy material above the Coffee Rock layer had Net Acidity concentrations below the Department of Environment and Conservation action criterion of 0.03% S. Based on previous experience with Coffee Rock in the Perth metropolitan area, it is expected that the material within and below the Coffee Rock layer is likely to be actual acid sulfate soils (ASS).

The assessment states if more than 100m³ of soil is likely to be disturbed at the site during development that further assessment of the presence of ASS is undertaken before ground disturbance occurs. In particular, where excavation of Coffee Rock layer is proposed, further assessment of the presence of ASS should be undertaken in this layer.

2.2.4 Contamination

The subject site is not listed as a contaminated site on the Department of Environment Regulation (DER) database.

2.3 Groundwater and surface water

A search of DPaW's Geomorphic Wetlands of the Swan Coastal Plain database indicates that a portion of the site is mapped as a Resource Enhancement Wetland (REW) (UFI 15842). The wetland present on the site belongs to the Bennett Brook Consanguineous Suite. Some inaccuracies in the boundary of this wetland were noted. The variations in the boundaries are supported by vegetation characteristics (i.e. wetland dependent vegetation) and historical aerial photographs. However, these boundary variations were not considered significant enough to warrant a wetland reclassification. The portion of the wetland that contains vegetation mapped as 'Good' condition will be retained as the wetland core. A buffer of variable width around this area will be maintained in public open pace. The wetland core and buffer area will require on-going management, and the treatment of the buffer, including any proposed rehabilitation and on-going management will be addressed in a Wetland and Public Open Space Management Plan to be prepared at subdivision stage. A project plan will be lodged with and approved by the City prior to the initiation of rehabilitation and/or revegetation works, in accordance with Policy No. 6.2.2 Rehabilitation and Revegetation of Natural Areas.

The presence of clayey layers in the soil profile mean that a 'perched water table' can form locally. In average and above average rainfall years the rate of recharge will be sufficient that any perched layers will be seasonal, with regional water table rising up over the course of winter to incorporate the perched layers into a continuous saturated column. In below average rainfall years the rainfall recharge may not be sufficient to cause the regional water table to rise significantly and the 'perched water table' may remain above the regional water table. Depending on the specific yield of the local soils, fluctuations in the regional water table may vary 1m to 2m seasonally.

2.4 Bushfire hazard

A BMP for the subject site has been prepared by Strategen. Refer to Appendix 3, Bushfire Management Plan.

The BMP takes into account existing conditions including:

- Topography – particularly ground slopes and accessibility;
- Vegetation cover/structure – remnant and likely hazardous vegetation; and
- Relationship to surrounding development.

The vegetation assessment for the land within 100m of the subject site comprises the following vegetation classes:

- Class B woodlands, including the wetland vegetation within the proposed local open space;
- Class C shrubland;

- Class G unmanaged grassland; and
- Low Threat Vegetation (comprising predominantly managed areas including road and verge, residential, commercial and primary school sites).

The bushfire attack level (BAL) contours affecting the subject site range between BAL 29 and BAL 12.5, with portion of the proposed road network being within the Asset Protection Zone. The BMP identifies a range of bushfire management measures that on implementation will enable the subject site to be developed whilst maintaining a manageable level of bushfire risk and compliance with the Guidelines.

The BMP includes a list of additional recommendations to inform ongoing planning stages of the development, including Notification on Title, BAL assessments at future planning stages, and compliance with the City's annual firebreak notice. These additional recommendations will be implemented through the subdivision and development stages.

Implementation of the BMP applies to the developer, local government and prospective landowners to ensure bushfire management measures are adopted and implemented on an ongoing basis.

2.5 Transport noise

A Transportation Noise Assessment for the subject site has been prepared by Lloyd George Acoustics, and is attached as Appendix 4.

Due to the setback of residential lots away from Corfield Street, the predicted future noise levels at residences are below the noise target and therefore no further mitigation is required.

Should any part of the commercial area be used for noise sensitive use (e.g. education, child care, etc.), the developers of this building should be required to undertake a site specific noise assessment to ensure internal noise levels meet those of Australian Standard 2107:2000 *Acoustics – Recommended Design Sound Levels and Reverberation times for Building Interiors.*

2.6 Heritage

2.6.1 Indigenous heritage

A search of the Department of Aboriginal Affairs register of Aboriginal heritage sites provides an understanding of the archaeological and ethnographic sites in a given area as well as providing information about previous surveys. The subject site has formed part of previous heritage surveys, however does not contain any registered aboriginal sites.

2.6.2 European heritage

The subject site does not contain any European heritage sites listed in the State Register of Heritage Places, local government inventory or other lists.

2.7 Context and other land use constraints

The site context and constraints have been identified and are discussed below. Refer to Figure 3, context and constraints.

2.7.1 Corfield Street interface

The subject site fronts Corfield Street, which is reserved as an 'Other Regional Road' under the provisions of the MRS. There is a general presumption against providing individual lot access or multiple road intersections with major arterial routes such as Corfield Street, which is reflected in LN and DC5.1. The configuration and location of intersections with Corfield Street will be subject to the approval of the City of Gosnells and Main Roads WA.

2.7.2 Primary school interface

The subject site abuts the Seaforth Primary School on its western boundary, requiring sensitive treatment to ensure an appropriate interface and safe and convenient vehicle movements around the school. The WAPC's Development Control Policy 2.4 – School Sites notes that school sites should be provided with frontage access to through roads constructed on at least two sides. The primary school has existing frontage to Corfield Street and Verna Street.

2.7.3 Bushfire hazard

The subject site is identified as being within a bushfire prone area on the Department of Fire and Emergency Services bushfire prone areas mapping system. The BMP prepared for the subject site indicates that the existing vegetation surrounding the land to the south and east is classified as being of Moderate to Extreme bushfire hazard. The portion of retained vegetation within the REW is also identified as being of Extreme bushfire hazard. The future subdivision of the land must comply with the approved BMP for the subject site, and future dwellings must comply with the required building construction standards to achieve an appropriate BAL rating and to meet the requirements of Australian Standard 3959-2009 where applicable.

2.7.4 Wetlands

An area of REW is located within the north-eastern portion of the subject site. Portions of the wetland are noted as being degraded and therefore potentially unlikely to be consistent with the Resource Enhancement classification. The extent of the wetland and associated buffer requires the approval of the DPaW and the City of Gosnells. The wetland core and buffer area will require on-going management. The treatment of the wetland core and buffer, including any proposed rehabilitation and on-going management will be addressed in a Wetland and Public Open Space Management Plan to be prepared at subdivision stage. A project plan will be lodged with and approved by the City prior to the initiation of rehabilitation and/or revegetation works, in accordance with the City's Policy No. 6.2.2 Rehabilitation and Revegetation of Natural Areas.

2.7.5 Water Corporation infrastructure

The Water Corporation's Serpentine-Canning water main travels along the northern and eastern boundaries of the subject site, within the adjoining primary school site and Corfield Street road reserve. A 5m wide building exclusion area, measured from the centre of the pipe, is required to protect the water main. The building exclusion area will likely be enforced through a condition of subdivision approval, requiring an easement or restrictive covenant.

The building exclusion area may be used for minor infrastructure, including as at-grade car parking, access and minor underground mains infrastructure. Non-destructive construction methods such as static rolling must be used where construction activities are undertaken within 20m of the water main.

PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING

SCALE	1:1,000 @ A3
DATE	04 January 2016
FILE	03 160104 4001 Context and Constraints.dwg
REVISION	2/EF/Rev/04.01.2016
	1/EF/First Draft/11.12.2015

Scale Bar (m) 0 10 20 30

CONTEXT AND CONSTRAINTS

LOT 1 (303) CORFIELD STREET
GOSNELLS, WESTERN AUSTRALIA

FIGURE 03

BASEPLAN SOURCE: NEARMAP, WATERCORP

3 Structure Plan

3.1 Land use

The proposed Structure Plan (refer to Plan 1) provides for the development of the subject site for a mix of commercial and residential purposes, consistent with the intent of the 'Development' zoning of the subject site under TPS6 and the 'Urban' zoning under the MRS. The proposed structure plan will facilitate the development of single houses across the subject site and a range of commercial uses, designating the following reserves, zones and residential densities:

Zones and Residential Design Codes Densities

- Residential (R30)
- Office

Reserves

- Local open space (LOS)

The proposed land uses integrate with the existing use of land in the vicinity for residential and commercial purposes, and complements the future use of the land to the west and south for urban purposes. The proposed structure plan has been designed to integrate with future development of the surrounding land.

The location of LOS provides for the integration and incorporation of the REW and associated buffer located along the east of the subject site.

3.2 Open space

The proposed structure plan contains one significant area of LOS along the eastern portion of the subject site fronting Corfield Street. The proposed area of LOS provides multiple functions, including containment of the REW and associated development buffer, disposal of drainage from the subject site, and local active and recreational activities.

In accordance with LN, the REW shall be ceded to the Crown free of cost and without payment of compensation by the Crown in addition to the open space contribution. The area of the REW is deducted from the gross subdivisible area on which the open space contribution is determined.

The proposed structure plan provides a total of 8,247m² of LOS on the subject site. This LOS comprises:

- 4,252m² of REW.
- 3,952m² of landscaped open space.

It is noted that LN has recently been reviewed by the WAPC, with the *Draft Liveable Neighbourhoods 2015* document being released for public comment in October 2015. Under the Draft LN document, the proposed LOS is classified as a Local Park, which are identified as ranging in size between 4,000m² – 1ha, with an accessibility catchment of 300m. Local Parks are designed to accommodate daily recreation for the local community. These parks are primarily designed to include recreational and nature space functions.

The total proportion of LOS provided is 10.35% of the gross subdivisible area of subject site – refer to Table 3, Public Open Space Schedule. This is surplus to the minimum requirement for 10% of the gross subdivisible area to be provided as POS under LN.

Table 3 – Public Open Space Schedule

Site area		3.4663ha
Deductions		
Drainage subject to inundation more frequently than 1:1 year event (bio-retention swales and basins)	0.1040ha	
Office site	0.3508ha	
Gross subdivisible area		3.0115 ha
Public open space @ 10 per cent		0.3012 ha
Public open space contribution		
May comprise: - minimum 80% unrestricted public open space - maximum 20% restricted public open space	 0.2409ha 0.0602ha	 0.3012ha
Unrestricted public open space sites		
Formalised local open space (excluding 1:1 year bio-retention basins)	0.3117ha	
Total unrestricted POS		0.3117ha
Restricted public open space sites		
N/A	0ha	
Total restricted POS		0ha
Public open space provision		0.3117ha
Percentage of public open space provided		10.35%

It is noted the area comprising the REW is not capable of being used for recreational purposes and is therefore not included as contributing towards restricted POS.

Consistent with the objectives of LN, the LOS provided within the proposed Structure Plan will serve a number of functions, including protecting margins of wetlands and integrating urban water management functions. The LOS serves as a buffer between the REW and adjacent areas identified for residential and commercial development. Drainage basins will accommodate stormwater seasonally as required within the LOS. The drainage system incorporates a treatment train of best management practice water quality controls such as vegetated swales and storage systems that provide water quality treatment. The LOS will also provide opportunities for both passive and active recreation. A Landscape Concept Plan has been prepared to demonstrate how the LOS may be landscaped and utilised (refer Appendix 5).

The area of LOS is bordered by Corfield Street and two internal roads, with potential for additional road frontage along the Office site. The layout of the proposed Structure Plan provides for future commercial development and/or dwellings to be oriented towards the LOS where possible to benefit from the amenity of the natural features and to encourage surveillance of the space.

The LOS is intended to be ceded free of cost to the Crown under Section 152 of the *Planning and Development Act 2005*. The LOS will be developed to acceptable standards.

3.3 Residential

The proposed Structure Plan will achieve a base residential density of R30, with potential for additional higher density lots within the Office zoned site. The majority of the subject site is to be zoned Residential (R30). This density is reflective of the existing surrounding residential development, with densities on the opposite side of Corfield Street generally R20/30. The future density of undeveloped land surrounding the subject site is currently unknown, however it is likely that densities similar to or higher than those proposed as part of the subject structure plan can be expected. A concept plan (refer to Figure 4) has been prepared to demonstrate one way in which the subject site could be subdivided in accordance with the proposed structure plan.

Residential lots will be oriented toward the primary street and LOS where possible, and all lots will gain direct access from the internal road network. A single Office zoned site is proposed located adjacent to the primary school site and in close proximity to the high natural amenity afforded by the proposed area of LOS. The Office zoned site will be developed for a mix of commercial and/or residential purposes. A residential density code of R80 applies to the Office site pursuant to clause 5.8.4(a)(iii) of TPS6.

The proposed structure plan will provide for the development of approximately 36 single residential lots. This has the potential to be increased to approximately 47 residential lots, should the Office site be developed for residential purposes. The potential residential lot and dwelling yield is summarised in Table 4 below.

Table 4 – Yield summary

Zoning	Average lot size	Estimated number of lots	Estimated number of dwellings
Residential R30	325m^2	36	36

Assuming an average household size of approximately 2.7 based on current and future trends within Gosnells, the estimated population within the subject site equates to approximately 97 people.

The total residential site area proposed by the Structure Plan is 1.1704ha, equating to an overall density of 30.8 dwellings per site hectare. This exceeds the targets set by Perth and Peel @ 3.5 million of 26 dwellings per site hectare, and by LN of 22 dwellings per site hectare.

The gross urban zoned area of the subject site (excluding LOS) is 2.6416 hectares, equating to an overall density of 13.6 dwellings per gross urban zoned hectare. This is a shortfall of 1.4 dwellings per hectare (4 single residential lots) from the Directions 2031 target of 15 dwellings per gross urban zoned hectare for new development areas. As outlined previously, the subject site is highly constrained by natural features, including the REW within the subject site and bushfire hazard from surrounding vegetation requiring sufficient hazard separation distances in the form of additional roads around the perimeter of the site. As the density proposed by the Structure Plan exceeds the targets set out in Perth and Peel @ 3.5 million and LN, the proposed shortfall to the Directions 2031 target is considered to be acceptable in this instance.

LEGEND

- Subject Site
- 1 — Existing Lot Number
- 24 — Contours
- Residential R30 - 36 lots
- Office *
- * A maximum density of R80 applies to residential development as per clause 5.8.4 of TPS6.
- Local Open Space
- Resource Enhancement Wetland
- Proposed Road Network

GENERAL NOTES

This is a preliminary concept plan prepared for discussion purposes only. The design will be subject to detailed consideration of all planning, engineering, environmental, and other technical consideration, as well as assessment and approval by relevant government agencies including the City of Gosnells, Western Australian Planning Commission, and Department of Parks and Wildlife.

SPECIFIC NOTES

1. The wetland extent and associated buffer will be subject to approval by the Department of Parks and Wildlife and the City of Gosnells.
2. Configuration and location of roundabout subject to approval by the City of Gosnells and Main Roads WA.
3. Possible access to/from office site to Corfield Street subject to approval by City of Gosnells and Main Roads WA.

PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING

SCALE	1:1,000 @ A3
DATE	18 April 2016
FILE	04 160418 4001 Concept Plan.dwg
REVISION	13/EF/Rev/04.01.2016
	12/EF/Rev/04.01.2016
	11/EF/Rev/18.12.2015

Scale Bar (m) 0 10 20 30

CONCEPT PLAN

LOT 1 (303) CORFIELD STREET
GOSNELLS, WESTERN AUSTRALIA

FIGURE 04

BASEPLAN SOURCE: NEARMAPS & WA ATLAS

3.4 Office

The Structure Plan proposes a single Office zoned site in the northern corner of the subject site. It is intended the site could be developed with a convenience store, child care centre and/or medical consulting rooms. An acceptable alternative use is residential. Three zones of TPS6 where residential, child care premises and medical centre uses are capable of approval are Local Centre, Office and Residential. The convenience store use is only permissible in some of these zones. A comparative assessment of the three zones has been undertaken to establish the most suitable designation for the subject site, at Table 5 below.

Table 5 – Zoning comparison

Zoning	Permissibility of Preferred Uses	Permissibility of Multiple or Grouped Dwellings	Comment
Local Centre	• Medical Centre – 'P' (permitted); • Child Care Premises and Convenience Store – 'D' (discretionary)	• Multiple dwellings – 'A' (discretionary subject to advertising) • Grouped dwellings – 'D' (discretionary)	The Local Centre zone allows for the preferred uses to be approved at the City's discretion, plus a broad range of other retail and commercial uses. In order to narrow the range of permissible uses, specifically shop (retail) uses, and to encourage residential uses, the Local Centre designation is not preferred.
Residential	• Child Care Premises and Medical Centre – 'A' (discretionary subject to advertising) • Convenience Store – 'X' (not permitted)	• Multiple dwellings and grouped dwellings – 'D' (discretionary)	Given the Structure Plan specifically anticipates the development of the site for the preferred uses, the designation of the site as Residential is not appropriate as it would require the mandatory advertising of these uses, and therefore does not provide any certainty for these uses.
Office	• Child Care Premises, Medical Centre and Convenience Store – 'D' (discretionary)	• Multiple dwellings and grouped dwellings – 'D' (discretionary)	The preferred uses are capable of approval (at the City's discretion) within the Office zone, and do not require further advertising. Similarly, residential uses are permissible in the Office zone. The Office zone does not prejudice the planning of the surrounding area, nor will it impact on the potential for retail floorspace, as Shop is a 'X' (prohibited) use within this zone. Office is considered to be the most appropriate zoning to accommodate the preferred uses proposed for this site.

For the above reasons Office is preferred over Local Centre and Residential.

A nominal commercial floorspace area of 1,600m² has been assumed for the purposes of determining employment self-sufficiency targets and for traffic analysis purposes. The 1,600m² assumes a standard size child care premises accommodating up to 65 children and 15 staff, plus a medical centre accommodating up to around 10 consultants.

Assuming an average household employment rate of around 1.3 jobs (as outlined with LN), once developed, the Structure Plan area will require a total of approximately 46.8 jobs. Should the Office site be developed for commercial purposes, accommodating up to approximately 35 jobs, this equates to an employment self-sufficiency of up to 75% (this percentage may fluctuate based on the final development outcome within the Office site). LN indicates a local employment self-sufficiency target ranging from a minimum 30% to over 60% as being acceptable where no alternative target has been set. It is likely that the ultimate employment self-sufficiency for the subject site will fall within this range.

The proposed Office site is considered to be highly suitable, as it acts in achieving the objectives LN and TPS6. The Office site encourages a mix of land uses within the subject site, addressing two of the principle aims of LN, being:

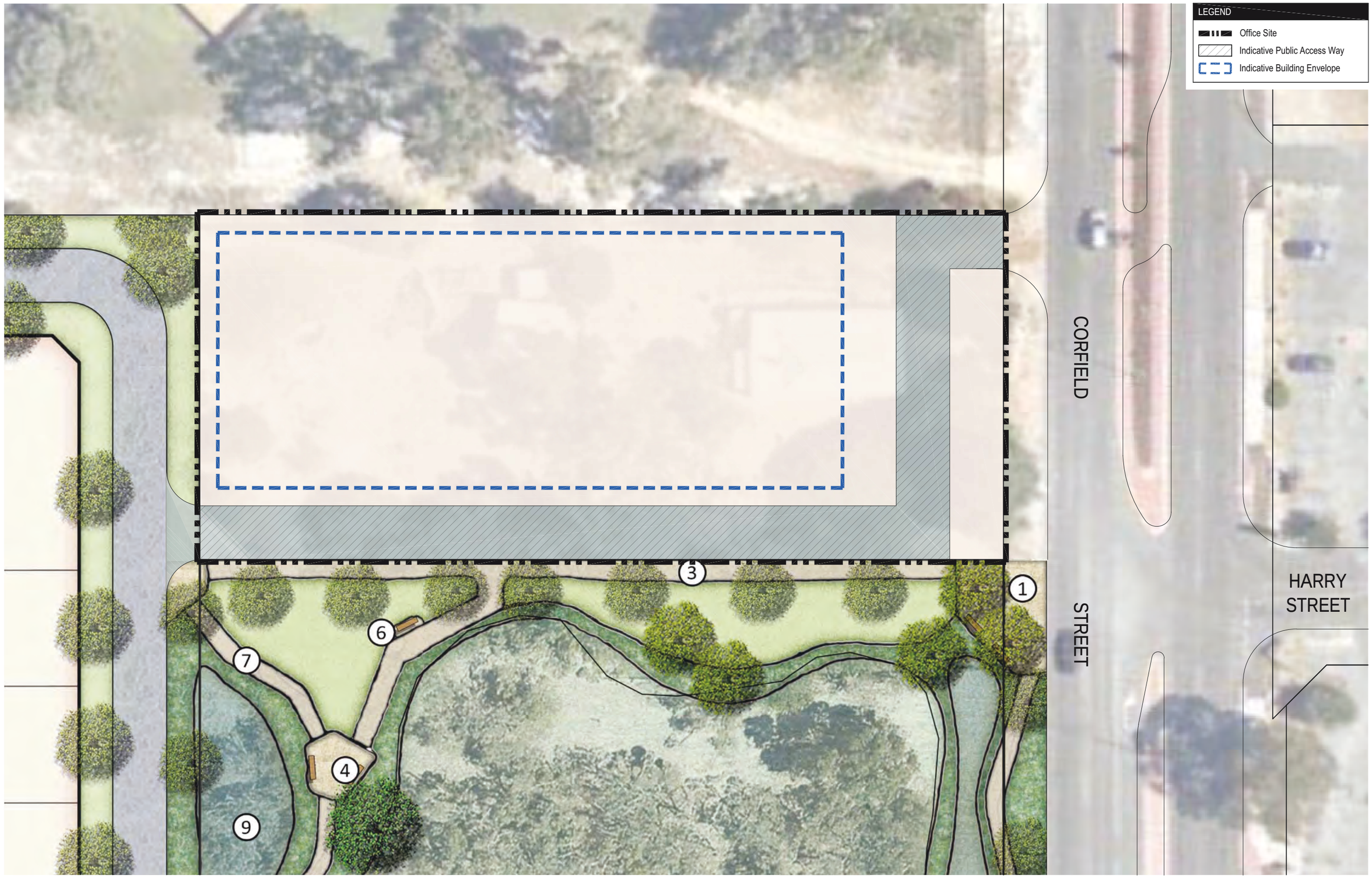
1. *To provide for an urban structure of walkable neighbourhoods clustering to form towns of compatible mixed uses in order to reduce car dependence for access to employment, retail and community facilities.*
7. *To facilitate mixed-use urban development which provides for a wide range of living, employment and leisure opportunities, capable of adapting over time as the community changes and which reflects appropriate community standards of health, safety and amenity*

The inclusion of the Office site in the Structure Plan is consistent with the TPS6 objectives of the Development zone, which promotes a variety of uses including commercial. The provision of a mix of uses within the subject site will increase the local services available to the wider Gosnells locality.

The Office site encourages and facilitates the provision of more localised business and employment opportunities, consistent with the provisions of SPP4.2. The site is complementary to and interacts with the Seaforth Primary School and the opposite neighbourhood centre.

The future development of the Office site will integrate harmoniously with the surrounding residential lots and will incorporate uses which are compatible with the predominantly residential use of the subject site. The Office site provides a suitable transition between the residential portion of the subject site and commercial uses on the opposite side of Corfield Street. An indicative layout plan (Figure 5) has been prepared which shows how the Office site could potentially be developed, incorporating a public access way connection linking Corfield Street with the residential portion of the structure plan, while providing direct and convenient access for passing vehicle traffic and servicing vehicles to the Office site.

The access point to Corfield Street is proposed to be located adjacent to the northern corner of the Office site. This is necessary to provide suitable separation to the existing median break, thereby allowing right-in access and reducing the risk of vehicles southeast-bound cars from travelling contraflow along Corfield Street to access the Office site. This access point is also necessary from a servicing and bushfire safety point of view; an easement within the Office site is required by the BMP to ensure two ingress/egress points are available to the overall Structure Plan area at all times for bushfire safety purposes. If access between the Office site and Corfield Street were to be restricted, an emergency access point will be required as an alternative (albeit entirely unideal) option. It is noted that the exact alignment and configuration of the access point will be subject to the approval of the City and DoP.



PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING

SCALE 1:1,000 @ A3
DATE 22 February 2017
FILE 160614 4001 Local Centre Indicative Layout Plan.dwg
REVISION 1/EF/First Draft/14.06.2016

Scale Bar (m)
0 10 20 30

OFFICE SITE INDICATIVE LAYOUT PLAN

LOT 1 (303) CORFIELD STREET
GOSNELLS, WESTERN AUSTRALIA

FIGURE 05

BASEPLAN SOURCE: NEARMAPS, WA ATLAS, LANDSPACE

3.6 Movement networks

A Traffic Report has been prepared by Riley Consulting to address the transport implications of the proposed structure plan, including estimated traffic generation and resultant traffic patterns on the surrounding road network. The Traffic Report also includes a capacity analysis of the key local intersections, as well as providing recommendations for any traffic management measures that may be required to ensure satisfactory traffic operations.

Refer Figure 6, movement network and Appendix 6 for the complete Traffic Report.

3.6.1 Road hierarchy

Traffic projections for the subject site show that, in accordance with LN, the key access street to Corfield Street can be classified as a Neighbourhood Connector, with all other internal roads classified Access Streets D. The typical road reserve for Neighbourhood Connector B entails a width of 19.4m with 7m trafficable carriageway pavement, on-street car parking and 4.1m wide verges on both sides. The maximum desirable traffic volume for this type of road is 3,000 vehicles per day (vpd). The Structure Plan incorporates a 20m wide road reservation, with the potential to be widened if necessary upon development of the adjoining land to the south-east.

The typical road reserve for Access Street D entails a width of 14.2m with 6m wide trafficable carriageway pavement and 4.1m wide verges on both sides. The Structure Plan proposes a slightly reduced width of 14m, resulting in 4m wide verges on both sides of the road. The 0.2m reduced width allows for sufficient lot depth within the physical constraints of the subject site, and will have no obvious impact on the streetscape.

Where fronting POS, access street verges adjacent to the POS may be reduced to 1.0m, with an overall road width of 13.5m. The maximum desirable traffic volume for this type of road is 1,000 vpd. Two 13.5m wide roads are proposed within the Structure Plan, abutting the proposed LOS and the adjoining primary school site. These roads are capable of accommodating embayed visitor parking.

3.6.2 Traffic projections

For the purposes of traffic analysis, it is assumed that the Structure Plan will ultimately be developed for approximately 36 residential lots and 1,600m² of commercial floorspace. The commercial floorspace is assumed to yield approximately 600m² of consulting room floorspace and a child care centre for up to 65 children. It is important to note that these commercial uses are indicative for the purposes of assessing the vehicle traffic implications of the proposed Office site, and it should not be assumed that the uses listed are those that will ultimately be developed.

Based on the above assumptions, the commercial traffic generation is far greater than residential uses and thus the attached Traffic Report provides a robust assessment for future years. The following provides a summary of the traffic generation and distribution for the above listed potential uses:

- The residential component of the Structure Plan is expected to generate 288 vehicle movements per day and 29 vehicle movements in the AM and PM peak periods.
- On the basis of 65 children in a potential child care centre, the centre could attract 351 vehicle movements per day. The AM peak period would see 140 vehicle movements, and 91 vehicles in the PM peak period. The PM peak period for the child care centre is unlikely to coincide with the PM peak periods for the residential and medical centre uses.

- The consulting rooms would be expected to attract 300 vehicle movements per day. 20 vehicle movements would be expected in the AM peak period and 30 in the PM peak period.

The expected traffic increases are less than 5% of the current traffic demands on Corfield Street and no material impact would be anticipated. Harry Street is shown to experience an increase of 6.6% assuming all traffic associated with the proposed Structure Plan is new.

The traffic generation of the Structure Plan is shown to be up to 189 vehicle movements in the AM peak hour. Peak hour assessment indicates that no traffic lane will experience an increase greater than 100 vehicles as a result of the future development of the subject site.

3.6.3 External intersections

Access to the subject site is proposed at two locations. The first is a formal road at the existing truncated corner of the subject site, providing a fourth approach to the intersection of Corfield Street and Harry Street. A secondary access is proposed to the north of the subject site to service the Office site.

Corfield Street / Harry Street is an existing priority intersection and a fourth approach would typically warrant some form of control. It is proposed that a roundabout be provided at this intersection. The roundabout, while not strictly necessary to provide access to the Structure Plan area, will benefit the broader locality by enhancing access to and from Harry Street and would ultimately be required as the undeveloped land to the south is developed and increases the number of vehicles travelling through the roundabout via the new neighbourhood connector proposed by this Structure Plan. The City of Gosnells has requested a roundabout is provided.

A restricted movement access is proposed to provide access to the Office site. It is recommended that a right-turn into the site be provided as access to the Office site is likely to be higher from the north, and a right-turn will remove any downstream U-turn potential. The existing median is suited to the provision of a standard right-turn lane. The location of the proposed access can conform to the intersection spacing requirements of AS2890.1 in regard to its separation to the opposite Corfield Shopping Centre. Analysis indicates that good Levels of Service would occur during both peak periods. Subject to the future land uses within the Office site, the access may be constructed as a road or a crossover. This will be assessed in detail at the time of development application for the Office site.

3.6.4 Public transport

There are two bus routes on Corfield Street currently passing the subject site, with stops on Harry Street. Routes 231 and 232 provide a loop service to Gosnells railway station on a regular frequency during peak period. Both routes travel via Harry Street to the northeast and Corfield Street to the northwest, with route 231 operating counter-clockwise (i.e. in a northeast direction) and route 232 operating clockwise (i.e. in a west direction). The proposed Structure Plan provides flexibility for future bus routes to operate via the neighbourhood connector through the subject site, extending via Harry Street.

Seaforth Train Station lies approximately 1.7km east of the subject site by foot.

3.6.5 Pedestrian and cycling facilities

Current planning guidelines suggest that all streets should be provided with a footpath wherever possible. With an overall traffic generation of less than 1000 vpd, a single footpath to each street is considered to be sufficient.

Cycling will be safe on the majority of internal streets as traffic flows are less than 1,000 vpd. On the neighbourhood connector, a shared path is proposed. However, longer term planning for the Harry Street extension may result in on-street cycling lanes being provided.

LEGEND

- Subject Site
- Residential (R30)
- Local Centre
- Local Open Space
- Resource Enhancement Wetland
- Proposed Road Network
- Existing Bus Route
- Existing Bus Stop
- 100 VPD Forecast Daily Traffic Volumes
- Existing Footpath
- Proposed Footpath
- Proposed Dual Use Path
- Neighborhood Connector
- Access Street
- Possible Access Point

NOTES

1. Configuration and location of roundabout subject to approval by the City of Gosnells and Main Roads WA.
2. Possible access to/from office site to Corfield Street subject to approval by City of Gosnells and Main Roads WA.

PLANNING SOLUTIONS | URBAN & REGIONAL PLANNING

SCALE 1:1,000 @ A3
DATE 15 June 2016
FILE 05 160615 4001 Movement Network.dwg
REVISION 3/EF/Rev/15.06.2016
2/EF/Rev/18.04.2016
1/EF/First Draft/04.01.2016

Scale Bar (m) 0 10 20 30

MOVEMENT NETWORK

LOT 1 (303) CORFIELD STREET
GOSNELLS, WESTERN AUSTRALIA

FIGURE 06

BASEPLAN SOURCE: NEARMAPS, WA ATLAS, AND RILEY CONSULTING

3.7 Water management

A Local Water Management Strategy (LWMS) has been prepared for the subject site in accordance with the Department of Water principles of Water Sensitive Urban Design, described in the Stormwater Management Manual.

The stormwater drainage system has been designed using a major/minor approach. The major drainage system includes the use of roads, swales, drainage reserves, detention basins and open spaces to provide safe passage of stormwater runoff from major storm events greater than 5yr ARI and up to the 100yr ARI.

Key points of the major drainage system strategy are as follows:

- Roads graded to direct flow overland to the lowest point in the catchment. The ultimate road low point will be adjacent to LOS, with overflow flood storage provided within the LOS. The LOS design should aim to create flood storage in an informal manner, minimising formal drainage basin areas.
- All lot finished levels will have a minimum 0.3m clearance above the estimated 100yr ARI flood level in the road and LOS.
- 100yr ARI flood detention storage located within the REW.
- No infiltration assumed within the basin.
- Outflow from the REW in the 100yr ARI event will discharge to the existing Corfield Street drainage network.

The minor drainage system is defined as a series of swales, kerbs, pipes and gutters designed to convey runoff generated by minor storms up to and including the 5yr ARI storm event. The minor drainage system incorporates a treatment train of best management practice water quality structural controls such as vegetated swales and storage systems that provide water quality treatment.

Key points of the minor drainage system strategy are as follows:

- Lots >350m² will use soakwells to infiltrate the 1yr 1hr ARI storm event.
- Lots ≤ 350m² or will have a point of discharge to the road drainage network.
- A bio-retention swale sized to attenuate the 1yr 1hr ARI event installed within the REW buffer. Rainfall events >1yr 1hr ARI overflow into the REW.
- Where required, pipe drains sized to convey runoff from the 5yr ARI storm event.
- Invert of bio-retention storages to have a minimum 0.5m separation to the estimated post-development groundwater level. Post-development groundwater level will be estimated as part of the UWMP concept design.
- Landscaped LOS areas are to be at least 50% native plants.

Refer to Appendix 7 for the complete Local Water Management Strategy.

3.8 Education facilities

There are no education facilities proposed as part of this structure plan. The subject site directly abuts the Seaforth Primary School to the northwest, which is a public school catering for ages from Kindergarten to Year 6. Seaforth Primary School does not have a local intake area so the only criterion for prioritising enrolments is proximity to the school. St Munchin's Catholic Primary School is located west of the subject site.

The subject site is located approximately 2.5km east of Southern River College. Lumen Christi College is accessible via Tonkin Highway to the north.

3.9 Activity centres and employment

There are no new activity centres proposed as part of this structure plan. The subject site is located opposite the Corfield Shopping Centre, which is identified as a Neighbourhood Centre under the City's draft Activity Centres Planning Strategy. This centre will provide for the daily convenience shopping needs of the future residents. The subject site is located approximately 3km from the Gosnells Town Centre (District Centre), which provides opportunity for local employment.

As outlined in Section 3.4 above, the northern portion of the subject site is designated as Office. The future use of this site for small scale commercial tenancies will increase the potential for local employment for residents in the surrounding area, complementing and expanding the services available at the adjacent Neighbourhood Centre.

The residential component of the proposed Structure Plan allows for home based businesses, home occupations, home offices and home stores to be established within the subject site, pursuant to separate approval by the City of Gosnells. No specific home-based business sites are identified.

3.10 Infrastructure coordination, servicing and staging

A preliminary assessment of the engineering works and civil infrastructure required to develop the site has been undertaken by Wood & Grieve Engineers. Refer to Appendix 8 for the complete engineering report.

3.10.1 Sewer reticulation

Water Corporation have advised that there is sufficient capacity in the existing sewer infrastructure at the corner of Corbett Street and Corfield Street to service the development of the subject site. The site will be serviced using a gravity sewer network connecting at this location, via a bored crossing.

3.10.2 Water reticulation

There are existing 1,400mm and 610mm diameter water mains running directly adjacent to the subject site on Corfield Street. These will need to be protected during construction of both the sewer and water infrastructure. The development is proposed to be provided with water reticulation via connections into the existing infrastructure at the corner of Harry Street and Corfield Street, as well as adjacent Lot 52 opposite the subject site. These connections will require bored crossings under Corfield Street.

3.10.3 Stormwater drainage

The disposal of stormwater will be via concrete pit and pipe infrastructure gravitating towards as basin in the LOS area. When this basin is at capacity (designed to store a 1 year ARI storm even), excess stormwater is directed into the wetland area via an overflow pipe.

The proposed stormwater strategy also involves redirecting existing stormwater on Corfield Street to a basin adjacent to Corfield Street. This replaces the existing sump at the eastern corner of the subject site. When this basin is at capacity (designed to store a 1 year ARI storm event), excess stormwater is directed into the wetland area via an overflow pipe.

In the event of a 100 year ARI event, the wetland area is designed to retain the majority of internal stormwater. Any excess outflow is to be directed into existing infrastructure running southeast along Corfield Street.

3.10.4 Underground power

Based on the information available from Western Power, it is assumed that there is exiting HV underground ringmain cable along Corfield Street. It is proposed that this existing ringmain is cut and jointed to a new ringmain cable and run in and out of a new switchgear within the POS. A new transformer will also be required within the area of LOS to service the future lots.

3.11 Developer contribution arrangements

No developer contributions are proposed. Requirements for developer contributions for infrastructure may be imposed by the WAPC as a condition of subdivision approval, pursuant to the principles outlined in State Planning Policy 3.6.

Appendix 1
Certificate of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
1/D71840	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	13/7/2015

RECORD OF CERTIFICATE OF TITLE

VOLUME 1777 FOLIO 791

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 1 ON DIAGRAM 71840

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

POWERSTAR PTY LTD OF UNIT L1/42 CEDRIC STREET STIRLING
ZEDITAVE PTY LTD OF 76 WALTERS DRIVE OSBORNE PARK
AS TENANTS IN COMMON IN EQUAL SHARES

(T N052802) REGISTERED 3/7/2015

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

1. *N160923 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 29/10/2015.

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----------

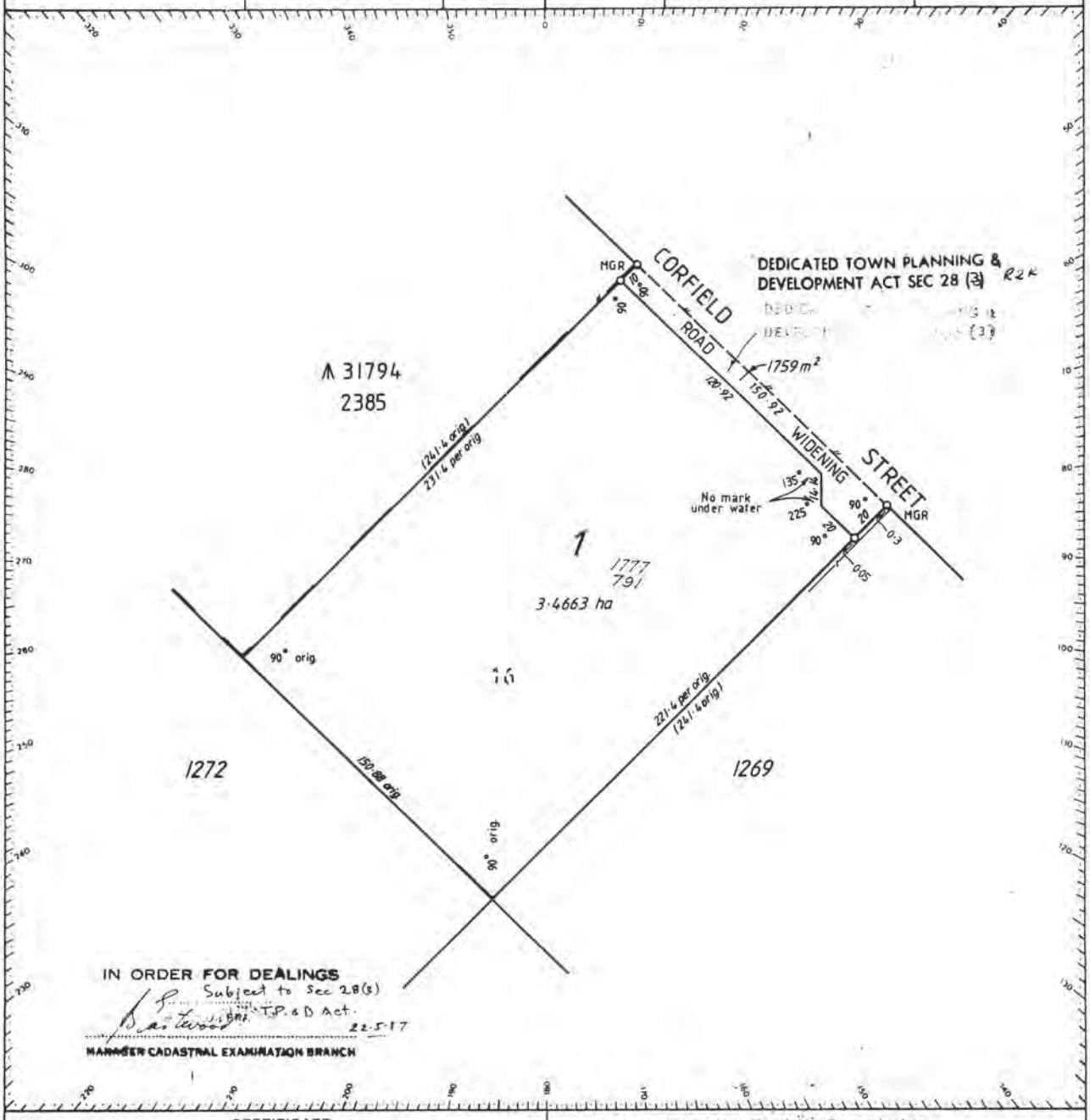
STATEMENTS:

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:	1777-791 (1/D71840)
PREVIOUS TITLE:	496-83
PROPERTY STREET ADDRESS:	303 CORFIELD ST, GOSNELLS.
LOCAL GOVERNMENT AUTHORITY:	CITY OF GOSNELLS

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING N160923

Town or District.	Number of Lot or Location.	Field Book.	Scale.	Certificate in which Land is Vested.	Area
CANNING	PT LOT 1268 OF LOC 16	53491 54177	1:2000	Vol. 496 Fol. 83	Total 3·6422 ha



CERTIFICATE

I hereby certify that this survey was performed by me personally (or under my own personal supervision, inspection and field check) in strict accordance with the Licensed Surveyors (Guidance of Surveyors) Regulations, 1961.

Date 1/4/87 John Bullock Licensed Surveyor

Approved by State Planning Commission

Date 807/2/25 /218 For Chairman 29 April 1987

Approved	On	Registered	Diagram No.
APPROVED Inspector of Plans and Surveys	Plan 2608(2)	87392 6·5·87	71840
Examined Date 15-9-87	Diagram		
	Index Plan PERTH 2000 21·09 21·10		

CP23336/7/86 Docket Diagram 22173

DIA 71840

Appendix 2
Environmental Assessment

Dilhorn House
2 Bulwer Street
PERTH WA 6000
T: (+61) 8 9227 2600
F (+61) 8 9227 2699

Environmental Assessment
Lot 1 (303) Corfield Street, Gosnells

Prepared For:	Viridian Property Group PO Box 6002 SWANBOURNE WA 6010
Report Number:	AP2015-112
Report Version:	V1
Report Date:	24 December 2015

DISCLAIMER

This document has been produced in accordance with and subject to an agreement between Aurora Environmental **("Aurora")** and the client for whom it has been prepared **("Client")**. It is restricted to those issues that have been raised by the Client in its engagement of Aurora and prepared using the standard of skill and care ordinarily exercised by Environmental / Occupational Health and Safety consultants in the preparation of such documents.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by Aurora and the Client without first obtaining the prior written consent of Aurora, does so entirely at their own risk and should not alter their position or refrain from doing so in reliance of this document. Aurora denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed by Aurora

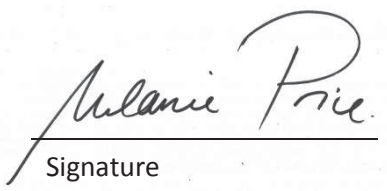
QUALITY ASSURANCE

Aurora Environmental has implemented a comprehensive range of quality control measures on all aspects of the company's operation.

An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed and signed off by senior members of the consultancy team prior to issue to the client.

Document No: POW2015-001-ENAS-001_pz_V0.1

Report No: AP2015-112

Author:	Paul Zuvela Manager - Environmental Impact Assessment		24 December 2015
		Signature	Date
Reviewed by:	Melanie Price Associate Environmental Scientist		24 December 2015
		Signature	Date

DISTRIBUTION

No. of copies	Report File Name	Report Status	Date	Prepared for:	Initials
1	POW2015-001-ENAS-001_pz_V0.1	DRAFT	21 December 2015	Powerstar Pty Ltd ATF Aveling Family Trust and Zeditave Pty Ltd Viridian Property Group Aurora Environmental	PZ
1	POW2015-001-ENAS-001_pz_V0.1	Version 1	24 December 2015	Powerstar Pty Ltd ATF Aveling Family Trust and Zeditave Pty Ltd Viridian Property Group Planning Solutions Aurora Environmental	PZ

TABLE OF CONTENTS

ATTACHMENTS III

LIST OF ABBREVIATIONS iv

1 INTRODUCTION 1

1.1 BACKGROUND 1

1.1 PURPOSE AND SCOPE 1

1.2 PLANNING CONTEXT 1

1.3 RELEVANT STUDIES 2

2 PRE-DEVELOPMENT ENVIRONMENT 3

2.1 CLIMATE 3

2.2 TOPOGRAPHY 3

2.3 GEOLOGY, GEOMORPHOLOGY AND SOILS 3

2.4 ACID SULFATE SOILS 4

2.5 VEGETATION AND FLORA 6

2.5.1 Bioregional Context 6

2.5.2 Beard's Vegetation Mapping 6

2.5.3 Vegetation Complex 6

2.5.4 Bush Forever 6

2.5.5 Conservation Significant Vegetation 7

2.5.6 Vegetation Types Condition 7

2.5.7 Vegetation Condition 8

2.5.8 Conservation Flora 8

2.6 FAUNA 10

2.7 SURFACE WATER 13

2.8 GROUNDWATER 14

2.9 CONTAMINATION 16

2.10 HERITAGE 17

2.10.1 Aboriginal Heritage 17

2.10.2 European Heritage 17

3 DEVELOPMENT PROPOSAL 18

4 ENVIRONMENTAL ISSUES AND MANAGEMENT 19

4.1 VEGETATION 19

4.2 FAUNA 19

4.3 CONTAMINATION 20

4.4 WETLANDS AND WATER MANAGEMENT 20

4.5 ACID SULFATE SOILS 21

4.6 BUSHFIRE MANAGEMENT 21

4.7 CONSTRUCTION IMPACTS 21

4.8 ABORIGINAL HERITAGE 22

5 ENVIRONMENTAL APPROVALS 23

5.1 COMMONWEALTH LEGISLATION 23

5.2 ENVIRONMENTAL PROTECTION ACT 1986 23

5.2.1 Section 48A 23

5.2.2 Section 38 23

5.2.3 Native Vegetation Clearing Permit 24

5.3 RIGHTS IN WATER AND IRRIGATION ACT 1914 24

6 SUMMARY 25

7 REFERENCES 26

TABLES IN TEXT

Table 1: Gosnells Long-Term Climate Averages

Table 2: Vegetation Complex Extent and Status

Table 3: Conservation Significant Flora

Table 4: Threatened Fauna

Table 5: Calculated Average Annual Maximum Groundwater Levels

Table 6: Pre-Development Groundwater Quality

PLATES IN TEXT

Plate 1: Acid Sulfate Soils Risk Mapping

ATTACHMENTS

LIST OF APPENDICES

Appendix 1: Preliminary Geotechnical and ASS Investigation Report

Appendix 2: NatureMap Search Results

Appendix 3: Protected Matters Search Tool Results

Appendix 4: Aboriginal Heritage Search Results

LIST OF ABBREVIATIONS

AHD	Australian Height Datum
ASS	Acid Sulfate Soils
BGL	Below Ground Level
BOM	Bureau of Meteorology
CWTH	Commonwealth
DAA	Department of Aboriginal Affairs
DEC	Department of Environment Conservation
DER	Department of Environment Regulation
DMA	Decision Making Authority
DoE	Department of Environment (Cth)
DoP	Department of Planning
DoW	Department of Water
DPaW	Department of Parks and Wildlife
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EPBC	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ha	Hectare(s)
km	Kilometre(s)
L	Litre
m	Metre(s)
Mg	Milligrams
mm	Millimetre(s)
No.	Number
ODP	Outline Development Plan
pH_F	pH Field
S	Sulfer
TPS	Town Planning Scheme

1 INTRODUCTION

1.1 BACKGROUND

Viridian Property Group (the Proponent) has commissioned Aurora Environmental to undertake an environmental assessment of Lot 1 (303) Corfield Street, Gosnells (the site).

The site is located in the south-eastern corridor of the Perth metropolitan area, approximately 20km south-east of the Perth central business district (Figure 1). It abuts Seaforth Primary School to the north/north-west and is bound by Corfield Street to the north-east and surrounded by privately owned land to the west, south and east (Figure 2).

The Department of Planning (DoP) and the City of Gosnells have provided in principle support for the preparation of a sub-precinct Outline Development Plan (ODP) to guide the future subdivision and development of the site for residential purposes.

1.1 PURPOSE AND SCOPE

The purpose of the environmental assessment is to identify any environmental constraints that might impact upon the development potential of the site and to identify whether any further investigations are needed and what environmental management strategies might be required to mitigate potential environmental risks.

In completing this Environmental Assessment, Aurora Environmental has:

- Reviewed soil mapping, acid sulfate soils (ASS) risk mapping, geology and geomorphology;
- Searched relevant Department of Parks and Wildlife (DPaW) and Department of Environment (DoE) databases to identify potential conservation significant flora, vegetation and fauna that may be present on the site;
- Searched the Department of Environment Regulation (DER) Contaminated Sites Database to confirm if there is any recorded contamination present on, or adjacent to the site;
- Reviewed available hydrological and hydrogeological information relevant to the site;
- Reviewed whether there are incompatible land uses or environmentally sensitive areas located near the site;
- Searched the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System to verify whether there are any previously recorded heritage sites on the site; and
- Conducted a site inspection to verify the findings from the desktop research.

1.2 PLANNING CONTEXT

The site is located within the City of Gosnells and is therefore, subject to the requirements of the City's Town Planning Scheme (TPS) No. 6 (the Scheme). The site is demarcated as 'Development' zone under the TPS and is located in an area that was covered under Amendments No. 130 and 142 of the TPS.

The purpose of the Development Zone as defined in the City's TPS No. 6 is:

> *"To provide for the progressive and planned development of land for a variety of uses including residential, commercial, industrial, recreational and community generally in accordance with an Outline Development Plan".*

A Structure Plan provides the framework to coordinate subdivision, development and use of land. Provision 7.3.4 of the City's Scheme Text requires the Structure Plan to address the following environmental matters:

- Key opportunities and constraints including landform, topography, hydrology, landscape, vegetation, soils, and conservation and heritage values.

1.3 RELEVANT STUDIES

Aurora Environmental is not aware of any previous environmental studies on the site. However, a Local Water Management Strategy (LWMS) (JDA, 2015) and a preliminary geotechnical and acid sulfate soils (ASS) assessment Golder Associates (2015) have been prepared in support of the Structure Plan for Lot 1.

2 PRE-DEVELOPMENT ENVIRONMENT

2.1 CLIMATE

Gosnells has a warm Mediterranean climate with mild wet winters and hot dry summers. The nearest weather station is the Gosnells City Research Centre (Site No. 009106) where the average annual rainfall is 817.6mm (recorded from 1961-present), with more than 500mm of the annual total being recorded during the period of May to August.

The hottest months are January and February with a mean maximum temperature of 33.2°C and a mean minimum of 18.6°C for January and for 18.8°C February. July is the coldest, wettest month with a mean maximum temperature of 18.7°C and mean minimum of 8.7°C (BOM, 2015). Monthly climate data is summarised in Table 1.

TABLE 1
GOSNELLS LONG-TERM CLIMATE AVERAGES

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Mean Max (°C)	33.2	33.2	30.5	26.5	22.8	19.6	18.7	19.5	20.8	24.0	27.4	30.4	*25.5*
Mean Min (°C)	18.6	18.8	17.2	14.8	11.8	9.7	8.7	9.0	10.2	11.8	14.4	16.2	*13.4*
Mean Rain (mm)	11.6	14.6	16.8	43.7	104.3	170.6	162.2	125.8	83.3	46.0	29.3	11.4	*817.6*
Mean Rain Days	1.5	1.5	2.5	5.0	9.3	12.6	13.9	11.9	9.6	5.9	4.0	2.0	*79.7*

Source: BOM (2015), data from 1961 to present.

2.2 TOPOGRAPHY

The site topography is relatively flat, though a low sand dune extends across the western portion of the site with a maximum elevation of approximately 24.5 metres Australian Height Datum (m AHD), gently falling away to the north-east (Figure 2). The lowest elevation is approximately 22mAHD adjacent to Corfield Street (Figure 2).

2.3 GEOLOGY, GEOMORPHOLOGY AND SOILS

The site is located on the Swan Coastal Plain which is a relatively low-lying, gently undulating area that lies between the Darling Scarp and the coast, extending from Geraldton to Dunsborough (Copp, 2001). The Plain can be classified into various geomorphological units with the site being located on a degraded dunal system of eolian original (Bassendean Dunes) with the north-eastern portion being mapped as an eolian deflation hollow.

Two geological units are present on the site, including Swamp Deposits (Qrw) and Bassendean Sands (Qpb).

According to Jordan (1986) approximately two-thirds of the site is mapped as S_8 which consists of white to pale grey sand at the surface and yellow sand at depth (Bassendean Sands). The sand is fine to medium grained, moderately sorted, sub-angular to rounded and of eolian origin. Bassendean

Sands have a moderate to high permeability, can be excavated easily, but are susceptible to erosion if left without adequate cover or are not stabilised.

The north-eastern portion of the site is mapped as Sp_2 which is described as Peat Rich Sand consisting of fine to medium-grained quartz sand with much brown to black organic material, grading to peat. Sp_2 is of lacustrine origin and exhibits low to moderate permeability, high corrosion potential and is subject to perennial flooding.

A very small portion of the site is mapped as Cs which is described as Sandy Clay – white-grey to brown, fine to coarse-grained, sub-angular to rounded sand, clay of moderate plasticity with gravel and silt layers near the scarp.

The geotechnical assessment (Appendix 1) included the excavation of 14 test pits extending to a depth of between 0.8m and 2.5m (Golder Associates, 2015). The sub-surface conditions encountered on Lot 1 are summarised as:

- **Topsoil – sand:** fine to coarse grained, pale grey to grey, trace silt, containing roots, very loose to loose, moist, extending from the surface to depths of between about 0.05m to 0.2m, overlying,
- **Sand:** fine to coarse grained, grey/white to yellow, with less than about 5% fines however, with about 12% clay/silt at Test Pit Location 1 at a depth of 1.7m below ground level (m BGL), generally medium dense to dense, however, loose to medium dense at Test Pit Location 4 and very loose at Test Pit Location 14, moist, extending to depths of between about 0.7m and the maximum investigated depth of about 2.5m.
- **Cemented Sand (Coffee Rock):** this was only encountered at Test Pit Locations 3 and 5 at depths of between about 0.7m and 1.0m, fine to coarse grained sand in an iron cemented matrix, red brown, medium to high strength, with some low strength zones, causing refusal of the excavator at depths of between 0.8m and 1.2m.

Golder Associates (2015) noted that Coffee Rock is a variable material in terms of its extent and degree of cementing. However, it was generally found across the north-eastern portion of the site in association with the wetland area.

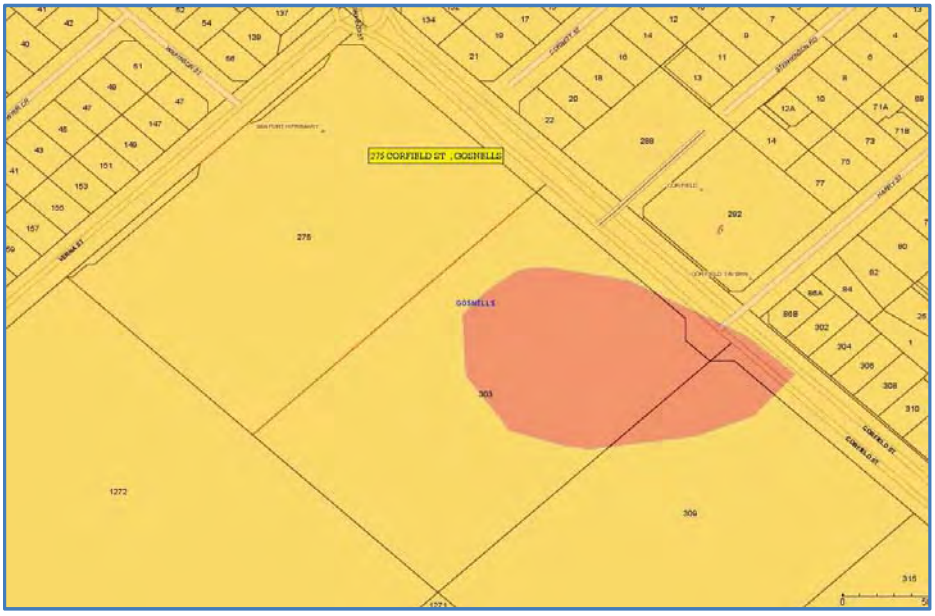
2.4 ACID SULFATE SOILS

Acid Sulfate Soils (ASS) is the name commonly given to naturally occurring soils and sediments that contain iron sulfide (iron pyrite) materials. In their natural state ASS are generally present in waterlogged anoxic conditions and do not present a risk to the environment. ASS can present issues when they are oxidised, producing sulfuric acid, which can impart a range of impacts on the surrounding environment, infrastructure and human health.

The majority of the site is mapped as ‘moderate to low’ risk of ASS occurring within 3m of the natural soil surface but a high risk of ASS being present beyond 3m of natural soil surface (Plate 1). The exception to this is the north-eastern portion of the site which is mapped as ‘high to moderate’ risk of ASS occurring within 3m of the natural soil surface (Plate 1). This area correlates with the area mapped as peaty sands in the geological mapping. When dewatered or if another form of disturbance occurs, areas containing recent sands (such as Bassendean Sands), can result in

acidification of the shallow groundwater aquifer caused by the progressive depletion of base cations capable of buffering soil acidity (Department of Environment Conservation; DEC, 2009). Of particular concern are areas of variably cemented iron and/or organic rich sands commonly referred to as coffee rock (DEC, 2009).

PLATE 1
ACID SULFATE SOILS RISK MAPPING



Golder Associates (2015) conducted a preliminary ASS assessment at the site to assess the general variability of ASS risk across Lot 1 (Appendix 1). Golder Associates (2015) collected soil samples at 0.5m intervals from all test pits excavated during the geotechnical investigation. Field screening tests (pH_F) were completed on 32 soil samples (30 primary and two duplicates). One sample was found to have a pH_F value below 4 which suggests the presence of actual ASS and therefore the inferred ASS risk for this sample was assessed as being high. The 'high risk' sample was collected from Test Pit Location 6 (See Appendix 1, Figure 2) within at a depth of 2m BGL with the material described as yellow/brown sand, trace clay, trace iron-cemented sand (Golder Associates, 2015).

Chromium suite testing was completed on 12 soil samples including two quality assurance/quality control samples to quantitatively assess the acid generating potential of the soil. Ten of the 12 samples recorded Net Acidity concentrations below the action criterion on 0.03% Sulfur (S) (Golder Associates, 2015). Two samples recorded Net Acidity concentrations above the 0.03% S criterion, with both of these samples being encountered above the Coffee Rock layer (Golder Associates, 2015).

The shallow sandy soils above the groundwater table at the site generally did not have recorded measurable levels of sulfide, however two samples of sandy material above the Coffee Rock layer had Net Acidity concentrations above the 0.03% S criterion. It is expected that material within and below the Coffee Rock layer is likely to be actual ASS.

2.5 VEGETATION AND FLORA

2.5.1 Bioregional Context

Western Australia supports 53 biogeographical subregions. The site is located in the Perth Subregion (SWA02) of the Swan Coastal Plain.

The Swan Coastal Plain Bioregion is a low-lying coastal plain, mainly covered with woodlands. It is dominated by Banksia (*Banksia* sp.) or Tuart (*Eucalyptus gomphocephala*) on sandy soils, Swamp Sheoak (*Casuarina obesa*) on outwash plains and Paperbark (*Melaleuca* sp.) in swampy areas.

The Perth Subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. The vegetation is dominated by heath and/or Tuart (*Eucalyptus gomphocephala*) woodlands on limestone, Banksia (*Banksia* sp.) and Jarrah (*Eucalyptus marginata*) woodlands on quaternary marine dunes of various ages and Marri (*Corymbia calophylla*) on colluvial and alluvial sands.

The Perth Subregion includes a complex series of seasonal wetlands and also includes the islands found offshore of Perth. The sub-regional area is 1,333,901ha in size (McKenzie *et al.*, 2002).

2.5.2 Beard's Vegetation Mapping

Beard (1979) vegetation mapping comprises statewide broadscale vegetation mapping at a scale of 1:250,000. The mapping contained in the Western Australian Local Government Association's Environmental Planning Tool indicates that the site is mapped as Beard Vegetation Association 1001. This Association is described as 'Medium very sparse woodland comprising Jarrah with low woodlands of *Banksia* and *Casuarina'.*

2.5.3 Vegetation Complex

Heddle *et al.* (1980) mapped the Perth area at a finer scale than Beard (1979). Vegetation complexes indicate patterns of vegetation at a regional scale, and are based upon factors such as landform, soil and climate.

The Heddle *et al.* (1980) mapping identifies the Forrestfield vegetation complex on the site. The vegetation associated with the Forrestfield Complex ranges from open forest of *Eucalytpus calophylla – E. wandoo - E. marginata* to open forest of *E. marginata – E. calophylla – Casuarina fraseriana – Banksia* spp. Fringing woodlands of *E. rudis* in the gullies that dissect this landform.

2.5.4 Bush Forever

The *Bush Forever* Strategy is a strategic plan which formally commenced in 2000 to protect approximately 51,200ha of regionally significant bushland, representing, where achievable, a target of at least 10 percent of each of the original 26 vegetation complexes of the Swan Coastal Plain portion of the Perth Metropolitan Region (Government of Western Australia, 2000a). None of the vegetation on Lot 1 is identified in *Bush Forever*.

2.5.5 Conservation Significant Vegetation

A vegetation association is considered under-represented if there is less than 30% of its original distribution remaining. From a representation and biodiversity perspective (not taking into account any other land degradation issues) there are several criteria being applied to vegetation (EPA, 2000):

- The threshold level below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European/pre-1750 extent of vegetation association;
- A level of 10% of the original extent is regarded as being a level representing 'Endangered'; and
- Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five classes, where:

- Presumed Extinct: probably no longer present in the bioregion;
- Endangered: <10% of pre-European extent remains;
- Vulnerable: 10-30% of pre-European extent remains;
- Depleted: 30-50% of pre-European extent exists; and
- Least Concern: >50% of pre-European extent exists and subject to little or no degradation over majority of this area.

The extent of Beard vegetation associations currently present against predicted pre-European extents was assessed most recently in 2013 (Government of Western Australia, 2014). As shown in Table 2, approximately 24% of the pre-European extent of Beard Vegetation Association 1001 remains and therefore would be regarded as 'Vulnerable'. If all of the vegetation on the site were cleared, the extent of the Beard Vegetation Association 1001 remaining would still be regarded as 'Vulnerable'.

TABLE 2
VEGETATION COMPLEX EXTENT AND STATUS

VEGETATION COMPLEX	TOTAL PRE-EUROPEAN EXTENT (ha)	PRESENT EXTENT (ha)	% REMAINING (ha)	% REMAINING IN SECURE TENURE
Beard Vegetation Association 1001 (on Bassendean Dunes)	53,283.54	12,742.70	23.91	1.22

Source: Government of Western Australia (2014)

2.5.6 Vegetation Types Condition

A site visit conducted by Aurora Environmental identified the vegetation on the site (Figure 3) as comprising:

- Low Open Woodland of *Melaleuca rhaphiophylla* over pasture grasses;
- Low Forest of *Melaleuca rhaphiophylla* over pasture grasses; and

- Low Open Woodland of *Eucalyptus marginata* over *Banksia* spp., *Nuytsia floribunda* and *Xylomelum occidentale* over weedy understorey.

2.5.7 Vegetation Condition

The majority of Lot 1 is considered to be 'Completely Degraded', with the areas of *Banksia* Woodland in a 'Degraded' condition (Figure 4). The area associated with the *Melaleuca* spp. wetland were mapped as either in 'Good' condition or 'Good to Degraded' (Figure 4). The vegetation condition has been severely compromised through historical clearing and previous agricultural activities including grazing. This has led to the removal of most of the understorey vegetation on the site and the establishment of weeds.

2.5.8 Conservation Flora

Appendix 2 contains the search results of DPAW's NatureMap database, identifying the threatened species that potentially occur within 1km of the site. Appendix 3 contains the search results of the Department of Environment's (DoE) Protected Matters Search Tool, identifying all conservation significant flora and ecological communities protected under the *Environment Protection and Biodiversity Conservation Act 1999* that may occur within the general vicinity of the site.

Table 3 represents a consolidated list of conservation significant flora that potentially occurs in the vicinity of the site.

TABLE 3
CONSERVATION SIGNIFICANT FLORA

SPECIES	STATUS	RANK	COMMENT
Slender Andersonia *Andersonia annelsii*	Threatened	Endangered	Species previously recorded in the Southern Jarrah Forest IBRA sub-region and therefore unlikely to be present on the site.
Summer Honeypot *Banksia mimica*		Endangered	Prostrate shrub found on white or grey sand over laterite or on sandy loams. Given previous clearing and grazing it is unlikely that this species would be present.
King Spider Orchid, Grand Spider Orchid *Caladenia huegelii*	Threatened	Endangered	Given previous clearing and grazing it is unlikely that this species would be present.
Swamp Star Flower *Calytrix breviseta subsp. breviseta*	Threatened	Endangered	Species found on sandy clays or on swampy flats. The lack of understorey species in the wetland area suggest that this species is unlikely to be present on the site.
Centrolepis caespitosa	Priority 4	Endangered	Tufted annual herb found on white sands, clays, salt flats and wet areas. Given previous clearing and grazing it is unlikely that this species would be present.
Wavy-leaved Smokebush *Conospermum*	Threatened	Vulnerable	Given previous clearing and grazing it is unlikely that this species would be present.

SPECIES	STATUS	RANK	COMMENT
undulatum			
Scarp Darwinia *Darwinia apiculata*	Threatened	Endangered	This species is found on lateritic soils which are not present on the site.
Muchea Bell *Darwinia foetida*	Threatened	Critically Endangered	This species is found on grey-white sand on swampy, seasonally wet sites. It has a very restricted distribution and is found around Muchea. Therefore, it is unlikely to be present on the site.
Dwarf Bee Orchid *Diuris micrantha*	Threatened	Vulnerable	Perennial herb that is found on brown loamy-clays in winter-wet swamps. This soil type is not present on the site.
Purdie's Donkey Orchid *Diuris purdiei*	Threatened	Endangered	A perennial herb found in winter-wet swamps on moist grey-black sand. Unlikely to be present on the site given past grazing.
Glossy-leafed Hammer Orchid *Drakaea elastica*	Threatened	Endangered	A perennial herb found in low-lying situations adjoining winter-wet swamps and white or grey sands. Given previous clearing and grazing it is unlikely that this species would be present.
Dwarf Hammer Orchid *Drakaea micrantha*	Threatened	Vulnerable	A perennial herb found on white-grey sands. Given previous clearing and grazing it is unlikely that this species would be present.
Cadda Road Mallee, Cadda Mallee *Eucalyptus balanites*	Threatened	Endangered	Small mallee tree found on sandy soils with lateritic gravel. This species is unlikely to be found on the site as its preferred soil type is not present.
Narrow curved-leaf Grevillea *Grevillea curviloba subsp. incurva*	Threatened	Endangered	Species found on sands and sandy-loams, typically in winter wet heath areas. Given previous clearing and grazing it is unlikely that this species would be present.
Wing-fruited Lasiopetalum *Lasiopetalum pterocarpum*	Threatened	Endangered	Multi-stemmed shrub found on dark red-brown loams or clayey sand over granite. These soil types are not present on the site.
Beaked Lepidosperma *Lepidosperma rostratum*	Threatened	Endangered	A tufted perennial plant found on peaty sands and clay. The geotechnical investigation confirmed that peaty sands are not present in the wetland area. It is unlikely that species is present on the site.
Selena's Synaphea *Synaphea* sp. Fairbridge Farm	Threatened	Critically Endangered	Dense clumped shrub found on sandy soils with lateritic pebbles, near winter-wet flats in low woodland. Given previous clearing and grazing it is unlikely that this species would be present.
Dwellingup	Threatened	Endangered	Caespitose shrub found on sandy or sandy-clay soils on

SPECIES	STATUS	RANK	COMMENT
Synaphea *Synaphea stenoloba*			winter wet flats associated with granite. Given previous clearing and grazing and the absence of granite, it is unlikely that this species would be present.
Star Sun-orchid *Thelymitra stellata*	Threatened	Endangered	Perennial herb found on sand, gravel and lateritic loam. Given previous clearing and grazing it is unlikely that this species would be present.
Acacia oncinophylla subsp. patulifolia	Priority 4	-	Shrub found on granitic soils and occasionally on laterite. These soil types are not present on the site.
Asteridea gracilis	Priority 3	-	Annual herb found on sand, clay and gravelly soils. Suitable habitat is on the site, however unlikely to be present due to past clearing and grazing.
Blue Boronia *Boronia tenuis*	Priority 4	-	Small shrub found on laterite, stony soils and granite. These soil types are not present on the site.
Halgania corymbosa	Priority 3	-	Small shrub found on gravelly soils and soils over granite. These soil types are not present on the site.
Stalked Water Ribbons *Aponogeton hexatepalus*	Priority 4	-	Rhizomatous aquatic perennial herb found in freshwater ponds, rivers and claypans. This species preferred habitat is not present on the site.
Meeboldina decipiens subsp. decipiens	Priority 3	-	Erect perennial grass-like or herb found on sand and sandy peat swamps. Potentially suitable habitat present on the site. However, this species is unlikely to be present due to past clearing and grazing.
Schoenus benthamii	Priority 3	-	Tufted perennial grass-like or herb found on white or grey sands and sandy clays in winter wet flats and swamps. Potentially suitable habitat is present on the site. However, this species is unlikely to be present due to past clearing and grazing.

Although a complete flora and vegetation survey was not completed as part of this study, Aurora Environmental considers it highly unlikely that the species listed in Table 3 would be present on the site due to past clearing and agricultural activities, including grazing which has taken place until recently.

2.6 FAUNA

Information about the potential conservation significant fauna in the vicinity of Lot 1 has been obtained by conducting a search of DPAW's NatureMap database (Appendix 2) and DoE's Protected Matters Search Tool (Appendix 3). The results of the search are summarised in Table 4.

TABLE 4
THREATENED FAUNA

SPECIES	CLASS	STATUS		NOTES
		STATE	CWTH	
Listed Threatened Species				
Australasian Bittern *Botaurus poiciloptilus*	Bird	Endangered	Endangered	**Unlikely** to use the site. This species prefers living in dense beds of reeds and rushes. This habitat is not present on the site.
Baudin's Black-Cockatoo *Calyptorhynchus baudinii*	Bird	Threatened	Vulnerable	This species **may occasionally** use habitat on the site. Limited foraging habitat is present on the site.
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Bird	Threatened	Endangered	This species **may occasionally** use habitat on the site. Limited foraging habitat is present on the site.
Forest Red-Tailed Black Cockatoo *Calyptorhynchus banksii naso*	Bird	Threatened	Vulnerable	This species **may occasionally** use habitat on the site. Limited foraging habitat is present on the site.
Malleefowl *Leipoa ocellata*	Bird	Threatened	Vulnerable	Species is found in semi-arid mallee scrub areas. This species is **unlikely** to be found on the site.
Australian Painted Snipe *Rostratula australis*	Bird	-	Endangered	Medium-sized wader that prefers freshwater wetlands that have a thick cover of low vegetation. The wetland on the site has no understorey and therefore is **unlikely** to provide suitable habitat for this species.
Woylie *Bettongia penicillata ogilbyi*	Mammal	Critically Endangered	Endangered	This mammal has a very restricted distribution due to predation and land clearing. The species is generally found in open forest and woodland with a low understorey of tussock grasses or woody scrub. The lack of suitable habitat on the site means that this species is **unlikely** to be present.
Chuditch *Dasyurus geoffroii*	Mammal	Vulnerable	Vulnerable	This mammal is generally found in sclerophyll forest, dry woodland and mallee shrubland. It is generally restricted to the Jarrah Forest and mixed Karri/Marri/Jarrah forest in the southwest and is rarely seen in the Perth metropolitan region due to extensive clearing and predation. The lack of suitable habitat on the site means that this species is **unlikely** to be present.
Western Ringtail	Mammal	Endangered	Vulnerable	This species is typically restricted to the south-west

SPECIES	CLASS	STATUS		NOTES
		STATE	CWTH	
Possum *Pseudocheirus occidentalis*				and south coast regions of Western Australia. It is not known to persist in the Perth metropolitan area. It is **unlikely** that this species would be present on the site.
Quokka *Setonix brachyurus*	Mammal	Vulnerable	Vulnerable	This species has a very restricted distribution on the mainland. It is not known top persist in the Perth metropolitan region and therefore is **unlikely** to be present on the site.
Quenda / Bandicoot *Isoodon obesulus subsp. fusciventer*	Mammal	Priority 5		Quenda generally prefer dense understorey areas. Thick understorey provides refuge and protection from predators. This species is **unlikely** to utilise the site.
Southern Brush-tailed Phascogale, Wambenger *Phascogale tapoatafa subsp. tapoatafa*	Mammal	Threatened		This species is known to occur in the south-west between Perth and Albany. It occurs in low densities in the northern Jarrah forests, with the highest densities in the south-west region. It is usually found in dry sclerophyll forests and open woodlands that contain hollow bearing trees. Predation and the degraded condition of the habitat on the site mean that this species is **unlikely** to be present on the site.
Listed Migratory Species				
Fork-tailed Swift *Apus pacificus*	Migratory Marine	International Agreement	Migratory	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Migratory Terrestrial	-	Migratory	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.
Rainbow Bee-eater *Merops ornatus*	Migratory Terrestrial	International Agreement	Migratory	A migratory species that has a wide range and is unlikely to rely upon the site for its survival. It **may occasionally** visit the site.
Great Egret, White Egret *Ardea modesta*	Migratory Wetlands	-	Migratory	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.
Cattle Egret *Ardea ibis*	Migratory Wetlands	International Agreement	Migratory	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.
Eastern Osprey *Pandion cristatus*	Migratory Wetlands	International Agreement	Migratory	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.
Painted Snipe *Rostratula benghalensis (sensu lato)*	Migratory Wetlands	Endangered	Endangered	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.

SPECIES	CLASS	STATUS		NOTES
		STATE	CWTH	
Hooded Plover *Charadrius rubricollis*	Migratory	Priority 4	International Agreement	A migratory species that has a wide range and is **unlikely** to rely upon the site for its survival.

During the site visit conducted by Aurora Environmental, two fauna habitat types were recorded. These comprise:

- *Melaleuca* Wetland over pasture grasses.
- Eucalypt / Banksia Woodland – this habitat type is associated with the higher ground, but is sparsely vegetated. The Banksia trees provide very limited foraging value for Black Cockatoos.

All habitat types have been degraded through past clearing, grazing and weed infestation. As a result, they lack structure and niche habitats that would support a diverse fauna assemblage. The wetland habitat has no understorey species and therefore is unlikely to support conservation significant fauna such as Quenda, which prefer a dense understorey to provide refuge from predators. The Eucalypt / Banksia Woodland is degraded, providing limited foraging value. Breeding and roosting is unlikely to be supported on the site due to an absence of suitable habitat trees.

2.7 SURFACE WATER

Lot 1 is located within the Swan-Canning Catchment, which comprises the 2,126km^2 coastal plain section of the Swan-Avon system. The Swan Canning river system is typified by a large urban and agricultural catchment and relatively shallow and slow-moving river conditions. No rivers or creek lines feature on the site or directly adjacent to the site. Rainfall runoff is expected to be limited due to the sandy permeable soils on the site. However, runoff from less permeable areas would flow towards the low point of the site near Corfield Street. An existing drainage sump is located outside of Lot 1 and adjacent to Corfield Street.

A search of DPaW's Geomorphic Wetlands of the Swan Coastal Plain database indicates that a portion of the site is mapped as a Resource Enhancement wetland (UFI 15842). The wetland present on the site belongs to the Bennett Brook Consanguineous Suite. Some inaccuracies in the boundary of this wetland were noted. The variations in the boundaries are supported by vegetation characteristics (i.e. wetland dependent vegetation) and historical aerial photos. However, these boundary variations were not considered significant enough to warrant a wetland reclassification. Wetland areas (closer to Corfield Street) will be retained in public open space.

Portions of Wetland UFI 15842 were noted as being degraded and therefore potentially unlikely to be consistent with the Resource Enhancement Classification. Due to the size of these areas, a reclassification has not been submitted to DPaW. Instead, the Structure Plan has retained the areas of the wetland in better condition (Figure 5). This is discussed further in Section 4.4.

There are no Environmental Protection (Swan Coastal Plain Lakes) Policy wetlands (EPA, 1992) on the site. The site is located within 10km of the RAMSAR listed Forrestdale Lake and Thomson Lake.

2.8 GROUNDWATER

The online *Hydrogeological Atlas* (DoW, 2015) indicates that groundwater beneath the site is contained within Surficial Sediments. Three aquifers are present beneath the site including the following (in order of increasing depth below ground level):

- Superficial;
- Osborne; and
- Leederville.

The Superficial Formation is of quaternary age and consists of a thin veneer of sand (Bassendean Sand) overlying sandy clay and clay (Guildford Formation). The Superficial Formation forms an unconfined aquifer containing generally fresh to slightly brackish groundwater (500 to 1500 milligrams/litre (mg/L) Total Dissolved Solids), with slightly acid to neutral pH (5 to 7) (Davidson, 1995). The water table is shallow, rising to within 0.5m of the surface during winter, depending on surface elevation. The seasonal variation of the water table is about 2m, reaching a maximum elevation in September/October and a minimum elevation in April/May.

The Osborne Formation is present under the site. The upper layer is the Kardinya Shale member which forms a confining bed hydraulically separating the Superficial Aquifer and the underlying Leederville Aquifer. Sub-cropping the Kardinya Shale is the Henley Sandstone member which forms part of the Leederville Aquifer.

The Leederville Formation is of Cretaceous age and consists of interbedded sandstone, siltstone and shale and is the major formation of the Leederville Aquifer. The Leederville Aquifer is a major regional aquifer, which yields large volumes of fresh groundwater. The groundwater in the Leederville Formation is under pressure (confined) with the potentiometric surface in this area at approximately ground level.

The Superficial Formation in the Gosnells area is characterised by a thin veneer of Bassendean Sand underlain by the clayey sediments of the Guildford Formation. Davidson and Yu (2008) estimate the average recharge in this area to be approximately 10% of rainfall or equivalent of 81 mm per year.

The presence of clayey layers in the soil profile means that a ‘perched water table’ can form locally (JDA, 2015). In average and above average rainfall years the rate of recharge will be sufficient that any perched layers will be seasonal, with regional water table rising up over the course of winter to incorporate the perched layers into a continuous saturated column. In below average rainfall years the rainfall recharge may not be sufficient to cause the regional water table to rise significantly and the ‘perched water table’ may remain above the regional water table (JDA, 2015).

Depending on the specific yield of the local soils, fluctuations in the regional water table may vary 1 to 2m seasonally (JDA, 2015).

The historical maximum groundwater contours as mapped in the Department of Water’s Perth Groundwater Atlas (accessed 15 June 2015) indicate that groundwater contours beneath the site are at 22m AHD which would suggest that the north-eastern portion of the site would be inundated in

winter. Groundwater levels in May 2003 were approximately 18m AHD which would be between 4m BGL and 6.5m BGL.

Groundwater or perched groundwater was not encountered at any test pit locations to the maximum investigated depth of 2.5m during the geotechnical investigation.

The winter maximum water table varies from year to year consistent with variations in the amount and intensity of rainfall and evapotranspiration (JDA, 2015). To determine the estimated pre-development groundwater levels over the site JDA (2015) conducted groundwater investigations. Five groundwater monitoring bores were installed across the site, with water levels measured in all of the bores on 9 June 2015, then measured on 5 occasions to 2 November 2015. The highest level in all of the bores was recorded on 2 October 2015. JDA (2015) calculated corrected average annual maximum groundwater levels for each bore (Table 5). Monitoring Bore CO1 was installed in the north-eastern corner of Lot 1 and was influenced by the existing stormwater sump and therefore has been excluded from estimation of pre-development groundwater levels.

TABLE 5
CALCULATED AVERAGE ANNUAL MAXIMUM GROUNDWATER LEVELS

BORE ID	WATER LEVEL 2/10/15 (mAHD)	ESTIMATED AVERAGE ANNUAL MAXIMUM GROUNDWATER LEVEL (mAHD)
CO2	20.54	21.34
CO3	20.35	20.71
CO4	20.02	20.30
CO5	19.62	20.29

Source: JDA (2015)

Groundwater quality for Bores CO1 to CO5 was monitored by JDA (2015) on three occasions from June to October 2015. Results are presented in Table 6.

TABLE 6
PRE-DEVELOPMENT GROUNDWATER QUALITY

PARAMETER	ANZECC GUIDELINE TRIGGER	SWAN CANNING WQIP	CO1	CO2	CO3	CO4	CO5
15 June 2015							
EC (mS/cm)	-		1.58	1.90	0.70	0.81	1.01
pH	-		6.03	6.43	5.20	5.32	5.44
Total N (mg/L)	1.20	1.00	0.5	1.5	1.2	1.7	0.3
NOx-N (mg/L)	0.15	-	0.015	0.005	0.006	1.300	0.017
NH_3-N (mg/L)	0.08	-	0.007	0.210	0.420	0.005	0.120
Total P (mg/L)	0.065	0.10	0.05	0.05	0.05	0.05	0.05

PARAMETER	ANZECC GUIDELINE TRIGGER	SWAN CANNING WQIP	CO1	CO2	CO3	CO4	CO5
FRP (mg/L)	0.040	-	0.005	0.005	0.006	0.005	0.005
4 August 2015							
EC (mS/cm)	-		0.86	1.65	0.70	0.72	1.37
pH	-		6.71	6.96	4.88	5.55	5.58
Total N (mg/L)	1.20	1.00	0.3	1.8	1.7	1.8	0.9
NOx-N (mg/L)	0.15	-	0.010	0.005	0.280	1.400	0.005
NH_3-N (mg/L)	0.08	-	0.009	0.210	0.430	0.007	0.190
Total P (mg/L)	0.065	0.10	0.05	0.05	0.05	0.05	0.05
FRP (mg/L)	0.040	-	0.005	0.005	0.005	0.005	0.005
2 October 2015							
EC (mS/cm)	-		0.865	1.786	0.711	0.651	1.641
pH	-		6.41	6.93	5.51	5.61	5.56
Total N (mg/L)	1.20	1.00	0.4	1.6	0.8	2.1	1.0
NOx-N (mg/L)	0.15	-	0.022	0.011	0.067	1.500	0.013
NH_3-N (mg/L)	0.08	-	0.016	0.190	0.500	0.005	0.150
Total P (mg/L)	0.065	0.10	0.05	0.05	0.05	0.05	0.05
FRP (mg/L)	0.040	-	0.005	0.005	0.005	0.005	0.005

Source: JDA (2015)

Total Nitrogen (TN) concentrations are higher than the Swan Canning Water Quality Improvement Plan (Swan River Trust, 2009) target values for Bores CO2 to CO5. Results show that measured levels of NOx_N and NH_3-N within bores C02 to C05 is generally higher than the ANZECC (2000) water quality guideline values. Measured Total Phosphorus (TN) values for all bores are below the Swan-Canning Water Quality Improvement target values.

2.9 CONTAMINATION

A review of the DER online register of reported contaminated sites (DER, 2015) confirmed that Lot 1 Corfield Street and the immediate surrounds have not been reported as a known or suspected contaminated site. Although the site is not listed on the Register, this does not necessarily exclude the potential for contamination to be present.

Historical aerial photography available via Landgate dating back to 1953 was examined to ascertain whether there were any activities conducted on the site (or near the site) that may represent a risk in terms of contamination.

The following provides a brief summary of the changes that have occurred on the site:

1953	Site is vegetated with a wetland in the north-eastern third of the site. The wetland extends across Corfield Street and to the south-east on the adjacent lot.
1965	Extensive clearing on the site and a house and some small garden sheds have been constructed in the northern corner of the site near Corfield Street. A small area of vegetation remains in the wetland area and a small area of vegetation remains in the south-western portion of the site. Cleared areas appear to be used for grazing.
1974	The site is cleared except for a portion of the wetland. The wetland appears to be inundated. Clearing has been conducted on the lot to the west of the site and buildings constructed on the Seaforth Primary School site. Corfield Street has been constructed and is sealed up to the north-eastern corner of the site.
1977	Additional clearing conducted on surrounding lots. No significant changes have occurred on the site.
1983	No significant changes have occurred on the site. Residential and commercial development is more established on the opposite side of Corfield Street. The wetland vegetation on the site is regenerating.
1995	No significant change from 1983, apart from the surrounding residential area is fully established.
2005	No significant change from 1995.
2010	No significant change from 2005.
2015	No significant change from 2010.

The review of historical aerial photographs confirmed that the site has been used for low intensity agriculture, most likely grazing. A dwelling and ancillary structures (i.e. small sheds) were constructed between 1953 and 1965. These structures remain on site. It is possible that some hazardous materials (e.g. asbestos containing materials, pesticides or other chemicals) may be present within (or beneath) the old dwelling or stored within the sheds. However, given that the site was likely to be used for low-level agricultural activity, such as grazing, it is considered that there is a low probability of contamination on the site. This view is supported by the historical aerial photos which do not show other land uses taking place on the site, or any evidence of widespread burial of wastes.

2.10 HERITAGE

2.10.1 Aboriginal Heritage

A desktop assessment of Aboriginal heritage values for the site was carried out by reviewing the DAA's Aboriginal Heritage Inquiry System. The search indicated that no previous heritage sites have been recorded on Lot 1 or on surrounding land (Appendix 4). This does not necessarily exclude the potential for sites to be found on Lot 1.

2.10.2 European Heritage

According to the State Heritage Office's *inHerit* database (Heritage Council, 2015) there are no records of any State listed heritage sites on Lot 1. Lot 1 is not listed on the City of Gosnells Municipal Heritage Inventory.

3 DEVELOPMENT PROPOSAL

The Proponent is proposing to subdivide Lot 1 into multiple residential and commercial lots, consistent with regional planning. The Structure Plan for the Study Area is shown in Figure 5.

Key elements of the Structure Plan include:

- Provision of a legible road network across the site that can be integrated with future development of adjacent land.
- The retention of a portion of Wetland UFI 15842 in public open space with a buffer between the retained wetland portion and surrounding land uses.
- The incorporation of the wetland in the stormwater management system, ensuring the site hydrology is maintained, consistent with pre-development conditions.
- The use of bio-retention treatment swales for detention and treatment of stormwater.
- Use of the wetland for stormwater attenuation for flood events, consistent with pre-development conditions.
- Use of higher density urban residential zonings to reduce landscape nutrient input at a domestic scale.
- The extensive use of local native plant species in open spaces, streetscapes and vegetation buffers.

4 ENVIRONMENTAL ISSUES AND MANAGEMENT

4.1 VEGETATION

Due to previous land clearing and agricultural activities on the site, the vegetation and floristic diversity has been severely compromised. This has resulted in a reduced species diversity and establishment of weeds. It is therefore unlikely that the site will support any conservation significant flora or vegetation communities that would be representative of a threatened ecological community. A spring flora and vegetation survey is not considered necessary at this stage due to the poor condition of the existing vegetation.

The Structure Plan retains some native vegetation in public open space (Figure 5). This coincides with the wetland area closer to Corfield Street. It is recommended that a Wetland and Public Open Space Management Plan be prepared at the time of subdivision to outline:

- The retention of native vegetation;
- The rehabilitation of the wetland including weed control measures and revegetation using native species;
- The integration of stormwater management systems into the public open space area;
- The integration of any planned facilities/amenities within the public open space area.

When site works are being undertaken, it is recommended that the areas to be retained are clearly demarcated (with exclusion fencing or bunting) to prevent unauthorised clearing.

4.2 FAUNA

Two degraded fauna habitat types were identified on the site. The Eucalypt / Banksia Woodland area provides limited foraging resources for the three black cockatoo species. However, the loss of this degraded habitat is not considered to be significant in terms of black cockatoo species for the following reasons:

- The habitat is highly degraded and provides very limited foraging resources;
- The habitat does not contain habitat trees suitable for breeding or roosting;
- The site contains less than 1ha of habitat; and
- The removal of habitat will not create a gap of more than 4km between patches of black cockatoo habitat.

The requirement for a referral to the DoE is addressed in Section 5.1.

The *Melaleuca* Wetland is degraded due to past land clearing and agricultural practices. The wetland area is of variable condition and is generally devoid of any understorey species. The lack of understorey will limit the fauna assemblage found on the site.

The Structure Plan retains the portion of the wetland in the best condition. Rehabilitation using native plants will improve the habitat values of the retained portion of the wetland. It is recommended that the rehabilitation of this wetland be outlined in a Wetland Management Plan.

In terms of fauna management for the project, the following recommendations are made:

- During clearing, the site contractor should use machinery to bump trees prior to felling to provide fauna the opportunity to vacate the area.
- Landscaping should incorporate native species to improve habitat values.

4.3 CONTAMINATION

On the basis of the available information it is considered that there is a low probability of contamination being present on the site. Further investigations do not appear to be warranted. However, the following should be noted:

- It is possible that some hazardous materials (e.g. asbestos containing materials, pesticides or other chemicals) may be present within (or beneath) the old dwelling or stored within the sheds.
- Pesticides in soil beneath houses/buildings are generally exempt under the *Contaminated Sites Act 2003* unless a change in land use is proposed whereby potential exposure to residual pesticides may result.
- Given that the site was likely to be used for low-level agricultural activity, such as grazing, it is unlikely that there would be any significant contamination on the site.
- It is recommended that the existing structures on the site are removed and wastes disposed to an appropriate landfill facility.

4.4 WETLANDS AND WATER MANAGEMENT

A significant portion of the site is mapped as a Resource Enhancement Wetland. On review of historical aerial photography, soil information and vegetation, Aurora Environmental is of the view that the current wetland mapping is incorrect in terms of wetland boundaries. However, these discrepancies are not significant enough to warrant a reclassification request. Instead, the portion of the wetland that contains vegetation mapped as 'Good' condition will be retained as the wetland core. A buffer of variable width around this area will be maintained in public open space (Figure 5).

Vegetation condition of the wetland is variable and generally in poor condition due to previous land clearing and grazing. Therefore, the degraded portions of the wetland are no longer consistent with the Resource Enhancement management category. Some of these areas are will be retained in the buffer of the wetland core in public open space. The buffer area will require on-going management. The treatment of the buffer, including any proposed rehabilitation and on-going management will be addressed in a Wetland and Public Open Space Management Plan to be prepared at subdivision.

The evidence suggests that the wetland on the site is a seasonal sumpland that exists as a result of perched groundwater above a layer of coffee rock at approximately 0.7m to more than 1m below ground level. Test Pit locations 3, 4 and 5 confirmed the presence of this coffee rock layer (Appendix 1; Golder Associates, 2015). Given that the wetland will mostly likely be reliant upon infiltrated rainwater (and to a lesser extent the regional groundwater system), it is proposed that the wetland be used as part of the stormwater management system for the site. This approach will ensure that

the wetland continues to receive clean water, which is beneficial under a drying climate scenario. To ensure that the wetland hydrology is not significantly altered, the volumes of stormwater directed to the wetland will be engineered to match pre-development conditions. Surface water run-off from the 1 year average recurrence interval (ARI) rainfall event will be detained and treated using bio-retention treatment swales (using sedges) to ensure that surface water quality is acceptable. The wetland area will be used to detain larger events consistent with pre-development conditions. The stormwater management system is documented in the Local Water Management Strategy and will be further refined in an Urban Water Management Plan at subdivision.

4.5 ACID SULFATE SOILS

Where disturbance to ASS is expected and cannot be avoided (e.g. through excavation of soils, drainage modification or dewatering), the DER will require that the developer undertakes appropriate site investigations to confirm the presence/absence and distribution of ASS. If present on the site, an ASS management plan will be required, outlining the measures to be implemented to mitigate potential adverse effects on the natural and built environment, while achieving acceptable soil and water quality outcomes.

Areas associated with the wetland, and in particular areas that contain a coffee rock layer may contain ASS and as such require management. Further consideration of ASS may be needed once the civil design for the development has been better defined.

4.6 BUSHFIRE MANAGEMENT

Areas adjacent to site contain native vegetation which represent a potential bushfire hazard. Similarly the proposed public open space area will contain retained native vegetation. A Bushfire Management Plan has been prepared for the site.

4.7 CONSTRUCTION IMPACTS

Construction activities have the potential to create nuisance impacts or adversely impact environmental values and amenity of the surrounding areas. These potential impacts, in most cases, can be adequately managed. Typical impacts include:

- Noise associated with machinery and equipment;
- Dust associated with clearing of vegetation, movement of soil and vehicle/equipment movement on-site;
- Erosion;
- Rubbish; and
- The introduction or spread of weeds and diseases.

Construction activities should be undertaken in accordance with the Control of Noise Practices set out in AS2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites* and the *Environmental (Noise) Regulations 1997.* Site works should be limited to the hours between 7am and 7pm on any day which is not a Sunday or Public Holiday. Works undertaken outside of this period should only be undertaken if permitted by the local authority.

In order to manage dust impacts, it is recommended that site works include the use of dust suppression techniques where required as well as establishing a complaints management system during site works.

The primary risk associated with erosion relates to the mobilisation of soil under dry conditions. To manage this risk, it is recommended that the disturbance area is kept to the minimum area required and that visual monitoring is conducted daily during construction.

All waste and rubbish produced on-site during the construction and demolition phases should be disposed at facilities provided for that purpose. On-site waste management facilities should be provided to encourage a clean site and reduce the incidence of wind-blown rubbish.

Areas of vegetation to be retained on the site should be clearly demarcated in the field to prevent inadvertent clearing of vegetation.

4.8 ABORIGINAL HERITAGE

The desktop review did not identify any previous records of Aboriginal heritage values for the site. However, it is recommended that an Aboriginal heritage Protocol is prepared and implemented during site construction works. The Protocol should set out procedures to be followed should a heritage site be discovered during site works to ensure compliance with the *Aboriginal Heritage Act 1972*.

5 ENVIRONMENTAL APPROVALS

5.1 COMMONWEALTH LEGISLATION

The Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* provides the DoE the authority to assess an action that may have the potential to significantly impact on a matter of national environmental significance.

The *EPBC Act* applies to 'actions' which:

- have a 'significant impact' on 'matters of national environmental significance';
- are undertaken by Commonwealth government agencies and have a significant impact on the environment anywhere in the world; or
- are undertaken by any person and have a significant impact on Commonwealth land (even if the activity is not actually carried out on the Commonwealth land).

If a project fits one of these descriptions, it is required to be referred to DoE. If the project is not consistent with any of the above descriptions, the environmental impact assessment provisions of the *EPBC Act* will not apply and there is no need to obtain the approval of the Commonwealth Minister for the Environment.

Based on the findings of desktop study and the site investigations, Aurora Environmental believes that there are no matters of national environmental significance that would be significantly impacted upon, and therefore referral under the *EPBC Act 1999* is not recommended.

5.2 ENVIRONMENTAL PROTECTION ACT 1986

5.2.1 Section 48A

Lot 1 is zoned appropriately for urban development. As a rezoning is not required, Section 48A of the *Environmental Protection Act 1986* will not apply.

5.2.2 Section 38

Decision making authorities (DMAs) (such as State Government departments or local authorities) can decide when and how to refer a proposal (such as a subdivision application) to the Environmental Protection Authority (EPA). The DMA may seek advice from the EPA prior to referring a proposal. If a DMA does refer a proposal to the EPA under Section 38(5) of the *Environmental Protection Act 1986 (EP Act)*, the EPA will then decide whether to:

- Formally assess the proposal;
- Not assess the proposal, but may give advice and make recommendations on the environmental aspects of the proposal to the proponent or any other relevant person or authority; or
- Refuse the proposal on environmental grounds.

Section 38 of the *EP Act* allows third parties (such as interested members of the community), to refer a subdivision proposal.

In Aurora Environmental's opinion the proposed development does not warrant referral to the EPA as there are no significant impacts that require formal assessment by the EPA.

5.2.3 Native Vegetation Clearing Permit

Under the *EP Act*, clearing of native vegetation requires a permit from the DER unless there is an exemption under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. In some instances, e.g. if a site falls within a defined environmentally sensitive area, the exemptions under the Regulations do not apply. Based on a search of Landgate's WA Atlas (Landgate, 2015), there are no environmentally sensitive areas declared over Lot 1.

A clearing application for Lot 1 will only be required if native vegetation is to be cleared in advance of receiving subdivision approval. However, if a subdivision is approved over Lot 1, a vegetation clearing permit will not be needed.

5.3 RIGHTS IN WATER AND IRRIGATION ACT 1914

Approval from the Department of Water may be required under the *Rights in Water and Irrigation (RIWI) Act 1914* if groundwater abstraction for irrigation or dust suppression, or if dewatering is required during construction.

6 SUMMARY

Lot 1 Corfield Street, Gosnells is a small greenfields site identified for future development. It is proposed to be subdivided and developed for mostly urban purposes, including residential uses and potentially office/commercial uses. The site is relatively unconstrained from an environmental perspective. The site's environmental values have been significantly degraded by historical clearing and low level agricultural uses. The Structure Plan (Figure 5) that has been prepared for the site has taken into consideration the key environmental attributes of the site and responded to these appropriately. Impacts to the environment can be adequately managed as outlined in this assessment report.

7 REFERENCES

ANZECC and ARMCANZ, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, October 2000.

Beard J.S. (1979) Vegetation Survey of Western Australia, 1 : 250 000 Series. The Vegetation of the Perth Area. Vegmap Publications, Applecross.

BOM, Bureau of Meteorology (2015). *Climate Statistics for Australian Locations.* Accessed on 13 June 2015 via http://www.bom.gov.au/climate/averages/tables/cw_009573.shtml. Bureau of Meteorology, Australia.

Copp, I. (2001). *Geology and Landforms of the South-West.* Department of Conservation and Land Management, Kensington, Western Australia.

DAA, Department of Aboriginal Affairs (2015). Information sourced on 18 December 2015. http://maps.dia.wa.gov.au/AHIS2/.

DEC (2009) Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes. Acid Sulfate Soil Guideline Series. Department of Environment and Conservation (DEC), Perth, WA.

DER, Department of Environment Regulation (2015). Information sourced on 6 May 2015. http://www.der.wa.gov.au/your-environment/contaminated-sites.

DoW, Department of Water (2015). Information sourced on 6 May 2015. http://www.water.wa.gov.au/Tools/Maps+and+atlases/Hydrogeological+atlas/default.aspx.

EPA, Environmental Protection Authority (1992) Environmental Protection (Swan Coastal Plain Lakes) Policy

Golder Associates (2015). *Geotechnical Investigation and Preliminary acid Sulfate Soils Assessment. Proposed Residential Development, 303 Corfield Street, Gosnells.* Report Prepared for Wood & Grieve Engineers. Report No. 1529456-003-R-Rev0.

Government of Western Australia (2014). *2014 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Simplified).* Current as of June 2015. Department of Parks and Wildlife, Perth.

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

Heritage Council (2015). inherit register sourced on 16 December 2015. http://inherit.stateheritage.wa.gov.au/Public/.

JDA (2015). *Lot 1 Corfield Street, Gosnells – Local Water Management Strategy. Draft.* Report prepared for Viridian Property Group. Document Reference J5998a.

Jordan, J.E. (1986). *Armadale Part Sheets 2033 I and 2133 IV, Perth Metropolitan Region, Environmental Geology Series.* Geological Survey of Western Australia.

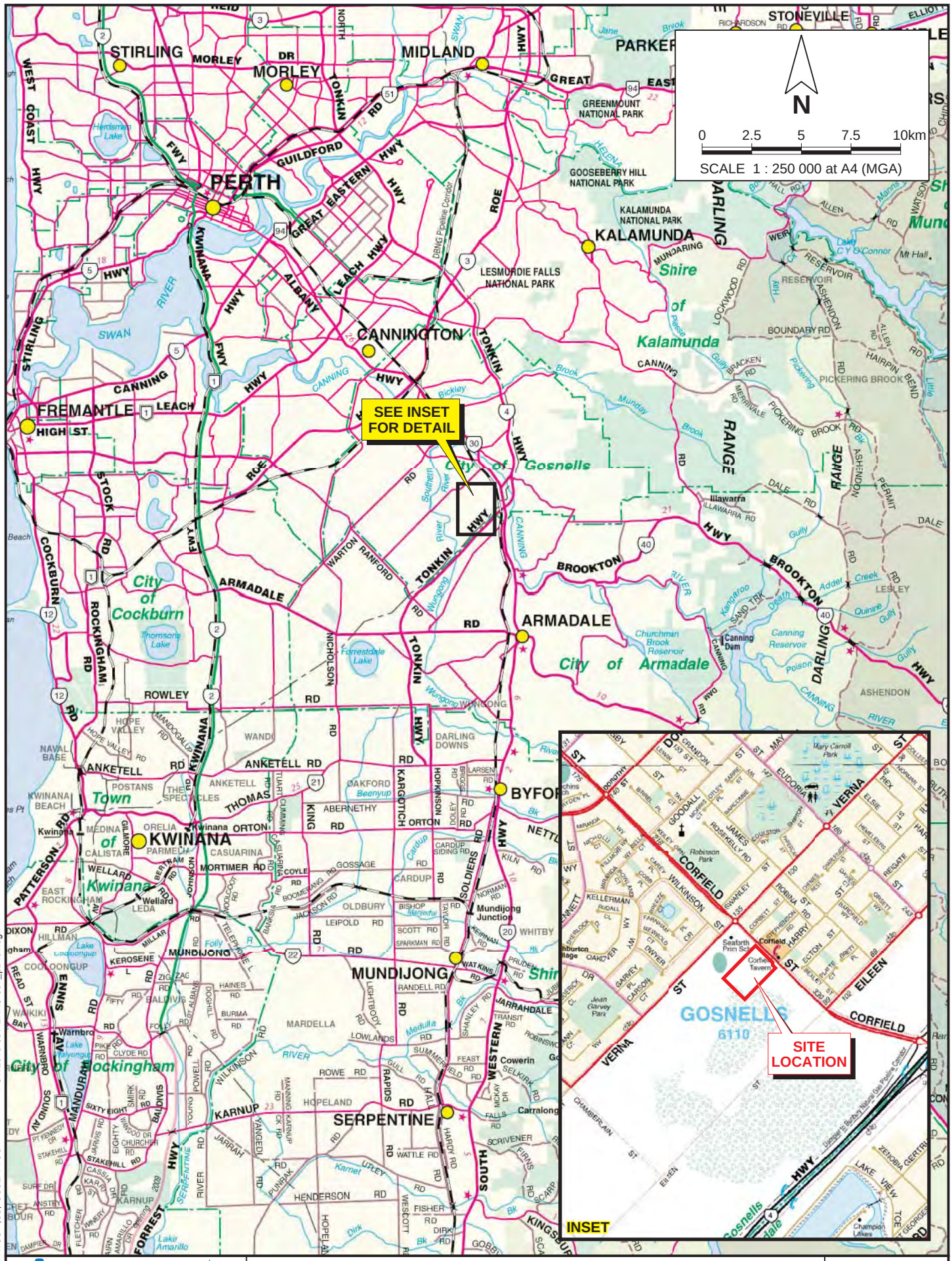
Landgate (2015). WA Atlas. Information sourced on 6 May 2015. https://www2.landgate.wa.gov.au/bmvf/app/waatlas/

Standards Australia (1981). AS2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*

Swan River Trust (2009). *Swan Canning Water Quality Improvement Plan.* Swan River Trust, Perth, Western Australia.

WALGA Western Australia Local Government Association (2004) - http://pbp.walga.asn.au/Documents/BiodiversityProject/MemberResources/1825_7_part_c_section_16_to_18.pdf

FIGURES



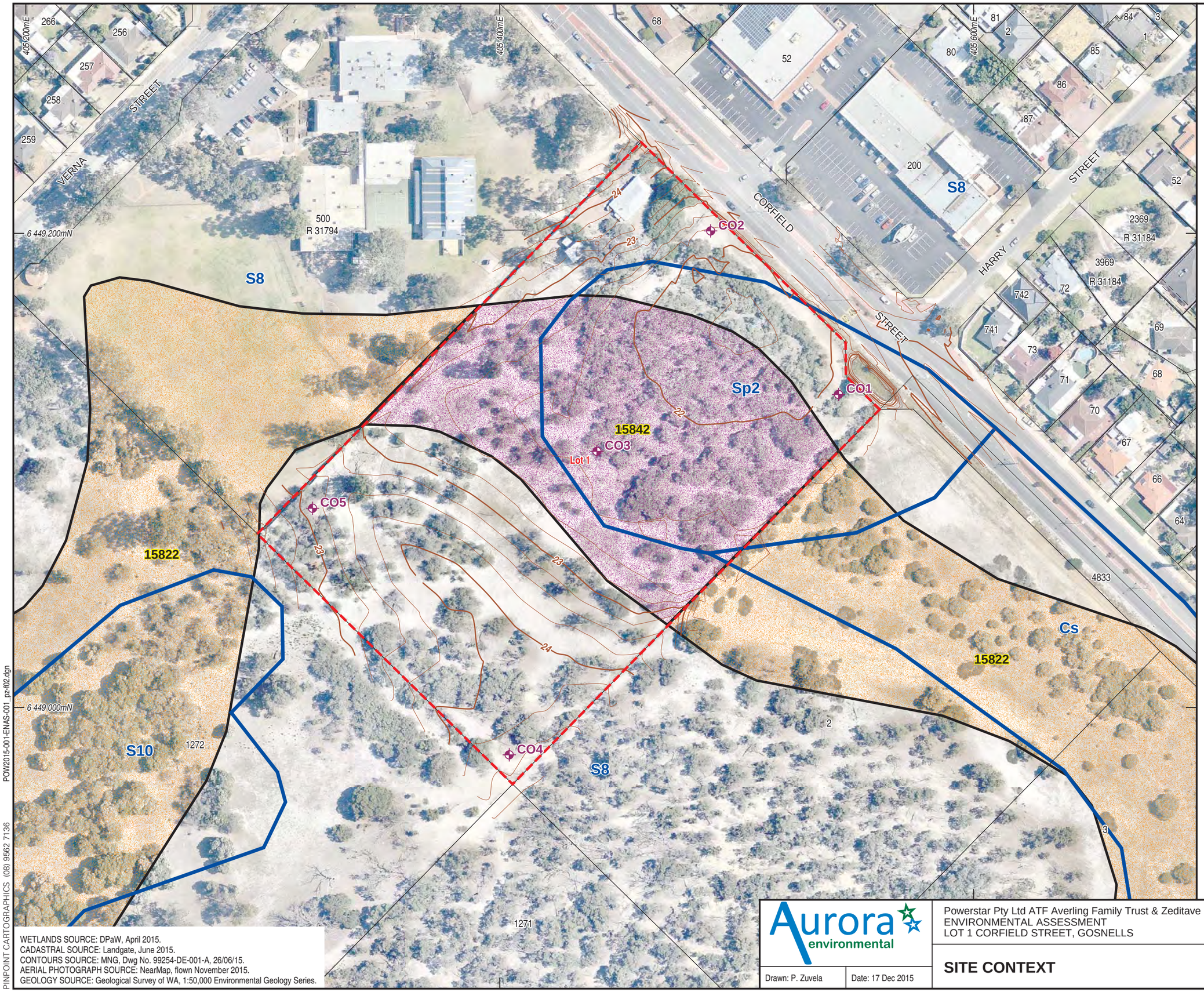
Aurora environmental

Powerstar Pty Ltd ATF Averling Family Trust & Zeditave Pty Ltd
ENVIRONMENTAL ASSESSMENT
LOT 1 CORFIELD STREET, GOSNELLS

Figure 1

REGIONAL LOCATION

Drawn: P. Zuvela | Date: 17 Dec 2015 | Job: POW2015-001



N

0 10 20 30 40 50m

SCALE 1 : 1 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour
- Groundwater Monitoring Bore Location

Geomorphic Wetlands

- Resource Enhancement
- Multiple Use
- 15842 Wetland UFI

Environmental Geology

- Geology Boundary
- Cs SANDY CLAY - white-grey to brown, fine to coarse-grained, subangular to rounded sand, clay of moderate plasticity gravel and silt layers near scarp
- S8 SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin
- S10 SAND - as S8 as relatively thin veneer over strong, blocky, brown silts and clays
- Sp2 PEAT-RICH SAND - fine to medium-grained quartz sand with much brown to black organic material, grades to peat, of lacustrine origin

WETLANDS SOURCE: DPaW, April 2015.
CADASTRAL SOURCE: Landgate, June 2015.
CONTOURS SOURCE: MNG, Dwg No. 99254-DE-001-A, 26/06/15.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown November 2015.
GEOLOGY SOURCE: Geological Survey of WA, 1:50,000 Environmental Geology Series.

Aurora environmental

Powerstar Pty Ltd ATF Averling Family Trust & Zeditave Pty Ltd
ENVIRONMENTAL ASSESSMENT
LOT 1 CORFIELD STREET, GOSNELLS

SITE CONTEXT

Drawn: P. Zuvela | Date: 17 Dec 2015

Figure 2

Job: POW2015-001

POW2015-001-ENAS-001_pz-f02.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

N

0 10 20 30 40 50m

SCALE 1 : 1 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary

Vegetation Types

- Vegetation Type Boundary
- **LoWB** Low Open Woodland Banksia
- **LoWMel** Low Open Woodland Melaleuca spp.
- **LoFMel** Low Forest Melaleuca spp.

N

0 10 20 30 40 50m

SCALE 1 : 1 000 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

Vegetation Condition

Vegetation Condition Boundary

G Good

Deg Degraded

CD Completely Degraded

N

0 10 20 30 40 50m

SCALE 1 : 1 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Proposed Subdivision
- Wetland

APPENDIX 1

Preliminary Geotechnical and ASS Investigation Report

August 2015

GEOTECHNICAL INVESTIGATION AND PRELIMINARY ACID SULFATE SOILS ASSESSMENT

Proposed Residential Subdivision Development, 303 Corfield Street, Gosnells

Submitted to:
Wood & Grieve Engineers
226 Adelaide Terrace
PERTH WA 6000

Report Number. 1529456-003-R-Rev0

Distribution:

1 Electronic Copy – Wood & Grieve Engineers
1 Electronic Copy – Golder Associates Pty Ltd
1 Electronic Copy – Viridian Property Group

REPORT

A world of capabilities delivered locally

Golder Associates

Table of Contents

1.0 INTRODUCTION 1

2.0 OBJECTIVES 1

3.0 FIELDWORK 1

3.1 Geotechnical Fieldwork 1

3.2 Acid Sulfate Soils (ASS) Fieldwork 2

4.0 LABORATORY TESTING 2

4.1 Geotechnical Testing 2

4.2 Acid Sulfate Soil Testing 2

5.0 SUBSURFACE CONDITIONS 3

5.1 Previous Studies 3

5.2 Regional Geology 3

5.3 Subsurface Conditions 3

5.4 Groundwater 3

6.0 GEOTECHNICAL DISCUSSION 4

6.1 General Discussion 4

6.2 Preliminary Site Classification 4

6.3 Site Preparation 4

6.4 Compaction 5

6.5 Structural Fill 5

6.6 Excavations 5

6.7 Retaining Structures 5

6.8 Soil Permeability 6

7.0 ACID SULFATE SOIL DISCUSSION 6

7.1 Field Screening Results 6

7.1.1 Chromium Suite Analysis 7

7.2 Preliminary Acid Sulfate Soils Assessment 7

8.0 LIMITATIONS 7

TABLES

Table 1: Summary of Geotechnical Test Results 2

Table 2: Permeability Test Results 6

FIGURES

Figure 1: Location Plan

Figure 2: Site Plan

APPENDICES

APPENDIX A
Test Pit Reports

APPENDIX B
Geotechnical Laboratory Test Reports

APPENDIX C
Acid Sulfate Laboratory Test Reports

APPENDIX D
Limitations

1.0 INTRODUCTION

This report presents the findings of a geotechnical investigation for the proposed residential subdivision development located at 303 Corfield Street, Gosnells. The location of the site relative to the surrounding area is shown on Figure 1, Location Plan. The work was authorised by Tony Anderson of Viridian Property Group by email on 6 July 2015.

The site covers an area of about 3.3 hectare. At the time of investigation, the site was relatively flat, moderately vegetated with grass and small trees with the eastern portion of the site heavily vegetated with trees. An existing residential structure was located in the northern corner of the site.

WGE have advised that it is likely that the site will be raised between 1.0 m to 1.5 m due to the drainage and flood considerations.

2.0 OBJECTIVES

The objectives of the investigation were to:

- Assess subsurface soil conditions across the site (within the depth of investigation) including soil profile and soil layer thicknesses.
- Provide existing and potential site classification(s) for the expected development in accordance with AS 2870-2011 "Residential Slabs and Footings", and provide comment on improvements required to achieve the potential site classification.
- Provide recommendations on earthworks including compaction method, testing and workability of *in situ* and imported materials.
- Assess groundwater levels and any perched water table levels (within the limitations of the investigation, if encountered).
- Provide recommendations on soil permeability for the design of stormwater drainage.
- Assess the suitability of the excavated *in situ* material for re-use as structural fill.
- Assess the extent of unsuitable material (if encountered).
- Provide geotechnical design parameters for earth retaining structures.
- Conduct a preliminary acid sulfate soils assessment at the site with a view to assessing the general variability of ASS risk across the site.

3.0 FIELDWORK

3.1 Geotechnical Fieldwork

The fieldwork for the investigation was carried out on 8 July 2015 and 10 July 2015 and comprised:

- Excavation of 14 test pits, TP01 to TP14, extending to depths of between about 0.8 m and 2.5 m.
- Perth sand penetrometer (PSP) testing adjacent to each test pit, extending to depths of between about 0.45 m to 1.95 m.
- Infiltration testing at two locations, I1 and I2, at a depth of about 1.0 m.

The investigation locations were positioned using a hand-held GPS, typically accurate to within ±5 m and are shown on Figure 2, Site Plan. Elevations were estimated from a supplied feature survey, and are shown on the test pit logs.

The test pits were excavated using a 5 tonne excavator fitted with a 500 mm wide toothed bucket, supplied and operated by Executive Plant Hire Pty Ltd. Test pit reports are presented in Appendix A along with a list of the notes and abbreviations used on the reports. The method of soil description and simplified cementation classification system adopted is also included. Test pit photographs are shown on the relevant test pit reports.

The PSP testing was undertaken in accordance with test method AS 1289.6.3.3 with the results presented on the test pit reports in Appendix A.

The *in situ* permeability testing was carried out using the 'inverse auger hole' technique described in Cocks (2007)[1], using machine slotted PVC pipe. The base of the pipe was installed at about 1.0 m depth below ground level.

A geotechnical engineer from Golder Associates (Golder) positioned the test locations, logged the materials encountered in the test pits, collected samples for laboratory testing, took photographs and carried out PSP and infiltration testing.

3.2 Acid Sulfate Soils (ASS) Fieldwork

The ASS component of the fieldwork was conducted in conjunction with the geotechnical component and comprised the collection of soil samples at typically 0.5 m intervals from all test pits.

Sampling was conducted by a geotechnical engineer from Golder in general accordance with Department of Environmental Regulation (DER) ASS investigation guidelines (Identification and Investigation of Acid Sulfate Soils and Acid Landscapes, DER 2013).

4.0 LABORATORY TESTING

4.1 Geotechnical Testing

Geotechnical laboratory testing on samples retrieved from the test pits during fieldwork, was conducted at Golder's NATA accredited laboratory and comprised determination of:

- Particle Size Distribution (2 tests)
- Atterberg Limits and Linear Shrinkage (1 test).

The test results are summarised below in Table 1. The laboratory test reports are presented in Appendix B.

Table 1: Summary of Geotechnical Test Results

Location	Depth (m)	Atterberg Limits (%)				PSD (% by mass)		
		LL	PL	PI	LS	Gravel	Sand	Fines
TP01	1.7–2.0	23	18	5	1.5	6	82	12
TP11	0.5–0.8	-	-	-	-	0	96	4

Note: LL – Liquid Limit; PL – Plastic Limit; PI – Plastic Index; LS – Linear Shrinkage; PSD – Particle Size Distribution; Gravel – material between 75 mm and 2.36 mm; Sand – material between 2.36 mm and 0.075 mm; fines – material less than 0.075 mm.

4.2 Acid Sulfate Soil Testing

Acid sulfate soil laboratory testing was conducted at ALS Environmental's NATA accredited laboratory and comprised:

- ASS field screening tests on 30 soil samples.

[1] Cocks, G., Disposal of Stormwater Runoff by Soakage in Perth Western Australia, Journal and News of the Australian Geomechanics Society, Volume 42 Number 3, September 2007.

- Chromium Suite testing on 12 soil samples.

The test results are presented in Appendix C, with the test results summarised in Table C1 and C2.

5.0 SUBSURFACE CONDITIONS

5.1 Previous Studies

Golder previously carried out a geotechnical and acid sulphate soils desktop study for the site. The findings of the desktop study were presented in a letter report (Golder reference 1529456-001-L-Rev0, dated 25 May 2015). The desktop study was carried out to broadly assess the ground conditions for the site based on published geological information and previous experience in the area.

5.2 Regional Geology

The Perth sheet of the 1:50,000 Environmental Geology Series of Maps indicates that the majority of the site is underlain by:

- Bassendean Sand (S_8), *SAND – white to pale grey at surface, yellow at depth, fine to medium grained, moderately sorted, sub-angular to sub-rounded, minor heavy minerals, of eolian origin.*

Across the eastern part of the site, subsurface conditions are shown to comprise:

- Swamp Deposits (Sp_2), *Peat-Rich SAND – fine to medium grained quartz sand with much brown to black organic material, grades to peat, of lacustrine origin*, underlain by
- Guildford Formation (Cs), *Sandy CLAY – white-grey to brown, fine to coarse grained, sub-angular to rounded sand, clay of moderate plasticity, gravel and silt layers near scarp.*

5.3 Subsurface Conditions

Based on the results of the geotechnical investigation, the subsurface conditions encountered across the site can be summarised as:

- TOPSOIL – SAND (SP): fine to coarse grained, pale grey to grey, trace silt, containing roots, very loose to loose, moist, extending from the surface to depths of between about 0.05 m to 0.2 m, overlying
- SAND (SP): fine to coarse grained, grey/white to yellow, with less than about 5% fines however with about 12% clay/silt at TP01 at a depth of 1.7 m, generally medium dense to dense however loose to medium dense at test pit location TP04 and very loose at test pit location TP14, moist, extending to depths of between about 0.7 m and the maximum investigated depth of about 2.5 m.
- CEMENTED SAND (COFEE ROCK) - only encountered at locations TP03 to TP05 at depths of between about 0.7 m and 1.0 m, fine to coarse grained sand in an iron cemented matrix, red brown, medium to high strength, with some low strength zones, causing refusal of the excavator at depths of between 0.8 m and 1.2 m.

Coffee Rock is recognised as a particularly variable material, both in terms of its extent and degree of cementing. Due to the nature of its formation by precipitation and leaching, Coffee Rock can vary from uncemented sand to weakly to well-cemented rock and is often encountered at or just above the groundwater level. Changes in elevation and cementation have been known to occur over very short distances.

Variations to the above profile do occur. The individual test pit logs should be referred for more detail.

5.4 Groundwater

The Perth Groundwater Atlas (1997) indicates that the estimated maximum groundwater level at the site is at between about RL 18 m AHD to RL 19 m AHD (about 4 m to 7 m below current ground level).

Groundwater or perched water was not encountered at any test locations to the maximum investigated depth of 2.5 m.

6.0 GEOTECHNICAL DISCUSSION

6.1 General Discussion

Based on the observed ground conditions, we consider that the following geotechnical issues require consideration:

- *Near surface soils with a relatively low permeability.* Cemented soils or soils with elevated fines content will have a relatively low permeability (compared to the clean sand or imported sand fill) and cannot be considered as free draining. As such these soils will act as a low permeability barrier to drainage and will need to be considered by the drainage designers.
- *The presence of cemented soil.* Cemented soil was encountered within the heavily vegetated area across the site. These materials caused shallow refusal of the excavator where encountered and may impact on certain aspects of the earthworks, especially deeper excavations for services.
- *Relatively loose near-surface sand over parts of the site.* As for typical Perth sand sites, conventional proof rolling using a heavy vibratory roller is required to improve the density of the near surface sand.

6.2 Preliminary Site Classification

Based on the conditions encountered within the site and the proposed fill depths, we consider a preliminary site classification of "Class A" in accordance with AS 2870-2011 will be applicable providing that the site preparation procedures detailed in Section 6.3 are implemented.

6.3 Site Preparation

The following site preparation procedures are recommended:

- Remove the existing residential structure, trees, shrubs and weeds including grubbing out roots and any tree stumps.
- Strip the topsoil, all organic material, roots and other unsuitable or deleterious material from the site. These materials should be stockpiled separately and are not suitable for re-use as engineered fill. We consider that a topsoil thickness of between 50 mm and 200 mm will typically require removal. However, a geotechnical engineer must view the site following the topsoil strip to assess whether sufficient topsoil has been removed.
- Proof compact the exposed surface to achieve the level of compaction outlined in Section 6.4 to a depth of at least 0.9 m below the stripped/excavated surface. Should loose zones be identified during proof compaction, over excavation and backfilling with compacted, approved fill will be required.
- Where fill is required to achieve the required levels, place and compact approved free draining granular fill, as outlined in Section 6.5, in layers of no greater than 0.3 m loose thickness to achieve the level of compaction specified in Section 6.4.
- Confirm that the specified level of compaction has been achieved to a depth of 0.9 m (or the full thickness of fill, whichever is greater) at structure locations and within pavement areas. Testing should be carried out at the rate of:
  - each retaining wall footing or at maximum 10 m centres along retaining walls; and
  - 1 test per 500 m^3 of placed fill; or
  - 1 test per 500 m^2; whichever is more frequent.

6.4 Compaction

The required level of compaction for fill and *in situ* soils is outlined below.

- Structural sand fill and *in situ* sand should be compacted to achieve a Perth sand penetrometer blow count of at least 8 blows per 300 mm in accordance with AS 1289 6.3.3. If difficulties are experienced with achieving this blow count, then *in situ* density testing may be required to confirm the correlation between Perth sand penetrometer blow count and relative density.
- Materials other than sand should be moisture conditioned and compacted to achieve a Modified dry density ratio of at least 95% in accordance with AS 1289 5.2.1. This is likely to apply where sandy soil contains more than about 5% fines or where fill material comprising both sand and gravel to cobble size pieces is used.

Care will need to be taken when compacting in the vicinity of existing buildings, walls and roads. This is particularly important if vibratory compaction is being carried out. Tynan (1973)[2] provides assistance with the selection of compaction equipment for use adjacent to structures.

6.5 Structural Fill

Imported granular fill must comply with the material requirements as stated in AS 3798-2007, "Guidelines on Earthworks for Commercial and Residential Developments". The fill should comprise clean sand, with less than about 5% fines, that is free of deleterious materials and organic matter.

Generally, the clean sand at the site (other than topsoil) is considered suitable for re-use as structural/non-structural fill.

6.6 Excavations

It is expected that the sandy materials on the site can generally be readily excavated to depths of at least about 2.5 m using standard earth moving equipment such as a 10 tonne or greater hydraulic excavator. Coffee Rock was encountered during the field investigation and caused refusal of a 5 tonne excavator at test pit locations TP03 to TP05, and it is expected that Coffee Rock may be present over the eastern portion of the site. Excavation of well-cemented materials such as Coffee Rock may require the use of a rock breaker for confined excavations such as for service trenches.

6.7 Retaining Structures

Backfill behind retaining structures should be free draining and low in fines content. Retaining structures should be designed in accordance with AS 4678–2002 "Earth-Retaining Structures". For the design of retaining structures, the following parameters are appropriate for sand fill compacted in accordance with Section 6.4 or compacted *in situ* sand:

- Angle of internal friction, $\phi = 34°$
- Coefficient of active earth pressure $K_a = 0.28$
- Coefficient of passive earth pressure $K_p = 3.54$
- At rest coefficient of earth pressure $K_o = 0.44$
- Bulk density: 18 kN/m^3.

Compaction plant can increase the lateral earth pressures acting on retaining walls. Hand held compaction equipment is recommended within 2 m of any such walls to minimise compaction pressures.

4 Tynan (1973) Ground Vibration and Damage Effects on Buildings, Australia Road Research Board, Special Report No. 11

6.8 Soil Permeability

The results of the permeability testing are presented in Table 2.

Table 2: Permeability Test Results

Test	Test Depth (m bgl)	Material	Permeability (m/day)
I1	1.0	SAND (SP): medium sense to dense, fine to coarse grained, with some low plasticity clay/silt	9
I2	1.0	SAND (SP): medium dense to dense, fine to medium grained	21

Based on our experience with similar sites, we consider that sandy soils with less than about 5% fines are appropriate for on-site disposal of stormwater. Assuming that the infiltration sumps are underlain by at least 1 m of clean sand and the base of the sumps are at least 1 m above the maximum expected groundwater level, a permeability of 5 m/day is considered appropriate for the soil present. The permeability value used for stormwater disposal design must make allowances for the following:

- Possible presence of Coffee Rock at shallower depths, especially across the eastern portion of the site.
- Clogging of the sand with fine particles through ongoing infiltration.
- Densification of *in situ* sands from compaction during construction.

Soakwells should be located at least 5 m from the edge of footings.

7.0 ACID SULFATE SOIL DISCUSSION

7.1 Field Screening Results

Field screening tests were conducted on soil samples collected typically at 0.5 m depth intervals. Field screening comprises analysis of pH_F and pH_{FOX} which involves splitting samples to provide two sub-samples. De-ionised water is then added to one sub-sample for measurement of pH_F and hydrogen peroxide is added to the other for measurement of pH_{FOX}. The introduction of peroxide in the pH_{FOX} test accelerates oxidation of sulfides in the soil resulting in the release of stored acidity and can provide an indication of the possible presence of PASS. For every sub-sample, the pH and strength of reaction was then recorded.

The intent of ASS field screening tests is to provide an initial evaluation of the potential (high, medium and low) for each soil sample collected to be ASS. The following criteria are used to provide an indication of the potential existence of either actual ASS (AASS) or potential ASS (PASS):

- A pH_F of 4 or less suggests the presence of actual AASS.

Three indicators are used together to indicate the high probability of PASS presence:

- A pH_{FOX} of less than 3
- A strong, or extreme, reaction
- A difference between pH_F and pH_{FOX} of greater than 3.

Where none or one of these indicators are observed in field test results, a given sample is inferred to have a low PASS potential. Where two indicators are observed, the sample is inferred to have a medium PASS potential and where three indicators are observed, the sample is inferred to have a high PASS potential.

ASS field screening was conducted by NATA accredited laboratories on 32 soil samples (30 primary and two duplicates). Only one sample was found to have a pH_F value below 4.

Based on the ASS indicators discussed above, the inferred ASS risk was high for one sample. The high risk sample was collected from TP06 at 2.0 m depth with the material described as yellow/brown sand, trace clay, trace iron-cemented sand.

It should be noted that the ASS field screening test provides an indication of ASS risk only and this risk should be confirmed by laboratory analysis.

7.1.1 Chromium Suite Analysis

Based on the ASS field screening tests and subsurface material encountered, 12 samples (including 2 QA/QC samples) were submitted for Chromium Suite of analysis to quantitatively assess the acid generating potential of the soil.

The Chromium Suite results are presented in Table C1 in Appendix C and are summarised below. The results of Chromium Suite analysis were assessed against the DEC action criteria[3] of 0.03% S.

Ten of the twelve samples recorded Net Acidity concentrations below the DEC action criterion of 0.03% S. Two samples recorded Net Acidity concentrations above the DEC action criterion of 0.03% S. Both samples were encountered above the coffee rock layer and were described as fine to medium grained sand, with some iron cemented sand.

7.2 Preliminary Acid Sulfate Soils Assessment

The shallow sandy soils above the groundwater table at the site generally did not have recorded measurable levels of sulphide, however two samples of sandy material above the Coffee Rock layer had Net Acidity concentrations below the DEC action criterion of 0.03% S. Based on previous experience with Coffee Rock in the Perth metropolitan area, it is expected that the material within and below the Coffee Rock layer is likely to be AASS.

It is advised that if more than 100 m^3 of soils is likely to be disturbed at the site during development that further assessment of the presence of acid sulfate soils is undertaken before ground disturbance occurs. In particular, where excavation of the Coffee Rock layer is proposed, further assessment of the presence of acid sulfate soils should be undertaken in this layer.

8.0 LIMITATIONS

Your attention is drawn to the document "Limitations", which is included in Appendix D of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

[3] DEC 2009. Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes. Perth, Western Australia: Department of Environment and Conservation.

Report Signature Page

GOLDER ASSOCIATES PTY LTD

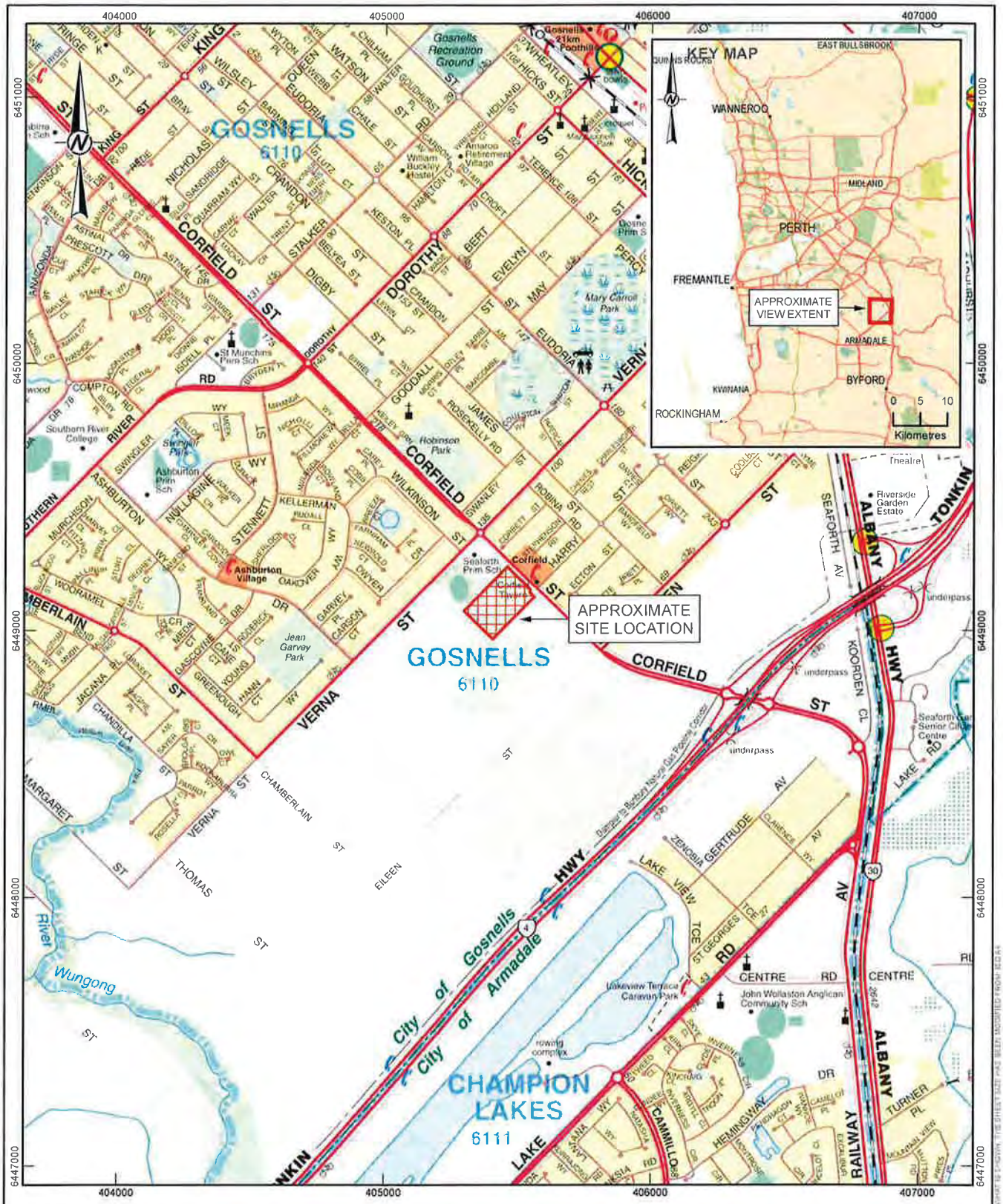
Ricky Long
Geotechnical Engineer

David Barrett
Senior Geotechnical Engineer

RL-DB/DK/asu

A.B.N. 64 006 107 857

\\golder.gds\gap\perth\jobs\geo\2015\1529456 - gosnells desk study\03 correspondence & report\1529456-003-r-rev0.docx



NOTES

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE

IMAGE SOURCED FROM METRO STREETSMART 2009
INSET BASE DATA/ROADS SOURCED FROM STREET PRO DATA 2009

0 200 400 600 800 1,000 m
1:20,000

CLIENT
WOOD & GRIEVE ENGINEERS

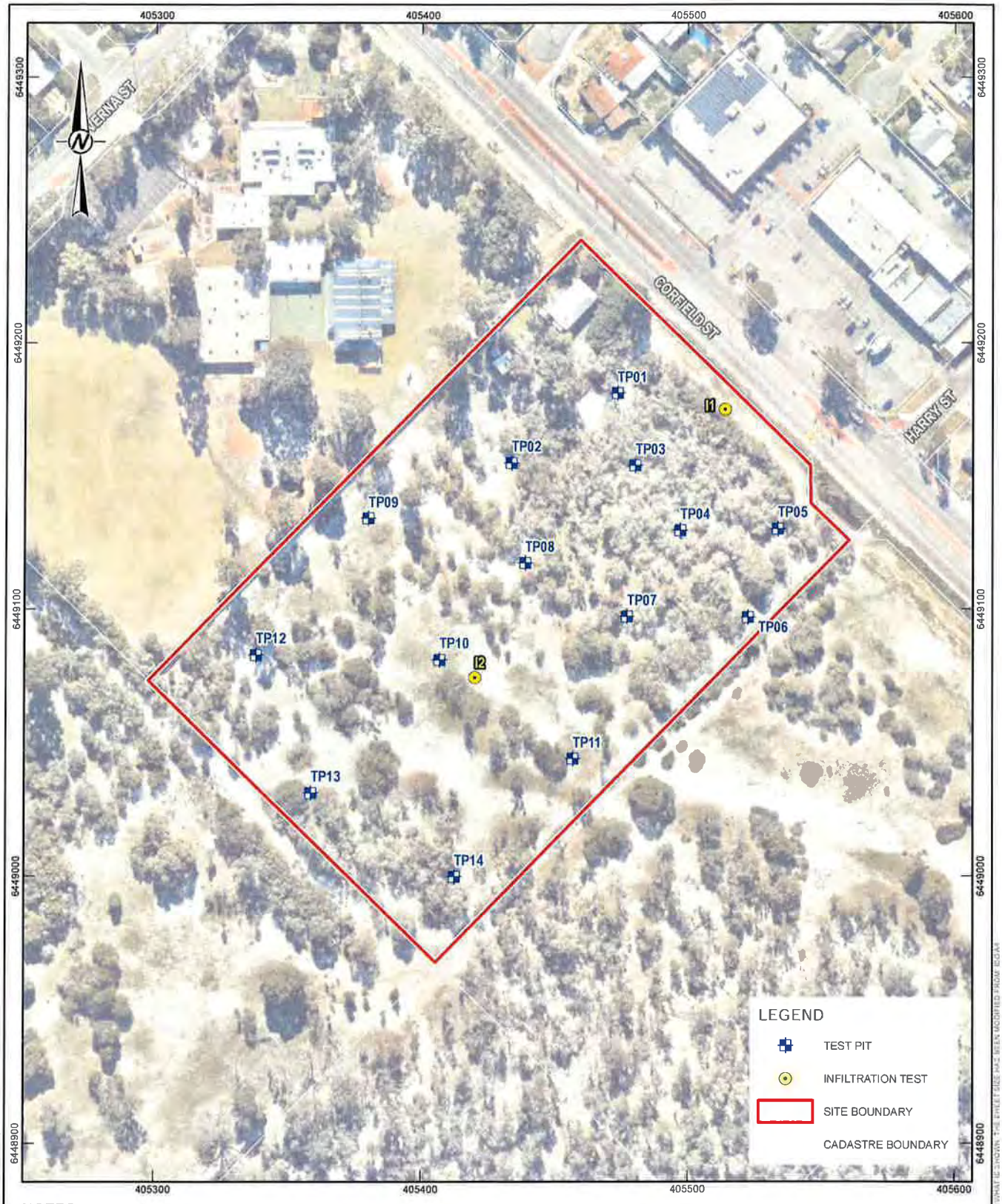
PROJECT
GEOTECHNICAL AND PRELIMINARY ACID SULFATE SOILS INVESTIGATION, LOT 303 CORFIELD STREET, GOSNELLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2015.08.17
DESIGNED	MS
PREPARED	MS
REVIEWED	DAB
APPROVED	DAB

TITLE
LOCATION PLAN

PROJECT NO	CONTROL	REV	FIGURE
1529456	003 R	0	1



NOTES

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE

AERIAL IMAGERY 2015.06.28 © NEARMAP (2015)
CADASTRE BOUNDARY AND ROADS © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2015)

0 20 40 60 80 100 m
1:2,000

CLIENT
WOOD & GRIEVE ENGINEERS

PROJECT
GEOTECHNICAL AND PRELIMINARY ACID SULFATE SOILS INVESTIGATION, LOT 303 CORFIELD STREET, GOSNELLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2015.08.17
DESIGNED	MS
PREPARED	MS
REVIEWED	DAB
APPROVED	DAB

TITLE
SITE PLAN

PROJECT NO	CONTROL	REV.	FIGURE
1529456	003 R	0	2

IF THIS BAR IS NOT 25mm LONG DO NOT SCALE DRAWING. THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1

25mm

0

Path: G:\Spatial_Information_Group\GIS_WORKSPACE_AUSTRALIA\01_WA\M0110_GOSNELLS\1529456\Projects\003-R\Rev0\1529456-003-R-F002-Rev0.mxd

APPENDIX A

Test Pit Reports

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS


FILL


GRAVEL (GP or GW)


SAND (SP or SW)


SILT (ML or MH)


CLAY (CL, CI or CH)


ORGANIC SOILS (OL or OH or Pt)


COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

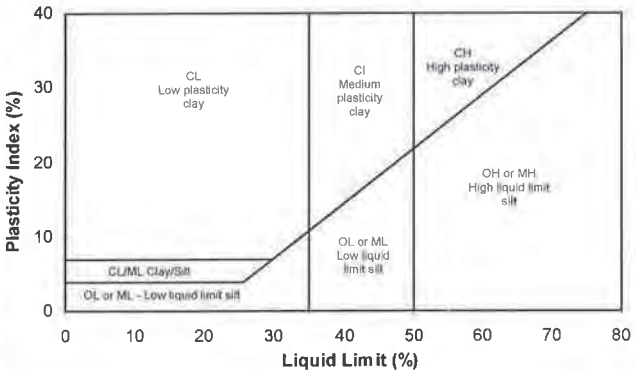
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, (Amdt1 – 1994 and Amdt2 – 1994), Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core – 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (s_v = peak value, s_r = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Static cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum \text{Axial lengths of core} > 100\text{ mm}}{\text{Length of core run}} \times 100$$

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

Golder Associates

STRENGTH

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa)	Field Guide
EL	Extremely Low	< 0.03	Easily remoulded by hand to a material with soil properties.
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK STRENGTH TEST RESULTS

▼ Point Load Strength Index, $I_s(50)$, Axial test (MPa)

◀ Point Load Strength Index, $I_s(50)$, Diametral test (MPa)

Relationship between $I_s(50)$ and UCS (unconfined compressive strength) will vary with rock type and strength, and should be determined on a site-specific basis. UCS is typically 10 to 30 x $I_s(50)$, but can be as low as 5.

ROCK MATERIAL WEATHERING

Symbol		Term	Field Guide
RS		Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
EW		Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW		
SW		Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength relative to fresh rock.
FR		Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type

B	Bedding parting
X	Foliation
C	Contact
L	Cleavage
J	Joint
SS/SZ	Sheared seam/zone (Fault)
CS/CZ	Crushed seam/zone (Fault)
DS/DZ	Decomposed seam/zone
IS/IZ	Infilled seam/zone
S	Schistocity
V	Vein

Coating or Infilling

Cn	Clean
Sn	Stain
Vr	Veneer
Ct	Coating or Infill

Planarity

Pl	Planar
Un	Undulating
St	Stepped

Roughness

Sl	Slickensided
Sm	Smooth
Ro	Rough

Vertical Boreholes – The dip (inclination from horizontal) of the defect is given.

Inclined Boreholes – The inclination is measured as the acute angle to the core axis.

NOMENCLATURE FOR DESCRIBING EOLIAN AND BEACHROCK CARBONATE SEDIMENTS

Carbonate Weathering or Leaching Sequence

FR	Fresh	Unaffected by leaching
SLe	Slightly leached	Pitted and with small leached holes.
MLe	Moderately leached	Holed variably, up to 20% core/volume affected.
HLe	Highly leached	More than 20% holes, cavities, leaching on deposition planes, rock may often be broken into pieces by settlement.
ELe	Extremely leached	Network of carbonate remnants, mostly holes, or gravel and cobble pieces, broken by the settlement of underlying leached material.

Classification of Eolian and Beachrock Carbonate Sediments[1]

Material Type	Total Carbonate Content	Grain Size (mm)			
		Fine Grained		Medium to Coarse Grained	
		0.002	0.06	2	60
Soils	100	CARBONATE MUD	CARBONATE SILT	CARBONATE SAND	CARBONATE GRAVEL
	50 / 0	CLAY	SILT	SAND	GRAVEL
Eolianites and Beachrocks	100	CALCILUTITE	CALCISILTITE	CALCARENITE	CALCIRUDITE
	90	SILICEOUS CALCILUTITE	SILICEOUS CALCISILTITE	SILICEOUS CALCARENITE	SILICEOUS CALCIRUDITE
	50	CALCAREOUS CLAYSTONE	CALCAREOUS SILTSTONE	CALCAREOUS SANDSTONE	CALCAREOUS CONGLOMERATE
	0				
Calcrete Facies		CAPROCK (Duricrust)[2]		CALCRETED CALCARENITE	CALCRETED CALCIRUDITE
		CALCRETE (Fluid deposition calcrete)			

Degree of Cementation for Eolian and Beachrock Carbonate Sediments[3]

Very well cemented	Generally very hard rock, cannot be scratched easily, core can be broken with blow from hammer
Well cemented	Hard rock, can be scratched with thumbnail, requires substantial effort to break core
Moderately well cemented	Soft rock, easily scratched, generally friable, rock core can be broken by hand
Weakly cemented	Very soft rock, crushed between fingers
Very weakly cemented	Near uncemented sand

[1] After Gordon R, 2003, Coastal Limestones, Journal and News of the Australian Geomechanics Society Vol 38, No 4.

[2] Sometimes referred to as surface kankar or kunkar.

[3] The terms very hard, hard, soft and very soft refer to the inter-granular cementation and are not terms to which a compressive, shear or point load strength value can be implied.

REPORT OF TEST PIT: TP01

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405467 m E 6449178 m N MGA94 50
SURFACE RL: 22.1 m DATUM: AHD
PIT DEPTH: 2.00 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	22.10	TP1-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, grey, trace silt, trace roots		L		Seat
				0.20 21.90				SP	SAND fine to coarse grained, grey white				
			0.5		TP1-2 ASS 0.50 m								
			1.0		TP1-3 ASS 1.00 m					M	MD - D		
			1.5		TP1-4 ASS 1.50 m								
				1.70 20.40	TP1 DS 1.70-2.00 m				yellow orange, with approximately 12% low plasticity clay				
			2.0	20.10	TP1-5 ASS 2.00 m				TEST PIT DISCONTINUED @ 2.00 m COLLAPSE BACKFILLED				
			2.5										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP01

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405467 m E 6449178 m N MGA94 50
SURFACE RL: 22.1 m DATUM: AHD
PIT DEPTH: 2.00 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP02

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405430 m E 6449155 m N MGA94 50
SURFACE RL: 22.3 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	22.30	TP2-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace rootlets				Seat
				0.10									
				22.20				SP	SAND fine to medium grained, grey white		L		
			0.5		TP2-2 ASS 0.50 m								
			1.0		TP2 QA/QC 1.00 m TP2-3 ASS 1.00 m					M	MD D		
			1.5		TP2-4 ASS 1.50 m								
			2.0		TP2-5 ASS 2.00 m								
			2.5	19.80	TP2-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP02

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405430 m E 6449155 m N MGA94 50
SURFACE RL: 22.3 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP03

Golder Associates

POSITION: Refer to Site Plan
COORDS: 405472 m E 6449153 m N MGA94 50
SURFACE RL: 21.8 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm
EX	L		0.0	0.05 21.75	TP3-1 ASS 0.00 m			SP	**TOPSOIL: SAND** **fine to coarse grained, grey, trace silt, trace roots**				Seat
								SP	SAND fine to coarse grained, pale brown to pale red				
			0.5		TP3-2 ASS 0.50 m					M	L - MD		25+
			1.0	1.00 20.80	TP3-3 ASS 1.00 m				COFFEE ROCK fine to coarse grained, red brown, low to medium strength				
	H												
	R			20.60					TEST PIT DISCONTINUED @ 1.20 m REFUSAL BACKFILLED				
			1.5										
			2.0										
			2.5										

REPORT OF TEST PIT PHOTOGRAPHS: TP03

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405472 m E 6449153 m N MGA94 50
SURFACE RL: 21.8 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP04

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405495 m E 6449127 m N MGA94 50
SURFACE RL: 21.9 m DATUM: AHD
PIT DEPTH: 0.80 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm (0 5 10 15 20 25)
EX	L		0.0	21.90	TP4-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, grey, trace silt, trace roots				Seal
				0.10 21.80				SP	SAND fine to coarse grained, grey white	M	L - MD		
			0.5		TP4-2 ASS 0.50 m								25+
	H			0.70 21.20	TP4 DS 0.70-0.80 m				COFFEE ROCK fine to coarse grained, red brown, low to medium strength				
	R			21.10					TEST PIT DISCONTINUED @ 0.80 m REFUSAL BACKFILLED				
			1.0										
			1.5										
			2.0										
			2.5										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP04

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405495 m E 6449127 m N MGA94 50
SURFACE RL: 21.9 m DATUM: AHD
PIT DEPTH: 0.80 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

REPORT OF TEST PIT: TP05

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405533 m E 6449128 m N MGA94 50
SURFACE RL: 21.9 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	0.05 21.85	TP5-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace rootlets				Seat
								SP	SAND fine to coarse grained, grey white				
				0.35 21.55					red brown				
			0.5		TP5 QA/QC 0.50 m TP5-2 ASS 0.50 m					M	MD - D		
	H		1.0	1.00 20.90	TP5-3 ASS 1.00 m				COFFEE ROCK fine to coarse grained, red brown, low to medium strength				
	R			20.70					TEST PIT DISCONTINUED @ 1.20 m REFUSAL BACKFILLED				
			1.5										
			2.0										
			2.5										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP05

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405533 m E 6449128 m N MGA94 50
SURFACE RL: 21.9 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

REPORT OF TEST PIT: TP06

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405522 m E 6449095 m N MGA94 50
SURFACE RL: 22.1 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L-M		0.0	22.10	TP6 QA/QC 0.00 m TP6-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace roots				Seat
				0.20 21.90				SP	SAND fine to coarse grained, pale yellow				
			0.5		TP6-2 ASS 0.50 m								
			1.0		TP6-3 ASS 1.00 m								
				1.20 20.90					yellow brown, trace clay, trace iron-cemented sand	M	MD - D		
			1.5		TP6-4 ASS 1.50 m								
			2.0		TP6-5 ASS 2.00 m								
			2.5	19.60	TP6-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP06

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405522 m E 6449095 m N MGA94 50
SURFACE RL: 22.1 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP07

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405474 m E 6449097 m N MGA94 50
SURFACE RL: 22.2 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	22.20	TP7-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace rootlets				Seat
				0.10 / 22.10				SP	SAND fine to medium grained, grey white		L		
				0.30 / 21.90					yellow brown				
			0.5		TP7-2 ASS 0.50 m								
			1.0		TP7-3 ASS 1.00 m					M			
			1.5		TP7-4 ASS 1.50 m						MD - D		
			2.0	2.00 / 20.20	TP7-5 ASS 2.00 m				brown grey, with iron cemented sand				
			2.5	19.70	TP7-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

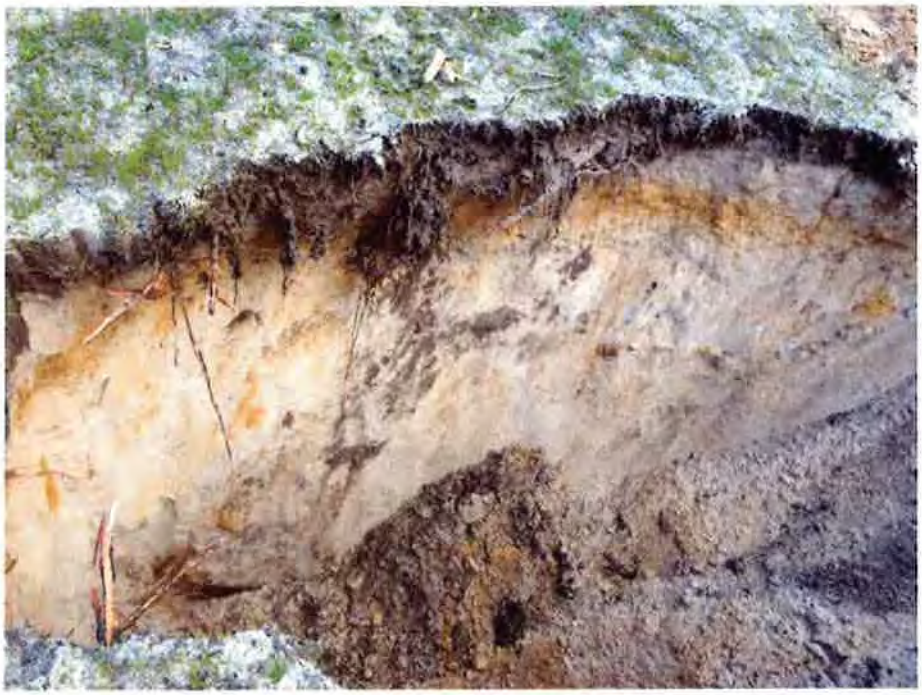
GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP07

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405474 m E 6449097 m N MGA94 50
SURFACE RL: 22.2 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15



1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP08

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405435 m E 6449118 m N MGA94 50
SURFACE RL: 22.2 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	22.20	TP8-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to medium grained, pale grey, trace silt, trace rootlets				Seat
				0.10									
				22.10				SP	SAND fine to medium grained, grey white				
			0.5		TP8-2 ASS 0.50 m								
			1.0		TP8-3 ASS 1.00 m					M	MD D		
			1.5		TP8-4 ASS 1.50 m								
			2.0		TP8-5 ASS 2.00 m								
			2.5	19.70	TP8-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01I RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP08

CLIENT:	Wood & Grieve Engineers	POSITION: Refer to Site Plan	
PROJECT:	Gosnells Residential Development	COORDS: 405435 m E 6449118 m N MGA94 50	SHEET: 1 OF 1
LOCATION:	303 Corfield Street, Gosnells	SURFACE RL: 22.2 m DATUM: AHD	MACHINE: 5 tonne Excavator
JOB NO:	1529456	PIT DEPTH: 2.50 m	CONTRACTOR: Executive Plant Hire
		BUCKET TYPE: 600 mm toothed bucket	LOGGED: RL DATE: 10/7/15
			CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP09

Golder Associates

POSITION: Refer to Site Plan
COORDS: 405376 m E 6449129 m N MGA94 50
SURFACE RL: 22.5 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	22.50	TP9-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace rootlets				Seat
				0.10 / 22.40				SP	SAND fine to coarse grained, grey white				
			0.5		TP9-2 ASS 0.50 m								
			1.0		TP9-3 ASS 1.00 m					M	MD - D		
			1.5		TP9-4 ASS 1.50 m								
			2.0		TP9-5 ASS 2.00 m								
			2.5	20.00	TP9-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP09

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405376 m E 6449129 m N MGA94 50
SURFACE RL: 22.5 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

REPORT OF TEST PIT: TP10

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405409 m E 6449078 m N MGA94 50
SURFACE RL: 22.6 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm (0 5 10 15 20 25)
EX	L-M		0.0	22.60	TP10-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to medium grained, pale grey, trace silt, trace rootlets				Seat
				0.10 / 22.50				SP	SAND fine to medium grained, grey white				
			0.5		TP10-2 ASS 0.50 m								
			1.0		TP10-3 ASS 1.00 m					M	MD D		
			1.5		TP10-4 ASS 1.50 m								
			2.0		TP10 QA/QC 2.00 m TP10-5 ASS 2.00 m								
			2.5	20.10	TP10-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP10

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405409 m E 6449078 m N MGA94 50
SURFACE RL: 22.6 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP11

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405457 m E 6449040 m N MGA94 50
SURFACE RL: 22.7 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm
EX	L		0.0	0.05 22.65	TP11 QA/QC 0.00 m TP11-1 ASS 0.00 m			SP SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace rootlets SAND fine to medium grained, grey white	M	L		Seat 0 5 10 15 20 25
			0.5		TP11 DS 0.50-0.80 m TP11-2 ASS 0.50 m								
			1.0		TP11-3 ASS 1.00 m								
			1.5		TP11-4 ASS 1.50 m						MD - D		
			2.0		TP11-5 ASS 2.00 m								
			2.5	20.20	TP11-6 ASS 2.50 m				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH BACKFILLED				

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP11

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405457 m E 6449040 m N MGA94 50
SURFACE RL: 22.7 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP12

Golder Associates

POSITION: Refer to Site Plan
COORDS: 405334 m E 6449079 m N MGA94 50
SURFACE RL: 23.5 m DATUM: AHD
PIT DEPTH: 1.70 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	23.50	TP12-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace rootlets		L		Seat
				0.15									
				23.35				SP	SAND fine to coarse grained, grey white				
			0.5		TP12-2 ASS 0.50 m					M			
			1.0		TP12-3 ASS 1.00 m						MD - D		
			1.5		TP12-4 ASS 1.50 m								
				21.80					TEST PIT DISCONTINUED @ 1.70 m COLLAPSE BACKFILLED				
			2.0										
			2.5										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP12

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405334 m E 6449079 m N MGA94 50
SURFACE RL: 23.5 m DATUM: AHD
PIT DEPTH: 1.70 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP13

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405359 m E 6449028 m N MGA94 50
SURFACE RL: 23.5 m DATUM: AHD
PIT DEPTH: 2.30 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	23.50	TP13-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace roots				Seat
				0.10 23.40				SP	SAND fine to coarse grained, grey white	M	L		
			0.5		TP13-2 ASS 0.50 m								
			1.0		TP13-3 ASS 1.00 m						MD - D		
			1.5		TP13-4 ASS 1.50 m								
			2.0		TP13-5 ASS 2.00 m								
				21.20					TEST PIT DISCONTINUED @ 2.30 m COLLAPSE BACKFILLED				
			2.5										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP13

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405359 m E 6449028 m N MGA94 50
SURFACE RL: 23.5 m DATUM: AHD
PIT DEPTH: 2.30 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP14

Golder Associates

CLIENT: Wood & Grieve Engineers
PROJECT: Gosnells Residential Development
LOCATION: 303 Corfield Street, Gosnells
JOB NO: 1529456

POSITION: Refer to Site Plan
COORDS: 405412 m E 6448998 m N MGA94 50
SURFACE RL: 24.2 m DATUM: AHD
PIT DEPTH: 1.80 m
BUCKET TYPE: 600 mm toothed bucket

SHEET: 1 OF 1
MACHINE: 5 tonne Excavator
CONTRACTOR: Executive Plant Hire
LOGGED: RL DATE: 10/7/15
CHECKED: DAB DATE: 17/7/15

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	PERTH PENETROMETER TEST (AS1289.6.3.3) Blows per 150 mm 0 5 10 15 20 25
EX	L		0.0	24.20	TP14-1 ASS 0.00 m			SP	TOPSOIL: SAND fine to coarse grained, pale grey, trace silt, trace roots				Seal
				0.10 / 24.10				SP	SAND fine to coarse grained, grey while to yellow	M	VL		
			0.5		TP14-2 ASS 0.50 m								
			1.0		TP14-3 ASS 1.00 m								
			1.5		TP14-4 ASS 1.50 m								
				22.40					TEST PIT DISCONTINUED @ 1.80 m COLLAPSE BACKFILLED				
			2.0										
			2.5										

REPORT OF TEST PIT PHOTOGRAPHS: TP14

CLIENT:	Wood & Grieve Engineers	POSITION: Refer to Site Plan	
PROJECT:	Gosnells Residential Development	COORDS: 405412 m E 6448998 m N MGA94 50	SHEET: 1 OF 1
LOCATION:	303 Corfield Street, Gosnells	SURFACE RL: 24.2 m DATUM: AHD	MACHINE: 5 tonne Excavator
JOB NO:	1529456	PIT DEPTH: 1.80 m	CONTRACTOR: Executive Plant Hire
		BUCKET TYPE: 600 mm toothed bucket	LOGGED: RL DATE: 10/7/15
			CHECKED: DAB DATE: 17/7/15

1. Test Pit

2. Spoil

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

APPENDIX B

Geotechnical Laboratory Test Reports

Particle Size Distribution & Plasticity Index Test Report

Perth Laboratory
84 Guthrie Street Osborne Park
Perth WA 6017
P: +61 8 9441 0700 F: +61 8 9441 0701
www.golder.com
perthlab@golder.com.au

Client:	WGE		
	226 Adelaide Terrace, Perth WA 6000		
Project:	Gosnells Residential Development	**Date:**	23/07/15
Location:	303 Corfield Street, Gosnells	**Project No.:**	1529456

Lab Reference Number:	151020	**Sample Identification:**	TP01
			1.7-2.0

Laboratory Specimen Description: SAND (with clay/silt, trace of gravel)
AS 1726 - Soil Classification: SC/SM (Borderline Classification)

Particle Size Distribution AS 1289.3.6.1

Sieve Size		% Passing	Specification
150.0	mm	100	
75.0	mm	100	
53.0	mm	100	
37.5	mm	100	
26.5	mm	100	
19.0	mm	97	
9.5	mm	94	
4.75	mm	94	
2.36	mm	94	
1.18	mm	93	
0.600	mm	82	
0.425	mm	68	
0.300	mm	50	
0.150	mm	25	
0.075	mm	12	

Plasticity Index and Moisture Content

Test		Method	Result	Specification
Liquid Limit	%	AS 1289.3.1.2	23	
Plastic Limit	%	AS 1289.3.2.1	18	
Plasticity Index	%	AS 1289.3.3.1	5	
Linear Shrinkage	%	AS 1289.3.4.1	1.5	
Moisture Content	%	AS 1289.2.1.1	12.1	

Sample History:	Air Dried
Preparation Method:	Dry Sieved
Cracking/Crumbling/Curling of linear shrinkage:	Yes
Linear shrinkage mould length (mm):	250

ND = not determined NO = not obtainable NP = non plastic

Notes:

Particle Size Distribution & Plasticity Index Test Report

Perth Laboratory
84 Guthrie Street Osborne Park
Perth WA 6017
P: +61 8 9441 0700 F: +61 8 9441 0701
www.golder.com
perthlab@golder.com.au

Client: WGE
226 Adelaide Terrace, Perth WA 6000

Project: Gosnells Residential Development **Date:** 23/07/15

Location: 303 Corfield Street, Gosnells **Project No.:** 1529456

Lab Reference Number: 151021 **Sample Identification:** TP11
0.5-0.8

Laboratory Specimen Description: SAND (trace of fines)

AS 1726 - Soil Classification: SP

Particle Size Distribution AS 1289.3.6.1

Sieve Size		% Passing	Specification
150.0	mm	100	
75.0	mm	100	
53.0	mm	100	
37.5	mm	100	
26.5	mm	100	
19.0	mm	100	
9.5	mm	100	
4.75	mm	100	
2.36	mm	100	
1.18	mm	100	
0.600	mm	87	
0.425	mm	69	
0.300	mm	43	
0.150	mm	15	
0.075	mm	4	

Plasticity Index and Moisture Content

Test		Method	Result	Specification
Liquid Limit	%	AS 1289.3.1.2	ND	
Plastic Limit	%	AS 1289.3.2.1	ND	
Plasticity Index	%	AS 1289.3.3.1	ND	
Linear Shrinkage	%	AS 1289.3.4.1	ND	
Moisture Content	%	AS 1289.2.1.1	ND	

Sample History: Air Dried
Preparation Method: Dry Sieved
Cracking/Crumbling/Curling of linear shrinkage:
Linear shrinkage mould length (mm):
ND = not determined NO = not obtainable NP = non plastic

Notes:

APPENDIX C

Acid Sulfate Laboratory Test Reports

Golder Associates

Golder Associates

Table 1: ASS Field Screening Test Results

Acid Sulfate Soil (ASS) Indicative Guideline

≤4.5 = Probable AASS	<3 = Likely PASS	>Moderate reaction = Likely PASS	<3 = Likely PASS

AASS = Actual Acid Sulfate Soil

PASS = Potential Acid Sulfate Soil

Lab ID	Golder Sample ID	Material Description					PASS Risk Rating			Inferred AASS	Chromium Suite									Acid Base Accounting*				
			Depth (mbgl)	pH_F	pH_{FOX}	Reaction Strength	$pH_F - pH_{FOX}$	HIGH	MEDIUM	LOW		pH_{KCl}	s-TAA (%S)		CRS (%S)		S_{CRA} (%S) (if pH < 4.5)		s-ANC (%S)		Potential Acidity (%S)	Actual Acidity (%S)	Retained Acidity (%S)	Measured ANC/FF (%S)	Net Acidity (exc. ANC) (%S)
												0.1	0.02		0.005		0.02		0.01						
EP1512189-1	TP1-2 ASS	SAND: fine to coarse grained, grey white	0.50	5.41	5.63	moderate	-0.22			X															
EP1512189-2	TP1-5 ASS	SAND: fine to coarse grained, yellow orrange with low plasticity clay	2.00	7.23	5.79	moderate	1.44			X															
EP1512189-3	TP2-2 ASS	SAND: fine to medium grained, grey white	0.50	5.52	5.89	moderate	-0.37			X															
EP1512189-4	TP2-6 ASS	SAND: fine to medium grained, grey white	2.50	5.39	5.97	slight	-0.58			X															
EP1512189-5/EP1512433-001	TP3-2 ASS	SAND: fine to coarse grained, pale brown to pale red	0.50	5.93	5.81	slight	0.12			X		6.7	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-6/EP1512433-002	TP3-3 ASS	COFFEE ROCK: fine to corase grained, red brown	1.00	7.56	5.71	moderate	1.85			X		6.7	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-7	TP4-1 ASS	TOPSOIL: SAND, fine to coarse grained, grey, trace silt	0.00	5.18	5.49	moderate	-0.31			X															
EP1512189-8/EP1512433-003	TP4-2 ASS	SAND: fine to coarse grained, grey white	0.50	5.94	5.99	moderate	-0.05			X		6.8	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-9/EP1512433-004	TP5	SAND: fine to coarse grained, red brown	0.50	6.60	5.98	moderate	0.62			X		6.6	<	0.02		0.005		-	<	0.01	0.005	0.000	0.000	0.000	0.005
EP1512189-10/EP1512433-005	TP5-2 ASS	SAND: fine to coarse grained, red brown	0.50	6.65	6.04	moderate	0.61			X		6.8	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-11/EP1512433-006	TP5-3 ASS	COFFEE ROCK: fine to coarse grained, red brown	1.00	7.20	6.09	slight	1.11			X		7.2	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-12	TP6-2 ASS	SAND: fine to coarse grained, pale yellow	0.50	5.78	6.00	moderate	-0.22			X															
EP1512189-13/EP1512433-007	TP6-5 ASS	SAND: fine to coarse grained, yellow brown, trace clay, trace iron-cemented sand	2.00	3.99	3.65	moderate	0.34			X	X	5.8	<	0.02	<	0.005		-		-	0.000	0.000	0.000	0.000	0.000
EP1512189-14	TP7-2 ASS	SAND: fine to medium grained, yellow brown	0.50	5.47	6.03	moderate	-0.56			X															
EP1512189-15/EP1512433-008	TP7-5 ASS	SAND: fine to medium grained, brown grey, with iron cemented sand	2.00	5.28	5.95	moderate	-0.67			X		6.9	<	0.02		0.010		-	<	0.01	0.010	0.000	0.000	0.000	0.010
EP1512189-16	TP8-2 ASS	SAND: fine to medium grained, grey white	0.50	5.93	5.97	moderate	-0.04			X															
EP1512189-17	TP8-5 ASS	SAND: fine to medium grained, grey white	2.00	5.66	6.02	slight	-0.36			X															
EP1512189-18	TP9-2 ASS	SAND: fine to coarse grained, grey white	0.50	5.47	6.04	slight	-0.57			X															
EP1512189-19/EP1512433-009	TP9-5 ASS	SAND: fine to coarse grained, grey white	2.00	5.53	6.06	slight	-0.53			X		6.8	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-20	TP10-2 ASS	SAND: fine to medium grained, grey white	0.50	6.33	6.06	slight	0.27			X															
EP1512189-21/EP1512433-010	TP10	SAND: fine to medium grained, grey white	2.00	6.32	6.04	slight	0.28			X		5.8	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-22/EP1512433-011	TP10-5 ASS	SAND: fine to medium grained, grey white	2.00	6.41	6.08	slight	0.33			X		6.7	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000
EP1512189-23	TP11-3 ASS	SAND: fine to medium grained, grey white	1.00	6.22	6.06	moderate	0.16			X															
EP1512189-24	TP12-2 ASS	SAND: fine to coarse grained, grey white	0.50	6.17	5.96	moderate	0.21			X															
EP1512189-25	TP12-4 ASS	SAND: fine to coarse grained, grey white	1.50	5.47	6.05	slight	-0.58			X															
EP1512189-26	TP13-2 ASS	SAND: fine to coarse grained, grey white	0.50	5.83	6.02	moderate	-0.19			X															
EP1512189-27	TP13-5 ASS	SAND: fine to coarse grained, grey white	2.00	5.99	6.04	slight	-0.05			X															
EP1512189-28	TP14-2 ASS	SAND: fine to coarse grained, grey white to yellow	0.50	5.62	5.92	moderate	-0.30			X															
EP1512189-29	TP14-4 ASS	SAND: fine to coarse grained, grey white to yellow	1.50	5.57	5.93	moderate	-0.36			X															
EP1512189-65/EP1512433-012	TP11-5	SAND: fine to medium grained, grey white	2.00	5.84	6.01	slight	-0.17			X		6.9	<	0.02	<	0.005		-	<	0.01	0.000	0.000	0.000	0.000	0.000

Note:
Fineness Factor = 1.5
Net Acidity Highlighted bold denote DER exceedances

Lab ID				EP1512189-9	EP1512189-10	RPD	EP1512189-21	EP1512189-22	RPD
Golder Sample ID				TP5	TP5-2 ASS		TP10	TP10-5	
Chem_Group	ChemName	Units	LOR						
ASS Parameters	pH Difference	pH Units	-10	0.62	0.61	<30	0.28	0.33	<30
	pH (Field)	pH_Units	0	6.60	6.65	<30	6.32	6.41	<30
	pH (Field ox)	pH_Units	0	5.98	6.04	<30	6.04	6.08	<30

Lab ID		EP1512189-9	EP1512189-10	RPD	EP1512189-21	EP1512189-22	RPD
Golder Sample ID		TP5	TP5-2 ASS		TP10	TP10-5	
Chem_Group	**ChemName**	**Units**	**LOR**				
Chromium Suite	pH_{KCl}	pH Unit	0.1	6.6	6.8	<30	6.8	6.7	<30
	s-TAA	%S	0.02	<0.02	<0.02	<30	<0.02	<0.02	<30
	CRS	%S	0.005	**0.005**	**<0.005**	**67**	<0.005	<0.005	<30
	s-ANC	%S	0.01	<0.01	<0.01	<30	<0.01	<0.01	<30
	Net Acidity (exc. ANC)	%S	0.02	<0.02	<0.02	<30	<0.02	<0.02	<30

Notes:

Where primary and duplicate concentrations are less than the LOR, RPDs of <30% have been considered

Where one of the concentration values are less than the LOR, the concentration have been halved for calculation of RPD

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP1512433**	Page	: 1 of 5
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR D BARRETT	Contact	: Customer Services EP
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: dbarrett@golder.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9427 7611	Facsimile	: +61-8-9209 7600
Project	: Ex EP1512189 1529456	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 1529456	Date Samples Received	: 17-Jul-2015 13:00
C-O-C number	: ----	Date Analysis Commenced	: 17-Jul-2015
Sampler	: R LONG	Issue Date	: 04-Aug-2015 11:14
Site	: 303 Corfield Street, Gosnells		
		No. of samples received	: 12
Quote number	: ----	No. of samples analysed	: 12

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Leanne Carey	Acid Sulfate Soils Supervisor	Perth ASS

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP3-2	TP3-3	TP4-2	TP5	TP5-2
			Client sampling date / time	[10-Jul-2015]	[10-Jul-2015]	[10-Jul-2015]	[10-Jul-2015]	[10-Jul-2015]
Compound	CAS Number	LOR	Unit	EP1512433-001	EP1512433-002	EP1512433-003	EP1512433-004	EP1512433-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	6.7	6.7	6.8	6.6	6.8
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	<0.005	0.005	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	<0.01	<0.01	<0.01
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	<0.01	<0.01	<0.01
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.06	0.04	0.06	0.06	0.05
Net Acidity (acidity units)	----	10	mole H+ / t	34	24	40	38	30
Liming Rate	----	1	kg CaCO3/t	3	2	3	3	2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP5-3	TP6-5	TP7-5	TP9-5	TP10
			Client sampling date / time	[10-Jul-2015]	[10-Jul-2015]	[10-Jul-2015]	[10-Jul-2015]	[10-Jul-2015]
Compound	CAS Number	LOR	Unit	EP1512433-006	EP1512433-007	EP1512433-008	EP1512433-009	EP1512433-010
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	7.2	5.8	6.9	6.8	6.8
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.010	<0.005	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	----	<0.01	<0.01	<0.01
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	<10	<10	<10
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	<0.01	<0.01	<0.01
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.07	0.08	0.06
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	45	48	35
Liming Rate	----	1	kg CaCO3/t	<1	<1	3	4	3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP10-5	TP11-5	----	----	----
			Client sampling date / time	[10-Jul-2015]	[10-Jul-2015]	----	----	----
Compound	CAS Number	LOR	Unit	EP1512433-011	EP1512433-012	--------	--------	--------
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**6.7**	**6.9**	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	**0.05**	**0.07**	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	**33**	**42**	----	----	----
Liming Rate	----	1	kg CaCO3/t	**2**	**3**	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP1512433**	Page	: 1 of 4
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR D BARRETT	Contact	: Customer Services EP
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: dbarrett@golder.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9427 7611	Facsimile	: +61-8-9209 7600
Project	: Ex EP1512189 1529456	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 1529456	Date Samples Received	: 17-Jul-2015
C-O-C number	: ----	Date Analysis Commenced	: 17-Jul-2015
Sampler	: R LONG	Issue Date	: 04-Aug-2015
Site	: 303 Corfield Street, Gosnells	No. of samples received	: 12
Quote number	: ----	No. of samples analysed	: 12

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out ir compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Leanne Carey	Acid Sulfate Soils Supervisor	Perth ASS

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA033-A: Actual Acidity (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.7	6.6	0.00	0% - 20%
EP1512433-011	TP10-5	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.7	6.8	0.00	0% - 20%
EA033-B: Potential Acidity (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.00	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EP1512433-011	TP10-5	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.00	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	0.00	No Limit
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	0.00	No Limit
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EP1512433-011	TP10-5	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	0.00	No Limit
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	0.00	No Limit
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA033-E: Acid Base Accounting (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: Net Acidity (sulfur units)	----	0.02	% S	0.06	0.05	18.2	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	3	2	40.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	34	30	12.5	No Limit
EP1512433-011	TP10-5	EA033: Net Acidity (sulfur units)	----	0.02	% S	0.05	0.06	18.2	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	2	3	40.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	33	36	8.70	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 166544)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	73.0756 mole H+ / t	95.0	79	103
EA033-B: Potential Acidity (QCLot: 166544)								
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.1798 % S	79.5	77	117
EA033-C: Acid Neutralising Capacity (QCLot: 166544)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	4.9 % CaCO3	101	95	109
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 166544)								
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **EP1512433**	Page	: 1 of 4
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR D BARRETT	Telephone	: +61-8-9209 7655
Project	: Ex EP1512189 1529456	Date Samples Received	: 17-Jul-2015
Site	: 303 Corfield Street, Gosnells	Issue Date	: 04-Aug-2015
Sampler	: R LONG	No. of samples received	: 12
Order number	: 1529456	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-B: Potential Acidity							
80° dried soil (EA033)							
TP3-2, TP3-3, TP4-2, TP5, TP5-2, TP5-3, TP6-5, TP7-5, TP9-5, TP10, TP10-5, TP11-5	**10-Jul-2015**	**17-Jul-2015**	09-Jul-2016	✓	**04-Aug-2015**	15-Oct-2015	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	12	16.67	10.00	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	8.33	5.00	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	8.33	5.00	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

ALS Water

QUALITY CONTROL REPORT

Work Order	: **EP1512433**	Page	: 1 of 4
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR D BARRETT	Contact	: Customer Services EP
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: dbarrett@golder.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9427 7611	Facsimile	: +61-8-9209 7600
Project	: Ex EP1512189 1529456	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 1529456	Date Samples Received	: 17-Jul-2015
C-O-C number	: ----	Date Analysis Commenced	: 17-Jul-2015
Sampler	: R LONG	Issue Date	: 04-Aug-2015
Site	: 303 Corfield Street, Gosnells	No. of samples received	: 12
Quote number	: ----	No. of samples analysed	: 12

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Leanne Carey	Acid Sulfate Soils Supervisor	Perth ASS

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA033-A: Actual Acidity (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.7	6.6	0.00	0% - 20%
EP1512433-011	TP10-5	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.7	6.8	0.00	0% - 20%
EA033-B: Potential Acidity (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.00	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EP1512433-011	TP10-5	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.00	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	0.00	No Limit
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	0.00	No Limit
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EP1512433-011	TP10-5	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	0.00	No Limit
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	0.00	No Limit
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA033-E: Acid Base Accounting (QC Lot: 166544)									
EP1512433-001	TP3-2	EA033: Net Acidity (sulfur units)	----	0.02	% S	0.06	0.05	18.2	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	3	2	40.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	34	30	12.5	No Limit
EP1512433-011	TP10-5	EA033: Net Acidity (sulfur units)	----	0.02	% S	0.05	0.06	18.2	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	2	3	40.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	33	36	8.70	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 166544)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	73.0756 mole H+ / t	95.0	79	103
EA033-B: Potential Acidity (QCLot: 166544)								
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.1798 % S	79.5	77	117
EA033-C: Acid Neutralising Capacity (QCLot: 166544)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	4.9 % CaCO3	101	95	109
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 166544)								
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

Joshua Rees

Rec. Joshua Rees 28/07/15 12:22pm

From: Long, Ricky <RLong@golder.com.au>
Sent: Tuesday, 28 July 2015 12:22 PM
To: Joshua Rees
Cc: Samples Perth; Barrett, David; Henderson, Alex; Mackenzie, Karen
Subject: RE: ALS Results - EP1512189
Attachments: ALS - COC - 1529456.xls

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Josh,

Could you please arrange for additional chromium suite analysis of the following samples:

List the required samples

1. TP3-2
2. TP3-3
3. TP4-2
4. TP5
5. TP5-2
6. TP5-3
7. TP6-5
8. TP7-5
9. TP9-5
10. TP10
11. TP10-5
12. TP11-5

Environmental Division
Perth
Work Order Reference
EP1512433

Telephone : + 61-8-9209 7655

Regards,

Ricky Long (BEng Civil & Structural) | Geotechnical Engineer (WA) | **Golder Associates Pty Ltd**
Level 3, 1 Havelock Street, West Perth, Western Australia 6005, Australia (PO Box 1914, West Perth WA 6872)
T: +61 8 9213 8228 | **M:** +61 0 401 008 348 | **E:** rlong@golder.com.au | **www.golder.com**

Winner of 22 BRW Client Choice Awards 2006-2013, including in 2013:
Best Consulting Engineering Firm (revenue greater than $200m)

Work Safe, Home Safe

From: Joshua Rees [mailto:Joshua.Rees@alsglobal.com]
Sent: Monday, 27 July 2015 1:42 PM

APPENDIX D

Limitations

IMPORTANT INFORMATION RELATING TO THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

At Golder Associates we strive to be the most respected global group of companies specialising in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organisational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Pty Ltd
Level 3, 1 Havelock Street
West Perth, Western Australia 6005
Australia
T: +61 8 9213 7600

Golder Associates

APPENDIX 2

NatureMap Search Results

NatureMap Species Report

Created By Guest user on 06/07/2015

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115°59' 49" E,32°05' 21" S
Buffer	1km
Group By	Species Group

Species Group	Species	Records
Amphibian	5	19
Bird	50	78
Dicotyledon	48	78
Fish	1	1
Invertebrate	10	17
Mammal	5	12
Monocotyledon	21	25
Reptile	12	30
TOTAL	**152**	**260**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amphibian					
1.	25398	*Crinia georgiana (Quacking Frog)*			
2.	25399	*Crinia glauerti (Clicking Frog)*			
3.	25400	*Crinia insignifera (Squelching Froglet)*			
4.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
5.	25412	*Heleioporus psammophilus (Sand Frog)*			
Bird					
6.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
7.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
8.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
9.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
10.	25536	*Accipiter fasciatus (Brown Goshawk)*			
11.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
12.	24831	*Acrocephalus australis subsp. gouldi (Australian Reed Warbler)*			
13.	24312	*Anas gracilis (Grey Teal)*			
14.	24316	*Anas superciliosa (Pacific Black Duck)*			
15.	24561	*Anthochaera carunculata (Red Wattlebird)*			
16.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
17.	24285	*Aquila audax (Wedge-tailed Eagle)*			
18.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
19.	24318	*Aythya australis (Hardhead)*			
20.	24359	*Burhinus grallarius (Bush Stone-curlew)*			
21.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
22.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
23.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
24.	24289	*Circus assimilis (Spotted Harrier)*			
25.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
26.	25592	*Corvus coronoides (Australian Raven)*			
27.	25595	*Cracticus tibicen (Australian Magpie)*			
28.	25596	*Cracticus torquatus (Grey Butcherbird)*			
29.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
30.	25727	*Fulica atra (Eurasian Coot)*			
31.		*Gallus gallus*			
32.	25530	*Gerygone fusca (Western Gerygone)*			
33.	24443	*Grallina cyanoleuca (Magpie-lark)*			
34.	24491	*Hirundo neoxena (Welcome Swallow)*			
35.	25661	*Lichmera indistincta (Brown Honeyeater)*			
36.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
37.	24820	*Ninox novaeseelandiae subsp. boobook (Boobook Owl)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
38.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
39.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
40.	25682	*Pardalotus striatus (Striated Pardalote)*			
41.	24409	*Phaps chalcoptera (Common Bronzewing)*			
42.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
43.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
44.	24747	*Platycercus spurius (Red-capped Parrot)*			
45.	24679	*Podargus strigoides subsp. brachypterus (Tawny Frogmouth)*			
46.	24770	*Porzana pusilla subsp. palustris (Baillon's Crake)*			
47.	24703	*Pterodroma lessonii (White-headed Petrel)*			
48.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
49.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
50.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
51.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
52.	24844	*Threskiornis molucca (Australian White Ibis)*			
53.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
54.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
55.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
Dicotyledon					
56.	15429	*Acacia alata var. alata*			
57.	3294	*Acacia dentifera*			
58.	11926	*Acacia drewiana subsp. drewiana*			
59.	3410	*Acacia lateriticola*			
60.	14131	*Acacia oncinophylla subsp. patulifolia*		P4	
61.	3574	*Acacia teretifolia*			
62.	17739	*Acetosa vesicaria*	Y		
63.	3692	*Aotus procumbens*			
64.	7849	*Asteridea gracilis*		P3	
65.	6327	*Astroloma foliosum (Candle Cranberry)*			
66.	1823	*Banksia incana*			
67.	1834	*Banksia menziesii (Firewood Banksia)*			
68.	4444	*Boronia tenuis (Blue Boronia)*		P4	
69.	5415	*Calothamnus lateralis*			
70.	5428	*Calothamnus rupestris (Mouse Ears)*			
71.	13653	*Calytrix breviseta subsp. breviseta*		T	
72.	40864	*Commersonia cygnorum*			
73.	13999	*Conospermum undulatum*		T	
74.	13470	*Cryptandra arbutiflora var. arbutiflora*			
75.	3091	*Drosera bulbigena (Midget Sundew)*			
76.	3101	*Drosera heterophylla (Swamp Rainbow)*			
77.	3872	*Euchilopsis linearis (Swamp Pea)*			
78.	3880	*Eutaxia virgata*			
79.	3887	*Gastrolobium acutum*			
80.	2158	*Hakea erinacea (Hedge-hog Hakea)*			
81.	2175	*Hakea lissocarpha (Honey Bush)*			
82.	2185	*Hakea myrtoides (Myrtle Hakea)*			
83.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
84.	2215	*Hakea undulata (Wavy-leaved Hakea)*			
85.	6686	*Halgania corymbosa*		P3	
86.	5173	*Hibbertia subvaginata*			
87.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
88.	4045	*Kennedia stirlingii (Bushy Kennedia)*			
89.	6374	*Leucopogon conostephioides*			
90.	6451	*Leucopogon tenuis*			
91.	8564	*Lotus subbiflorus*	Y		
92.	6897	*Microcorys longifolia*			
93.	19585	*Monotaxis grandiflora var. grandiflora*			
94.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
95.	2284	*Petrophile biloba (Granite Petrophile)*			
96.	2312	*Petrophile striata*			
97.	4716	*Stachystemon vermicularis*			
98.	2325	*Synaphea pinnata (Helena Synaphea)*			
99.	15532	*Synaphea spinulosa subsp. spinulosa*			
100.	4535	*Tetratheca hirsuta (Black Eyed Susan)*			
101.	11625	*Thomasia glutinosa var. glutinosa*		P3	
102.	13479	*Trymalium ledifolium var. rosmarinifolium*			
103.	15618	*Verticordia plumosa var. plumosa*			
Fish					
104.		*Bostockia porosa*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Invertebrate					
105.		*Antichiropus variabilis*			
106.		*Argiope trifasciata*			
107.		*Ballarra longipalpus*			
108.		*Celaenia excavata*			
109.		*Cormocephalus aurantiipes*			
110.		*Idiommata blackwalli*			
111.		*Missulena hoggi*			
112.		*Scolopendra morsitans*			
113.		*Urodacus novaehollandiae*			
114.		*Urodacus planimanus*			
Mammal					
115.	24088	*Antechinus flavipes subsp. leucogaster (Yellow-footed Antechinus, Mardo)*			
116.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
117.	24223	*Mus musculus (House Mouse)*	Y		
118.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale, Wambenger)*		T	
119.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
Monocotyledon					
120.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
121.	1273	*Borya sphaerocephala (Pincushions)*			
122.	1277	*Caesia occidentalis*			
123.	15377	*Caladenia reptans subsp. reptans*			
124.	17692	*Cytogonidium leptocarpoides*			
125.	1472	*Haemodorum simplex*			
126.	1473	*Haemodorum simulans*			
127.	18074	*Lepidobolus preissianus subsp. preissianus*			
128.	118	*Lepilaena australis (Austral Water Mat)*			
129.	1236	*Lomandra odora (Tiered Matrush)*			
130.	1097	*Lyginia barbata*			
131.	17976	*Meeboldina decipiens subsp. decipiens*		P3	
132.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
133.	532	*Paspalum urvillei (Vasey Grass)*	Y		
134.	43762	*Pauridia occidentalis var. quadriloba*			
135.	1478	*Phlebocarya ciliata*			
136.	974	*Schoenus benthamii*		P3	
137.	1023	*Schoenus tenellus*			
138.	1260	*Stypandra glauca (Blind Grass)*			
139.	1481	*Tribonanthes australis*			
140.	12072	*Wurmbea dioica subsp. alba*			
Reptile					
141.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
142.	24980	*Christinus marmoratus (Marbled Gecko)*			
143.	25027	*Ctenotus australis*			
144.	25047	*Ctenotus impar*			
145.	25005	*Lialis burtonis*			
146.	25184	*Menetia greyii*			
147.	25191	*Morethia lineoocellata*			
148.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
149.	25252	*Notechis scutatus (Tiger Snake)*			
150.	25253	*Parasuta gouldii*			
151.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
152.	25526	*Varanus tristis (Racehorse Monitor)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

APPENDIX 3

Protected Matters Search Tool Results

Australian Government
Department of the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

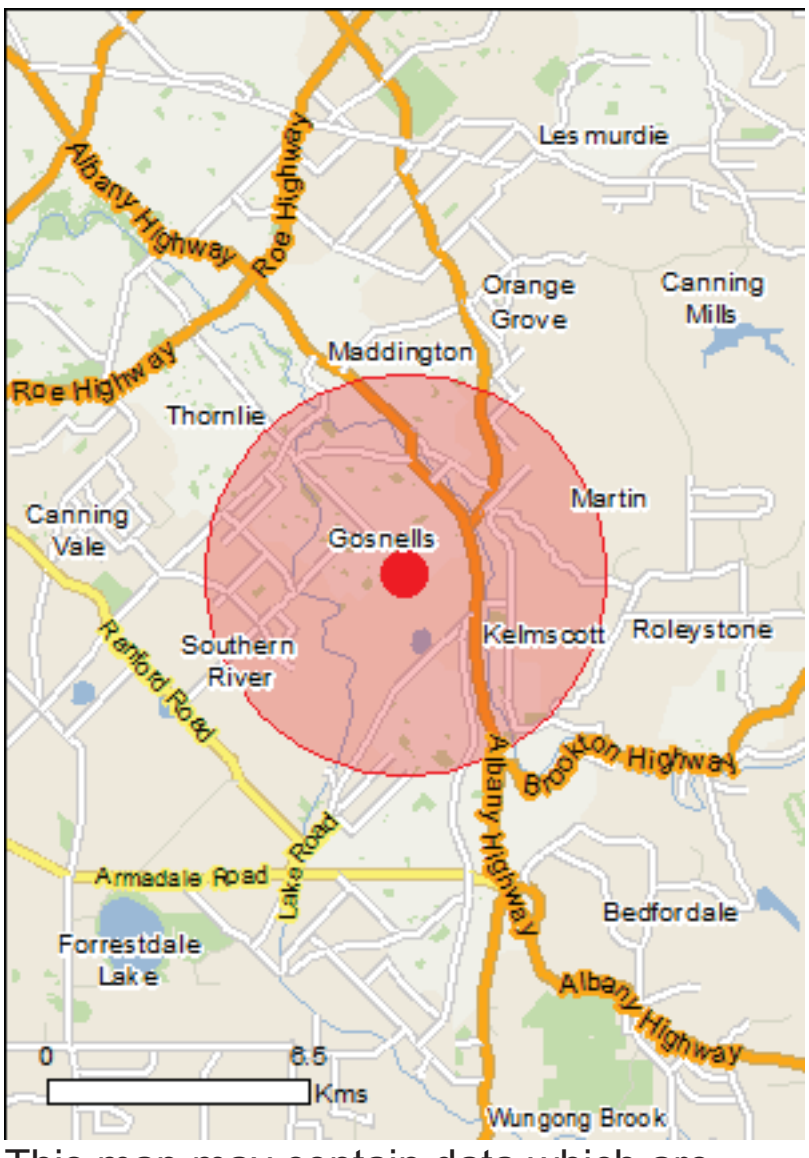
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/06/15 20:45:39

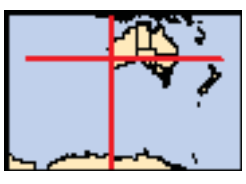
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	29
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	39
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale & thomsons lakes	Within 10km of Ramsar

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat may occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia mimica Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Calytrix breviseta subsp. breviseta Swamp Starflower [23879]	Endangered	Species or species habitat likely to occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Conospermum undulatum Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat likely to occur within area
Darwinia apiculata Scarp Darwinia [8763]	Endangered	Species or species habitat may occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Eucalyptus balanites Cadda Road Mallee, Cadda Mallee [24264]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D.Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		

Name	Threatened	Type of Presence
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Pandion cristatus		
Eastern Osprey [82411]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Unnamed WA49299	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Gibbs Road Swamp System	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.09024 115.99787

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX 4

Aboriginal Heritage Search Results

Search Criteria

0 Registered Aboriginal Sites in Custom search area (2); 405249.01mE, 6448975.36mN z50 (MGA94) : 405623.33mE, 6449226.49mN z50 (MGA94)

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Aboriginal Affairs by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at heritageenquiries@daa.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land within the following Indigenous Land Use Agreement(s): Whadjuk People ILUA

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will ‘impact’ (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines and Petroleum (DMP) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMP, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.dpc.wa.gov.au/lantu/Claims/Pages/SouthWestSettlement.aspx.

Further advice can also be sought from the Department of Aboriginal Affairs (DAA) at heritageenquiries@daa.wa.gov.au.

overnment of **Western Australia**
epartment of **Aboriginal Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

ight

ght in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved.

inate Accuracy

cy is shown as a code in brackets following the coordinates. Map coordinates (Latitude/Longitude and Easting/Northing) are based on the GDA 94 Datum. sting/Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '500000mE:Z50' means Easting=500000, 50.

nology (NB that some terminology has varied over the life of the legislation)

D/Site ID: This a unique ID assigned by the Department of Aboriginal Affairs to the place

- **Registered Site**: The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*
- **Other Heritage Place which includes:**
  - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*
  - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*

Reason: e.g. Exclusion - Relates to a portion of an Aboriginal site or heritage place as assessed by the Aboriginal Cultural Material Committee (ACMC). e.g. ch as the land subject to a section 18 notice.

Place ID: Used in conjuction with Status Reason to indicate which Registered Site this Place originates from.

s and Restrictions:

- **File Restricted = No:** Availability of information (other than boundary) that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- **File Restricted = Yes:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the Request to Access Restricted Information letter and form.
- **Boundary Restricted = No:** place location is shown as accurately as the information lodged with the Registrar allows.
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact DAA.
- **Restrictions:**
  - **No Restrictions:** Anyone can view the information.
  - **Male Access Only:** Only males can view restricted information.
  - **Female Access Only:** Only females can view restricted information

y ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

List of Registered Aboriginal Sites with Map

sults

overnment of Western Australia
epartment of Aboriginal Affairs

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Legend

Selected Heritage Sites

- Registered Sites
- Aboriginal Community Occupied
- Aboriginal Community Unoccupied
- Town
- Search Area

Appendix 3
Bushfire Management Plan

intelligent outcomes | respected experience

Bushfire Management Plan

Lot 1 Corfield St, Gosnells

Prepared for
Planning Solutions
by Strategen

July 2016

strategen
ENVIRONMENTAL

Bushfire Management Plan

Lot 1 Corfield St, Gosnells

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ACN: 056 190 419

July 2016

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. 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 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 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 has also not attempted to determine whether any material matter has been omitted from the data. Strategen 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. The making of any assumption does not imply that Strategen 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 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.

Client: Planning Solutions

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	Rev A	For review by Client	D Panickar / R Banks	Electronic	1 June 2016
Final Report	**Rev 0**	**Issued for use**	**D Panickar / R Banks**	**Electronic**	**3 June 2016**
Final Report	**Rev 1**	**Issued for use**	**D Panickar**	**Electronic**	**21 Jul 2016**
Final Report	**Rev 2**	**Issued for use**	**D Panickar**	**Electronic**	**7 April 2017**

Filename: PSO16230_01 R001 Rev 2 - 7 April 2017

Table of contents

1. Introduction **1**
1.1 Background 1
1.2 Purpose and application of the plan 1

2. Spatial consideration of bushfire threat **3**
2.1 Existing site characteristics 3
2.1.1 Location 3
2.1.2 Land use 3
2.1.3 Assets 3
2.1.4 Access 3
2.1.5 Water and power supply 4
2.2 Existing fire environment 4
2.2.1 Vegetation 4
2.2.2 Site topography and slope under vegetation 4
2.2.3 Bushfire weather conditions 8
2.2.4 Bushfire history, fuel age, risk of ignition and potential ignition sources 8
2.2.5 Potential bushfire scenarios 9
2.2.6 Bushfire suppression response capability 9
2.3 Bushfire hazard assessment 9
2.4 BAL assessment 11
2.4.1 Fire Danger Index 11
2.4.2 Vegetation class 11
2.4.3 Slope under classified vegetation 11
2.4.4 Distance between proposed development areas and the classified vegetation 12
2.4.5 Method 1 BAL calculation 12

3. Bushfire management measures **14**
3.1 Hazard separation distances and Asset Proetection Zones (APZs) 14
3.2 Increased building construction standards 14
3.3 Vehicular access 14
3.4 Reticulated water supply 15
3.5 Additional measures 15

4. Proposal compliance and justification **17**

5. Implementation and enforcement **21**
5.1 Document review 21
5.2 Stakeholder consultation 21

6. References **22**

List of tables

Table 1: Method 1 BAL calculation (BAL contours) 12
Table 2: Vehicular access requirements for public roads and emergency access ways 14
Table 3: Acceptable solutions assessment against bushfire protection criteria 18
Table 4: Proposed works program 21

List of figures

Figure 1: Site overview 2
Figure 2: Vegetation class 5
Figure 3: Bushfire hazards 10
Figure 4: Bushfire Management Plan: Lot 1 Corfield Street, Gosnells 16

List of appendices

Appendix 1 January wind profiles for Gosnells City
Appendix 2 City of Gosnells Annual Fire Hazard Reduction Notice
Appendix 3 On-site POS landscaping plan

1. Introduction

1.1 Background

Planning Solutions, on behalf of their client has prepared a Local Structure Plan (LSP) over Lot 1 Corfield Street, Gosnells (the subject site). The LSP outlines a proposed layout to inform future rezoning, subdivision and land use across the subject site (Figure 1).

The subject site is located within a designated bushfire prone area as per the Western Australia State Map of Bush Fire Prone Areas (DFES 2016) and consequently, a Bushfire Management Plan (BMP) is required to support the LSP in accordance with *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2015a) and *Guidelines for Planning in Bushfire-Prone Areas* (the Guidelines; WAPC 2015b).

A preliminary bushfire management assessment was prepared for the subject site by Blue Oar Pty Ltd. in September 2015 prior to the release of SPP 3.7 and the Guidelines. Subsequently, Planning Solutions has commissioned Strategen to prepare a BMP for the subject site in accordance with SPP 3.7 and the Guidelines to support the LSP.

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 subject site through implementation of a range of bushfire management measures. The BMP outlines how future on-site assets can be protected during the summer months when the threat from bushfire is at its peak. This is particularly relevant when existing fire appliances in the area may be unable to offer an immediate emergency suppression response; therefore, development design should aim to provide mitigation strategies that protect future life and property from bushfire as a priority.

Figure 1: Site overview

Scale 1:2,800 at A4

0 25 50 75 100 m

N

Legend

- Subject site
- Existing cadastre

Coordinate System: Transverse Mercator

Note that positional errors may occur in some areas

Date: 3/06/2016

Author: JCrute

Source: Aerial image: Landgate, flown 02/2016. Subdivision Plan: Client 05/2016. Existing cadastre: SLIP, Landgate 2016.

Path: Q:\Consult\2016\PSO\PSO16230\ArcMap_documents\R001\Rev0\PSO16230_01_R001_Rev0_F001.mxd

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

2. Spatial consideration of bushfire threat

2.1 Existing site characteristics

2.1.1 Location

The subject site is located approximately 19 km south-southeast of the Perth Central Business District in the City of Gosnells (CoG).

The subject site encompasses approximately 3.47 ha is bound by the following, as depicted in Figure 1:

- Corfield Street, residential properties and a commercial precinct to the north
- Seaforth Primary School to the west
- undeveloped agricultural/rural land to the south and east.

2.1.2 Land use

The subject is zoned 'Development' under the CoG Town Planning Scheme No. 6 (TPS 6).

Development of the subject site will result in development of:

- 36 Lots ranging from 323m^2 to 326m^2 in size, consistent with lot sizes in this location
- one Public Open Space (POS) lot encompassing 0.82 ha
- one 'office zoned site' encompassing 0.35 ha,

In addition to the above, provisions for road, water, sewerage, power, gas and communication infrastructure will be incorporated into the proposed subdivision.

The on-site POS area incorporates a Resource Enhancement Wetland (REW) which contains vegetation that will be retained for conservation purposes. Landscaping will occur within the POS area as depicted in the landscpain plan contained in Appendix 3. Long term management of the POS area will be the responsibility of CoG.

Adjacent landholdings are a combination of 'Development', 'Public Purposes (Seaforth Primary School)', "Local Centre' and 'Residential' lots subject to zoning amendments under TPS 6.

2.1.3 Assets

The subject site currently contains limited assets, restricted to historical rural infrastructure (e.g. fencing etc.). Proposed development of the subject site will significantly increase the critical life and property assets contained within. The proposed development will intensify the number residents, visitors and built assets across the subject site.

Environmental assets within the subject site are predominantly contained within the REW proposed to be retained.

2.1.4 Access

The proposed vehicular access network will provide two links to Corfield Street to the east. The proposed vehicular access network will also provide buffers and access for emergency service vehicles between proposed residences and adjacent vegetation.

2.1.5 Water and power supply

Water and power supply services will be extended throughout the subject site from surrounding areas which will result in provision of a reticulated water supply including emergency use fire hydrants, hose reels and underground power supply for proposed residences and the office zoned site.

2.2 Existing fire environment

2.2.1 Vegetation

The subject site and the surrounding land within 100 m currently consist of the following vegetation classes as depicted in Figure 2:

- Class B woodland (Plate 1; Plate 2)
- Class C shrubland (Plate 3)
- Class G unmanaged grassland (Plate 4)
- Low Threat Vegetation as per clauses 2.2.3.2 (e) and (f) of AS3959-2009.

Vegetation within the subject site, outside of the REW, will be cleared for development and has not been classified.

2.2.2 Site topography and slope under vegetation

The following information (depicted in Figure 2) summarises the slope characteristics under the classified vegetation to inform the BAL assessment outlined in Section 2.4:

- retained Class B woodland vegetation within the subject site will be located 0-5 degrees downslope of proposed built assets
- Class B woodland and Class G grassland vegetation to the southwest of the subject site is located 0-5 degrees downslope of proposed built assets
- Class B woodland, Class C shrubland and Class G grassland vegetation to the southeast of the subject site is located at equal elevation to proposed built assets
- no other classified vegetation is located within 100 m of the subject site.

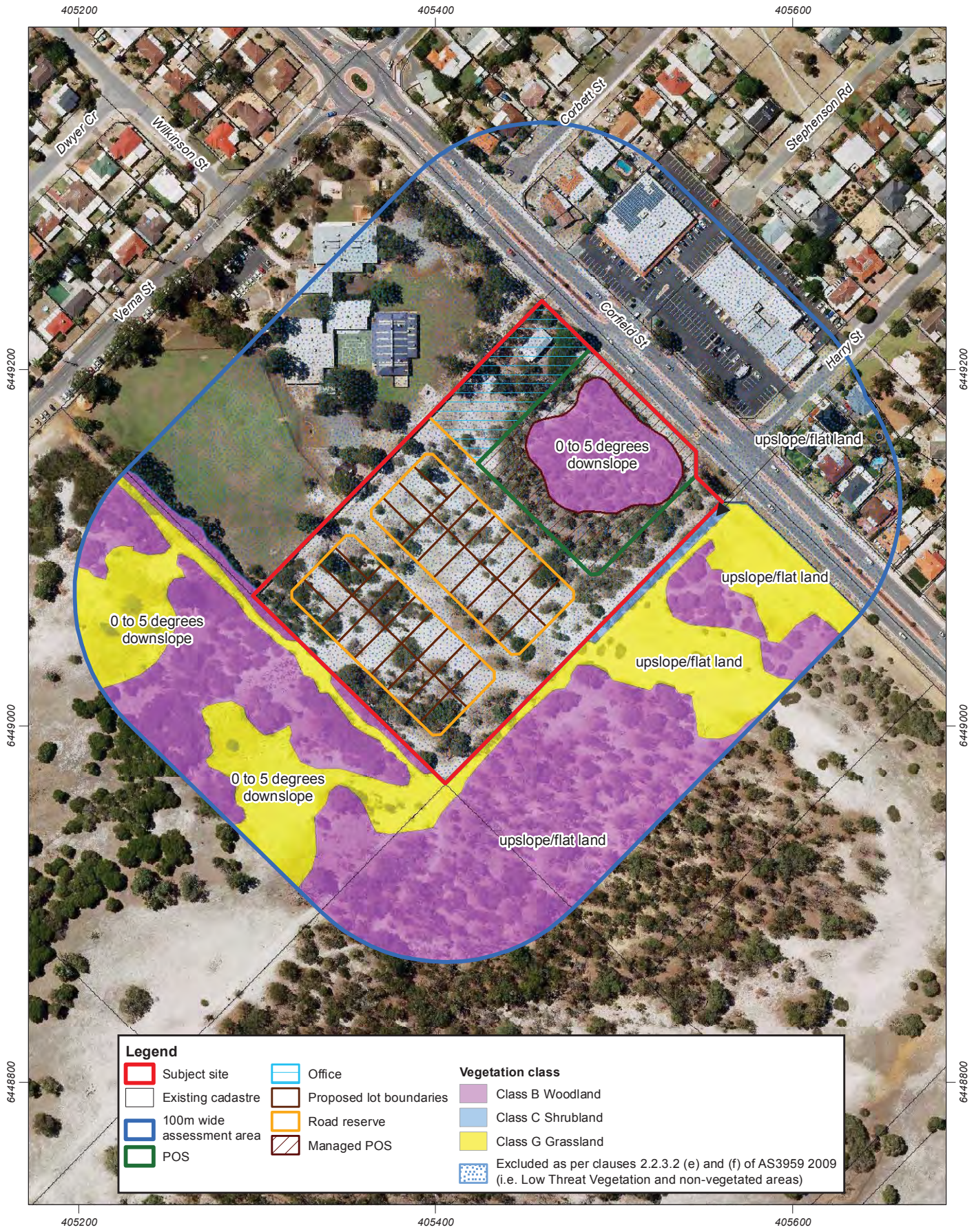


Figure 2: Vegetation class

Scale 1:2,922 at A4

0 25 50 75 100 m

N

Coordinate System: Transverse Mercator
Note that positional errors may occur in some areas
Date: 3/06/2016
Author: JCrute
Source: Aerial image: Landgate, flown 02/2016. Subdivision Plan: Client 05/2016. Existing cadastre: SLIP, Landgate 2016.

Path: Q:\Consult\2016\PSO\PSO16230\ArcMap_documents\R001\Rev0\PSO16230_01_R001_Rev0_F002.mxd

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

Plate 1: Class B woodland vegetation within the REW POS area

Plate 2: Class B woodland vegetation south of the subject site

Plate 3: Class C shrubland south of the subject site

Plate 4: Class G grassland south of the subject site (background)

2.2.3 Bushfire weather conditions

Worst case bushfire weather condition

Southwest Western Australia generally experiences a cool to mild growing season in the months of August through to November of each year, followed by four months of summer drought conditions, which is when the potential for bushfire occurrence is at its peak.

Worst case (adverse) bushfire weather conditions can occur during this dry period when a low pressure trough forms off the west coast and strong winds develop from the north or northeast. These conditions are sometimes associated with 'Extreme' or 'Catastrophic' fire dangers, which are consistent with very high temperatures, low relative humidity and very strong winds. Based on the predominant summer climatic conditions of the local area, 'Extreme' and 'Catastrophic' fire dangers normally occur less than 5% of the time during the designated bushfire season, which equates to around six days between December and March (McCaw & Hanstrum 2003).

Predominant bushfire weather conditions

Predominant fire weather conditions are considered to occur 95% of the time during the designated bush fire season and these conditions generally align with average summer climatic conditions of the locality.

Average 9:00 am and 3:00 pm January wind profiles for Gosnells City are contained in Appendix 1. These illustrate that the predominant winds during the designated bush fire season are from the east and southeast in the morning averaging around 9.7 km/h; and from the south, west and southwest in the afternoon averaging around 12.2 km/h (BoM 2016).

The mean 9:00 am and 3:00 pm relative humidity for Gosnells City during the designated bush fire season is around 56% and 37% respectively, with average monthly maximum temperatures peaking at around 33.1°C in February.

The predominant bushfire weather conditions discussed above correlate with an average fire danger index of 'High', as determined using the Commonwealth Science and Industrial Research Organisation (CSIRO) Fire Danger and Fire Spread Calculator (CSIRO 1999).

2.2.4 Bushfire history, fuel age, risk of ignition and potential ignition sources

Vegetation within and directly adjacent to the subject site does not contain any evidence of recent bushfire occurrence. Given the largely cleared nature of the understorey within these areas, the resulting fuel loads are moderate.

The risk of ignition pre-development was assessed as low throughout the subject site due to the low levels of public access and visitation. However, Strategen considers that the risk of ignition will increase due to the long unburnt nature of the site, high fuel loads and increasing levels of public access and resident occupancy at the bushland interface.

The potential sources of ignition in the area are expected to be from:

- deliberately lit fire (i.e. arson)
- lightning strike
- accidental causes, such as vehicle accidents and sparks from vehicle exhausts
- escapes from unauthorised camp fires, particularly throughout the broader fire environment and bushland reserves
- escapes from prescribed burns
- pole-top fires
- incorrect disposal of cigarettes.

2.2.5 Potential bushfire scenarios

Bushfire runs in land within 100 m of the subject site are moderate in length (no more than 500 m of continuous vegetation with a canopy width greater than 20 m).

Based on the above, a bushfire certainly has the potential to ignite and occur in and around the site, particularly from the southwest and southeast; however, the relatively patchy bushfire runs are not expected to facilitate significantly elevated levels of radiant heat and ember attack because any such fire is likely to burn out prior to escalation of its full rate of spread potential.

Bushfire impacts are most likely to be received from the southeast in the morning and the south/southwest in the afternoon in association with the predominant prevailing winds during the bushfire season, but due to limited bushfire runs in these directions, there is limited scope for significant bushfire impacts to be received.

2.2.6 Bushfire suppression response capability

Local volunteer bushfire brigades and career fire service stations at Gosnells, Maddington and Armadale are able to respond to a bushfire scenario within the subject site within 30 minutes. This is considered sufficient capability in light of the surrounding limited fire environment to enable prompt bushfire suppression and containment of uncontrolled bushfire in and adjacent to the site.

2.3 Bushfire hazard assessment

Strategen has mapped the bushfire hazard levels within 100 m of the subject site (refer to Figure 3) on the basis of the vegetation classes identified in Section 2.2.1 and the slope under classified vegetation assessed in Section 2.2.2. The following bushfire hazard levels were assigned:

- Class B woodland vegetation within the proposed POS area[1]: 'Extreme'
- Class B woodland vegetation adjacent to the southeast and southwest boundaries of the subject site: 'Moderate'
- Class C shrubland vegetation adjacent to the southeast boundary of the subject site: 'Moderate'
- Class G grassland vegetation adjacent to the southeast and southwest boundaries of the subject site: 'Moderate'.

[1] Vegetation in this area has been classified on the basis of the landscaping plan contained within Appendix 3.

Figure 3: Bushfire hazards

Scale 1:2,922 at A4

0 25 50 75 100 m

N

Coordinate System: Transverse Mercator

Note that positional errors may occur in some areas

Date: 3/06/2016

Author: JCrute

Source: Aerial image: Landgate, flown 02/2016. Subdivision Plan: Client 05/2016. Existing cadastre: SLIP, Landgate 2016.

Path: Q:\Consult\2016\PSO\PSO16230\ArcMap_documents\R001\Rev0\PSO16230_01_R001_Rev0_F003.mxd

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

2.4 BAL assessment

Classified vegetation assigned with a 'Moderate' or 'Extreme' bushfire hazard level is considered bushfire prone in accordance with methodology specified by Office of Bushfire Risk Management (OBRM). The bushfire prone extent assessed for this site, as depicted in Figure 3, is not consistent with the Western Australian State *Map of Bush Fire Prone Areas* (DFES 2015). Several areas (including the subject site itself) mapped as bushfire prone in DFES (2015) are no longer considered to be bushfire prone due to absence of classified vegetation.

Any proposed development located within 100 m of the bushfire prone vegetation depicted in Figure 3 is subject to BAL assessment in accordance with Australian Standard *AS 3959–2009 Construction of Buildings in Bushfire-prone Areas* (SA 2009).

The Method 1 procedure for calculating the BAL (as outlined in AS 3959–2009) incorporates the following factors:

- state-adopted Fire Danger Index (FDI) rating
- vegetation class
- slope under classified vegetation
- distance maintained between proposed development areas and the classified vegetation.

Based on the specified BAL, construction/setback requirements for proposed buildings can then be assigned.

2.4.1 Fire Danger Index

A blanket rating of FDI 80 is adopted for Western Australian environments, as outlined in AS 3959–2009 and endorsed by Australasian Fire and Emergency Service Authorities Council.

2.4.2 Vegetation class

Vegetation class is depicted in Figure 2 and consists of Class B woodland, Class C shrubland and Class G grassland.

2.4.3 Slope under classified vegetation

Slope under classified vegetation is assessed in Section 2.2.2, with a summary provided as depicted in Figure 2:

- retained Class B woodland vegetation within the subject site will be located 0-5 degrees downslope of proposed built assets
- Class B woodland and Class G grassland vegetation to the southwest of the subject site is located 0-5 degrees downslope of proposed built assets
- Class B woodland, Class C shrubland and Class G grassland vegetation to the southeast of the subject site is located at equal elevation to proposed built assets
- no other classified vegetation is located within 100 m of the subject site.

2.4.4 Distance between proposed development areas and the classified vegetation

Strategen has assessed the minimum separation distances prior to mitigation between proposed lots and the classified vegetation extent (Figure 3):

- dwellings on proposed lots along the southwest boundary maintain a minimum 17 m separation to the adjacent classified vegetation
- dwellings on proposed lots along the southeast boundary maintain a minimum 21 m separation to the adjacent classified vegetation
- dwellings on proposed lots adjacent to the POS area maintain a minimum 29 m separation to the adjacent classified vegetation
- future buildings in the office zoned site will maintain a minimum 17 m separation to the adjacent classified vegetation in the POS area.

2.4.5 Method 1 BAL calculation

A Method 1 BAL calculation has been completed for the subject site in accordance with AS 3959–2009 following assessment of the abovementioned parameters (Table 1). The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux) that may be received by the proposed dwelling and subsequently informs the standard of building construction required for that dwelling to withstand such impacts. BAL contours derived from the assessment are depicted in Figure 4.

Table 1: Method 1 BAL calculation (BAL contours)

BAL	Vegetation class	Slope under classified vegetation	Distance from classified vegetation
Asset Protection Zone (APZ)*	Class B woodland	Vegetation at equal elevation to, or upslope from subject lots	0-<14 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	0-<17 m
	Class C shrubland	Vegetation at equal elevation to, or upslope from subject lots	0-<9 m
	Class G unmanaged grassland	Vegetation at equal elevation to, or upslope from subject lots	0-<8 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	0-<9 m
BAL 29	Class B woodland	Vegetation at equal elevation to, or upslope from subject lots	14-<20 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	17-<25 m
	Class C shrubland	Vegetation at equal elevation to, or upslope from subject lots	9-<13 m
	Class G unmanaged grassland	Vegetation at equal elevation to, or upslope from subject lots	8-<12 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	9-<14 m

BAL	Vegetation class	Slope under classified vegetation	Distance from classified vegetation
BAL 19	Class B woodland	Vegetation at equal elevation to, or upslope from subject lots	20-<29 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	25-<35 m
	Class C shrubland	Vegetation at equal elevation to, or upslope from subject lots	13-<19 m
	Class G unmanaged grassland	Vegetation at equal elevation to, or upslope from subject lots	12-<17 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	14-<20 m
BAL 12.5	Class B woodland	Vegetation at equal elevation to, or upslope from subject lots	29-<100 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	35-<100 m
	Class C shrubland	Vegetation at equal elevation to, or upslope from subject lots	19-<100 m
	Class G unmanaged grassland	Vegetation at equal elevation to, or upslope from subject lots	17-<50 m
		Vegetation downslope at a maximum angle of 5 degrees from subject lots	20-<50 m

3. Bushfire management measures

Strategen has identified a range of bushfire management measures that on implementation will enable all subject site to be developed whilst maintaining a manageable level of bushfire risk and compliance with the Guidelines. The bushfire management measures are depicted in Figure 4 (where applicable) and discussed in the following subsections.

3.1 Hazard separation distances and Asset Proetection Zones (APZs)

The hazard separation distances between classified vegetation and proposed lots will allow APZs to be contained within individual lots to achieve compliance with AS 3959–2009. All APZs are to be wholly contained within the subject site and comprise road reserves, lot setbacks and POS areas maintained in a low fuel state.

The APZs are required to be maintained on a regular and ongoing basis at a fuel load less than 2 t/ha to achieve a low threat minimal fuel condition status.

No buildings are permitted within APZs and all APZs will need to be cleared and implemented prior to dwelling construction on individual lots. In addition, the location and alignment of APZs will need to be reassessed following modification to the extent of bushfire prone vegetation on the surrounding landholdings. Should this vegetation be removed, the APZs may not be required.

Formal Hazard Separation Zones (HSZs) are not required around APZs in this instance, since proposed construction for each proposed dwelling meets the standard appropriate to the BAL for that location (WAPC 2015b).

3.2 Increased building construction standards

Strategen has designated BAL requirements for each proposed lot in accordance with AS 3959–2009. This has resulted in a combination of BAL 12.5, BAL 19 and BAL 29 contours being applied to all proposed lots within the subject site.

3.3 Vehicular access

The proposed vehicular access network will provide one formal link to Corfield Street to the east (Figure 4). An easement in gross for the public at large will be constructed between the proposed office zoned site and POS area to provide a secondary access point to Corfield Street. This easement in gross will comply with the requirements for an emergency access way under the Guidelines.

The public roads and easement in gross (emergency access way) created as part of the proposed development are compliant with Guideline requirements as detailed in Table 2.

Table 2: Vehicular access requirements for public roads and emergency access ways

Technical requirements	Public Road	Emergency Access Way
Minimum trafficable surface	6 m*	6 m*
Horizontal clearance	6 m	6 m
Vertical clearance	4.5 m	4.5 m
Maximum grade <50 m	1 in 10	1 in 10
Minimum weight capacity	15 tonnes	15 tonnes
Maximum crossfall	1 in 33	1 in 33
Curves minimum inner radius	8.5	8.5

*Widths 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 and one metre wide road shoulders.

3.4 Reticulated water supply

Water supply services will be extended throughout the subject site from surrounding areas of development, which will result in provision of a reticulated mains water supply for proposed residences.

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 for the subject site, 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.

3.5 Additional measures

Strategen makes the following additional recommendations to inform ongoing planning stages of the development:

1. Notification on Title: Strategen recommends that a notification on title be placed on all proposed lots as a condition of subdivision to ensure all landowners/proponents and prospective purchasers are aware that their lot is in a designated bushfire prone area and that increased building construction standards will apply to future buildings. The notification on title is also to include that the site is subject to a Bushfire Management Plan.
2. BAL assessment at future planning stages: Management measures recommended in the BMP for individual dwellings (i.e. BAL ratings and APZs) are currently based on lot locations rather than building locations and bushfire prone vegetation of which a large proportion is temporary and proposed to be cleared at some future stage. Consequently, Strategen recommends that BALs be reassessed following any modification to the surrounding vegetation extent.
3. Compliance with the City of Gosnells annual firebreak notice: the developer/land manager and prospective land purchasers are to comply with the current City of Gosnells annual firebreak notice (Appendix 2).

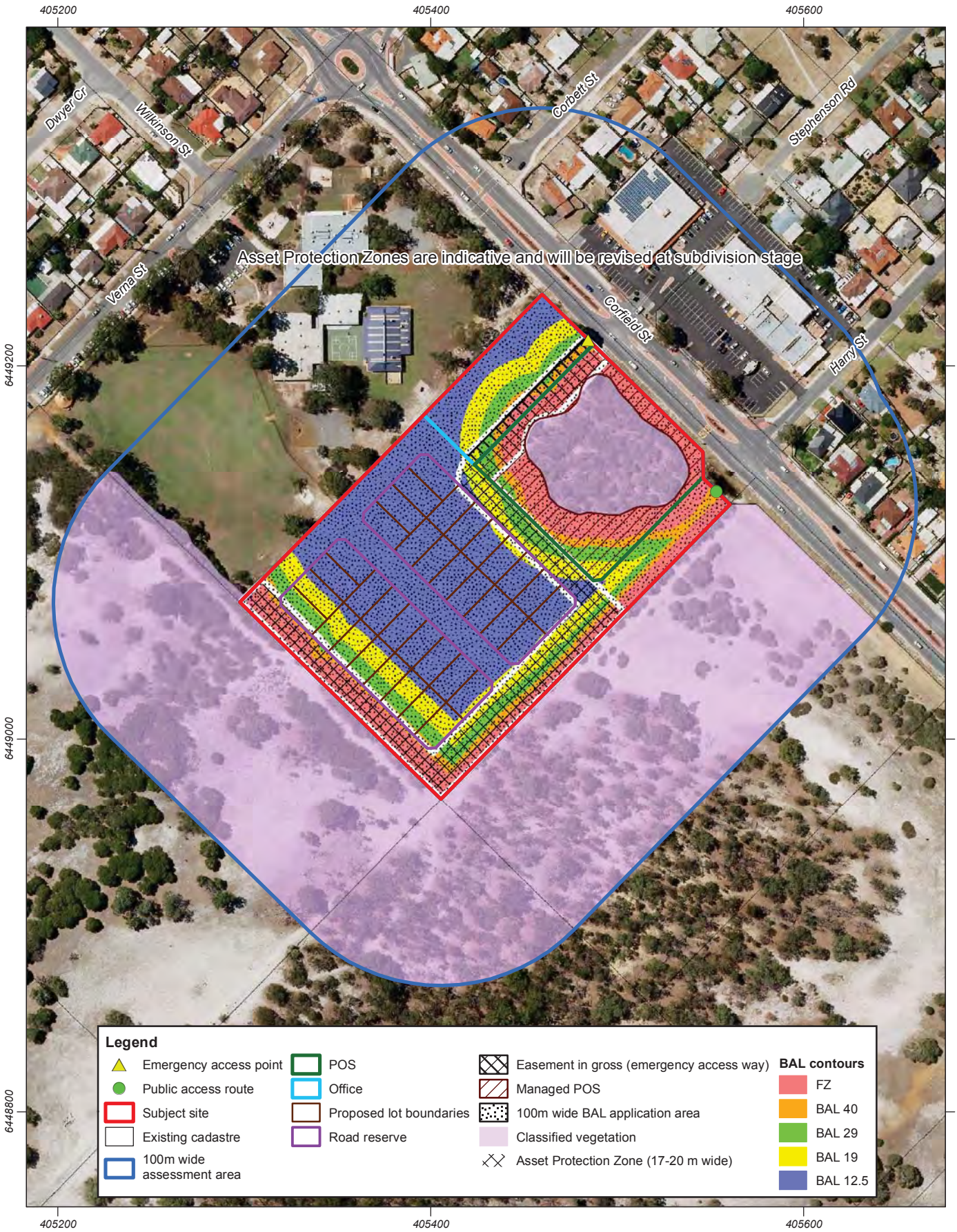


Figure 4: Bushfire Management Plan: Lot 1 Corfield Street, Gosnells

Scale 1:2,800 at A4

0 25 50 75 100 m

Coordinate System: Transverse Mercator
Note that positional errors may occur in some areas
Date: 22/07/2016
Author: JCrute
Source: Aerial image: Landgate, flown 02/2016. Subdivision Plan: Client 05/2016. Existing cadastre: SLIP, Landgate 2016.

Path: Q:\Consult\2016\PSO\PSO16230\ArcMap_documents\R001\Rev0\PSO16230_01_R001_Rev0_F004.mxd

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

4. Proposal compliance and justification

Proposed development of Lot 1 Corfield Street, Gosnells is required to comply with SPP 3.7 and the Guidelines, as required 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 increasing the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact is paramount
- **5.2**: Reduce vulnerability to bushfire through the identification and assessment of bushfire hazards in decision-making at all stages of the planning and development process
- **5.3**: Ensure that planning proposals and development applications take into account bushfire protection requirements and include specified bushfire protection measures where land has or will have a moderate or extreme bushfire hazard level, and/ or where a rating higher than BAL-Low applies
- **5.4**: Achieve a responsible approach between bushfire management measures and landscape amenity and biodiversity conservation values, with consideration of the potential impacts of climate change.

In response to the above requirements of SPP 3.7 and the Guidelines, bushfire management measures, as outlined in Section 3 have been devised for the proposed development accordance with Guideline acceptable solutions where possible to meet compliance with bushfire protection criteria. All performance principles have been achieved by the implementation of 'acceptable solutions' and as such, a summary of the '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	Solution	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	Acceptable solution 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 3.2, which demonstrates that development will only occur in areas of BAL 29 or lower. No development is to occur in BAL 40 or BAL FZ areas.	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	Acceptable solution 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).	Refer to Section 3.1 and Figure 4, which demonstrate that APZs are able to be maintained between all proposed lots and classified vegetation (i.e. no buildings are proposed in areas subject to BAL FZ or BAL 40). The reduction in the prescribed minimum 20 m wide APZ as per the Guidelines is in accordance with AS 3959-2009, which combined with heightened building construction standards meet the intent of the bushfire protection criteria.	The measures proposed are considered to comply and meet the intent of Element 2 Siting and design of development
		Acceptable solution A2.2 Hazard Separation Zone Every building and its contiguous APZ is surrounded by an HSZ, depicted on submitted plans, that meets detailed requirements (refer to the Guidelines for detailed HSZ requirements). An HSZ may not be required if the proposed construction meets the standard appropriate to the BAL for that location, and does not exceed BAL–29.	HSZs are not proposed since individual dwelling construction meets the standard appropriate to the BAL for that location.	
Element 3: Vehicular access	To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event	Acceptable solution 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 3.3 and Figure 4, which demonstrate that: • one formal vehicular access route to Corfield Street will be provided for all proposed lots via the internal road network • an easement in gross for the public at large will be constructed between the proposed office zoned site and POS area to allow for additional access in the event of a bushfire. These measures will ensure that residents and visitors/fire services can safely evacuate/service the subject site in the event of a bushfire.	The measures proposed are considered to comply and meet the intent of Element 3 Vehicular access

Bushfire protection criteria	Intent	Solution	Proposed bushfire management measures	Compliance statement
		Acceptable solution A3.2 Public road A public road is to meet the requirements in Table 2, Column 1.	Refer to Section 3.3, which demonstrates that all proposed public roads will meet minimum requirements outlined in Table 2 of the Guidelines.	
		Not applicable 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 requirements will need to be achieved (refer to the Guidelines for detailed cul-de-sac requirements).	N/A. No cul-de-sacs are proposed as part of the development.	
		Not applicable A3.4 Battle-axe Battle-axe access leg should be avoided in bushfire prone areas. Where no alternative exists, (this will need to be demonstrated by the proponent) detailed requirements will need to be achieved (refer to the Guidelines for detailed battle-axe requirements).	N/A. No battle-axe lots are proposed as part of the development.	
		Not applicable A3.5 Private driveway longer than 50 m A private driveway is to meet detailed requirements (refer to the Guidelines for detailed private driveway requirements).	N/A. No private driveways longer than 50 m are proposed as part of the development.	
		Acceptable solution 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 requirements (refer to the Guidelines for detailed EAW requirements).	Refer to Section 3.3 and Figure 4, which demonstrate that: • one formal vehicular access route to Corfield Street will be provided for all proposed lots via the internal road network • an easement in gross for the public at large complying with the Guideline requirements for an emergency access way will be constructed between the proposed office zoned site and POS area to allow for emergency access in the event of a bushfire. These measures will ensure that residents and visitors/fire services can safely evacuate/service the subject site in the event of a bushfire.	

Bushfire protection criteria	Intent	Solution	Proposed bushfire management measures	Compliance statement
		Not applicable 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 fire fighting purposes. Fire service access routes are to meet detailed requirements (refer to the Guidelines for detailed fire service access route requirements).	N/A. No fire service access routes are proposed as part of the development.	
		Not applicable 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. No firebreaks are proposed as part of the 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.	Acceptable solution A4.1 Reticulated areas 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.	Refer to Section 3.4, which demonstrates that all proposed lots will be provided a reticulated water supply and network of hydrants in accordance with local water authority, City and DFES requirements.	The measures proposed are considered to comply and meet the intent of Element 4 Water
		Not applicable A4.2 Non-reticulated areas Water tanks for fire fighting 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.	
		Not applicable 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.	

5. Implementation and enforcement

Implementation of the BMP applies to the developer, local government and prospective landowners to ensure bushfire management measures are adopted and implemented on an ongoing basis. A summary of the bushfire management measures described in Section 3, 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
Creation of APZs	Prior to development of interfacing lots	Developer
Maintenance of APZs	As required to achieve 2 t/ha threshold all year round	Developer during development, CoG thereafter
Implementation of increased building construction standards	On development of individual lots	Builder, prospective landowners
Construction of public roads as per approved subdivision	Prior to development of lots for each respective stage	Developer
Provision of reticulated water supply and fire hydrant network	Prior to development of lots for each respective stage	Developer
Notification on Title	Following subdivision approval	Developer
Reassessment of the BAL and separation distances	Following any modification to the surrounding vegetation extent prior to building construction.	Landowner (if required)
Compliance with current fire control order	All year round as specified in the current fire control order	Developer/land manager/prospective landowners

5.1 Document review

This BMP will be updated as necessary following the date of approval to ensure:

1. Implementation is assessed and corrective actions are applied in cases of non-compliance.
2. The effectiveness and impact of fire prevention work is evaluated and any significant changes in development design or the surrounding environment are reassessed in a revised BMP.

The developer will be responsible for updating and revising the BMP until such time that the development is complete, after which time CoG will be the authority responsible for updating and revising the BMP.

5.2 Stakeholder consultation

Strategen has undertaken consultation with the developer and CoG to ensure aims and objectives of the BMP are in accordance with stakeholder expectations and the BMP maintains compliance with the Guidelines

6. References

Bureau of Meteorology (BoM) 2016, *Climate statistics for Australian locations: Monthly climate statistics for Gosnells City*, [Online], Commonwealth of Australia, available from: *http://www.bom.gov.au/climate/averages/tables/cw_009106.shtml*, [26 May 2016].

Commonwealth Science and Industrial Research Organisation (CSIRO) 1999, *Fire Danger and Fire Spread Calculator*, Commonwealth Science and Industrial Research Organisation, Perth.

Department of Fire and Emergency Services (DFES) 2015, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: *http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx*, [17 Feb 2016].

McCaw L and Hanstrum B 2003, 'Fire environment of Mediterranean south-west Western Australia', in *Fire in Ecosystems of South-West Western Australia: Impacts and Management*, eds I Abbott & ND Burrows, Backhuys Publishers, Leiden, Netherlands, pp. 171–188.

Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.

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

Western Australian Planning Commission (WAPC) 2015b, *Guidelines for Planning in Bushfire-Prone Areas*, Western Australian Planning Commission, Perth.

Appendix 1
January wind profiles for Gosnells City

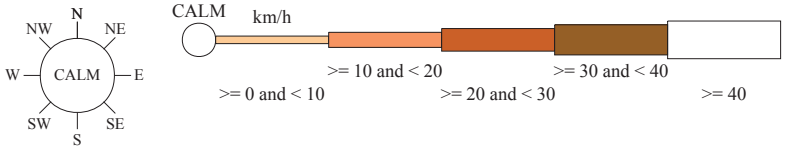
Rose of Wind direction versus Wind speed in km/h (17 Jul 1991 to 30 Sep 2010)

Custom times selected, refer to attached note for details

GOSNELLS CITY

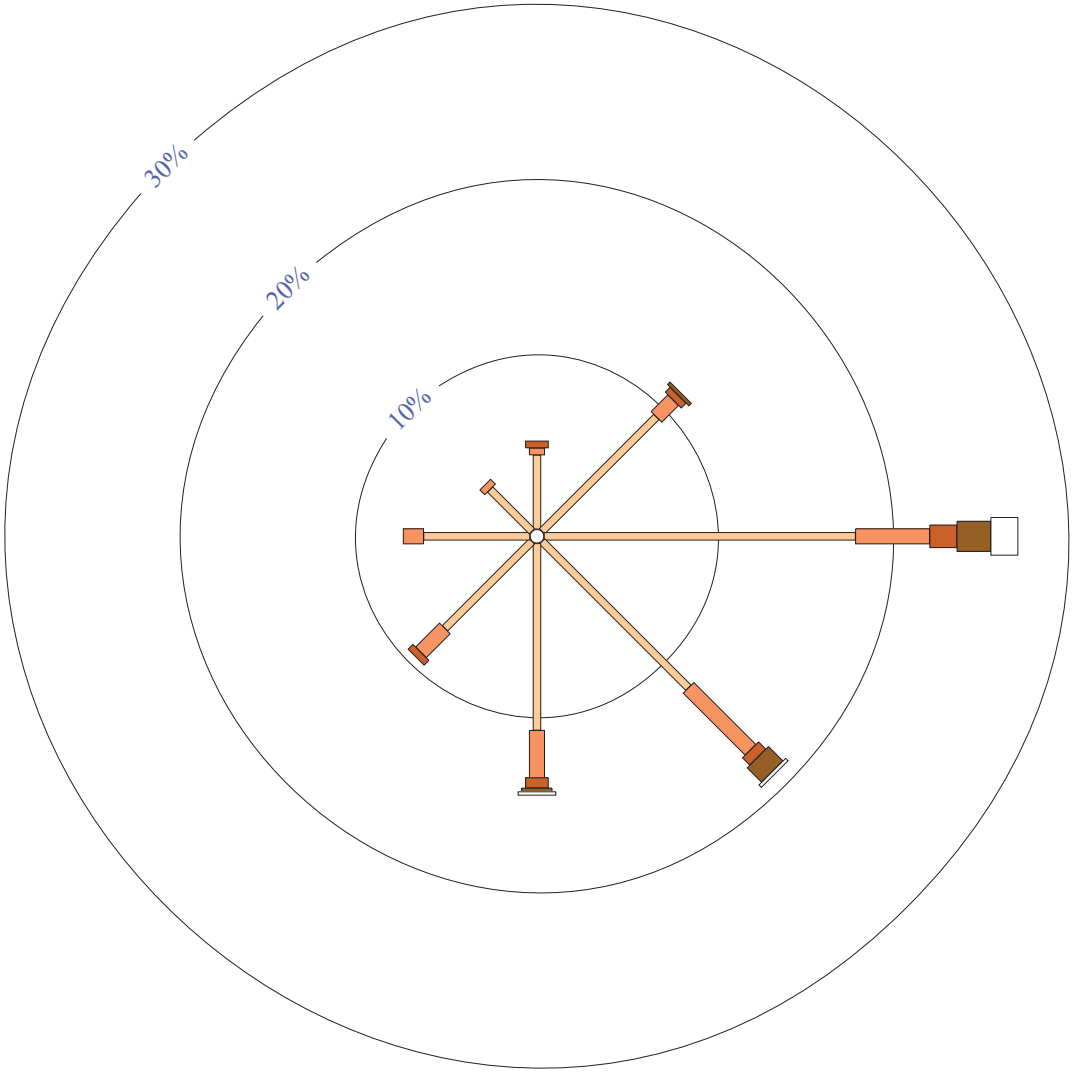
Site No: 009106 • Opened Jan 1961 • Still Open • Latitude: -32.0486° • Longitude: 115.9839° • Elevation 10m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am Jan
512 Total Observations

Calm 2%



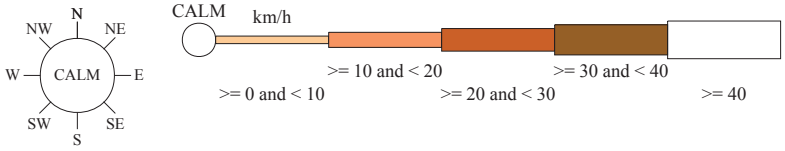
Rose of Wind direction versus Wind speed in km/h (17 Jul 1991 to 30 Sep 2010)

Custom times selected, refer to attached note for details

GOSNELLS CITY

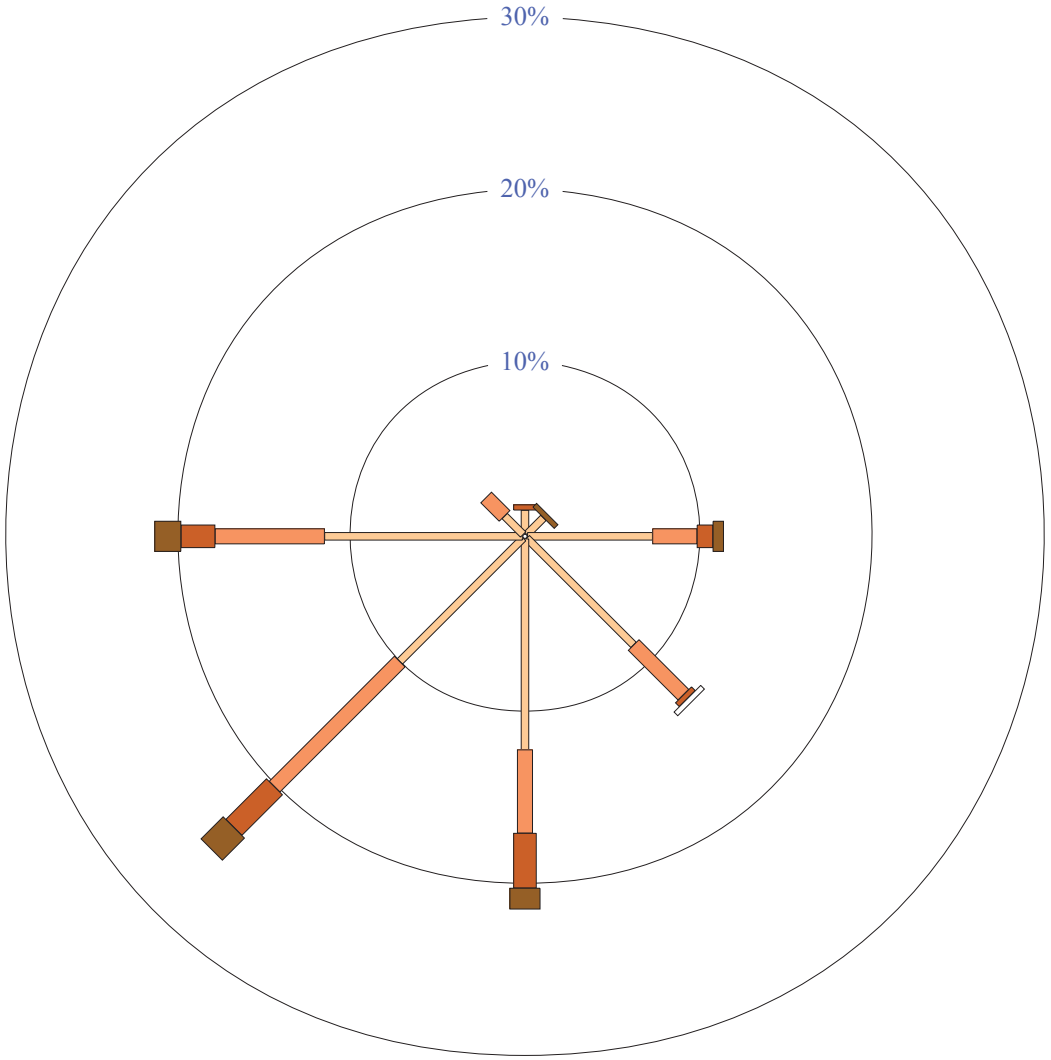
Site No: 009106 • Opened Jan 1961 • Still Open • Latitude: -32.0486° • Longitude: 115.9839° • Elevation 10m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm Jan
331 Total Observations

Calm 1%



Appendix 2
City of Gosnells Annual Fire Hazard Reduction Notice

Annual Fire Hazard Reduction Notice
Bush Fires Act 1954 Section 33(1)

To prevent bush fires and to minimise the spread of a bush fire, all owners and occupiers of land within the City's district are required to comply with the requirements of this Annual Fire Hazard Reduction Notice.

1. Owners and occupiers of land zoned "General Rural" or "Special Rural"

On or before 30 November in each year, all owners or occupiers of land zoned "General Rural" or "Special Rural" under the City of Gosnells Town Planning Scheme No.6 ("Scheme") are required to:

(a) Clear and maintain the land free of all flammable matter to a height no greater than 10cm;

or

(b) Maintain a mineral earth firebreak immediately inside all external boundaries of each lot on the land; and

(c) Maintain a mineral earth firebreak within 20 metres of all haystacks and stockpiled flammable matter.

Mineral earth firebreaks must be continuous (no dead ends) and maintained to a minimum standard of 3 metres wide by 4 metres high (vertical clearance) so as to provide unimpeded access for emergency vehicles. Driveways must also be maintained to these standards.

Firebreaks are intended to provide safe access on your property for emergency vehicles and to ensure fire does not travel under the vehicles or underfoot.

NOTE: The firebreaks and requirements set out above must be maintained up to and including 30 April in the following year.

2. Owners and occupiers of all other land, which is not zoned "General Rural" or "Special Rural"

At all times throughout the year, all owners or occupiers of land zoned other than "General Rural" or "Special Rural" under the Scheme are required to clear and maintain the land free of all flammable matter to a height no greater than 10cm.

NOTE: For the purposes of this Notice, Flammable matter includes, but is not limited to, vegetation (except for living trees, shrubs, plants and lawns under cultivation), prunings, cardboard, wood, paper, general rubbish and any other combustible material.

Permission needed to vary requirements

If, due to the topography of your land, you are unable to adhere to the requirements set out in this Notice, you may apply in writing to the City for permission to provide firebreaks in alternative locations or take alternative measures.

Unless and until permission in writing is granted by the City, you shall comply with the requirements of this Notice.

Penalty for non-compliance

Failing to comply with the requirements of this Notice is an offence under the *Bush Fires Act 1954* (Act), which carries a penalty of up to $5,000. In addition, where the owner or occupier of the land fails to comply with a Notice given pursuant to Section 33(1), the City may enter the land to carry out the work required to comply with the Notice and also recover any costs and expenses incurred in carrying out that work from the owner or occupier of the land.

Other Requirements

Restricted burning times

These are the times of the year during which it is unlawful to set fire to bush without a permit (permits required):

- 1 October to 30 November (dates inclusive); and
- 1 April to 31 May (dates inclusive).

Prohibited burning times

It is unlawful to set fire to bush during 1 December to 31 March, both dates inclusive.
Restricted and Prohibited Burning periods may be extended due to un-seasonal weather patterns.

Burning Restricted	Burning Prohibited	Burning Restricted	Burning Restricted
Permits required from 1 October to 30 November	From 1 December to 31 March	Permits required from 1 April to 31 May	Permits required for non rural properties from 1 June to 30 September

To apply for a permit:

- Contact Ranger Services on 9397 3031
- Contact Health Services on 9397 3021

Burning rubbish, refuse or other material

With the exception of land in areas zoned "General Rural" or "Special Rural" under the Scheme, the City of Gosnells *Animals, Environment and Nuisance Local Law 2009* provides that a person shall not set fire to or cause to be set fire, any rubbish, refuse or other material at any time unless otherwise approved in writing by an authorised person.

The penalty for an offence under the Local Law is a fine of $250.

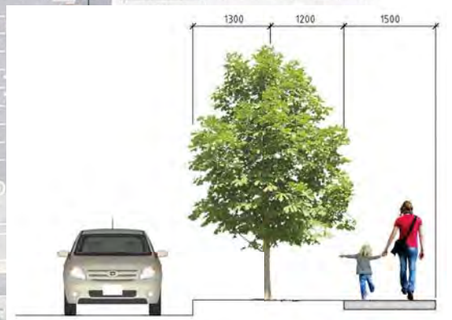
"Maintaining a fire hazard free property is your responsibility."

For all enquiries relating to this Notice please call Customer Service on 9397 3000.

**PO Box 662
Gosnells 6990
Western Australia**

www.gosnells.wa.gov.au
council@gosnells.wa.gov.au

Appendix 3
On-site POS landscaping plan



TYPICAL SECTION 1:50@A1

CORFIELD STREET

LEGEND

- EXISTING WETLAND WEED CONTROL AND ENHANCED PLANTING
- VEGETATED SWALE PLANTED WITH ENDEMIC WETLAND SPECIES
- GARDEN BED PLANTED WITH ENDEMIC FRINGING WETLAND SPECIES
- TURF AREAS (IRRIGATED)
- EXISTING TREES RETAINED
- NEW TREE PLANTING (ENDEMIC SPECIES)

NOTES

- FINE FUEL LOAD (I.E. DEAD VEGETATION MATTER LESS THAN 6MM IN THICKNESS) IS TO BE MAINTAINED WITHIN 2 TONNES PER HECTARE ON A REGULAR BASIS.
- TREE TRUNKS TO BE LOCATED NO CLOSER THAN 6M FROM BUILDING WALLS
- ALL BRANCHES BELOW 2M IN HEIGHT TO BE REMOVED.
- TREE CANOPIES TO BE LOCATED NO CLOSER THAN 5M FROM EACH OTHER.
- ALL SHRUBS (>0.5 M IN HEIGHT) TO BE REMOVED. WHERE SEDGES OR SIMILAR ARE PREFERRED FOR PLANTING, THEY MUST COMPLY WITH THE FOLLOWING:
  - NOT BE LOCATED UNDER TREES OR WITHIN 3M OF BUILDINGS.
  - SHOULD NOT BE PLANTED IN CLUMPS GREATER THAN 5M2IN AREA.
  - CLUMPS OF SHRUBS SHOULD BE SEPARATED FROM EACH OTHER AND ANY EXPOSED WINDOW OR DOOR BY AT LEAST 10M.
- GROUND COVERS (<0.5 M IN HEIGHT) TO BE LOCATED GREATER THAN 3M FROM DWELLINGS AND MAINTAINED ON A REGULAR BASIS TO ENSURE ALL DEAD MATERIAL IS REMOVED.

1. NORTHERN ENTRY NODE TO PARK AND DEVELOPMENT, WITH CONNECTIONS TO EXISTING RETAIL & COMMERCIAL.
2. SOUTHERN ENTRY NODE TO DEFINE ENTRY TO PARK AND DEVELOPMENT WITH PUBLIC ART.
3. FOOTPATH TO PROVIDE ACCESS AND SERVICE TO NEW COMMERCIAL.
4. SMALL SEATING NODE.
5. INFORMAL KICK-ABOUT AREA.
6. BENCH SEAT.
7. INSITU CONCRETE PATH.
8. PROPOSED RESIDENTIAL.
9. PROPOSED COMMERCIAL.
10. EXISTING RETAIL & COMMERCIAL.
11. 1:1 YEAR STORM EVENT STORAGE
12. 1:5 YEAR STORM EVENT STORAGE
13. 1:100 YEAR STORM EVENT STORAGE
14. DUAL USE PATH
15. PEDESTRIAN PATHS

PREPARED FOR VIRIDIAN PROPERTY GROUP

LANDSCAPE CONCEPT PLAN

JOB NO. 1603101
1:400 @ A1

C1.101 REV F APR 2017

0 4 8 16 24 40m

LANDSCAPE ARCHITECTS
414 ROKEBY RD SUBIACO WA 6008
T: (08) 9388 9566 E: mail@plane.com.au
LANDSPACE PTY LTD ACN 056 538 679

PLAN E

Appendix 4
Transportation Noise Assessment

Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770 F:9300 4199
E: terry@lgacoustics.com.au W: www.lgacoustics.com.au

Transportation Noise Assessment

Lot 1 (303) Corfield Street, Gosnells

Reference: 15043165-01.docx

Prepared for:
Powerstar P/L atf Averling Family Trust & Zeditave P/L
C/- Viridian Property Group

Member Firm of Association of Australian Acoustical Consultants

Report: 15043165-01.docx

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

T: 9300 4188 / 9401 7770
F: 9300 4199

Contacts	Daniel Lloyd	Terry George	Mike Cake	Matt Moyle
E:	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	mike@lgacoustics.com.au	matt@lgacoustics.com.au
M:	0439 032 844	0400 414 197	0438 201 071	0412 611 330

Prepared By:	Terry George 
Position:	Project Director
Date:	21 December 2015

Table of Contents

1 INTRODUCTION 1
2 CRITERIA 2
3 METHODOLOGY 3
3.1 Site Measurements 3
3.2 Noise Modelling 5
3.2.1 Ground Topography, Road Design & Cadastral Data 5
3.2.2 Traffic Data 5
3.2.3 Ground Attenuation 6
3.2.4 Parameter Conversion 6
4 RESULTS 6
4.1 Noise Monitoring 6
4.2 Noise Modelling 8
5 ASSESSMENT 11

List of Tables

Table 2-1 Outdoor Noise Criteria 3
Table 3-1 Noise Relationship Between Different Road Surfaces 5
Table 4-1 Measured Average Noise Levels – Monitoring Locations 6

List of Figures

Figure 1-1 Subject Site Locality 1
Figure 1-2 Proposed Subdivision Plan 2
Figure 3-1 Logger Location 4
Figure 3-2 Photograph of Noise Logger on Site 4
Figure 4-1 Noise Monitoring Results 7
Figure 4-2 Existing $L_{Aeq(Day)}$ Noise Contour Plot 9
Figure 4-3 Future $L_{Aeq(Day)}$ Noise Contour Plot: Roadside POS 10

Appendices

A Terminology

1 INTRODUCTION

It is proposed to subdivide Lot 1 (303) Corfield Street in Gosnells into residential and commercial use with *Figure 1-1* providing the general locale of the site and *Figure 1-2* the proposed layout. The proposed layout shows commercial properties and public open space (POS) closest to Corfield Street with residences set-back some 100 metres.

Corfield Street currently carries around 17,000 vehicles per day and this is expected to increase to around 25,000 vehicles per day in the future. As such, the City of Gosnells has requested a Transport Noise Assessment to be undertaken against the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*.

Figure 1-1 Subject Site Locality

Appendix A contains a description of some of the terminology used throughout this report.

Figure 1-2 Proposed Subdivision Plan

2 CRITERIA

The criteria relevant to this assessment is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC). The objectives in the Policy are to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- Protect major transport corridors and freight operations from incompatible urban encroachment;
- Encourage best practice design and construction standards for new development proposals and new or redevelopment transport infrastructure proposals;
- Facilitate the development and operation of an efficient freight network; and
- Facilitate the strategic co-location of freight handling facilities.

The Policy's outdoor noise criteria are shown below in *Table 2-1*. These criteria applying at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2-1 Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(Day)}$	60 dB $L_{Aeq(Day)}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

Note: The 5 dB difference between the target and limit is referred to as the margin.

In the application of these outdoor noise criteria to new noise sensitive developments, the objectives of this Policy is to achieve -

- acceptable indoor noise levels in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- a 'reasonable' degree of acoustic amenity in at least one outdoor living area on each residential lot.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken at 1-metre from the existing building on the site (refer *Figures 3-1 & 3-2*) in order to:

- Quantify the existing noise levels;
- Determine the differences between different acoustic parameters ($L_{A10,18hour}$, $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$); and
- Calibrate the noise model for existing conditions.

The instrument used was an ARL Type 316 noise data logger, located 16 metres from the edge of the road, with the microphone 1.4 metres above ground level. The logger was programmed to record hourly L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels. This instrument complies with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. The logger was field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics also holds current laboratory calibration certificate for the loggers.

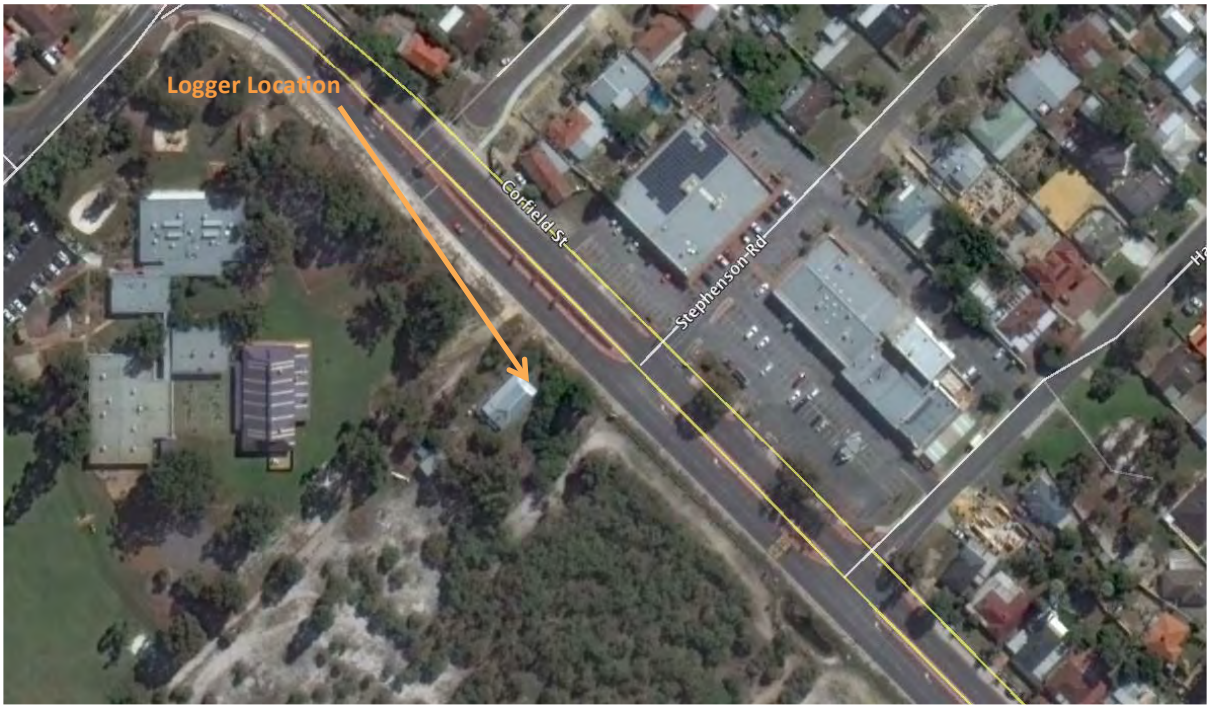


Figure 3-1 Logger Location

Figure 3-2 Photograph of Noise Logger on Site

3.2 Noise Modelling

The computer programme *SoundPLAN 7.4* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered. Note that corrections are applied to the exhaust of –8.0 dB (based on Transportation Noise Reference Book, Paul Nelson, 1987) and to the engine source of –0.8 dB, so as to provide consistent results with the CoRTN algorithms for the no barrier scenario.

Predictions are made at heights of 1.4 metres above ground floor level and at 1.0 metre from an assumed building façade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Some topographical data was already on file, so this was combined with that provided by Planning Solutions for the site itself.

Buildings have also been included as these can provide barrier attenuation when located between a source and receiver, in much the same way as a hill or wall provides noise shielding. The commercial properties are assumed to be double storey with a height of 7.0 metres, whereas all houses are assumed to be single storey buildings with a height of 4.0 metres.

Finished lot levels were not available at the time of this study so were assumed to be at existing ground.

3.2.2 Traffic Data

Traffic data includes:

- Road Surface – The noise relationship between different road surface types is shown below in *Table 3-1*.

Table 3-1 Noise Relationship Between Different Road Surfaces

Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

The existing road surface is dense graded asphalt and this is assumed to remain in the future.

- Vehicle Speed – The existing and future posted speeds are 60km/hr.
- Traffic Volumes – Existing traffic counts were obtained from Main Roads Western Australia where in October 2014, north of Tonkin Highway, there were 16,697 vehicles per day, with 6% of these being heavy vehicles.

  From the City of Gosnells Noise Guidelines Document, the forecast traffic volumes in this area are 25,000 vehicles per day. The percentage heavy vehicles are assumed to remain unchanged.

3.2.3 Ground Attenuation

The ground attenuation has been assumed to be 0.1 (10%) for the road, 0.6 (60%) throughout the subdivision, except for the public open space, which was set to 1.00 (100%). Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The WAPC Policy however uses $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles).

As noise monitoring was undertaken, the relationship between the parameters is based on the results of the monitoring – refer *Section 4.1*.

4 RESULTS

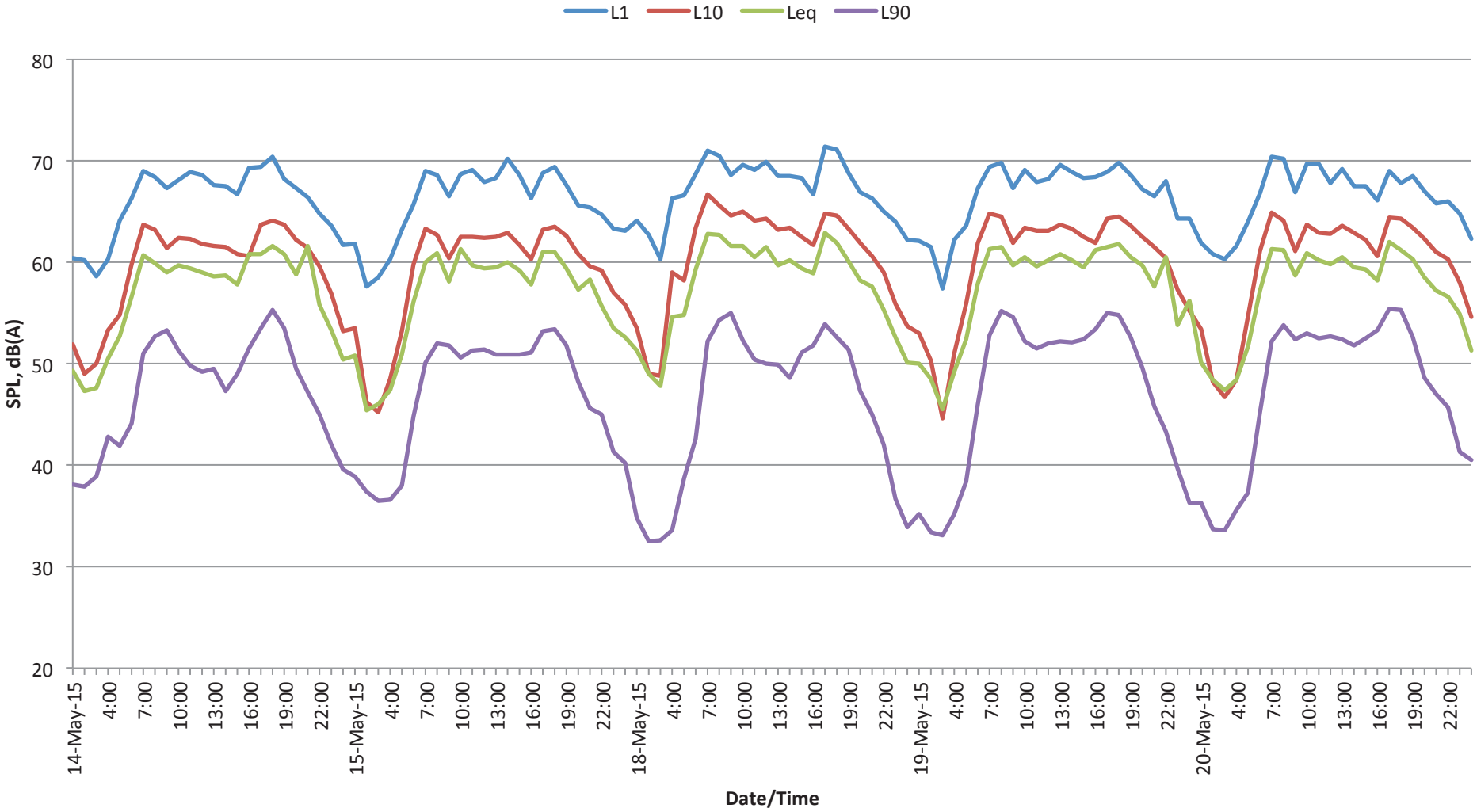
4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4-1* and shown graphically in *Figure 4-1*.

Table 4-1 Measured Average Noise Levels – Monitoring Locations

Date	Average Weekday Noise Level, dB			
	$L_{A10,18hour}$	$L_{Aeq,24hour}$	$L_{Aeq\ (Day)}$	$L_{Aeq\ (Night)}$
Thursday 14 May 2015	61.3	58.4	59.8	52.0
Friday 14 May 2015	61.3	58.1	59.5	51.7
Monday 14 May 2015	62.5	59.4	60.7	54.0
Tuesday 14 May 2015	62.3	59.1	60.5	53.4
Wednesday 14 May 2015	62.1	58.6	60.0	52.5
Average	**61.9**	**58.7**	**60.1**	**52.7**

Figure 4-1 Noise Monitoring Results



The average differences between the weekday $L_{A10,18hour}$ and $L_{Aeq(Day)}$ is 1.8 dB and this conversion has been used in the modelling. The average differences between the weekday $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is 7.4 dB. This same difference has been assumed to exist in future years. As such, it is the daytime noise levels that will dictate compliance since these are at least 5 dB more than night-time levels.

4.2 Noise Modelling

The noise modelling results are provided for the following scenarios:

- Figure 4-2: Existing $L_{Aeq(Day)}$ Noise Levels
- Figure 4-3: Future $L_{Aeq(Day)}$ Noise Levels