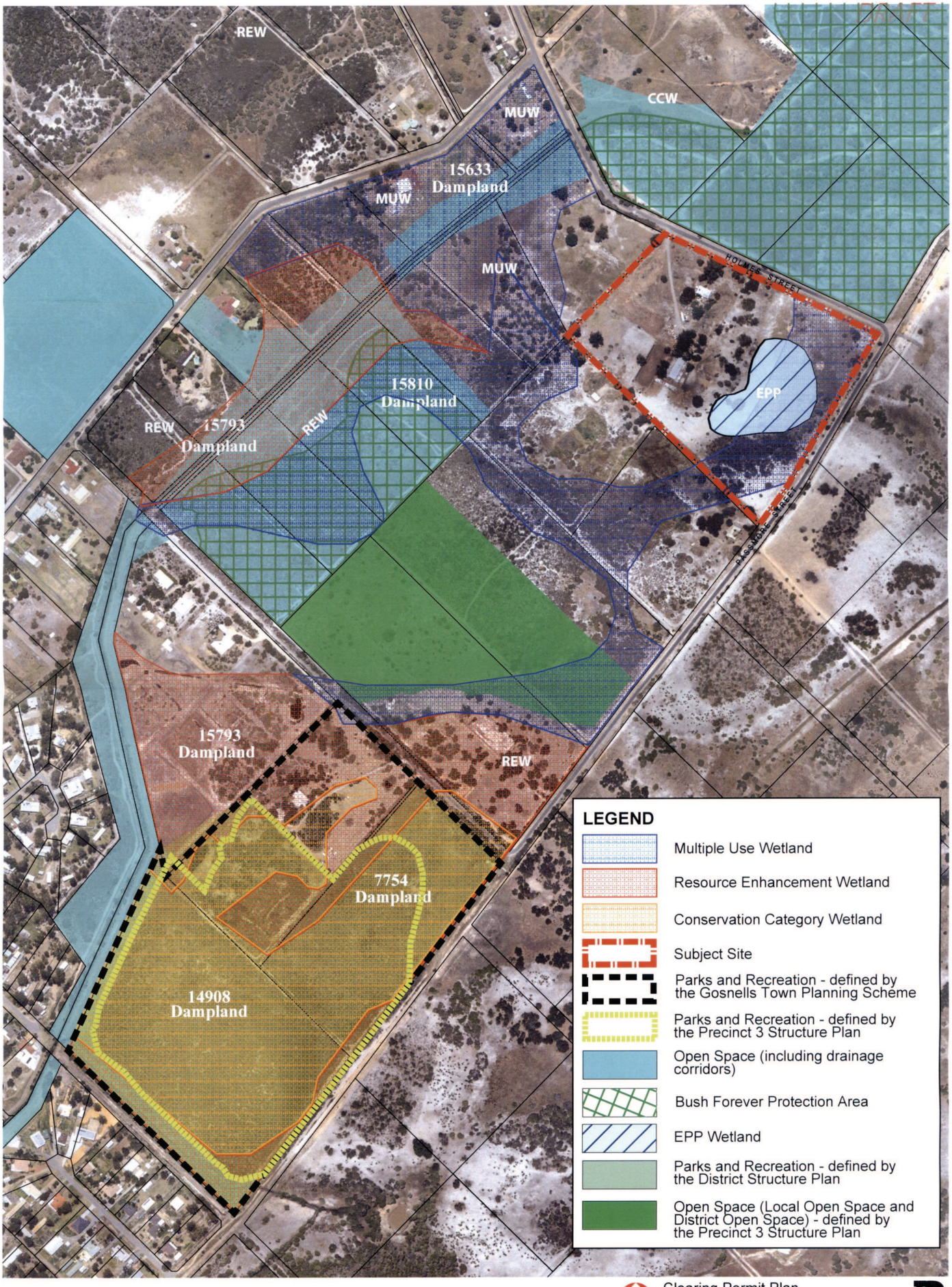
APPENDIX A
Clearing Permit Plan



Clearing Permit Plan

Lot 1792 Holmes Street
Southern River

Date: 7 August 2013
Designer: CH
Scale: NTS @ A3
Drawn: CH
Drawing No: 710-085 CP1A Overlapping Zoning 230812.ai

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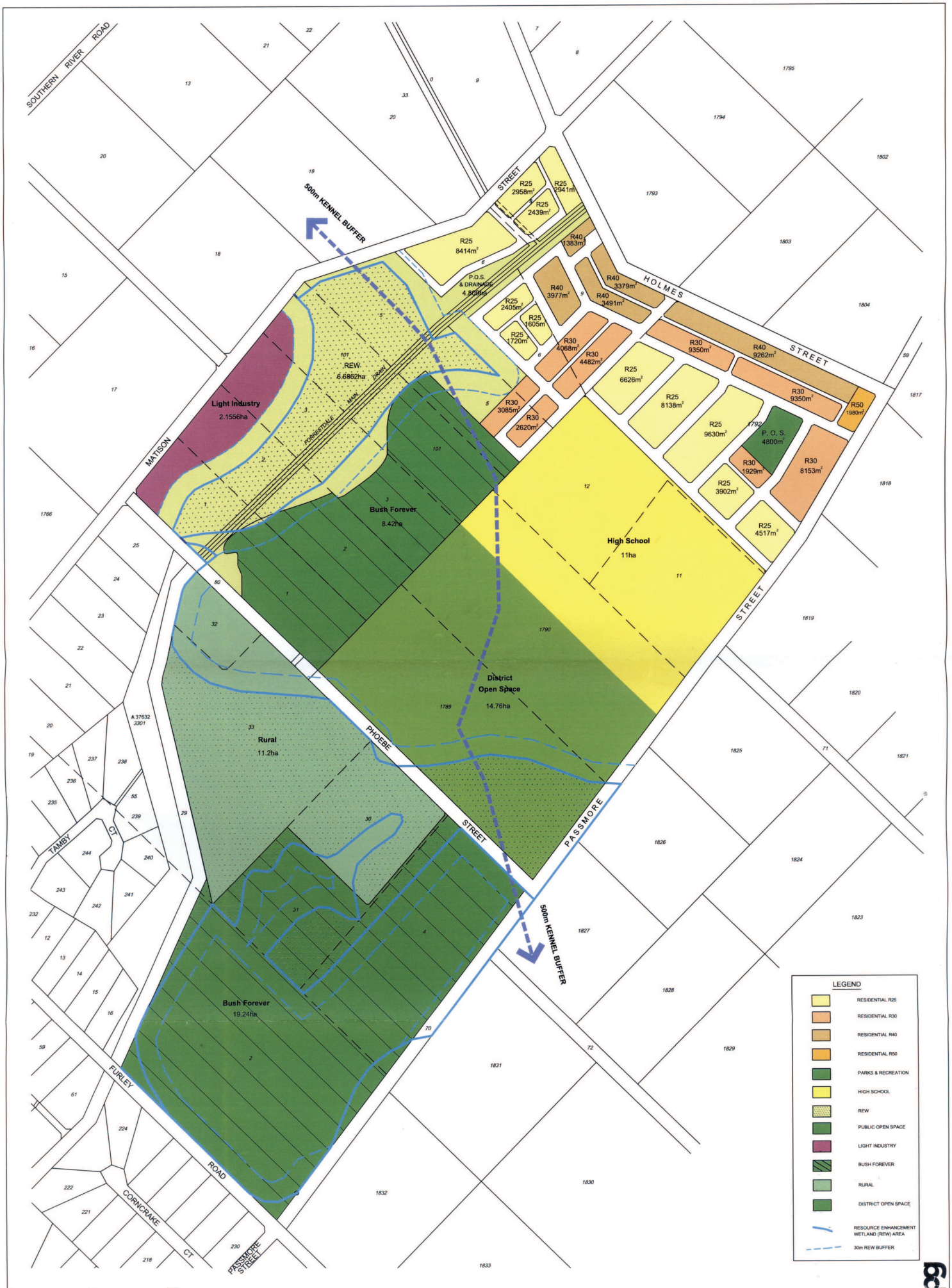
APPENDIX B

Southern River Precinct 3D ODP



SOUTHERN RIVER SUB-PRECINCT 3D O.D.P.

APPENDIX C

Environmental Impact Assessment

Bioscience

ENVIRONMENTAL IMPACT ASSESSMENT

PRECINCT 3D

SOUTHERN RIVER

Integrating Resource Management

TABLE OF CONTENTS

TABLE OF FIGURES

1. INTRODUCTION

1.1. Background

Town Planning Group and Dynamic Planning Solutions has commissioned Bioscience to undertake an Environmental Assessment of Lots 1, 4, 30-33, 1789 Phoebe Street, Lots 1-6, 8 Matison Street, Lots 9, 1792 Holmes Street, Lots 11-12, 1790 Passmore Street and Lot 2 Furley Road as part of the Southern River Precinct 3D. The purpose of which is to assess any potential environmental constrains for land development.

The subject site consists of 19 lots totalling 100 ha. It is located approximately 18 km from Perth CBD and around 20km from the coast. The land is generally being used for grazing of horses and has done so for over 30 years.

Figure 1: Location of subject site

Existing infrastructure within the subject area includes a house and sheds on Lots 2, 3, 6, 8 Matison Street and Lots 30 and 32 Phoebe Street. Infrastructure within lots 9 and 1792

Holmes Street and lots 11-12 Passmore Street include some dilapidated sheds with a building slab within lot 11. The remaining lots have no existing infrastructure.

1.2. Scope of Works

This report is in accordance with the Environment Protection Authority (EPA) *Guidance Statement Number 33 – Environmental Guidance for Planning and Development* (2008). The aim of which is to identify the biophysical factors that may impede rezoning and land development, pollution management issues and issues relating to aesthetic, cultural and social surroundings of the land.

An Environmental Assessment (EA) of Lots 1, 4, 30-33, 1789 Phoebe Street, Lots 1-6, 8 Matison Street, Lots 9, 1792 Holmes Street, Lots 11-12, 1790 Passmore Street and Lot 2 Furley Road Southern River has been commissioned by Town Planning Group and Dynamic Planning Solutions on behalf of landowners for rezoning and residential development as part of the City of Gosnells Precinct 3D.

The objectives of the EA are to:

- Provide information on key environmental characteristics within the subject site and surrounding area
- Identify the environmental factors and constraints that affect the development of the subject site
- Recommend appropriate management strategies to maximise development whilst protecting environmental functions, values, and attributes
- Identify any relevant permissions or approvals required for development of the subject area

The scope of the EA is as follows:

- Review of surrounding land uses and compatibility
- Identify site soils, potential/actual Acid Sulfate Soils (ASS), geology and geomorphology

- Identify any Aboriginal or European heritage via search on relevant databases.
- Ecological features of significance
- Surface and groundwater hydrology with consideration of local catchment, wetlands and water bodies
- Potential nuisance insects
- On site hydrological and soil assessment
- Level 1 on site assessment of flora and fauna

2. PLANNING AND POLICY

The following State, District and Local planning documents are relevant to the subject area:

- State Planning Strategy (WAPC, 1997)
- Metropolitan Region Scheme (MRS) (WAPC, 2011)
- City of Gosnells Town Planning Scheme No. 6 (TPS6) (WAPC, 2010)
- Southern River Precinct 3 Structure Plan (City of Gosnells, 2008)

The subject area is currently zoned "Urban Deferred" as per the MRS updated 01 February 2011, and "General Rural" with surrounding adjacent land also zoned "General Rural" under the City of Gosnells Town Planning Scheme No. 6 updated 22 October 2010 (Figure 1).

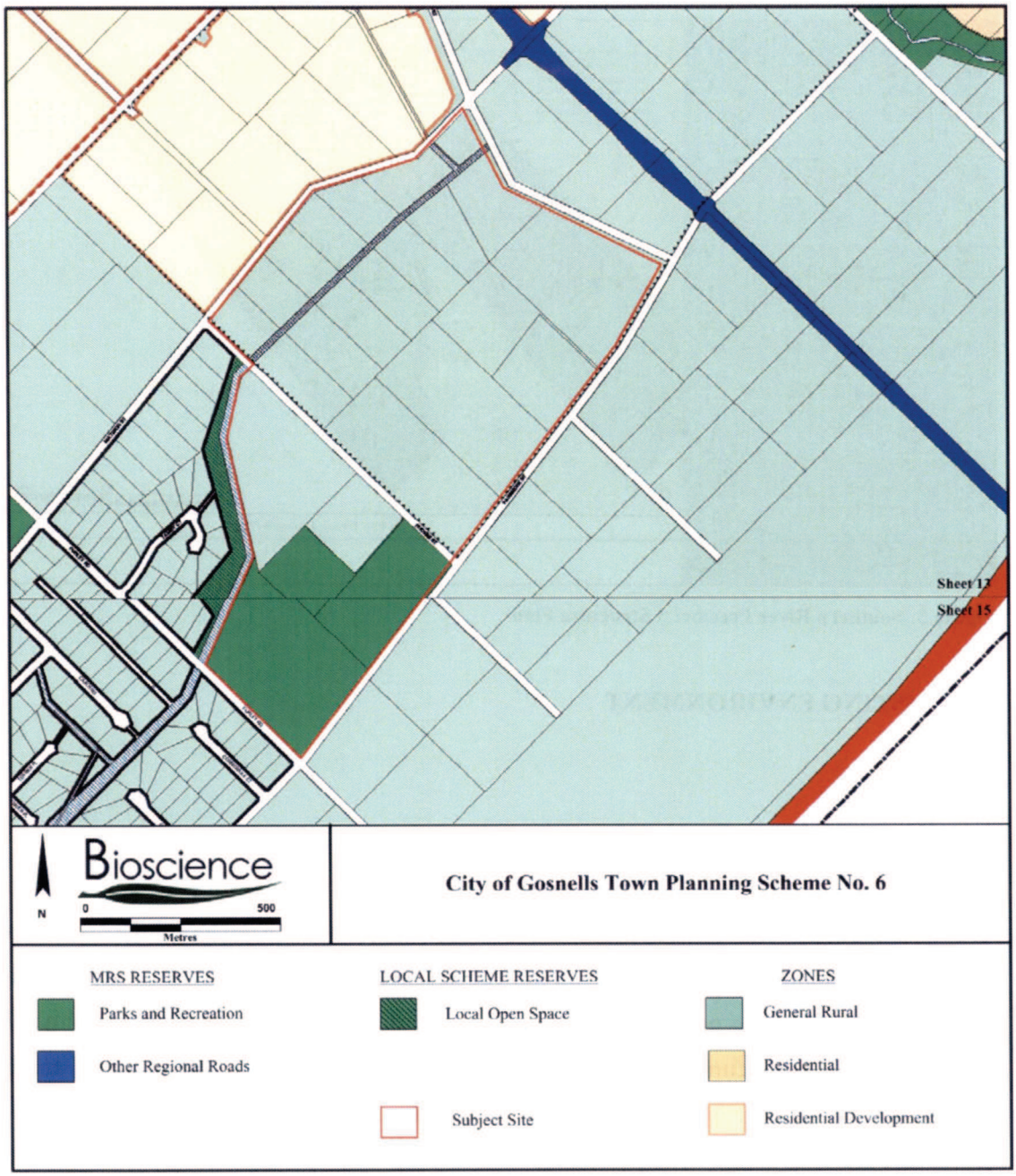


Figure 2: City of Gosnells Town Planning Scheme No. 6

Under the Southern River Precinct 3 Structure Plan (2008) the subject area is zoned "Residential", "Community Purpose (High School)", "Open Space", "Wetlands including Buffers" (REW), "Wetlands including Buffers" (EPP Lake), "Bush Forever protection area", "General Rural" and "Widening Required for Forrestdale Main Drain" (Figure 3).

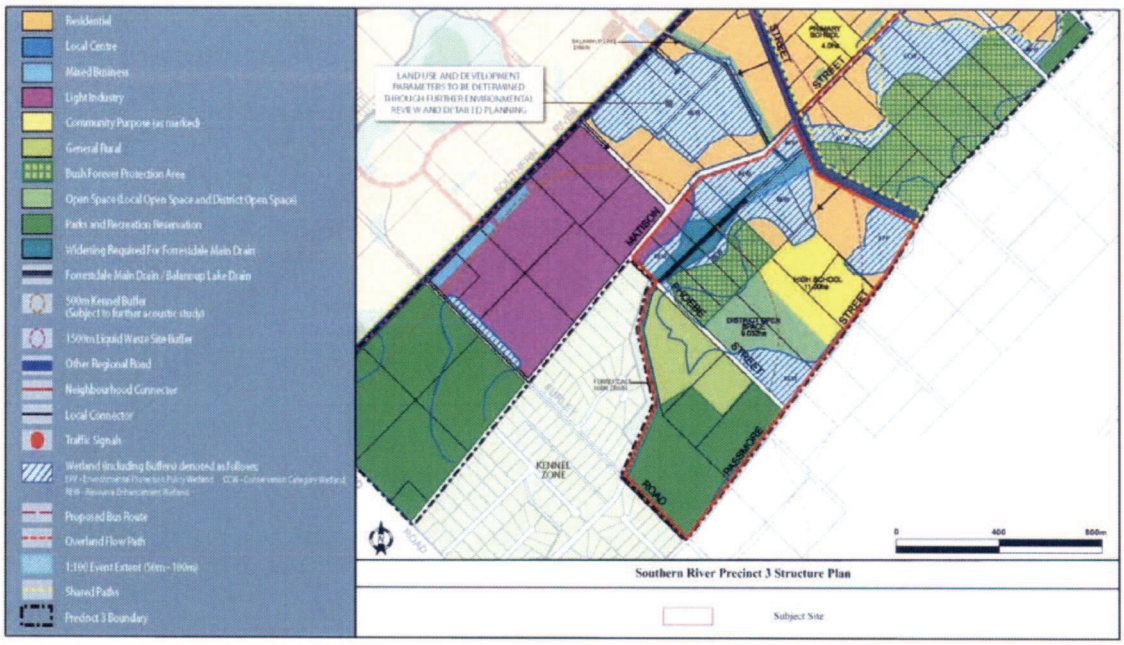


Figure 3: Southern River Precinct 3 Structure Plan

3. EXISTING ENVIRONMENT

3.1. Climate

The south west of Western Australia is characterised by a Mediterranean climate comprising hot dry summers and cool wet winters. According to the Bureau of Meteorology (BoM) the average annual rainfall within the vicinity of the proposed development is 825mm (Gosnells City No. 009106). The monthly distribution of rainfall (Figure 4) indicates approximately 79% of the rainfall occurs during the months of May to September. The potential annual evaporation of the area is 1800 mm, which is significantly more than annual precipitation (Davidson and Yu, 2006). The prevailing wind is from a south-westerly direction, however easterly winds common, particularly in the summer months.

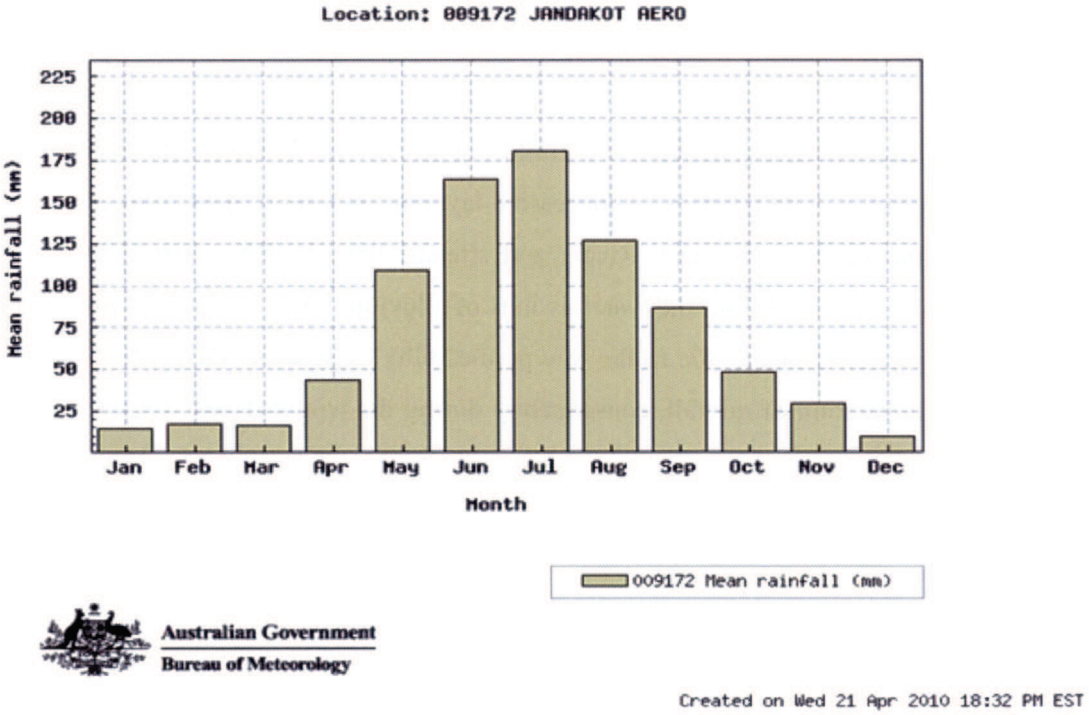


Figure 4: Mean annual rainfall

3.2. Geology Geomorphology and Soils

3.2.1. Geology

According to the Department of Mines and Petroleum (DoMP) geological mapping of Western Australia (1:500 000) (DoMP, 2009) the subject area is within the Coolyena group. The Coolyena group is a sedimentary siliciclastic rock type described as undivided; chalk, greensand, glauconitic sandstone, siltstone, marl: characteristically glauconitic; which includes Osbourne and Lancelin formations; Molecap and Poison hill grasslands and Gin Gin chalk. The regolith consists of lacustrine deposits which include lakes, playas and fringing dunes.

3.2.2. Geomorphology and Soils

The subject site is located on the Swan Coastal Plain within the Bassendean dune system, an area characterised by low dunes of siliceous sand interspersed with poorly drained areas or

wetlands. Soils tend to be a deep bleached grey colour sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m.

Underlying the Bassendean formation is the Guildford formation. The soils of the Guildford formation are complex, and comprise a successive layering of soils formed from erosion of material from the scarp to the east. Rivers and streams have mostly carried the eroded material, which is deposited from the water as fans of alluvium. The Guildford formation is characterised by poor drainage due to the low permeability of sub-soil clays which prevent the downward infiltration of rainfall, consequently during the winter month's water logging and surface inundation can occur. In addition, the clay fraction of the Guildford formation is known to have highly variable Plasticity Indices (Hillman et al., 2003).

The geology at the site as per the Geological Survey of Western Australia 1:50000 (Gozzard, 1986) Environmental Geological Series Armadale Map part of sheet 2033 I and part of sheet 2133 IV is (Figure 5):

- 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 over sandy clay to clayey sand of the Guilford formation
- Sp1 – PEATY SAND – Grey to black, fine to medium grained, moderately sorted quartz sand, slightly peaty of lacustrine origin

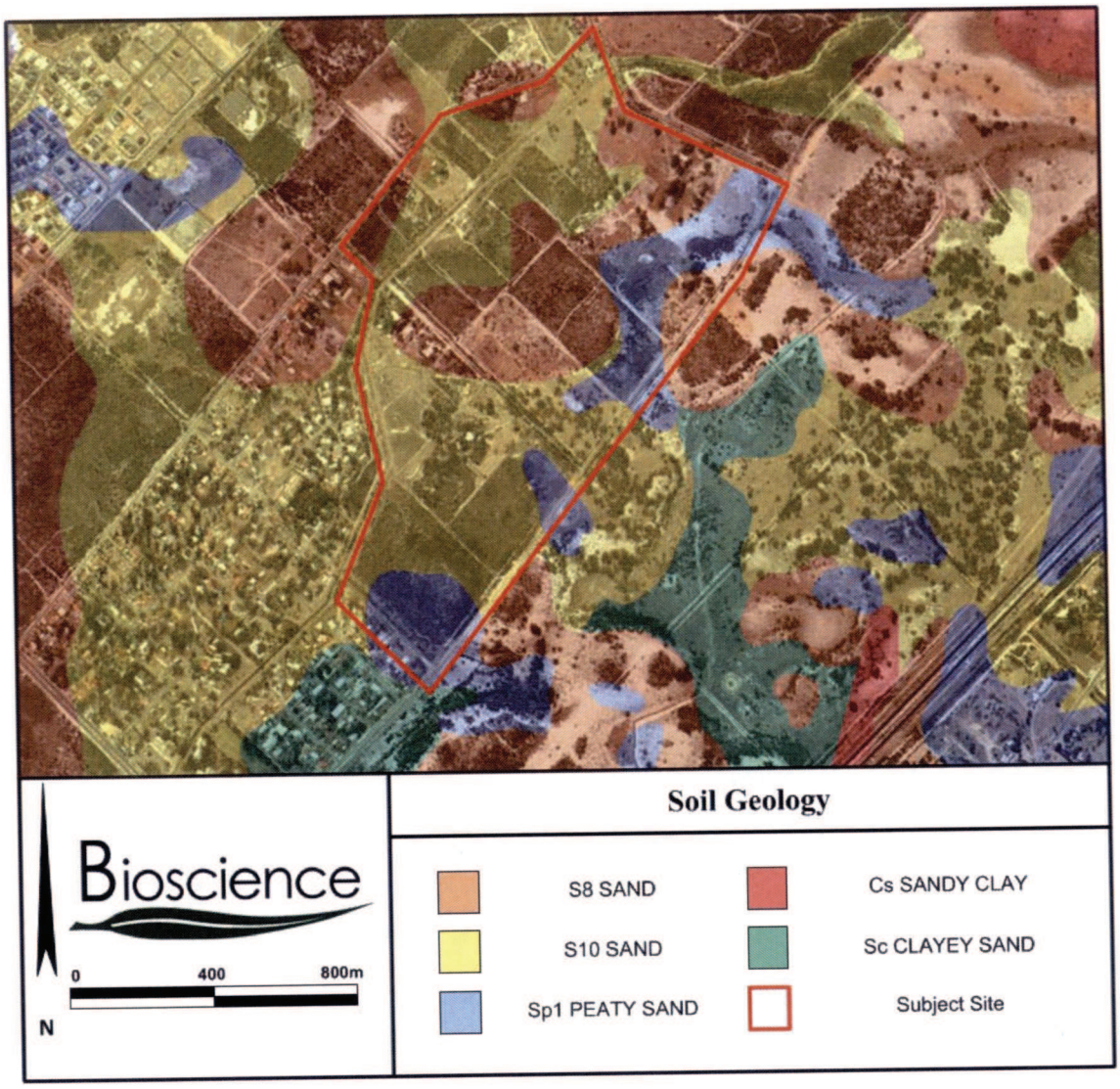


Figure 5: Soil Geology

3.3. Topography

The site is located on the Swan Coastal Plain to the east of the darling scarp. The topography of the site is gently undulating with low relief. The area generally lies around 22m AHD with some areas over 24m AHD (Figure 6).

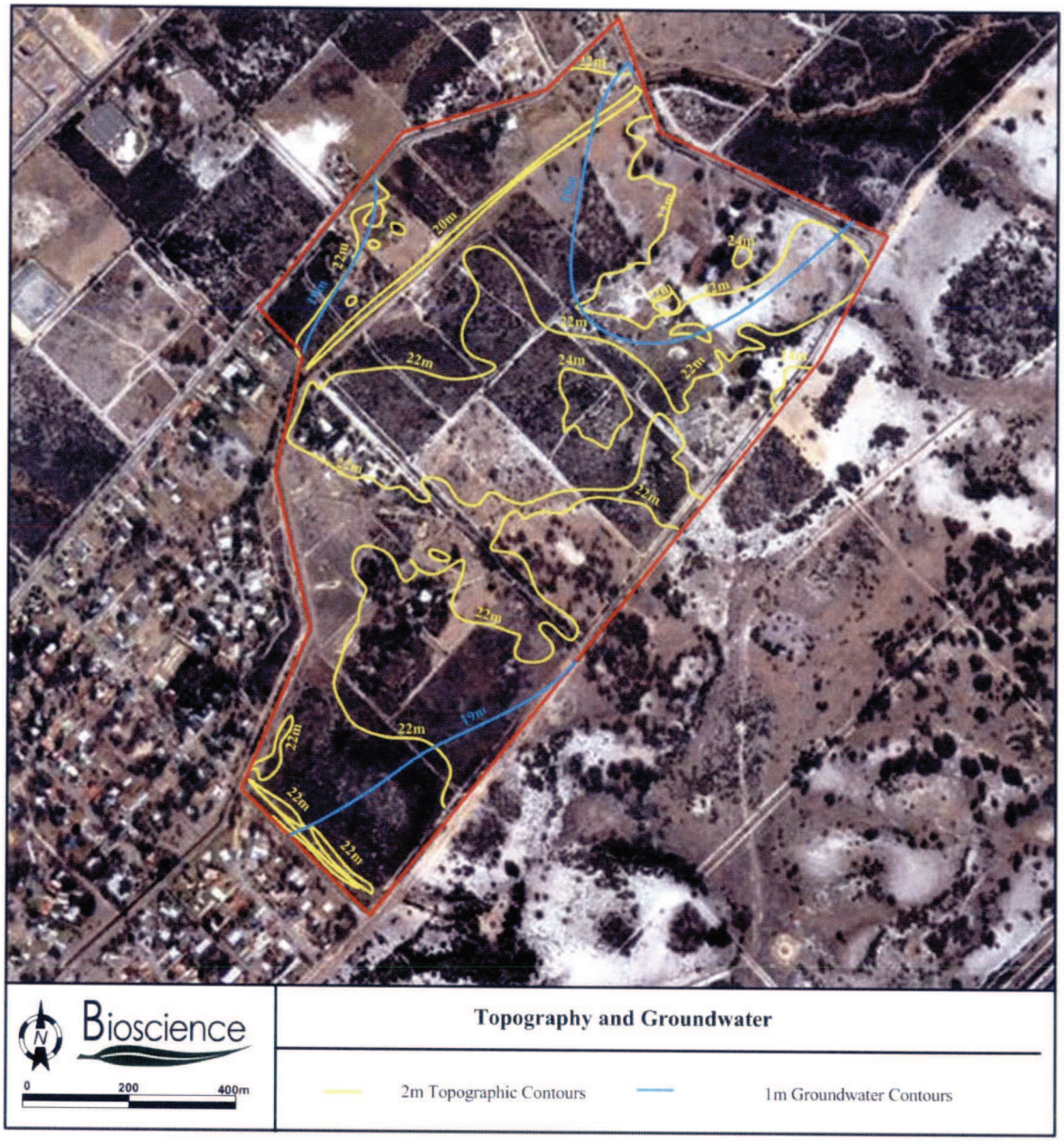


Figure 6: Topography and groundwater levels (DoE, 2004)

3.4. Vegetation and Flora

The study area is within the Swan Coastal Plain Biogeographic Region of the South-west Botanical Province (Thackway and Cresswell, 1995, Paczkowska and Chapman, 2000), an area that extends from Jurien Bay to the north to Dunsborough to the south, and west of the Darling Scarp. Historically this biogeographic region has been extensively cleared for both urban and agricultural purposes.

The subject site has around 60 percent remnant bushland. The remaining area has been cleared for building envelopes and grazing for horses and as such generally contains introduced grasses. A large percentage of the bushland areas belong to Bush Forever sites 340 and 465 and contain a combination of *Eucalyptus* and *Banksia* woodland.

Bioscience conducted a modified Environmental Protection Authority's Guidance 51 Vegetation Survey (EPA, 2004) Level 1 flora and vegetation assessment which consisted of both desktop assessment and site investigation as outlined below:

A desktop study of potential rare and endangered flora and ecological communities listed under the *Wildlife and Conservation Act 1950* and *EPBC Act 1999* was undertaken by analysis of the following databases:

- *NatureMap*: Western Australia's biodiversity online mapping (DEC, 2011)
- *Florabase*: WA Herbarium guide to Western Australian Flora online (Western Australian Herbarium, 1998)
- *Protected Matters*: National Environmental Significance online mapping (DoSEWPaC, 2010)

A site investigation of all flora and vegetation units present was conducted by Bioscience however the vegetation was largely degraded such that the protocols for a Level 1 or a Level 2 EPA Guidance 51 assessment could not be applied. Accordingly Bioscience undertook a modified vegetation survey of the subject land involving a careful walk-through of all areas containing native vegetation to document all species present.

3.4.1. Flora of Conservation Significance

A search on DEC's NatureMap online indicated that 1 Declared Rare Flora (DRF) and 8 Priority flora exist within 3km of the centre of the subject site (32° 06' 31 S, 115° 58' 12 E) (Appendix A). Of those Rare and Priority flora one is listed under the EPBC Act 1999 as Endangered.

Table 1: DRF and Priority Flora within search area

Species	DEC Conservation Code	EPBC Act Category
Acacia benthamii	P2	-
Aponogeton hexatepalus	P4	-
Austrostipa jacobsiana	P1	-
Byblis gigantea	P3	-
Caladenia huegelii	DRF	Endangered
Eremaea asterocarpa subsp. brachyclada	P1	-
Stenanthemum sublineare	P2	-
Thysanotus glaucus	P4	-
Verticordia lindleyi subsp. lindleyi	P4	-

No DRF or Priority flora was identified within the subject area during site visits, however this is not to say that there is none present as the survey was not conducted during spring whilst plants are flowering more identifiable. Due to the degraded state of the subject area it is unlikely that any DRF or Priority flora is present due to their fragile and specific nature.

3.4.2. Vegetation Complexes and Floristic Community Types

The site varies from parkland cleared to bushland. The site includes three Bush Forever Sites. Bush Forever site 340 located within lots 1-4, site 464 located along the north-eastern boundary on the opposite side of Holmes Road and site 465 located within lots 4, 31 Phoebe Street and 2 Furley Street (Figure 7); depict the likely vegetation complexes that once resided within the property. According to the *Bush Forever* site description (from *Bush Forever* Volume 2 Government of WA 2000) the Southern River complex exists within sites 340, 465 and 464.

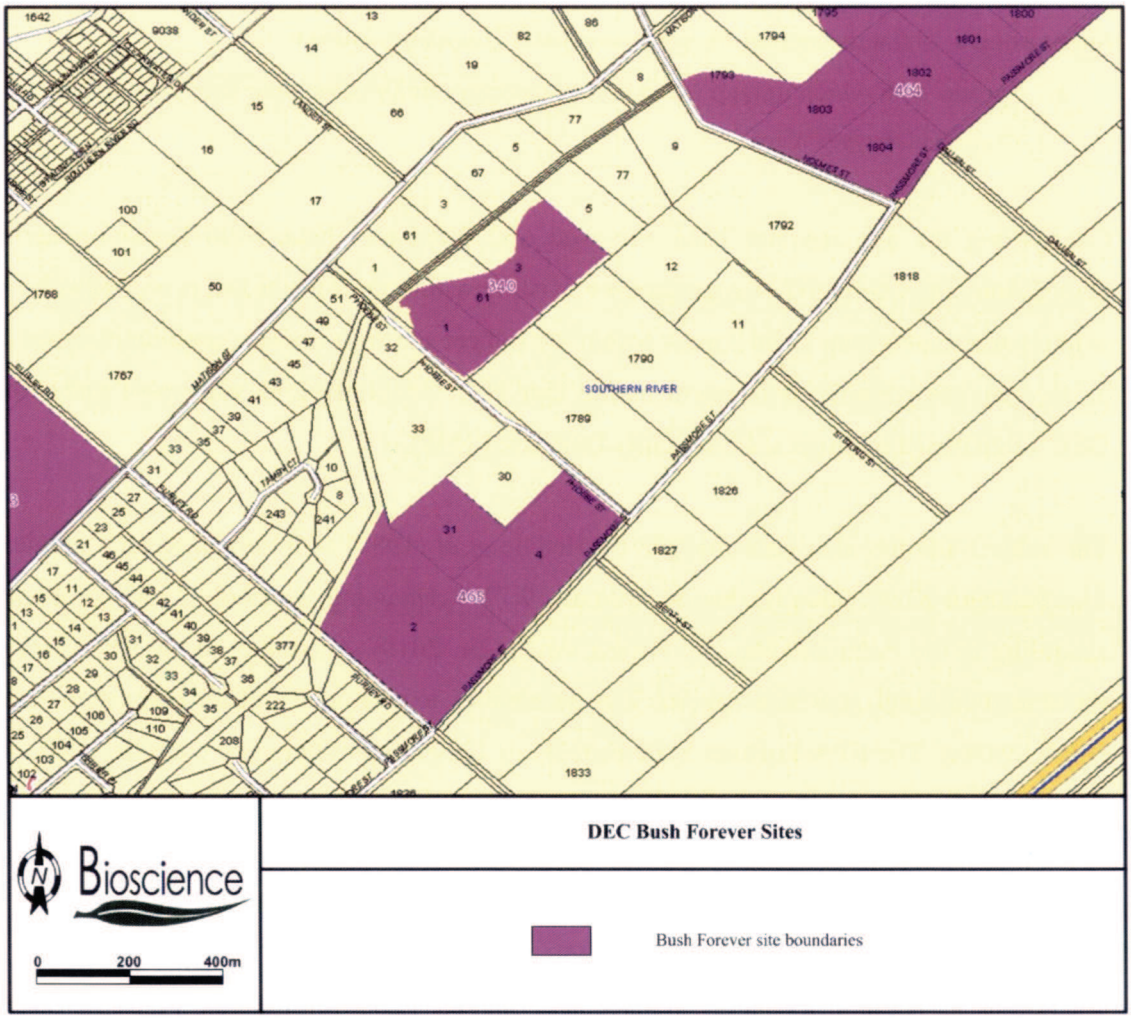


Figure 7: DEC Bush Forever site locations

In addition to the vegetation complexes the *Bush Forever* site description, describes that six Floristic Communities Types (Gibson et al., 2000) within three supergroups are likely to reside within the site; including,

Supergroup 2: Seasonal Wetlands

- *4 *Melaleuca preissiana* damplands
- *5 Mixed shrub damplands
- *8 Herb-rich shrublands in clay pans
- *15 Forests and woodlands of deep seasonal wetlands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

- *23a Central *Banksia attenuata — B. menziesii* woodlands

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

- *group with which upland Muchea Limestone communities have been associated

*Not sampled, types inferred

Considering the site has not been surveyed and inferences have been based on aerial photography the likelihood of supergroup 4 existing within the subject site is not unlikely. It is likely that supergroup 2 and 3 exist within the subject site with floristic community types 4, 5, 15, and 23a possible. It is worth noting that FCT: 15 is listed as vulnerable under the DEC's threatened Ecological Community Database (2010).

The subject site has also been mapped by Heddle *et al* (1980) as Southern River Complex. The Southern River Complex has as little as 19.72% remaining with only 2.18% protected according to the Perth Biodiversity Project (WALGA, 2010). According to the EPA 30% is the threshold level at which species loss accelerates exponentially at an ecosystem level (EPA, 2000a). The EPA Position Statement No. 2 (2000a) considers any complex <30% as 'Endangered'.

3.4.3. Vegetation of Conservation Significance

According to Natural Resource Management Shared Land Information Platform online (NRM, 2008) a Threatened Ecological Community exists within Bush Forever Site 465 however no other TECs are located within the remaining site.

3.4.4. Adjacent Off Site Vegetation

The adjacent off site vegetation includes variations of *Eucalyptus* and *Banksia* woodland/shrubland and semi-cleared rural lots urban to the north, variations of *Eucalyptus* and *Banksia* woodland and cleared pastureland to the east, variations of *Eucalyptus* and *Banksia* woodland/shrubland and semi-cleared rural lots to the south, and cleared pastureland, urban and *Eucalyptus* and *Banksia* woodland to the west. The area to the north is part of the Precinct 3 development plan and as such will become a combination of residential, light industrial, community purpose as well as Parks and Recreation, Open Space and Forrestdale Main Drain which will create an ecological link to Southern River.

3.4.5. Recommendations

It is recommended that where possible native bushland be retained and incorporated into the development as POS and landscaping. Additional consideration must be made to avoid impacts such as; inappropriate recreation, dumping, fire, and invasive species that may affect Bush Forever site 465 containing a Threatened Ecological Community. Many of these threats can be controlled with adequate fencing and creation of footpaths.

3.5. Fauna

A desktop of potential rare and endangered fauna listed under the *Wildlife and Conservation Act 1950* and *EPBC Act 1999* was undertaken by analysis of *NatureMap:* Western Australia's biodiversity online mapping (DEC, 2011).

A site investigation was conducted by Bioscience for the presence of rare and endangered fauna and fauna habitat. Fauna survey of the subject land involved a careful walk-through of the subject area documenting all native species present as well as presence of fauna habitat.

3.5.1. Fauna of Conservation Significance

Native Fauna within Western Australia are protected under the *Wildlife and Conservation Act 1950* however greater protection is placed on fauna considered rare or threatened. Australia has also signed agreements with China (CAMBA) and Japan (JAPAN) for protection of migratory birds and migratory bird habitat. The DEC classifies rare native fauna under 6 conservation codes.

A search on DEC's *NatureMap* online indicated that 1 Threatened and 1 Priority fauna exists within 3km of the centre of the subject site (32° 06' 31 S, 115° 58' 12 E). Of the Threatened and Priority fauna one is listed under the EPBC Act (1999) as Endangered.

Table 2: Threatened and Priority Fauna within search area

Species	DEC Conservation Code	EPBC Act Category
Calyptorhynchus latirostris (Carnaby's Cockatoo)	T	Endangered
Isoodon obesulus ssp. fusciventer (Southern Brown Bandicoot, Quenda)	P5	-

The Carnaby's Cockatoo is endemic to southwest Western Australia and require a habitat comprising of both *Eucalyptus* woodland and shrubland or kwongan heath close assemblage within the wheatbelt (breeding grounds) as well as Eucalyptus, Banksia, Casuarina, Pinus woodlands along the coast (feeding grounds). The subject area contains Eucalyptus and Banksia woodlands which may provide habitat for the Carnaby's Cockatoo.

The Southern Brown Bandicoot or Quenda is found in dense scrubby, often swampy vegetation with dense cover up to 1m in height. They nest in a heap of ground litter over a shallow depression and are omnivorous feeding on almost anything with a seasonally changing diet as different foods become available. CALM (now DEC) conducted a ground fauna trapping program (Licence SF005124) for Precinct 3 during October 2005 in which 19 Quenda's were captured over 9 days. It is highly likely that Quenda's inhabit the subject area particularly areas left uncleared.

3.5.2. Recommendations

According to EPA's *Guidance Statement Number 33 – Environmental Guidance for Planning and Development* (2008), fauna is best protected by retaining bushland areas. It is recommended that native bushland be retained where possible to provide essential habitat to local threatened fauna such as the Carnaby's Cockatoo and Quenda.

3.6. Hydrogeology, Surface Water and Drainage

3.6.1. Groundwater

According to Davidson and Yu (2006) the study area appears to be located within the Jandakot Mound, which is bounded to the north by the Swan and Canning Rivers, to the east by Southern River and Byford superficial aquifer, to the south by the Karnup Drain and to the west by the Ocean. Given this mapping was conducted on a regional scale the actual hydrogeology of the site may be rather complex.

The majority of groundwater recharge like other areas within the Swan Coastal Plain, results from rainfall infiltration, however additional recharge results from rainwater runoff from the Darling Scarp (Davidson and Yu, 2006). An estimated annual recharge of up to 24% is relatively high for the Swan Coastal Plain and due in part to high hydraulic conductivity of the Bassendean sands and the shallow water table.

The Jandakot Mound has a transmissivity ranging from 200 - 1000m^2/day, an average annual fluctuation of approximately 0.64m and ultimately discharges into either the Swan River (15150 m^3/day), Canning River (7000 m^3/day), the Ocean (66450 m^3/day), Karnup Drain (1700 m^3/day), Southern River (3000m^3/day) or Lake Forrestdale (6200m^3/day).

According to the Department of Environment's (DoE's) *Perth Groundwater Atlas* (DoE, 2004) the site is characterised by having a high groundwater table with low salinity (1000 - 3000mg/L). Groundwater levels at the site in May 2003 (minimum) were around 18m - 19m ADH (Figure 4). The all time maximum groundwater levels for the site are around 22m ADH.

3.6.2. Surface Water and Drainage

3.6.2.1. Wetlands

The Geomorphic Wetlands Dataset displays the location, boundary, geomorphic classification and management category of wetlands on the Swan Coastal Plain. The information contained within the dataset was originally digitised from the *Wetlands of the Swan Coastal Plain Volume 2B Wetland Mapping, Classification and Evaluation: Wetland Atlas*, which was captured at a scale of 1:25,000 (Hill et al. 1996b). According to the dataset the subject area consists of thee Multiple Use Wetlands (MUW) (15633 Dampland, 15792 Dampland, and 15810 Dampland), one Resource Enhancement Wetland (15793 Dampland) and two Conservation Category Wetlands (14988 Dampland, 7754 Dampland). Some southern parts of the area form part of the Directory of Important Wetlands Australia (DIWA) Gibbs Road Swamp System (Figure 7).

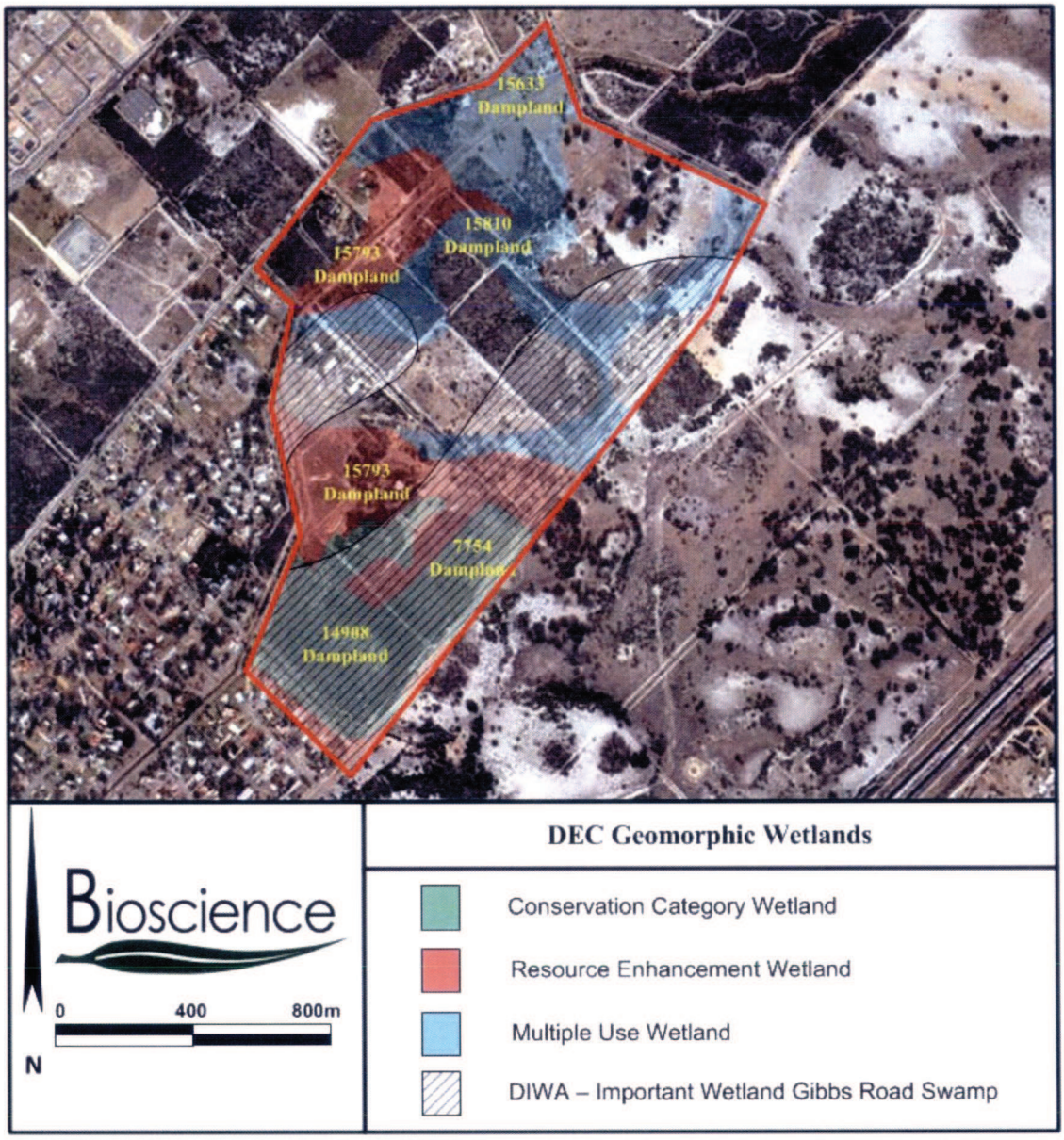


Figure 8: Wetland Classification

3.6.2.2. Lakes

Around one third of lot 1792 is classified as an *Environmental Protection (Swan Coastal Plains) Policy* 1992 (EPP) lake (Figure 7) which is included in the City of Gosnells 2004 structure plan. EPP lakes are generally recognised as having significant conservation value; however this seems to contradict the current MUW classification in regards to both management category and boundaries. The lake also appears to be experiencing increasing dry periods as observed by aerial photography. Bioscience is preparing a request to have the

wetland removed from the EPP lakes register by following the guidance for modifying wetlands.

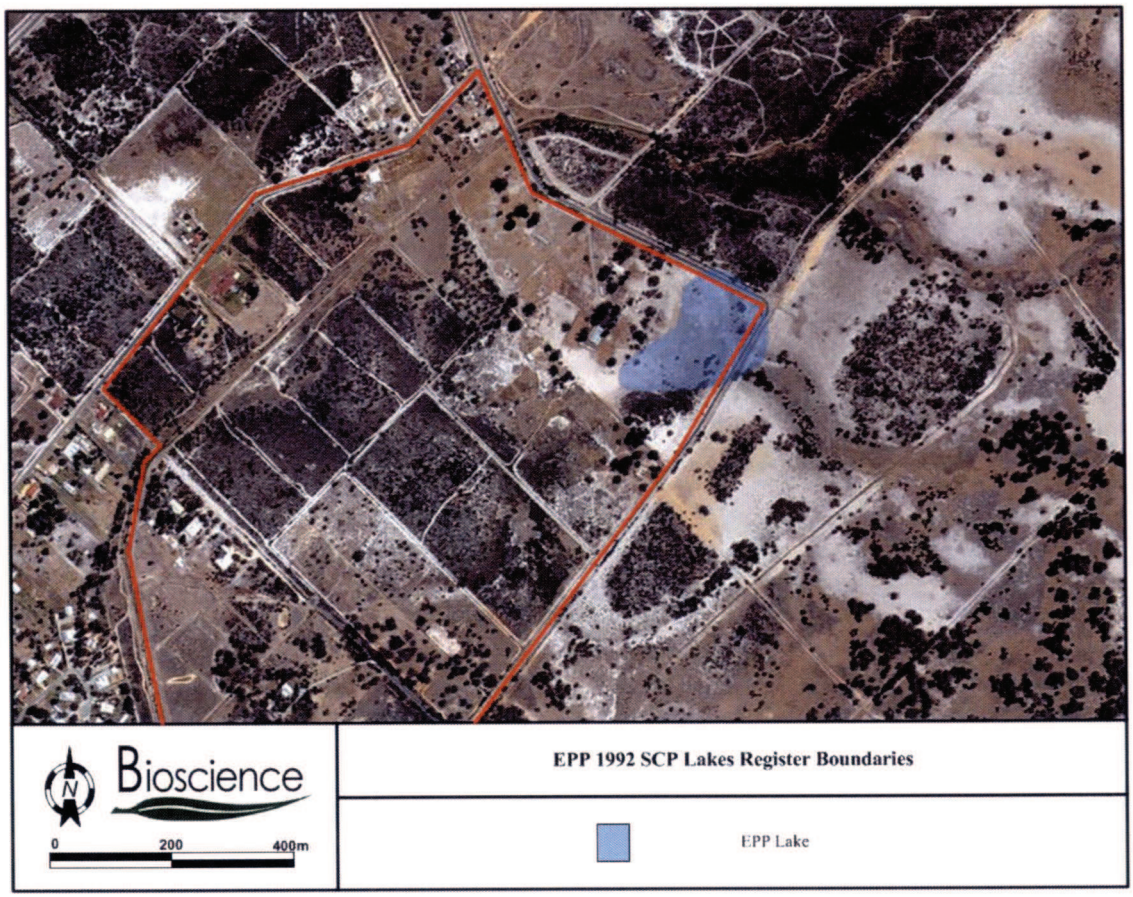


Figure 9: Environmental Protection Policy 1992 SCP Lakes

3.6.2.3. Drainage

The subject site is located within the Forrestdale Drain sub-catchment of the Swan-Avon Canning River catchment in the south west division. The Forrestdale Drain is a large sub-catchment extending south past Armadale Road and west almost to the Kwinana Freeway (Figure 8). The Forrestdale Main Drain runs from Forrestdale Lake and discharges into the Southern River.

Figure 10: Sub Catchments

3.6.3. Recommendations

A Local Water Management Strategy (LWMS) is currently being prepared by Bioscience. The LWMS will demonstrate that the development will be undertaken in a sustainable manner through total water cycle management in accordance with Water Sensitive Urban Design (WSUD) principles. These include water conservation, water quantity and quality, groundwater, stormwater, ecosystem health, protection of infrastructure, public health and social considerations. The LWMS will aim to:

- Identify possible impacts on local groundwater quality and quantity to ensure post-development conditions are equal to or better than pre-development conditions.
- Promote management of the urban water cycle as a single system in which all urban water flows are recognised as a potential resource and where the interconnectedness

of water supply, stormwater, wastewater, flooding, water quality, waterways, estuaries and coastal waters is recognised.

- Maximise the opportunities for compliance with best practice stormwater management including retention of stormwater on site/at the source.
- Promote use of water conservation mechanisms that increase the efficiency of the use of water.
- Identify site constraints and opportunities for the re-use and recycling of water.
- Conserve and/or re-vegetate local native vegetation to minimise water use and maximise filtration, particularly where landscaping is proposed.

Wetlands existing within the development are best conserved by the creation of buffer protection zones and retention and rehabilitation of remnant vegetation which can best be achieved through the preparation of a Wetland Management Plan.

The Forrestdale Drain that runs through the subject site can contribute some ecological and aesthetic value to the area with the implementation of "living stream" management. Living streams mimic the morphological and vegetative characteristics of natural streams whilst also treating stormwater via physical and biological processes (Appendix B). This will have the ability to enhance community recreational value and complement nearby Bush Forever site 340 by increasing habitat diversity.

3.7. Acid Sulfate Soils

Acid sulfate soils (ASS) are naturally occurring soils which contain iron sulfides, most commonly pyrite (DEC, 2009b). These soils can produce a variety of iron compounds and sulfuric acid conditions when exposed to air. The resulting low pH can release other substances such as heavy metals into the surrounding environment which potentially threatens the health of receiving ecological systems (DEC, 2009b). Minimising the disturbance of acid sulfate soils is recommended so as to prevent any detrimental impacts on the environment and its surroundings.

Disturbance risk is assessed on the basis of depth from natural ground-surface on the precept that most land development activities including drainage, excavations and dewatering

generally do not extend to greater than 3m below natural ground-level. The map includes areas where ASS risk has been predicted using available desk-top information and limited ground-truthing with areas where intensive on-ground mapping and soil analysis work has been carried out.

DEC has compiled maps of ASS risk areas for several coastal regions of Western Australia. These maps are not an accurate representation of the risk areas but rather give a general indication and encourage site-specific investigations to determine management strategies. The land generally holds a moderate-low risk with some areas along the south-eastern boundary holding a moderate-high risk (Figure 10).

The extent and severity of these soils with regards to acid sulfate potential is unknown and will require further testing and investigation. Proposed development activities such as major earth works, infrastructure earth works such as the installation of sewers, and lowing of the ground water can disturb and accentuate ASS areas (DEC, 2009a). Serious environmental, economic, engineering and health impacts may occur if proper management of the area is not undertaken. Acid sulfate soils can be remediated by applying an adequate amount of limestone to neutralize the soil and reduce its acid sulfate potential (DEC, 2009a).

Soil samples were collected during geotechnical investigation were analysed using the DEC field test procedure as well as LECO carbon sulphur analyser and redox potential. Overall these give an indication of whether or not soils are actual, potential or non acid sulphate soils. Twenty samples underwent these tests and 3 samples came back as being potential acid sulphate soils. These soils are generally soils deeper than 2.5 metres with higher clay contents, or the presence of coffee rock. 16 samples returned results that indicate they are not acid sulphate soils but have a sulphur content above the 0.03% threshold for treatment of acid sulphate soils.

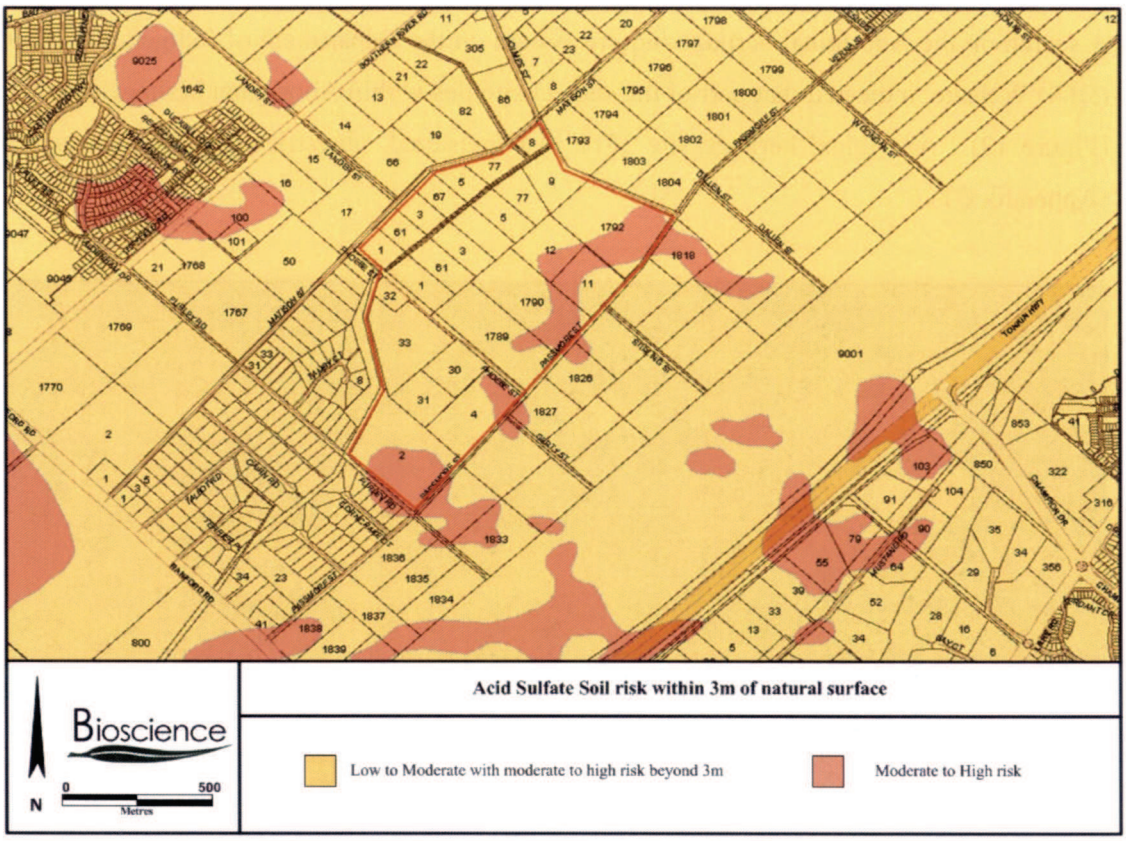


Figure 11: DEC Acid Sulphate Soil Risk

3.7.1. Recommendations

Both the desktop and preliminary field investigations suggest that ASS is a potential concern where site works disrupt the natural soil surface. The only a foreseeable site works that might disrupt major amount of the natural soil is sewer construction, thus further assessment maybe required prior to the submission of a dewatering licence (if required). As the sewer excavation depths at this point in time are unknown, undertaking an ASS assessment before plans are finalised may results in samples being undertaken in inappropriate locations and depths. Should the proposed investigations indicate actual and/or potential ASS are present on the site, then an ASS management plan will be developed.

3.8. Heritage

3.8.1. Aboriginal

A search on the Aboriginal heritage inquire system on the Department of Indigenous Affairs (DIA) Website, indicated that part of the subject site lies within Aboriginal heritage site 3511 (Figure 12). Aboriginal heritage site 3511 is a registered, unrestricted, closed access site (Appendix C).

Figure 12: Department of Indigenous Affairs Aboriginal Heritage Sites

3.8.1.1. Recommendations

The DIA recommends that an Aboriginal heritage management plan be established to avoid disturbance to heritage sites. Guidelines for Aboriginal heritage management can be obtained from the DIA.

3.8.2. European

A search on the Heritage Council of Western Australia (2011) database reveals no European heritage exists within the subject area.

3.9. Contamination

The land is not registered as a contaminated site with DEC, and the current and past land use is not registered as being a potentially contaminating. The Contaminated Sites Act 2003 and associated regulations and guidelines require a tiered assessment process, and if no evidence of contamination is found from both desktop and initial field investigations, no further action is required.

3.10. Nuisance Insects

The subject site is lies within UFI: 50802 Multiple Use Wetland and as such gets seasonally inundated providing breeding habitat for nuisance midge and mosquitoes. The risk of midge and mosquito populations becoming unacceptable is moderate to low due to the absence of permanent water bodies however due to winter inundation adequate stormwater management is required to reduce future risk.

3.10.1. Recommendations

Stormwater management and constructed wetlands should be in accordance with EPA's *Guidance 40: Management of mosquitoes by land developers* (EPA, 2000b) for minimisation of mosquito breeding ground and integrate Water Sensitive Urban Design (WSUD) principles to ensure optimal management of stormwater run-off.

4. ENVIRONMENTAL APPROVALS

The following environmental and heritage legislations and policies are relevant to the proposed development and subject to approvals:

- *Environmental Protection Act 1986*
- *Environmental Protection and Biodiversity Conservation Act 1999*
- *Wildlife Conservation Act 1950*
- *Aboriginal Heritage Act 1972*
- *Environmental Protection (Swan Coastal Plain) Policy 1992*

The EPA acts as the regulatory authority under the *EP Act* 1986 who will consider all potential environmental impacts associated with the development including rezoning and subdivision.

Under the Commonwealth *EPBC Act* 1999 matters of national environmental significance are protected and subject to approvals. Matters of environmental significance include:

- Listed Threatened Species and Ecological Communities
- Listed migratory species
- Declared Ramsar wetlands
- Commonwealth marine area
- World heritage
- National heritage
- Nuclear actions

The *EPBC Act 1999* states under section 18 and 20 that a person shall not take an action that has, will have or likely to have significant impact on a listed threatened species, communities and listed migratory species without approval.

The *Wildlife Conservation Act 1950* states under section 23F that it is an offense to take or destroy rare flora or fauna unless issued a licence under the Act.

The *Aboriginal Heritage Act 1972* states that it is an offence to alter, damage, remove, destroy, conceal, deal with or assume possession of any object on or under an Aboriginal Heritage site. An application under Section 18 of the Act is required by owners for actions that will or may lead to disturbance of Aboriginal sites.

The *Environmental Protection (Swan Coastal Plain) Policy 1992* states that a person shall not cause or permit the filling, excavation, mining, discharge or disposal of effluent, or construction or alteration of the drainage system within the lake unless authorised under the Act.

5. SUMMARY OF ENVIRONMENTAL CONSTRAINTS AND RECOMMENDATIONS

There are no environmental constraints that would hinder the proposed development outlined within Figure 3 structure plan. However the following recommendations have been made:

- where possible and practical existing vegetation be incorporated in landscaping and streetscaping throughout the development
- additional consideration be made to avoid impacts such as; inappropriate recreation, dumping, fire, and invasive species that may affect Bush Forever site 465 containing a Threatened Ecological Community. Many of these threats can be controlled with adequate fencing
- attempt to restore wetlands to a higher value and conservation category through integrated Wetland Management Plans
- consider creating a "living stream" within Forrestdale Drain which can contribute some ecological and aesthetic value to the area
- undertake an ASS assessment before plans are finalised for deeper excavation
- minimise mosquito breeding habitat and integrate Water Sensitive Urban Design (WSUD) principles to ensure optimal management of stormwater run-off.

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APPENDIX A

DEC's NatureMap search results for flora and fauna existing within 3km of the centre of the subject area (32° 05' 36 S, 115° 58' 27 E)

NatureMap Species Report

Created By Guest user on 11/08/2011

Method 'By Circle'
Centre 115°58' 11" E,32°06' 30" S
Buffer 3km

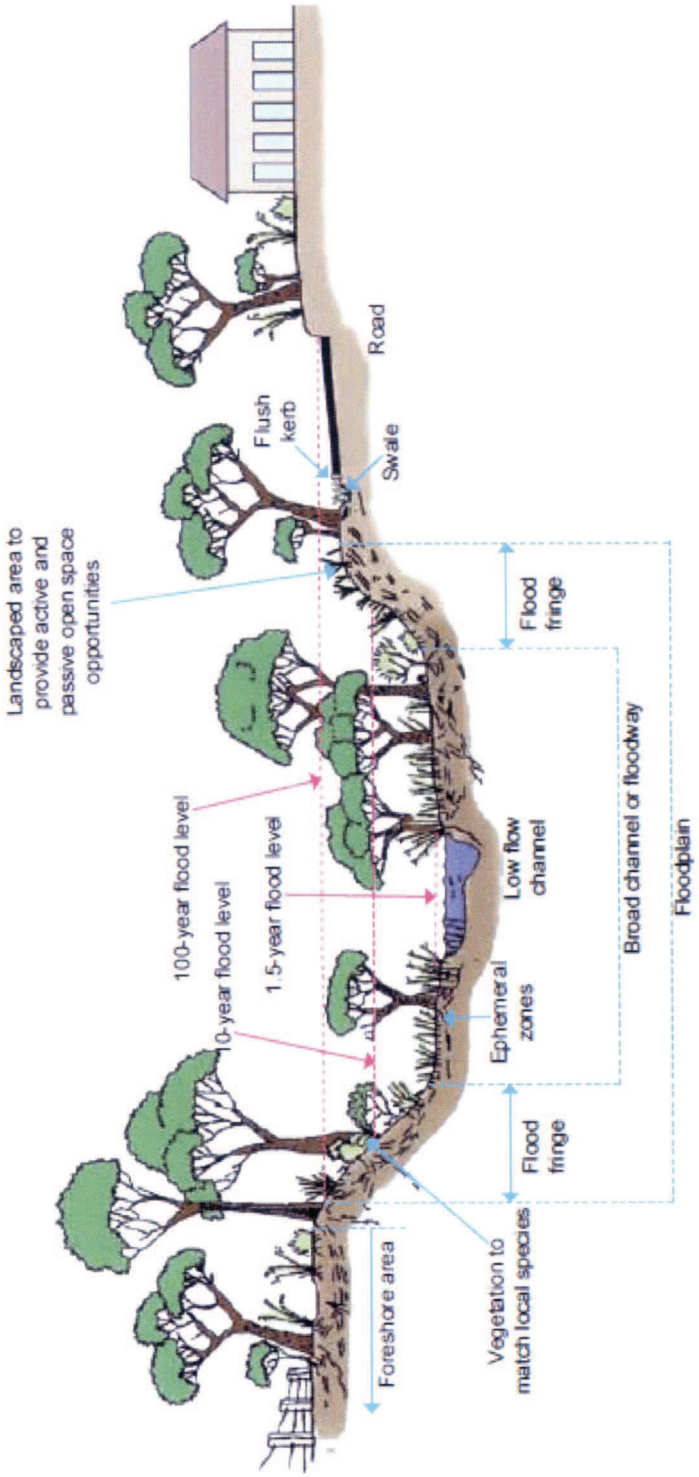
	Name ID	Species Name	Naturalised	Conservation Code	'Endemic To Query Area
1.	3237	*Acacia benthamii*		P2	
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
3.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
4.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
5.	25536	*Accipiter fasciatus (Brown Goshawk)*			
6.	38756	*Amanita umbrinella*			
7.	13380	*Amphibromus nervosus*			
8.	24312	*Anas gracilis (Grey Teal)*			
9.	24316	*Anas superciliosa (Pacific Black Duck)*			
10.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw)*			
11.	-446	*Anser sp.*			
12.	24561	*Anthochaera carunculata (Red Wattlebird)*			
13.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
14.	12724	*Anthotium junciforme*			
15.	-396	*Anthus novaeseelandiae*			
16.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
17.	24285	*Aquila audax (Wedge-tailed Eagle)*			
18.	24341	*Ardea pacifica (White-necked Heron)*			
19.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
20.	38481	*Austrostipa jacobsiana*		P1	
21.	20733	*Austrostipa juncifolia subsp. Southern River (B.J. Keighery 2160)*			Y
22.	24318	*Aythya australis (Hardhead)*			
23.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
24.	-326	*Barnardius zonarius*			
25.	5393	*Beaufortia squarrosa (Sand Bottlebrush)*			
26.	1387	*Burchardia umbellata (Milkmaids)*			
27.	3178	*Bybilis gigantea (Rainbow Plant)*		P3	
28.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
29.	25716	*Cacatua sanguinea (Little Corella)*			
30.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
31.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
32.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo)*		T	
33.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
34.	26587	*Centroceras clavulatum*			
35.	-408	*Chalcites basalis*			
36.	-365	*Chalcites lucidus*			
37.	24321	*Chenonetta jubata (Australian Wood Duck)*			
38.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
39.	24399	*Columba livia (Domestic Pigeon)*			
40.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
41.	25592	*Corvus coronoides (Australian Raven)*			
42.	17104	*Corymbia calophylla (Marri)*			
43.	24671	*Cotumix pectoralis (Stubble Quail)*			
44.	25595	*Cracticus tibicen (Australian Magpie)*			
45.	25596	*Cracticus torquatus (Grey Butcherbird)*			
46.	25400	*Crinia insignifera (Squelching Froglet)*			
47.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*			
48.	11049	*Diuris corymbosa*			
49.	12939	*Diuris magnifica*			
50.	-361	*Egretta novaehollandiae*			
51.	-384	*Elanus axillaris*			
52.	-357	*Elseyornis melanops*			
53.	-353	*Eolophus roseicapillus*			
54.	14097	*Eremaea asterocarpa subsp. brachyclada*		P1	
55.	25622	*Falco cenchroides (Australian Kestrel)*			
56.	25727	*Fulica atra (Eurasian Coot)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
57.	25530	*Gerygone fusca (Western Gerygone)*			
58.	6161	*Gonocarpus pithyoides*			
59.	24443	*Grallina cyanoleuca (Magpie-lark)*			
60.	1470	*Haemodorum paniculatum (Mardja)*			
61.	2216	*Hakea varia (Variable-leaved Hakea)*			
62.	25734	*Himantopus himantopus (Black-winged Stilt)*			
63.	24491	*Hirundo neoxena (Welcome Swallow)*			
64.	24153	*Isoodon obesulus subsp. fusciventer (Southern Brown Bandicoot)*		P5	
65.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
66.	15498	*Kunzea glabrescens (Spearwood)*			
67.	19954	*Lachnagrostis aemula*			
68.	-334	*Lalage sueurii*			
69.	11911	*Laxmannia ramosa subsp. ramosa*			
70.	5850	*Leptospermum laevigatum (Coast Teatree)*	Y		
71.	6434	*Leucopogon polymorphus*			
72.	19579	*Leucopogon sp. Murdoch (M. Hislop 1037)*			
73.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
74.	25661	*Lichmera indistincta (Brown Honeyeater)*			
75.	7408	*Lobelia tenuior (Slender Lobelia)*			
76.	2838	*Macarthuria apetala*			
77.	25654	*Malurus splendens (Splendid Fairy-wren)*			
78.	24598	*Merops ornatus (Rainbow Bee-eater)*			
79.	-329	*Microcarbo melanoleucos*			
80.	24223	*Mus musculus (House Mouse)*			
81.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
82.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
83.	25682	*Pardalotus striatus (Striated Pardalote)*			
84.	541	*Pennisetum setaceum (Fountain Grass)*	Y		
85.	-333	*Petrochelidon nigricans*			
86.	24659	*Petroica goodenovii (Red-capped Robin)*			
87.	24409	*Phaps chalcoptera (Common Bronzewing)*			
88.	1479	*Phlebocarya filifolia*			
89.	-336	*Phylidonyris niger*			
90.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
91.	18353	*Pithocarpa pulchella var. pulchella*			
92.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
93.	25703	*Podargus strigoides (Tawny Frogmouth)*			
94.	1690	*Pterostylis nana (Snail Orchid)*			
95.	-364	*Purpureicephalus spurius*			
96.	-347	*Rhipidura albiscapa*			
97.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
98.	13312	*Rhodanthe pyrethrum*			
99.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
100.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
101.	4205	*Sphaerolobium linophyllum*			
102.	19704	*Stenanthemum sublineare*		P2	
103.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*			
104.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*			
105.	27318	*Struvea plumosa*			
106.	7806	*Stylidium utriculariodes (Pink Fan Triggerplant)*			
107.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
108.	24331	*Tadorna tadornoides (Australian Shelduck)*			
109.	24844	*Threskiornis molucca (Australian White Ibis)*			
110.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
111.	1334	*Thysanotus glaucus*		P4	
112.	25519	*Tiliqua rugosa*			
113.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
114.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
115.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
116.	6077	*Verticordia drummondii (Drummond's Featherflower)*			
117.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
118.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			

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

APPENDIX B

Living Streams. Image from the Department of Water *Water Sensitive Urban Design: Living Streams* (2011).



Typical cross section of a living stream

Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

Site 3511

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable] The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.

[Unreliable] The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status

L - Lodged	→	IA - Information Assessed	→	ACMC Decision Made
Information lodged, awaiting assessment		Information Awaiting ACMC Decision Assessment Only		**R - Registered Site** **I - Insufficient information** **S - Stored Data**

***Explanation of Assessment**

Sites lodged with the Department are assessed under the direction of the Registrar of Aboriginal Sites. These are not the final assessment.

Final assessment and decisions will be determined by the Aboriginal Cultural Material Committee (ACMC).

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels

Report created 16 Aug 2011 10:54:53. Identifier: 826472.

List of Registered Aboriginal Sites with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
3511	R	C	N	Southern River	Mythological	Camp, Hunting Place	*Registered Informant names available from DIA.	Not available for closed sites	S02601