Rehabilitation Management Plan

(Offset Proposal)

Lot 137 Hopeland Road, Hopeland

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Site Overview

The 30.4 hectare (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of Perth in the Shire of Serpentine Jarrahdale. The site is bordered by Punrak Road on its western and northern extents.

The Extractive Industry Licence / Development Approval issued by the Shire of Serpentine-Jarrahdale (PA16/164) proposes to extract sands from a 12.14 ha portion of the site.

The site is primarily used for horse training and agistment. The land use has resulted in the site being predominantly cleared of vegetation with only a small extent of native vegetation remaining which has been heavily grades grazed for many years.

By extracting the sand, the property will be left in a state more suitable for pasture growth and therefore agistment while providing a bushland buffer between agistment paddocks, and (eventually) shade for horses. The new rehabilitated bushland precinct will be fenced, which will result in a better outcome for the vegetation as it will be protected, and not grazed which has occurred previously.

A Level 2 Flora and Vegetation Survey was undertaken in September and November 2016. The vegetation condition within the survey areas ranged from a small area of 0.33 ha in ‘Very Good to Good’ within portions of intact Banksia Woodland vegetation unit, with the remaining majority of the survey area classified as ‘ Good to Completely Degraded’. The condition rating within the 1.99 ha Banksia woodland area is outlined in Table 1 below.

Table 1: Vegetation Condition in the 1.99 ha Banksia Woodland Area

Vegetation Condition (Keighery 1994)	Area (ha) within the Survey Area
Excellent	0
Good – Very Good	0.26
Good	0.07
Good to Degraded	0.61
Degraded	0.87
Degraded - Completely Degraded	0.01
Completely Degraded	0.17
Total	**1.99**

Restoration Methodology

History

Banksia woodlands - A restoration guide for the Swan Coastal Plain (J. Stevens et al, 2016) provides the platform to achieve biodiversity protection, enhancement and restoration. The book synthesises more than 20 years knowledge derived from research and development conducted by Kings Park and Botanic Garden, The University of Western Australia in collaboration with Hanson Construction Materials (formerly Rocla Quarry Products). This research is inclusive of:

- how the soil profile has been rebuilt prior to the recontouring post extraction
- different techniques of topsoil placement
- various ripping methods to deal with soil compaction
- broadcast seeding vs mechanical seeding

These techniques are outlined in detail within Attachment 1.

Site Specific Restoration

In order to replace and improve upon the 0.33 ha of 'Good to Very Good' native vegetation that will be lost during the excavation campaign, Hanson will rehabilitate ~1.25 ha along the western boundary of the area extracted. The species outcome will be maximised by utilising the available topsoil and other seed inputs on the property.

This will provide a buffer between agistment paddocks, and (eventually) shade for horses. These restoration areas are shown in Figure 1 and will be fenced, which will result in a better outcome for the vegetation as it will be protected, and not grazed which has occurred previously.

The rehabilitation will commence in Area A on the commencement of extraction from Stage 3. Available topsoil with good seed mix will be direct transferred for rehabilitation before extraction occurs.

Seeding

A seed mix with suitable topsoil (where available) will be disseminated where required so that canopy species in particular are represented across the site. On advice from Kings Park, the canopy species required to be sown are as below:

- *Banksia attenuata*
- *Banksia menziesii*
- *Banksia ilicifolia*
- *Eucalyptus marginate*
- *Corymbia calophylla*

Restoration Assessment

Restoration techniques and timing of works will be undertaken in accordance with the below Project Schedule, with site activities to occur at specific times of the year.

Outcomes from seeding and topsoil placement (in year 1) will be reviewed after 3 years and infill tube stock planting will occur, if required, at a maximum rate of 1 plant per 5.5m x 5.5m quadrant particularly focussing on the canopy Banksia species. Please see Table 2 below for further detailed timelines.

This will also allow for the rehabilitated vegetation to be similar to the mapped vegetation being:-

- 30% overstorey
- 20 % midstorey
- 50% understorey

Further information is available within *Banksia woodlands - A restoration guide for the Swan Coastal Plain* (J. Stevens et al, 2016) presented in Attachment 1.

Table 2: Restoration Timeline (prior to extraction from Stage 3)

Year	Activity	Timeframe
1	• Seed collection will precede clearing of the bushland from the site.*	October – March
	• Clear vegetation	December to March
	• Direct transfer available topsoil.**	January – April
	• Canopy species seeded	June – August
	• Rehabilitation report of works undertaken	October
2	• Weed management.	June – August
	• Rehabilitation report of works undertaken	October
3	• Weed management.	June – August
	• Assessment of rehabilitation to determine seedling survival patterns.	October
	• Identify gaps between restoration outcomes.	November
	• Commence generation of tube stock material for supplementary planting of canopy species.	November
	• Rehabilitation report of works undertaken	October
4	• Plant supplementary tubestock (as required).	June- July
	• Weed Management.	June – August
	• Rehabilitation report of works undertaken	October

*Hanson will collect seed for each year (when good collections are available) up to the point when the vegetation is cleared.

**Topsoil will not be stockpiled beyond the rehabilitation period in that year.

Figure 1-1
Rehabilitation Areas

Banksia woodlands represent an important part of the rich fabric of Southwest Australia's biodiversity. Their close proximity to the sprawling Perth Metropolitan Region has seen 60% of woodlands lost in some areas, with many of the remnants under increasing threats from processes associated with fragmentation. Integrating future planning with restoration knowledge from scientists and management practitioners is critical if we are to successfully manage and conserve these nationally important woodlands.

Banksia woodlands - A restoration guide for the Swan Coastal Plain provides the platform to achieve this biodiversity protection, enhancement and restoration. The book synthesises more than 20 years knowledge derived from research and development conducted by Kings Park and Botanic Garden, The University of Western Australia in collaboration with Hanson Construction Materials (formerly Rocla Quarry Products) and highlights how long-term industry-scientific partnerships driven by mutual visions can deliver leading restoration solutions. The book reflects the ethos of providing a truly integrated restoration scientific approach integrating concepts from restoration target definition, genetic guidelines, seed-plant-soil interactions, and their practical application.

With significant contributions from experts across government, academia and industry this book provides the first comprehensive overview for practitioners, researchers and policy makers to assist Banksia woodland restoration activities and decisions, and a platform from which to build future strategies if these iconic systems are to remain an important part of the WA system.

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BANKSIA WOODLANDS

Jason C. Stevens, Deanna P. Rokich, Vernon J. Newton, Russell L. Barrett and Kingsley W. Dixon

UWAP

BANKSIA WOODLANDS

A restoration guide for the Swan Coastal Plain

Jason C. Stevens, Deanna P. Rokich, Vernon J. Newton, Russell L. Barrett and Kingsley W. Dixon

NOTE:
PAVEMENT TO BE:

- APPLY TWO COAT SEAL FROM THE EXISTING GATE TO HOPELAND ROAD.
- 200mm THICK COMPACTED CRUSHED GRANITE BASECOURSE ON THE EXISTING LIMESTONE/GRAVEL FORMATION, (ASSUMED EXISTING LIMESTONE/GRAVEL FORMATION TO BE GREATER THAN 100mm THICK)

OR

- IF THE EXISTING LIMESTONE /GRAVEL FORMATION IS LESS THAN 100mm THICK, THEN 100mm 'CRACKER DUST' IS TO BE INSTALLED.

FOR PASSING WIDENING, PAVEMENT TO BE 300mm THICK CRUSHED GRANITE BASE COURSE ON A COMPACTED SUBGRADE.

PROJECT:
LOT 137 PUNRAK ROAD HOPELAND

No.	DATE	REVISION	BY
A	29-6-2017	PRELIMINARY PLOT FOR COMMENT	MJV

Porter Consulting Engineers
Level 2 Kishorn Court
58 Kishorn Road
Mt Pleasant 6153 WA
PO Box 1036
Canning Bridge 6153 WA
Tel (08) 9315 9955
Fax (08) 9315 9959
Email: office@porterseng.com.au
www.porterseng.com.au
THOMAS Pty Ltd ACN 070 097 168 as Trustee for the Consulting Engineering Unit Trust trading as Porter Consulting Engineers ABN 78 626 396 285

CLIENT:
HANSON

DRAWING:
LAYOUT PLAN

STATUS: **FOR COMMENT**

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CHECK	
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SHIRE OF SERPENTINE-JARRAHDALE
PLANNING APPROVAL

Date 13/08/2019 Signed (Authorised Officer)

RPS

LEVEL 2 FLORA AND VEGETATION SURVEY

Lot 137 Punrak Road, Hopeland

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005
PO Box 170, WEST PERTH WA 6872
T: +61 8 9211 1111
F: +61 8 9211 1122
E: environment@rpsgroup.com.au
W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street
MOSMAN PARK WA 6012

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Disclaimer

SUMMARY

RPS Australia West Pty Ltd (RPS) was engaged by the landowners (Michelle and Craig McAllister) to undertake a Targeted *Caladenia huegelii* and Level 2 Flora and Vegetation Survey of approximately 5.9 hectares (ha) within Lot 137 Punrak Road (the survey area), 2.12 ha of which comprises remnant Banksia woodland.

RPS understands that the Department of Environment Regulation (DER) undertook a preliminary assessment of the native vegetation on site in October 2015, and subsequently requested the provision of additional data in order to address issues relating to the potential presence of conservation significant flora (Threatened ephemeral orchid species *Drakaea elastica* and *Caladenia huegelii*), and to determine the Floristic Community Types (FCTs) present within the Banksia vegetation.

Lot 137 Punrak Road is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 Hopeland Road to the south and House No. 446 to the east. Lot 137 Punrak Road is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1).

Lot 137 Punrak Road is primarily used for horse training. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent of native vegetation, within the survey area, remaining intact.

In accordance with *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority (EPA) and DPaW (Department of Parks and Wildlife) 2015), the assessment comprised a desktop study and a two visit level 2 field survey, undertaken by experienced RPS flora botanist Caroline Gill. The initial survey was conducted on 19 and 20 September 2016, and the supplementary on 8 November 2016. The field survey included:

- targeted search for flora of conservation significance
- establishment and sampling of three floristic sites (quadrats) to characterise the flora and vegetation of the survey area
- identification of the conservation status of flora and vegetation communities present.

The vegetation of the survey area was described and mapped, and a comprehensive flora inventory compiled. A multivariate analysis of the floristic data using RRIMERV6 statistical software package was carried out to assist in the assessment of vegetation conservation significance.

Level 2 Flora and Vegetation Survey Findings

- A total of 82 discreet flora taxa (species, subspecies and varieties) were recorded during the current survey, of which 71 were native, and 11 were naturalised alien (weed) species. The 71 native taxa represented 31 families and 62 genera.

- The 11 exotic (weed) species represented 13.4% of the total flora. One Weed of National Significance was recorded for the survey area – **Zantedeschia aethiopica* (arum lily), also listed as a Declared Pest – s22(2) under the *Biosecurity and Agriculture Management Act 2007*. It is listed for C3 – Management for the whole of the state, meaning that it should be managed to alleviate the harmful impact of the species on the environment.

- No Threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) or under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded within the survey area.

- No Priority-listed species as currently listed by the Department of Parks and Wildlife (DPaW) were recorded within the survey area for the current survey.

- One vegetation community was described and mapped for all of the remnant native vegetation within the survey area: *Em/Af.Ba.Lm* – Banksia Woodland – Scattered *Eucalyptus marginata* and *Allocasuarina fraseriana* over *Banksia attenuata, B. menziesii* and *B. illicifolia* Low Open Woodland to Low Open Forest over *Kunzea glabrescens* and *Adenanthos cygnorum* Tall Shrubland over *Hibbertia hypericoides* and *Leucopogon conostephioides* Low Open Shrubland over *Phlebocarya ciliata, Desmocladus flexuosus* and *Dasypogon bromeliifolius* Herbland.

- The Hierarchical Cluster Analyses undertaken using PRIMERv6 comparing the floristics of each site from the current survey with the Gibson et al. (1994) dataset shows the three quadrats grouping variously with the Floristic Community Types (FCT) 21a – Central *Banksia attenuata – Eucalyptus marginata* woodlands and FCT21c Low-lying *Banksia attenuata* woodlands or shrublands.

- No EPBC-listed TECs occurs within the survey area.

- No DPaW-listed Threatened Ecological Communities (TECs) were recorded within the survey area.

- The vegetation shared affinities with both FCT21a and the Priority 3 Priority Ecological Community (PEC) FCT21c.

- The vegetation condition within the survey area ranged from Very Good to Good within portions of intact Banksia Woodland vegetation unit, to Completely Degraded along tracks and throughout the highly modified sections of the survey area.

- Only 25.7% of the pre-European extent of vegetation association Bassendean 1000 remains within the Perth (SWA02) subregion, and 1.76% of the present extent is in secure tenure.

- Only 19.69% of Southern River Complex remains within the Interim Biogeographic Regionalisation for Australia (IBRA) Swan Coastal Plain bioregion and 1.5% of the present extent is protected secure tenure. The extent remaining of both Bassendean 1000 vegetation association and Bassendean Complex Central and South is below the threshold level of 30% set by the EPA, therefore the vegetation in Good or better condition represented within the survey area is considered to be conservation significant.

Conclusions

In considering the conservation significance of the intact native vegetation within the survey area, it was assessed against criteria relating to rarity, biodiversity, representativeness of the flora and vegetation, condition, and location in the landscape, i.e. whether or not it is contiguous with like vegetation (providing an ecological linkage – corridor or stepping stone), or an isolated fragment.

The absence of Threatened and Priority Flora within the survey area means the rarity is considered low.

The presence of 71 native taxa within the vegetation means biodiversity is moderately high.

At a state level the vegetation was assessed as being conservation significant based on the potential presence of the state-listed Priority 3 PEC FCT21c – Low-lying *Banksia attenuata* woodlands or shrublands.

At a national level the vegetation was not considered to have sufficient conservation value to be considered a Matter of National Environmental Significance (MNES) under the EPBC Act because it did not satisfy the criteria relating to patch size for the EPBC-listed TEC Banksia Woodlands of the Swan Coastal Plain.

The conservation significance of the vegetation is compromised by its condition and fragmented nature. Condition within the survey area ranged from Very Good to Good within portions of intact Banksia Woodland vegetation, to Completely Degraded along tracks and throughout the highly modified sections. The intact vegetation within the survey area is not contiguous with other areas of similar vegetation but consists of an isolated fragment surrounded by previously cleared farmland and planted exotic tree and shrub species. The nearest patch of intact vegetation of similar size lies approximately 400 metres to the east.

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1.0 INTRODUCTION

1.1 Project Background

RPS Australia West Pty Ltd (RPS) was engaged by the landowners (Michelle and Craig McAllister) to undertake a Level 2 Flora and Vegetation Survey of approximately 5.9 hectares (ha) within Lot 137 Punrak Road (the survey area), 2.12 ha of which comprises remnant Banksia woodland.

RPS understands that the Department of Environment Regulation (DER) undertook a preliminary assessment of the native vegetation on site in October 2015, and subsequently requested the provision of additional data in order to address issues relating to the potential presence of conservation significant flora (Threatened ephemeral orchid species *Drakaea elastica* and *Caladenia huegelii*), and to determine the Floristic Community Types (FCTs) present within the Banksia vegetation.

Lot 137 Punrak Road is bordered by Punrak Road to the western and northern extents and by the landholdings of House Number (No.) 444 Hopeland Road to the south and House No. 446 to the east. Lot 137 Punrak Road is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1).

Lot 137 Punrak Road is primarily used for horse training. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent of native vegetation, within the survey area, remaining intact.

1.2 Guiding Principles and Legislative Framework

Federal and state legislation pertaining to the conservation of native flora and vegetation include the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Biodiversity Conservation Act 2016* (BC Act) and the *Environmental Protection Act 1986* (EP Act). Section 4A of the EP Act states that the following principles should be adhered to in order to protect the environment of Western Australia:

1 The Precautionary Principle – Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

2 The Principle of Intergenerational Equity – The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

3 The Principle of the Conservation of Biological Diversity and Ecological Integrity – Conservation of biological diversity and ecological integrity should be a fundamental consideration.

1.2.1 Conservation Significant Flora

Within Western Australia Threatened Flora are listed as such if they are considered to be in danger of extinction, rare or otherwise in need of special protection. These taxa are legally protected under the BC Act. The removal of these taxa or impact to their surroundings is not permitted without prior ministerial approval. The Department of Parks and Wildlife (DPaW) maintains a list of Priority Flora species, which may be rare or threatened but for which there are either insufficient survey data to determine accurately their status, or which are rare but not currently considered to be threatened. A Priority Flora taxon is assigned to one of five priority categories. Threatened Flora and Priority Flora categories are defined in Appendix I (Table 1.1).

Many taxa listed as Threatened Flora under the BC Act have additional protection as they are also listed as Threatened Flora under one of six threat categories (Extinct, Extinct in the wild, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the EPBC Act. Threatened Flora taxa are defined as Matters of National Environmental Significance (MNES) under the EPBC Act and penalties apply for any damage to individuals, populations or habitats of these flora.

1.2.2 Vegetation of Conservation Significance

Under the BC Act and the EPBC Act, Threatened Ecological Communities (TECs), classified by DPaW in one of the TEC categories (Appendix I, Table 1.2) have limited protection. Other ecological communities are classified by DPaW in the category of Priority Ecological Communities (Appendix I, Table 1.3) pending further survey and/or definition. A subset of the DPaW-listed TECs are also listed and protected as MNES under the EPBC Act. EPBC Act threat categories for TECs are defined in Appendix I (Table 1.4).

In addition to state and Commonwealth protected and listed conservation significant flora the *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority (EPA) and DPaW 2015) provides a definition of significant flora and vegetation that may be considered significant for reasons other than statutory listing based on the following features – a keystone role, relictual status, anomalous features indicating a potential new discovery, a representation of a species range (range extensions, extremes or an outlier population), status as a restricted subspecies, variety, or naturally occurring hybrid, a restricted distribution (local endemism), association with a restricted habitat type or poor reservation. (This document states that conservation significance includes these criteria, but is not limited to them. It may include flora that are poorly represented in the Western Australian Herbarium and short-range endemic flora i.e. those with a known range less than 200 km).

1.3 Survey Objectives and Scope of Works

This Level 2 Flora and Vegetation Survey aimed to describe the flora and vegetation values of the survey area and determine the spatial location and conservation significance of these values. The specific objectives were to provide an indication of the vegetation associations and floral taxa present within the survey area so that potential impacts on the flora values can be adequately assessed.
The survey included:

- targeted field search for Threatened and Priority Flora, naturalised alien taxa (weeds) and any other flora of other conservation significance that may be present within the survey area
- compilation of a comprehensive vascular flora inventory of all flora species recorded within the survey area (using the current nomenclature of the Western Australian Herbarium)
- description and delineation of the vegetation units and vegetation condition within the survey area.

2.0 METHODS

The Level 2 Flora and Vegetation Survey was undertaken in accordance with the latest guidance: *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA and DPaW 2015).

2.1 Desktop Assessment

The desktop assessment of the survey area and surrounding region was undertaken incorporating a review of:

- Level 1 Flora and Vegetation Survey Report (RPS 2015)
- outputs from RPS' internal GIS database
- high resolution aerial imagery
- vegetation complex mapping (Heddle et al. 1980) for the site and determination of the pre-European extent remaining of the complex(s) represented
- significance of the survey area for conservation significant species in a local and regional context
- search results from Commonwealth Government databases for Threatened Flora and TECs protected under the EPBC Act, DPaW databases and mapping for Threatened and Priority Flora, and Ecologically Sensitive Areas
- search results for Declared Plants listed under *Biosecurity and Agriculture Management Act 2007* and other naturalised alien flora taxa (weeds) known to be invasive and threats to biodiversity.

2.2 Field Survey

The Level 2 Flora and Vegetation Survey was conducted by RPS Botanist Caroline Gill under Licence to Collect Flora for Scientific or Other Prescribed Purposes No. SL011854, according to the latest EPA and DPaW guidance.

Caroline undertook the initial survey over two days from 19 to 20 September 2016, and a one-day supplementary survey on 8 November 2016. The survey methods and sampling quadrat sizes used were based on the requirements for Level 2 Flora and Vegetation Surveys in the Swan Coastal Plain region as outlined in EPA and DPaW (2015).

The detailed survey involved:

- a targeted search for Threatened and Priority flora (*Caladenia huegelii* in particular) and Declared Plants as determined by the desktop study results and deemed likely to occur within the survey area

- comprehensive, quadrat-based flora recording and collection. Three bounded 10 metre (m) × 10 m quadrats were established and sampled in intact, mature vegetation in areas of best condition to provide data for the floristic classification and mapping of the vegetation of the survey area. These quadrats were permanently marked with fence droppers in all four corners to facilitate the supplementary survey.

- collecting the following information at each sampling site
  - site code
  - GPS location at the north-west corner (GDA94, accuracy <5 m)
  - photograph/s from north-west corner
  - landform and soil description
  - dominant growth form, height, cover and species for the three traditional strata (upper, mid- and ground) compatible with the Western Australian Planning Commission (WAPC) (2000) Vegetation Structure Classes
  - any other location information that might be useful in vegetation classification including slope, aspect, litter, fire history, vegetation/landform/soil correlations
  - assessment of vegetation condition and description of disturbances
  - a comprehensive species list (annuals and perennials), including weeds

- opportunistic collections to complement the records from the quadrats, to ensure that the survey area has been well characterised, the important values identified, and a comprehensive flora inventory compiled

- vegetation condition mapping, using the Keighery (1994) Condition Scale

- vegetation unit descriptions and mapping using the Bush Forever Vegetation Structure Classes (WAPC 2000).

2.3 Data Analysis

2.3.1 Flora and Taxonomy

The flora inventory was compiled from all flora species recorded and collected within the survey area from quadrats and opportunistic locations. Flora specimens were either identified in the field, or collected and identified using the keys, publications and databases of the Western Australian Herbarium. Nomenclature was aligned with the current names in FloraBase (Western Australian Herbarium 2016).

2.3.2 Vegetation Mapping

Vegetation community mapping was conducted using a combination of aerial photo-interpretation, regional and local vegetation mapping, on-ground confirmation and vegetation structure data. Each vegetation unit was defined by the dominant plant species (>2% cover throughout unit), using the Bush Forever Vegetation Structure Classes (WAPC 2000) (Appendix 1, Table 1.5).

Condition assessment mapping was conducted using 1:5,000 aerial photo-interpretation and on-site confirmation, using the Keighery (1994) Condition Scale (Appendix 1, Table 1.6).

2.3.3 Multivariate Analysis of Floristic Data

Floristic Community Types (FCTs) are based on a survey of the vegetation of the Swan Coastal Plain from Seabird to Dunsborough, completed by Gibson et al. (1994). The purpose of the survey was to determine the number and type of vegetation communities present across the southern Swan Coastal Plain and to then assess how much of each remained and whether they are adequately represented and protected within reserves. There were 592 plots surveyed. Each FCT defined as a result of Gibson et al. (1994) was given Conservation Status and Reservation Status.

The floristic site data from the current survey was combined with the Gibson et al. (1994) dataset and analysed using PRIMER v6 software. The analysis aimed to compare the floristic composition of the sites sampled for this survey to the floristic composition of FCTs defined by Gibson et al. (1994) for the Swan Coastal Plain. This analysis facilitated the assessment of the conservation significance of the vegetation of the survey area in a regional context and assisted in mapping the vegetation.

The survey data was reconciled with the Swan Coastal Plain dataset of Gibson et al. (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded while some infraspecies that have been identified since 1994 were reduced to species level.

A resemblance matrix of the presence/absence data for the combined dataset was constructed using the Bray Curtis Similarity Coefficient and a hierarchical cluster analysis was carried out on this matrix using the group average linkage method. The output from this analysis was illustrated as a dendrogram. Further, a "similarity profile" SIMPROF permutation test was carried out at each node of this dendrogram to look for statistically significant clusters in an *a priori* unstructured set of samples.

Once an FCT had been assigned to each vegetation community, a comparison could be made against the DPaW's TEC/PEC database in order to assess the conversation significance of the vegetation.

2.3.4 Banksia Woodland TEC Assessment

Assessment of the remnant Banksia woodland within the survey area was undertaken in accordance with the Approved Conservation Advice (Threatened Species Scientific Committee 2016) for the recently-listed Banksia Woodland TEC. The assessment used to determine if the TEC occurs within the survey area involved four steps as follows:

- **Step 1**: Assess the vegetation against the key diagnostic characteristics relating to the location, physical environment, soils and landforms, vegetation structure and floristic composition
- **Step 2**: Assess the condition of the vegetation.
- **Step 3**: Determine the size of the patch and assess against the minimum patch size threshold.
- **Step 4**: Assess the vegetation in the context of the surrounding environment.

3.0 REGIONAL SETTING

3.1 Climate, Landforms and Soils

The survey area is located on the Swan Coastal Plain, which experiences a Mediterranean climate characterised by hot, dry summers and cool, wet winters, with an average maximum summer temperature of 30.5 °C and an average minimum winter temperature of 7 °C (Bureau of Meteorology 2016).

The Swan Coastal Plain consists of five major geomorphological elements as defined by McArthur and Bettanay (1960). From west to east these are the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf. These systems lie roughly parallel to the coast and are distinguished by their geology, topography, vegetation and soils.

The survey area lies within the Bassendean Dune system consisting of gently undulating low vegetated hills of quartz sands with numerous inter-dunal swamps and lakes. This dune system is the oldest and most leached of the three dune systems (Beard 1981). The Bassendean Dune System is described as being of "generally low relief, often with broad swales or relatively flat sand sheets between the low dunes. Soils are predominantly deep grey leached quartz sands".

3.1.1 Interim Biogeographical Regionalisation of Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 Biogeographic Regions (bioregions), based on climate, geology, landform, flora and fauna (DotE n.d.). Western Australia includes 23 IBRA bioregions subdivided into 53 subregions. The Swan Coastal Plain, in which the survey area is located, is a low-lying coastal plain, mainly covered with woodlands dominated by Banksia or tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to laterite-capped Mesozoic sediments dominated by Jarrah woodland (Mitchell et al. 2002).

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or tuart woodlands on limestone, Banksia and jarrah / Banksia woodlands on Quaternary marine dunes of various ages, and marri on colluvial and alluvials (Mitchell et al. 2002).

3.2 Regional Vegetation Mapping

3.2.1 Beard Vegetation Mapping

The survey area is situated in South West Botanical Province and the Darling Botanical District (Beard 1990). This region typically consists of forest country with related woodlands and is divided into four botanic subdistricts. The survey area is located within the Swan Coastal Plain Subregion in the Drummond Botanical Subdistrict, which according to Beard (1990) consists mainly of the following vegetation communities:

- *Banksia* Low Woodland on leached sands and Melaleuca Swamps in poorly drained areas.
- Woodland of tuart (*Eucalyptus gomphocephala*); and jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) on less leached soils.

Vegetation mapping of the Pinjarra region was completed by Beard (1979) at a scale of 1:250,000. Shepherd et al. (2002) reassessed Beard's existing mapping dividing some of the broader vegetation units up into smaller units.

The vegetation within the survey area is mapped as vegetation association Bassendean 1000: Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; tea-tree (*Melaleuca* spp.) (Shepherd et al. 2002).

The remnant extent and reservation status of vegetation association Bassendean 1000 within the IBRA Subregion is presented in Table 1.

Table 1: Pre-European Extent, Current Extent and Reservation Status of Vegetation Association Bassendean 1000 within the Perth IBRA Subregion

Vegetation Association	Pre-European Extent (ha)	Present Extent (ha) Remaining	% of Present Extent Remaining	% of Present Extent In Secure Tenure
1000	94,175	23,768	25.7	1.76

(Government of Western Australia 2015)

The remnant extent and reservation status of vegetation association Bassendean 1000 within the local government area is presented inTable 1.

Table 2: Pre-European Extent, Current Extent and Reservation Status of Vegetation Association Bassendean 1000 within the Shire of Serpentine Jarrahdale

Vegetation Association	Pre-European Extent (ha)	Present Extent (ha) Remaining	% of Present Extent Remaining	% Current Extent in All DPaW-Managed Land
1000	7,980	1,409	17.66	8.43

(Government of Western Australia 2015)

3.2.2 Heddle Vegetation Complexes

Vegetation complexes are vegetation associations that are characteristic of various combinations of soil, landform and rainfall. A large part of the Swan Coastal Plain has been mapped for vegetation complexes by Heddle et al. (1980). These complexes are closely related to the Swan Coastal Plain Dune Systems (Quindalup, Spearwood, Bassendean, and Pinjarra Plain) and north to south variations in climate and rainfall.

Heddle et al. (1980) mapped the vegetation within the survey area as Southern River Complex: Open woodland of *Corymbia calophylla, Eucalyptus marginata, Banksia* spp. with fringing woodland of *E. rudis and Melaleuca rhaphiophylla* along creek beds.

The remnant extent and conservation status of the Southern River Complex on the Swan Coastal Plain south of Moore River is presented in Table 3.

Table 3: Southern River Complex on the Swan Coastal Plain

Vegetation Complex	Pre-European Extent (ha)	Current 2013 Extent (ha)	% Remaining	Total Area Remaining in Bush Forever (ha)	% Remaining within Bush Forever
Southern River	57,171.55	11,254.99	19.69	2,514.31	22%

(Source: Perth Biodiversity Project 2013)

The remnant extent and conservation status of the Southern River Complex on within the Shire of Serpentine-Jarrahdale is presented in Table 4.

Table 4: Southern River Complex within the Shire of Serpentine-Jarrahdale

Vegetation Complex	Pre-European Extent (ha)	Current 2010 Extent (ha)	% Remaining	Total Area Remaining in Bush Forever (ha)	% Remaining within Bush Forever
Southern River	7,653	759.50	9.92	1,172.25	76%

(Source: Perth Biodiversity Project 2010)

3.3 Previous Biological Surveys

A Level 1 Flora and Vegetation Assessment (RPS 2015) was undertaken by Caroline Gill in June 2015 as part of the initial investigations into the flora and vegetation values of the site, and to determine the need for further assessment. Additionally, in June 2016, a targeted *Drakaea elastica* survey (RPS 2016) was undertaken of the Banksia woodland to provide additional data to the Department of Environment Regulation (DER) to facilitate environmental approvals for the survey area. The *Drakaea elastica Targeted Search Memorandum Report* is provided in Appendix 2.

3.4 Local Vegetation Mapping

The Level 1 Flora and Vegetation Survey (RPS 2015) involved the mapping of the vegetation units and condition for the survey area. Two vegetation units were described and mapped for the survey area as follows:

3.4.1.1 Em/Af.Ba.Bm – Banksia Woodland

Scattered *Eucalyptus marginata* and *Allocasuarina fraseriana* over *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* Low Open Woodland to Low Open Forest over *Kunzea glabrescens* and *Adenanthos cygnorum* Tall Shrubland over *Hibbertia hypericoides* and *Leucopogon conostephioides* Low Open Shrubland over *Phlebocarya ciliata*, *Desmocladus flexuosus* and *Dasypogon bromeliifolius* Herbland (Plate 2).

3.4.1.2 Remnant and Planted Trees and Shrubs over Pasture

Remnant and regrowth *Eucalyptus marginata, Xylomelum occidentale* and planted eastern-states *Eucalyptus* spp. over scattered planted eastern-state *Acacia* spp. over a Closed Grassland of exotic pasture grasses and herbs.

4.0 RESULTS

4.1 Desktop Survey

4.1.1 Threatened and Priority Flora Database Search Results

A search of DPaW's Threatened and Priority Flora database, Threatened and Priority Flora List, and the Western Australian Herbarium's Specimen database was undertaken to identify known Threatened Flora and Priority Flora records within a 5 km radius of the survey area using the search coordinates 396982.45 mE; 6415837.71 mS (GDA94 Zone 50 H).

Thirty-four conservation significant species were identified, including eight Threatened Flora, five Priority 1, three Priority 2, eleven Priority 3 and seven Priority 4 species (Table 5). Table 5 additionally identifies the listed species protection status under the EPBC Act.

The listed species were ranked in terms of their "likelihood of occurrence" within the survey area based on proximity of known records and habitat preference. Only 10 species listed in Table 5 were assessed as likely or possibly occurring within the survey area.

Table 5: Threatened and Priority Flora Database Search Results

Species	Conservation Code (State)	Conservation Code (EPBC)	"Likelihood of Occurrence" within the Survey Area
Caladenia huegelii	Threatened	CR	Possible
Drakaea elastica	Threatened	CR	Possible/Likely
Lasiopetalum pterocarpum	Threatened	CR	Unlikely
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Threatened	CR	Unlikely
Synaphea sp. Pinjarra Plain (A.S. George 17182)	Threatened	CR	Possible/Likely
Synaphea sp. Serpentine (G.R. Brand 103)	Threatened	CR	Possible/Likely
Tetraria australiensis	Threatened	VU	Possible
Verticordia plumosa var. *ananeotes*	Threatened	CR	Unlikely
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	Priority 1		Possible
Andersonia sp. Saxatilis (F. & J. Hort 3324)	Priority 1		Unlikely
Paracaleana gracilicordata	Priority 1		Unlikely
Paracaleana granitica	Priority 1		Unlikely

Species	Conservation Code (State)	Conservation Code (EPBC)	"Likelihood of Occurrence" within the Survey Area
Synaphea odocoileops	Priority 1		Unlikely
Grevillea crowleyae	Priority 2		Unlikely
Grevillea manglesii subsp. *ornithopoda*	Priority 2		Unlikely
Johnsonia pubescens subsp. *cygnorum*	Priority 2		Possible/Likely
Acacia horridula	Priority 3		Unlikely
Acacia oncinophylla subsp. *oncinophylla*	Priority 3		Unlikely
Amanita fibrillopes	Priority 3		Unknown
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Priority 3		Unlikely
Cyathochaeta teretifolia	Priority 3		Unlikely
Dillwynia dillwynioides	Priority 3		Unlikely
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) PN	Priority 3		Unlikely
Isopogon drummondii	Priority 3		Unlikely
Jacksonia gracillima	Priority 3		Unlikely
Stylidium longitubum	Priority 3		Possible
Lasiopetalum glutinosa var. *glutinosa*	Priority 3		Unknown
Aponogeton hexatepalus	Priority 4		Unlikely
Drosera occidentalis subsp. *occidentalis*	Priority 4		Unlikely
Eucalyptus rudis subsp. *cratyantha*	Priority 4		Unlikely
Parsonsia diaphanophleba	Priority 4		Unlikely
Senecio leucoglossus	Priority 4		Unlikely
Stylidium irenae	Priority 4		Possible
Verticordia lindleyi subsp. *lindleyi*	Priority 4		Possible/Likely

4.1.2 TEC and PEC Database Search Results

An area search undertaken of DPaW's TEC/PEC database as part of the desktop study identified seven TECs and one PEC (Table 6) within a 5 km radius of the survey area using the search coordinates 396982.45 m E; 6415837.71 m S (GDA94 Zone 50 H).

Table 6: TEC/PEC Database Search Results

Name	Description	Status*
SCP3a	*Eucalyptus calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain	Critically Endangered
SCP3b	*Eucalyptus calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain	Vulnerable
SCP3c	*Eucalyptus calophylla – Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	Critically Endangered

Name	Description	Status*
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	Endangered
SCP10a	Shrublands on dry clay flats	Endangered
SCP15	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	Vulnerable
SCP07	Herb rich saline shrublands in claypans	Vulnerable
SCP21c	Low-lying *Banksia attenuata* woodlands or shrublands	Priority 3

*BC Act

4.2 Field Survey

4.2.1 Flora

4.2.1.1 Flora Statistics

Eighty-two vascular plant taxa were recorded for the current survey, 11 of which were exotic (weed) species. These species were recorded for the intact bushland portion (the western half) of the survey area and were not recorded for remainder of the survey area. The eastern portion of the survey area, which has been subject to historical clearing of the native vegetation consisted of numerous planted eastern-states Eucalypts and Acacias. The list of species recorded for the intact bushland portion of the survey area is presented in Appendix 3. Detailed site data is presented in Appendix 4, and a species listed by site in Appendix 5.

The taxa recorded represent 62 genera from 31 families. The families represented by the greatest number of species are presented in Table 7.

There were a number of taxa that could not be identified to species level due to inadequate fruiting or flowering material available at the time of the survey. These taxa are labelled "sp.".

Table 7: Dominant Families within the Survey Area

Family	Common Name	No. of Taxa
FABACEAE	Peas	11
ASPARAGACEAE	-	10
ORCHIDACEAE	Orchids	7
MYRTACEAE	Myrtles	6
PROTEACEAE	-	6

4.2.1.2 Flora of Conservation Significance

No Threatened species, as listed under the BC Act or Priority Flora species as listed by DPaW were located within the survey area. No species governed by the EPBC Act were recorded within the survey area.

No flora species of other conservation significance as stated in Bush Forever (WAPC 2000).

4.2.1.3 Introduced Flora (Weeds)

Eleven introduced flora taxa (weeds) were recorded for the intact bushland portion of the survey area, which represents 13.4% of the total flora taxa recorded.

One species listed as a Declared Plant under the *Biosecurity and Agriculture Management Act 2007* was recorded during the survey – arum lily *(*Zantedeschia aethiopica)* (Plate 1), listed as (C3) Declared Pest for the whole state.

Plate 1: Arum Lily *(*Zantedeschia aethiopica)* within the Survey Area

4.2.2 Vegetation Units

Two vegetation units were described and mapped for the survey area (Figure 2). Descriptions and photographs of the vegetation units for the survey area are as follows.

4.2.2.1 Em/Af.Ba.Bm – Banksia Woodland

Scattered *Eucalyptus marginata* and *Allocasuarina fraseriana* over *Banksia attenuata, B. menziesii* and *B. ilicifolia* Low Open Woodland to Low Open Forest over *Kunzea glabrescens* and *Adenanthos cygnorum* Tall Shrubland over *Hibbertia hypericoides* and *Leucopogon conostephioides* Low Open Shrubland over *Phlebocarya ciliata, Desmocladus flexuosus* and *Dasypogon bromeliifolius* Herbland (Plate 2).

Plate 2: Em/Af.Ba.Bm – Banksia Woodland

The Em/Af.Ba.Bm vegetation unit is the only intact vegetation type within the survey area.

The Banksia Woodland vegetation was sampled at three quadrats. A total of 71 native taxa were recorded for this vegetation unit.

4.2.2.2 Remnant and Planted Trees and Shrubs over Pasture

Remnant and regrowth *Eucalyptus marginata, Xylomelum occidentale* and planted eastern-states *Eucalyptus* spp. over scattered planted eastern-states *Acacia* spp. over a Closed Grassland of exotic pasture grasses and herbs (Plate 3).

Plate 3: Remnant and Planted Trees and Shrubs over Pasture

This vegetation unit does not represent a true floristic community, but rather a completely degraded and modified portion of the survey area. Scattered remnant and re-emergent native species recorded here included *Eucalyptus marginata*, *Xylomelum occidentale*, *Banksia menziesii*, *Hibbertia hypericoides*, *Macrozamia riedlei*, *Acacia ?sessilis* and *Stirlingia latifolia*, however most of the vegetation comprised planted non-indigenous tree and shrub species, and pasture grasses and weeds. These planted species were not recorded as part of the flora inventory for the survey area.

4.2.3 Multivariate Analysis of Floristic Data

4.2.3.1 Data Compatibility

Floristic data from the three quadrats sampled for the current survey were considered compatible with the Gibson et al. (1994) dataset due to consistencies in quadrat size (10 m × 10 m), nomenclature, species-richness (indicative of sampling effort) and vegetation condition between the test sites and the Swan Coastal Plain dataset.

4.2.3.2 Hierarchical Cluster Analysis and FCTs

The Hierarchical Cluster Analyses was undertaken using PRIMERv6 comparing the floristics of each site from the current survey with the complete 509 site Gibson et al. (1994) Swan Coastal Plain dataset. The analysis was initially run on the Swan Coastal Plain dataset alone to see if the output showed similar groupings to the original Gibson analysis, that is, the 509 sites fell out in the four main groups (supergroups), broadly

reflecting geomorphological elements, as they did in the original analysis. Most of the sites did group with sites from the same FCT, however, some sites from closely related Banksia-dominated community types (e.g. FCT21a, FCT21c and FCT28) grouped together as did some shrubland sites from different community types (e.g. FCT24 and FCT26a). The seasonal wetland community types (FCT1a, FCT1b FCT2, FCT3a and FCT3b) did not form a separate supergroup but fell out with some of the claypan sites from FCT7 to FCT10.

These differences in the hierarchical clustering had been anticipated, and can be attributed to the use of different statistical analysis software which uses a different default beta value in the group-average linkage (UPGMA) clustering routine. Neil Gibson confirmed that it was likely that we would not be able to recreate the 1994 analysis results exactly because PRIMER does not allow you to change the beta value in the UPGMA algorithm. The version of PATN used 20 years ago used a value of -0.1 as a default, this parameter is not accessible in PRIMER which uses a default of 0.0 (N. Gibson 2016, pers. comm. 21 November).

Despite the obvious differences between the original 1994 analysis and the current PRIMERv6 analysis the majority of the Gibson et al. (1994) sites did group according to their FCTs. Furthermore, most sites from Supergroup 3 (FCT20-23 centred on Bassendean dunes) formed a distinct supergroup as they did in the original analysis (Appendix 6, Graph 6-1).

Each of the three test sites was then added separately to the full dataset in order to minimise disruption to the original groupings. Site RHQ1 grouped with FCT21c but also showed affiliations with FCT21a (Appendix 6, Graph 6-2). Site RHQ2 also grouped with FCT21c but showed affiliations with FCT21a (Appendix 6, Graph 6-3). Site RHQ3 grouped with FCT21c but showed affiliations with FCT21a and FCT6 (probably due to the high number of weeds present in this test site) (Appendix 6, Graph 6-4).

Given that all three test sites were clearly affiliated with the Bassendean dune woodland communities (Supergroup 3) an analysis was run on a subset of the Gibson dataset, that is, those sites that represented the Supergroup 3 community types including FCT20a to FCT23b, in an effort to clarify these mixed affiliations. A SIMPROF test was run on each classification to test the significance of the groups (shown as black lines on the dendrograms). The classification dendrogram for these analyses show RHQ1 forming a statistically significant cluster (alpha = 0.01) with two FCT21c sites and one FCT21a site (Appendix 6, Graph 6-5). Site RHQ2 formed a statistically significant cluster with one FCT21a site, and was next most affiliated with five more FCT21a, and three FCT21c sites (Appendix 6, Graph 6-6). Site RHQ3 formed a statistically significant cluster with five FCT21a sites and one FCT21b site (Appendix 6, Graph 6-7).

To further test the test sites' affiliations with FCT21a and FCT21c community types the analyses were re-run for each test site using only the site data for the Swan Coastal Plain sites classified by Gibson et al. (1994) as belonging to either FCT 21a, FCT21b or

FCT21c. RHQ1 grouped with two FCT21c sites (Appendix 6, Graph 6-8), RHQ2 grouped with one FCT21a site (Appendix 6, Graph 6-9), and RHQ3 grouped with five FCT21a sites (Appendix 6, Graph 6-10).

4.2.3.3 Landform and Species Occurrence as an Indicator of FCT

The landform and species recorded for all three floristic quadrats are more characteristic FCT21c than FCT21a. Recorded species including *Banksia ilicifolia*, *Kunzea glabrescens Adenenthos cygnorum* and *Scholtzia involucrata* which occur at much greater frequencies in FCT21c than in FCT21a. This site is low-lying which is typical of FCT21c.

4.2.3.4 Geographic Distribution of FCTs

There are several Gibson et al. (1994) sites in relatively close proximity to the survey area representing both FCT21a and FCT21c. These sites occur between 5 km and 10 km from the survey area. Proximity of these records to the survey area supports the classification results.

The above results are summarised in Table 8.

Table 8: FCTs Estimated from PATN MERv6 Analyses of the Test Data and Swan Coastal Plain Dataset, and Assessment of Soils, Landform and Species Presence

Site	Dendrogram FCT all Gibson Data	Dendrogram FCT Woodlands Centred on Bassendean Dunes – Supergroup 3	Dendrogram FCT Community Types – FCT21a, FCT21b, FCT21c	Soil, Landform, Species Presence	Geographic Distribution of FCTs
RHQ1	21c/21a	21c/21a	21c	21c	21c/21a
RHQ2	21c/21a	21a/21c	21a	21c	21c/21a
RHQ3	21c/21a/6	21a/21b	21a	21a	21c/21a

4.2.3.5 Vegetation Condition

The vegetation condition within the survey area ranged from Very Good to Good within portions of intact Banksia Woodland vegetation, to Completely Degraded along tracks and throughout the highly modified sections of the survey area.

The vegetation condition of the survey area is presented in Figure 3.

5.0 DISCUSSION

5.1 Floristic Diversity and Representation

In assessing the conservation significance of flora within the survey area, consideration is given to rarity, biodiversity, endemism and representativeness of the flora in the area.

5.1.1 Rarity

The rarity of the flora was assessed via the various categories of Threatened Flora (protected under the BC Act and under the EPBC Act), Priority Flora (listed by DPaW) and flora of other conservation significance, as defined by EPA (2004).

No Threatened or Priority Flora species were recorded at the time of the survey, nor were any flora of other conservation significance. All species recorded were locally and regionally common. It should be noted however that the survey was undertaken at a sub-optimal time for detecting spring flowering ephemerals such as orchids.

Thus the rarity of the survey area flora was assessed as low.

5.1.2 Biodiversity

Seventy-one native taxa were recorded for the *Em/Af.Ba.Bm* – Banksia Woodland vegetation within the survey area.

Floristic diversity was assessed as moderately high.

5.2 Vegetation Conservation Significance

5.2.1 Bioregional Representation

On a regional scale the survey area is mapped as vegetation association Bassendean 1000 (Shepherd et al. 2002) and Southern River Complex (Heddle 1980).

Bassendean 1000 vegetation association is estimated to have 25.7% of its pre-European extent remaining within the Perth (SWA02) Subregion and 1.76% of the present extent in secure tenure (Government of Western Australia 2015).

Within the IBRA Swan Coastal Plain bioregion, between Moore River and Dunsborough, the Southern River Complex is estimated to have 19.69% of its pre-European extent remaining and 1.5% of the present extent in secure tenure (Perth Biodiversity Project 2013).

The EPA's criteria for assessing vegetation conservation significance in relation to clearing are:

- 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-clearing extent of the vegetation type.
- A level of 10% of the original extent is regarded as being a level representing "endangered".

The extent remaining of both Bassendean 1000 vegetation association and Southern River Complex is below the threshold level of 30% set by the EPA.

5.2.2 National Threatened Ecological Communities

The Banksia Woodland vegetation was assessed to determine whether the EPBC-listed TEC – *Banksia Woodlands of the Swan Coastal Plain* was present within the survey area. The assessment followed the approach set out in the Conservation Advice for the TEC (Threatened Species Scientific Committee 2016) as detailed in section 2.3.4 of this document.

5.2.2.1 Banksia Woodlands of the Swan Coastal Plain

The 2.12 ha area of intact Banksia Woodland within the survey area satisfies the key diagnostic characteristics for the TEC in terms of its location and physical environment, soils and landform, structure and floristic composition.

Approximately 0.33 ha of the Banksia Woodland meets the minimum condition thresholds for the ecological community as it is in Good or better condition, and therefore exceeds the minimum condition threshold of Good.

The Banksia Woodland within the survey area does not, however, meet the minimum patch size thresholds for the ecological community, as the patch in Very Good to Good condition is only 0.26 ha in size, and the patch in Good condition only 0.07 ha. The areas for each condition grading within the Banksia Woodland in the survey area, and the minimum patch sizes required to satisfy this criterion (according to the Conservation Advice) are presented in Table 9.

Table 9: Vegetation Condition of the Banksia Woodland within the Survey Area and Minimum Patch Sizes for Different Condition Grades

Vegetation Condition (Keighery 1994)	Area (ha) within the Survey Area	Conservation Advice Minimum Patch Size (ha)
Excellent	0	0.5
Very Good	0.26	1
Good	0.07	2

Although a portion of the vegetation satisfies the minimum condition threshold for the TEC, the Banksia Woodland within the survey area does not satisfy the patch size requirement – it does not therefore have sufficient conservation value to be considered a MNES.

5.2.3 Western Australian Threatened and Priority Ecological Communities

No state-listed TECs were recorded within the survey area for the current survey.

5.2.3.1 FCT Determination

The Banksia woodland within the survey area was found to be affiliated with several community types but in particular FCT21a and FCT21c which are described as follows:

FCT21a – Central *Banksia attenuata – Eucalyptus marginata* woodlands. This community type occurs in the central part of the coastal plain between Perth and Capel, on Bassendean and Spearwood dunes as well as alluvial soils. Species richness for this FCT is moderately high and weed frequency is relatively low (Gibson et al. 1994).

FCT21c – Low-lying Banksia attenuata woodlands or shrublands. This community type occurs sporadically between Gingin and Bunbury and is largely restricted to the Bassendean system. Species richness for this FCT is relatively low and it tends to occur on more low-lying and wetter sites (Gibson et al. 1994).

Based on the summary of results in Table 8 it is difficult to make a clear determination as to which FCT is represented by each test site within the Banksia woodland vegetation of the survey area. The analyses show that the vegetation has strong affinities to both FCT21a and FCT21c. Sites RHQ1 and RHQ2 are showed greater affinity with FCT21c due to the presence of key species and their position in the landscape, and RHQ3 showed a greater affinity to FCT21a.

5.2.3.2 Conservation Status of FCTs within the Survey Area

FCT21a – Central *Banksia attenuata – Eucalyptus marginata* woodlands has a reservation status of Well Reserved and a conservation status of considered Low Risk (Gibson et al. 1994).

FCT21c – Low-lying *Banksia attenuata* woodlands or shrublands has a reservation status of Well Reserved and a conservation status of considered Susceptible (Gibson et al. 1994) and is listed as a Priority 3 PEC.

The vegetation shared affinities with both FCT21a and the Priority 3 Priority Ecological Community (PEC) FCT21c.

5.3 Survey Limitations

Botanists who conduct flora and vegetation surveys for environmental impact assessment in Western Australia are obliged to report on the limitations/constraints in such studies. Some potential limitations/constraints on surveys (e.g. inadequate scope of survey, inappropriate methods, inexperienced personnel, inadequate contextual data, poor access to survey sites, disturbances to the environment such as recent fire, or insufficient survey effort) may adversely impact on the scientific rigour, completeness or the validity of the survey results.

It is estimated that the flora inventory obtained for the survey area represents >75% of its flora taxa.

As with any biological survey, additional flora species including potential Threatened, Priority or other conservation significant species may be detected in subsequent surveys. The data presented in this report provides an indication only of the location, distribution, and population size of Priority Flora and species of other conservation significance.

At least 10% of the flora in Western Australia is undescribed, with new species being identified regularly. The flora identifications were completed to a standard limited by the technical resources available at the time such as available identification keys and publications. Specialist taxonomists were consulted where appropriate and/or possible.

6.0 CONCLUSIONS

In considering the conservation significance of the intact native vegetation within the survey area, it was assessed against criteria relating to rarity, biodiversity, representativeness of the flora and vegetation, condition, and location in the landscape, i.e., whether or not it is contiguous with like vegetation (providing an ecological linkage – corridor or stepping stone), or an isolated fragment.

The absence of Threatened and Priority Flora within the survey area means the rarity is considered low.

The presence of 71 native taxa within the vegetation means biodiversity is moderately high.

At a state level the vegetation was assessed as being conservation significant based on the potential presence of the state-listed Priority 3 PEC [illegible] – Low-lying Banksia attenuata woodlands or shrublands.

At a national level the vegetation was not considered to have sufficient conservation value to be considered a Matter of National Environmental Significance (MNES) under the EPBC Act because it did not satisfy the criteria relating to patch size for the EPBC-listed TEC Banksia Woodlands of the Swan Coastal Plain.

The conservation significance of the vegetation is compromised by its condition and fragmented nature. Condition within the survey area ranged from Very Good to Good within portions of the Banksia Woodland vegetation, to Completely Degraded along tracks and throughout the highly modified sections. The intact vegetation within the survey area is not contiguous with other areas of similar vegetation but consists of an isolated fragment surrounded by previously cleared farmland and planted exotic tree and shrub species. The nearest patch of intact vegetation of similar size lies approximately 400 m to the east.

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FIGURES

RPS

Job Number: L1505501
Doc Number: 001
Date: 30.07.15
Scale: Map 1: 25,000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate

0 25 50 100 m

Figure 1
Survey Area Boundary and Site Location

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LEGEND
Survey Area
Site Boundary
Vegetation Units
Em/Af.Ba.Bm – Banksia Woodland
Scattered Eucalyptus marginata and Allocasuarina fraseriana over Banksia attenuata, B. menziesii and B. ilicifolia Low Open Woodland to Low Open Forest over Kunzea glabrescens and Adenanthos cygnorum Tall Shrubland over Hibbertia hypericoides and Leucopogon conostephioides Low Open Shrubland over Phlebocarya ciliata, Desmocladus flexuosus and Dasypogon bromeliifolius Herbland
Remnant and Planted Trees and Shrubs over Pasture
Remnant and regrowth Eucalyptus marginata (Jarrah), Xylomelum occidentale (Woody Pear) and planted eastern-states Eucalyptus spp. over scattered planted eastern-states Acacia spp. over a Closed Grassland of exotic pasture grasses and herbs.
PA16/164
RPS
GDA 1994 MGA Zone 50
Figure 2
Vegetation Units

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APPENDIX I

Definitions

APPENDIX 1: Definitions

Table 1-1: Conservation Codes for Western Australian Flora

Category	Definition
T	Threatened Flora (Extant) Taxa1 that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: ▪ CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild ▪ EN: Endangered – considered to be facing a very high risk of extinction in the wild ▪ VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	Presumed Extinct Flora Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*).
P1	Priority One: Poorly-known taxa Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	Priority Two: Poorly-known taxa Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, state forest, vacant Crown land, water reserves. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly-known taxa Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring ▪ Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. ▪ Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. ▪ Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	Priority Five: Conservation Dependent taxa Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

(WAH 2016)

Table 1-2: Threatened Ecological Communities Category of Threat

Category	Definition
PD	Presumed Totally Destroyed An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies: A. Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats; or B. All occurrences recorded within the last 50 years have since been destroyed.
CR	Critically Endangered An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria: A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply: – Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately five years). – Modification throughout its range is continuing such that in the immediate future (within approximately five years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately five years). ii. There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. iii. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences, which may be capable of being rehabilitated if such work begins in the immediate future (within approximately five years).
EN	Endangered An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii): i. Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years). ii. Modification throughout its range is continuing such that in the short-term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years). ii. There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. iii. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Category	Definition
VU	Vulnerable An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long-term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A. The ecological community exists largely as modified occurrences, which are likely to be capable of being substantially restored or rehabilitated. B. The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.
DD	Data Deficient An ecological community, which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biol[illegible] that is suspected to belong to any of the above categories These ecological communities have a high priority for survey [illegible] research.)
LR	Lower Risk An ecological community that has been adequate[illegible] surveye[illegible] and does not qualify for any of the above categories of threat and appe[illegible]s unlike[illegible] to be [illegible]nder threat of significant modification or destruction in the short to m[illegible]m term [illegible]ure.

(Source: English and Blyth 1997)

Table 1-3: Priority Ecological Commun[illegible] Cate[illegible]ory Definitions

Category	Definition
P1	Priority One: Poorly-kn[illegible] w[illegible] ecologi[illegible] communities Ecological communities with [illegible]parently few, small occurrences, all or most not actively managed for [illegible]servation (e.g. within agricultural or pastoral lands, urban areas, active mineral lease[illegible] and[illegible] which current threats exist. Communities m[illegible]y [illegible] included if they are comparatively well-known from one or more loca[illegible]i[illegible]s [illegible]t do [illegible]t meet adequacy of survey requirements, and/or are not well defined, and a[illegible]ear to [illegible] unde[illegible] immediate threat from known threatening processes across their range.
P2	Pri[illegible]ty [illegible]wo: Poorly-known ecological communities Comm[illegible]ities that are known from few small occurrences, all or most of which are actively managed [illegible]or conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly known ecological communities A. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation, or: B. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; C. Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Category	Definition
P4	Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. A. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. B. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. C. Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

(Source: DPaW 2008)

Table 1-4: EPBC Act Listed Threatened Ecological Communities Category of Threat

Category	Definition
CR	Critically Endangered If an ecological community is facing an extremely high risk of extinction in the wild in the immediate future.
EN	Endangered If an ecological community is not Critically Endangered but is facing a very high risk of extinction in the wild in the immediate future.
VU	Vulnerable If an ecological community is not Critically Endangered or Endangered but is facing a very high risk of extinction in the wild in the medium term future.

(Source: Commonwealth of Australia 2013)

Table 1-5: Vegetation Structure Classes (WAPC 2000)

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

(Source: Western Australian Planning Commission 2000)

Table 1-6: Vegetation Condition Scale

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

(Source: Keighery 1994)

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APPENDIX 2

Drakaea elastica Targeted Search Memorandum Report

RPS

Level 2, 27-31 Troode Street, West Perth WA 6005
PO Box 170, West Perth WA 6872
T +61 8 9211 1111 F +61 8 9211 1122 E environment@rpsgroup.com.au W rpsgroup.com.au

MEMORANDUM

TO:	ROCLA QUARRY PRODUCTS		
ATTENTION:	Vern Newton		
FROM	Caroline Gill		
DATE:	25 July 2016	**OUR REF:**	EBL1505501
SUBJECT:	TARGETED DRAKAEA ELASTICA SURVEY, PUNRAK RD HOPELAND		

Background and Scope of Works

The purpose of the targeted conservation significant flora search was to provide additional data to DER in order to facilitate the approval for the mining of sand within Lot 137 Punrak Road. The DER had requested a supplementary survey to be undertaken in order to adequately assess the likelihood of occurrence of Threatened flora species *Drakaea elastica*. The collection of the requested data required a survey during the optimal detection time for the target species (June/July), when the glossy green leaves would be evident if the species was present on site.

The targeted search focussed on suitable habitat for the species in Intact remnant Banksia woodland within Lot 137 in Good or better vegetation condition (Keighery 1994).

Drakaea elastica (Plate 1) is a tuberous, perennial herb, 0.12-0.3 m high. The species' small glossy green leaves typically emerge in June with flowering occurring between October and November. The species occurs on white or grey sand in low-lying situations adjoining winter-wet swamps (Florabase 2016).

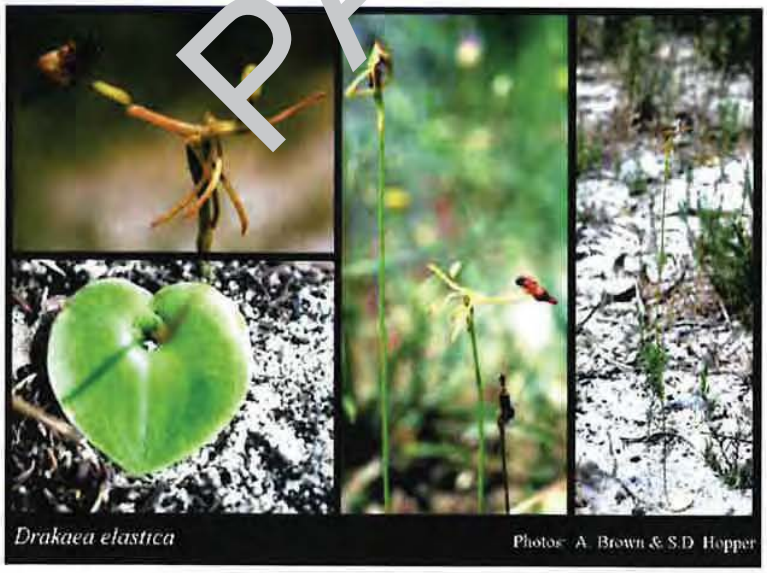

Plate 1: *Drakaea elastica* (Source: Florabase, 2016)

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Methods

The targeted search was undertaken on Friday 1st July 2016, by qualified RPS botanist Caroline Gill. The search was undertaken using a handheld GPS, and involved a systematic grid-based search along transects spaced 5 metres apart within the Banksia woodland vegetation.

The following information was to be recorded for any *D. elastica* individuals identified:

- number of plants
- location using the GPS (UTM Datum GDA94)
- health of the population
- photographs of the plant.

Results

Despite a thorough search no *Drakaea elastica* individuals were recorded within the search area. Numerous occurrences of several other ephemeral orchid species were however recorded for the survey, including *Pterostylis* spp., *Caladenia* spp., *Pyrorchis nigricans*, and the miniature *Corybas ?recurvus*.

Limitations

Botanists who conduct flora and vegetation surveys for environmental impact assessment in Western Australia are obliged to report on the limitations/constraints in such studies.

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

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APPENDIX 3

Flora Inventory

APPENDIX 3: Flora Inventory

Table 3-1: Inventory of Flora Species

Family	Weed	Species Name
ARACEAE	*	*Zantedeschia aethiopica*
ASTERACEAE	*	*Arctotheca calendula*
	*	*Hypochaeris glabra*
	*	*Ursinia anthemoides*
FABACEAE	*	*Lupinus cosentinii*
IRIDACEAE	*	*Gladiolus caryophyllaceus*
	*	*Romulea rosea*
ORCHIDACEAE	*	*Disa bracteata*
POACEAE	*	*Avena barbata*
	*	*Briza maxima*
	*	*Lamarta cylindrica*
ANARTHRIACEAE		*Lyginia barbata*
ARALIACEAE		*Trachymene pilosa*
ASPARAGACEAE		*Chamaescilla corymbosa*
		Lomandra hermaphrodita
		Lomandra micrantha subsp. *micrantha*
		Lomandra nigricans
		Lomandra odora
		Lomandra preissii
		Lomandra suaveolens
		Sowerbaea laxiflora
		Thysanotus manglesianus
		Thysanotus sparteus
ASTERACEAE		*Lagenophora huegelii*
CASUARINACEAE		*Allocasuarina fraseriana*
COLCHICACEAE		*Burchardia congesta*
CYPERACEAE		*Lepidosperma pubisquameum*
		Lepidosperma squamatum
DASYPOGONACEAE		*Dasypogon bromeliifolius*
DILLENIACEAE		*Hibbertia hypericoides*
DROSERACEAE		*Drosera erythrorhiza*
		Drosera menziesii
ELAEOCARPACEAE		*Tetratheca ?hirsuta*
ERICACEAE		*Conostephium pendulum*
		Leucopogon conostephioides
FABACEAE		*Fabaceae* sp.
		Acacia ?sessilis
		Acacia huegelii

Family	Weed	Species Name
		Acacia lasiocarpa var. *lasiocarpa*
		Acacia saligna
		Bossiaea eriocarpa
		Daviesia triflora
		Gompholobium tomentosum
		Hovea trisperma
		Kennedia prostrata
GOODENIACEAE		*Dampiera linearis*
HAEMODORACEAE		*Anigozanthos manglesii* subsp. *manglesii*
		Conostylis aculeata
		Conostylis juncea
		Phlebocarya ciliata
HALORAGACEAE		*Gonocar[illegible] pithyoides*
HEMEROCALLIDACEAE		*Agrostoc[illegible]sutum*
IRIDACEAE		*[illegible]atersonia [illegible]identalis*
LORANTHACEAE		*Nu[illegible]sia [illegible]ribunda*
MOLLUGINACEAE		*M[illegible]arthu[illegible] australis*
MYRTACEAE		*Eucalyptus marginata*
		[illegible]nzea glabrescens
		Melaleuca pauciflora
		Melaleuca thymoides
		Scholtzia involucrata
		Taxandria linearifolia
ORCHIDACEAE		*Caladenia flava*
		Duiris sp.
		Orchidaceae sp.
		Pterostylis nana
		Pterostylis vittata
		Pyrorchis nigricans
PHYLLANTHACEAE		*Poranthera microphylla*
PITTOSPORACEAE		*Billardiera variifolia*
POACEAE		*Austrostipa compressa*
PROTEACEAE		*Adenanthos cygnorum*
		Banksia attenuata
		Banksia ilicifolia
		Banksia menziesii
		Stirlingia latifolia
		Xylomelum occidentale
RESTIONACEAE		*Desmocladus flexuosus*
RUTACEAE		*Philotheca spicata*
STYLIDIACEAE		*Stylidium amoenum*
		Stylidium brunonianum
ZAMIACEAE		*Macrozamia riedlei*

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APPENDIX 4

Detailed Site Data

APPENDIX 4: Detailed Site Data

Site RHQ1

Site Type: Quadrat
Location: Hopeland, WA
Date: 19/09/2016
Quadrat size: 10m x 10m
GPS (NW corner): WP695
396856 mE 6415642 mN
(GDA94 Zone 50 H)
Topography: Low-lying flat on Bassendean dunes
Soil: Grey Bassendean sand
Natural litter: 50%
Bare ground: <5%

Vegetation Condition: Very Good – Vegetation structure altered; obvious signs of disturbance. No fire for many years.

Vegetation Description:
Scattered *Eucalyptus marginata* and *Allocasuarina fraseriana* over *Banksia attenuata, B. menziesii* and *B. ilicifolia* Low Open Forest over *Kunzea glabrescens* Tall Open Scrub over a mixed Low Open Shrubland including *Leucopogon conostephioides Stirlingia latifolia, Conostephium pendulum* and *Scholtzia involucrata* over *Phlebocarya ciliata, Desmocladus flexuous* and *Dasypogon bromeliifolius* Open Herbland.

Associated Species:
*Agrostocrinum hirsutum, Austrostipa compressa, Banksia attenuata, Banksia ilicifolia, Banksia menziesii, Bossiaea eriocarpa, *Briza maxima, Burchardia congesta, Caladenia flava, Conostephium pendulum, Conostylis juncea, Dasypogon bromeliifolius, Desmocladus flexuosus, Drosera erythrorhiza, Fabaceae sp., Hovea trisperma, *Hypochaeris glabra, Kunzea glabrescens, Lepidosperma squamatum, Leucopogon conostephioides, Lomandra odora, Lyginia barbata, Macarthuria australis, Philotheca spicata, Phlebocarya ciliata, Poranthera microphylla, Pterostylis nana, Pterostylis vittata, Pyrorchis nigricans, Scholtzia involucrata, Stirlingia latifolia, Trachymene pilosa* and **Ursinia anthemoides*

Site RHQ2

Site Type: Quadrat
Location: Hopeland, WA
Date: 19/09/2016
Quadrat size: 10m x 10m
GPS (NW corner): WP696 396840 mE 6415626 mN (GDA94 Zone 50 H)
Topography: Low-lying flat on Bassendean dunes
Soil: Grey Bassendean sand
Natural Litter: 60%
Bare Ground: <5%

Vegetation Condition: Very Good – Vegetation structure altered; obvious signs of disturbance. No fire for many years.

Vegetation Description:
Scattered *Allocasuarina fraseriana* over *Banksia attenuata, B. menziesii* and *B. ilicifolia* Low Woodland over *Kunzea glabrescens* Tall Shrubland over *Hibbertia hypericoides and Stirlingia latifolia* Low Open Shrubland over *Desmocladus flexuosus* and *Lyginia barbata* Very Open Herbland.

Associated Species:
*Acacia huegelii, Allocasuarina fraseriana, Banksia attenuata, Banksia ilicifolia, Banksia menziesii, Bossiaea eriocarpa, *Briza maxima, Burchardia congesta, Caladenia flava, Conostylis aculeata, Conostylis juncea, Dasypogon bromeliifolius, Desmocladus flexuosus, Drosera erythrorhiza, Gompholobium tomentosum, Hibbertia hypericoides, Hypochaeris glabra, Kunzea glabrescens, Lagenophora huegelii, Lepidosperma squamatum, Lomandra micrantha* subsp. *micrantha, Lomandra preissii, Lyginia barbata, Patersonia occidentalis, Phlebocarya ciliata, Sowerbaea laxiflora, Stirlingia latifolia* and **Ursinia anthemoides.*

Site RHQ3

Site Type: Quadrat
Location: Hopeland, WA
Date: 19/09/2016
Quadrat size: 10m x 10m
GPS (NW corner): WP697 396885 mE 6415677 mN (GDA94 Zone 50 H)
Topography: Low-lying flat on Bassendean dunes
Soil: Grey Bassendean sand
Natural Litter: 30%
Bare Ground: 0%

Vegetation Condition: Good – Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained.

Vegetation Description:
Scattered *Allocasuarina fraseriana* over *Banksia attenuata, B. menziesii* and *B. ilicifolia* Low Open Forest over *Hibbertia hypericoides* and *Stirlingia latifolia* Low Open Shrubland over *Desmocladus flexuosus, Drosera erythrorhiza* and **Briza maxima* Herbland.

Associated Species:
*Allocasuarina fraseriana, Banksia attenuata, Banksia ilicifolia, Banksia menziesii, Billardiera variifolia, Bossiaea eriocarpa, Burchardia congesta, Caladenia flava, Conostephium pendulum, Conostylis juncea, Dasypogon bromeliifolius, Desmocladus flexuosus, Drosera erythrorhiza, *Ehrharta calycina, Hibbertia hypericoides, *Hypochaeris glabra, Lyginia barbata, Phlebocarya ciliata, Pyrorchis nigricans, Scholtzia involucrata, Stirlingia latifolia, Stylidium brunonianum, Thysanotus manglesianus* and **Ursinia anthemoides.*

RPS

APPENDIX 5

Species by Site

APPENDIX 5: Species by Site

Species	Floristic Sampling Site		
	RHQ1	RHQ2	RHQ3
Acacia huegelii		x	
Agrostocrinum hirsutum	x		
Allocasuarina fraseriana		x	x
Austrostipa compressa	x		
Banksia attenuata	x	x	x
Banksia ilicifolia	x	x	x
Banksia menziesii	x	x	x
Billardiera variifolia			x
Bossiaea eriocarpa	x	x	x
Briza maxima	x	x	x
Burchardia congesta	x	x	x
Caladenia flava	x	x	x
Conostephium pendulum	x		x
Conostylis aculeata		x	
Conostylis juncea	x	x	x
Dasypogon bromeliifolius	x	x	x
Desmocladus flexuosus	x	x	x
Drosera erythrorhiza	x	x	x
Ehrharta calycina			x
Fabaceae sp.	x		
Gompholobium tome[illegible]m		x	
Hibbertia hyperic[illegible]des		x	x
Hovea trisperma	x		
Hypochaeris glabra	x	x	x
Kunzea glabrescens	x	x	
Lagenophora huegelii		x	
Lepidosperma squamatum	x	x	
Leucopogon conostephioides	x		
Lomandra micrantha subsp. *micrantha*		x	
Lomandra odora	x		
Lomandra preissii		x	
Lyginia barbata	x	x	x
Macarthuria australis	x		
Patersonia occidentalis		x	
Philotheca spicata	x		
Phlebocarya ciliata	x	x	x

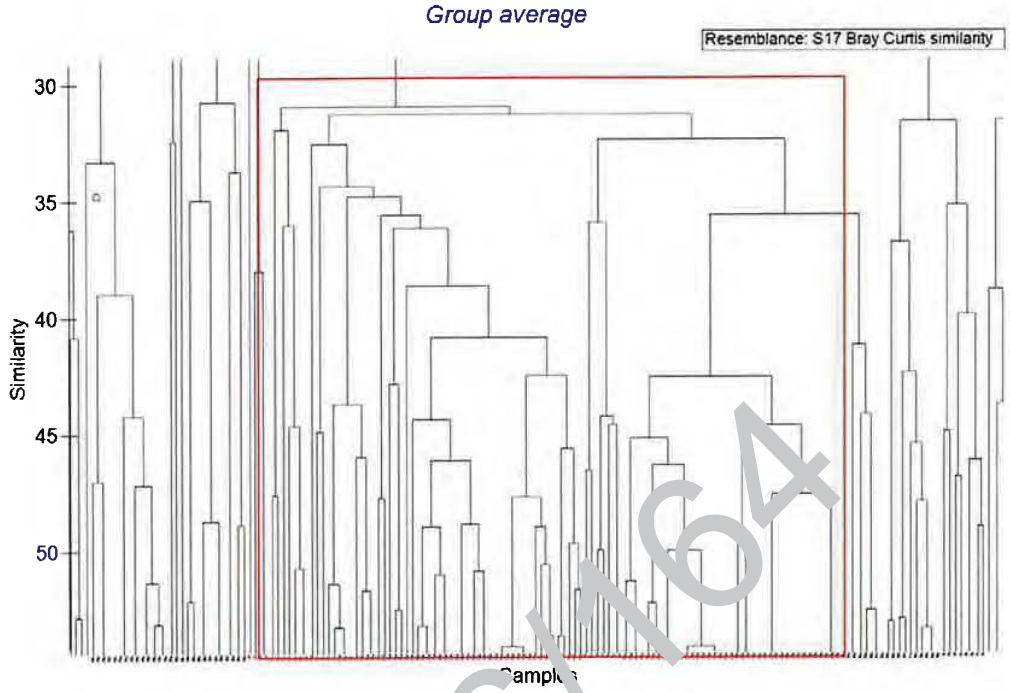
Species	Floristic Sampling Site		
	RHQ1	RHQ2	RHQ3
Poranthera microphylla	x		
Pterostylis nana	x		
Pterostylis vittata	x		
Pyrorchis nigricans	x		x
Scholtzia involucrata	x		x
Sowerbaea laxiflora		x	
Stirlingia latifolia	x	x	x
Stylidium brunonianum			x
Thysanotus manglesianus			x
Trachymene pilosa	x		
Ursinia anthemoides	x	x	x

RPS

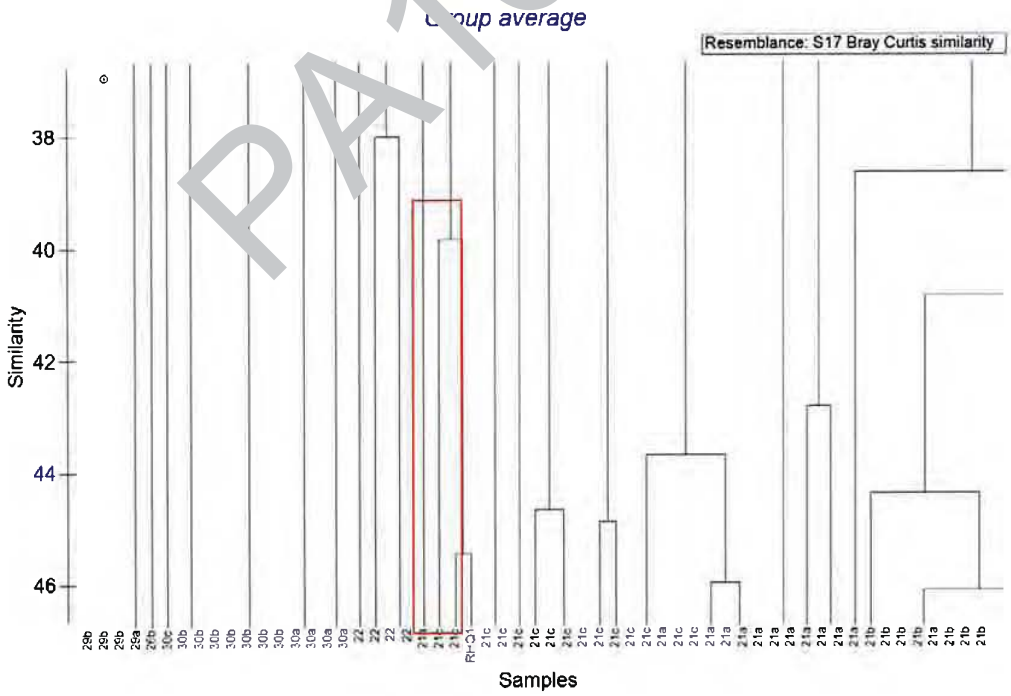
APPENDIX 6

Hierarchical Cluster Analysis Dendrograms

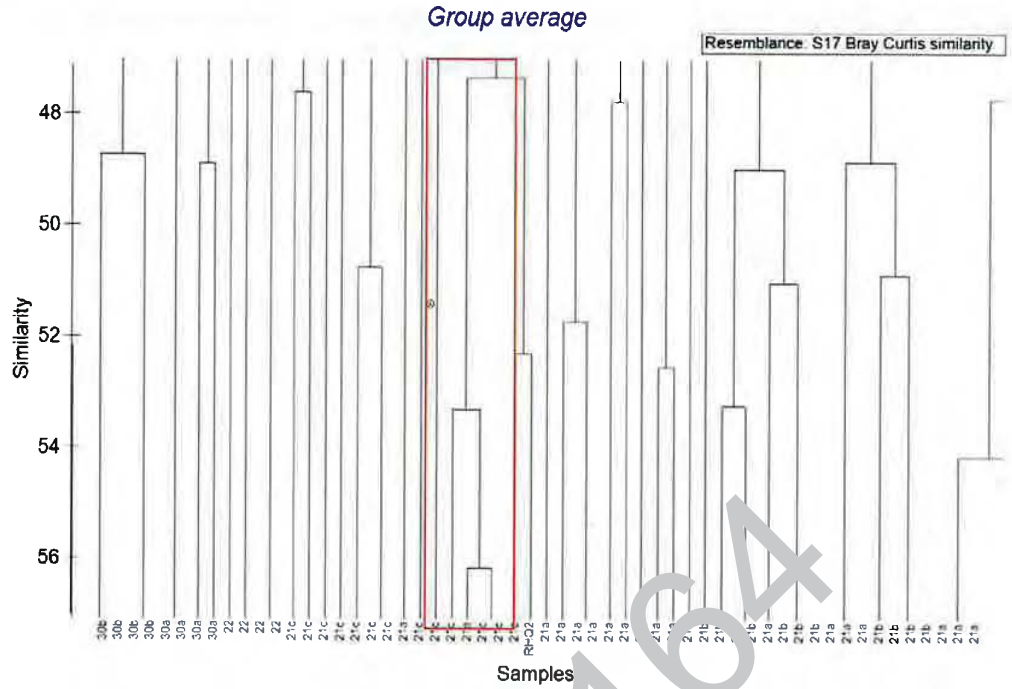
APPENDIX 6: Hierarchical Cluster Analysis Dendrograms



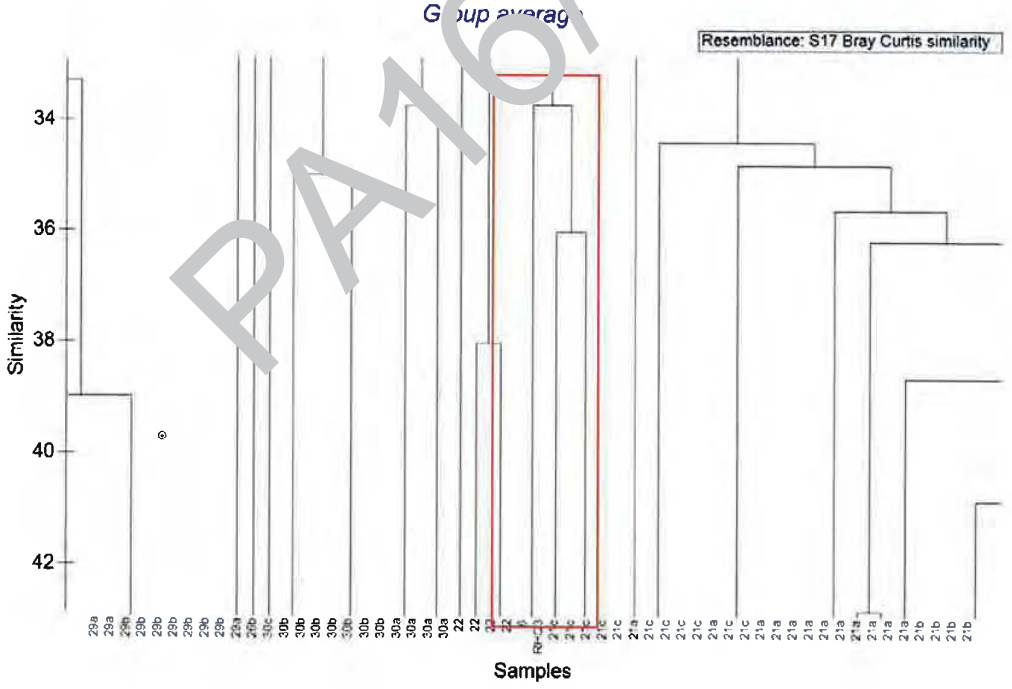
Graph 6-1: Relevant Portion of Classification Dendrogram Showing Grouping of Sites from Gibson et al. (1994) Supergroup 3 FCTs



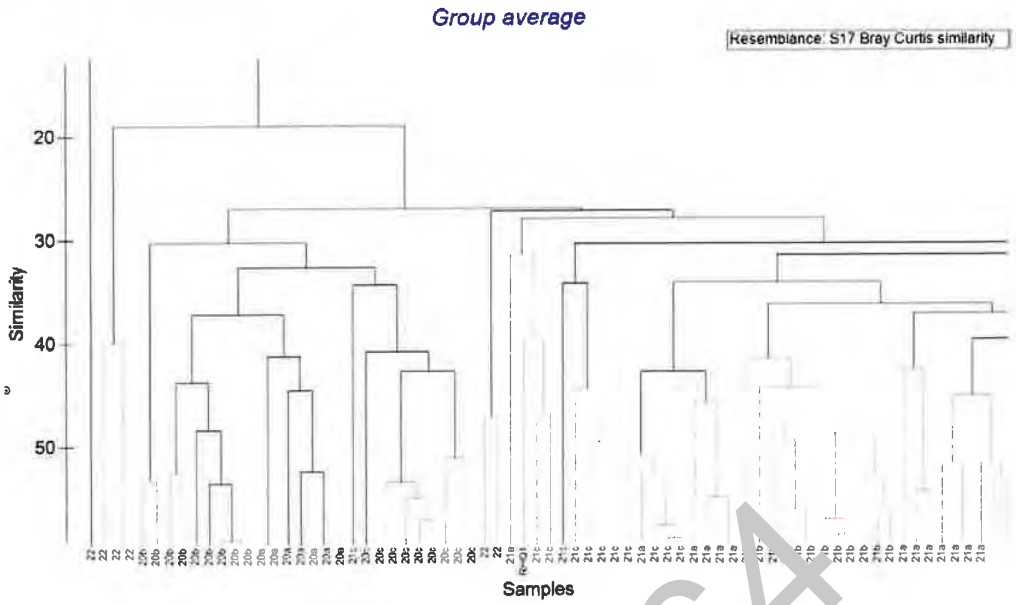
Graph 6-2: Relevant Portion of Classification Dendrogram Showing Relationship between RHQ1 and Gibson et al. (1994) FCTs



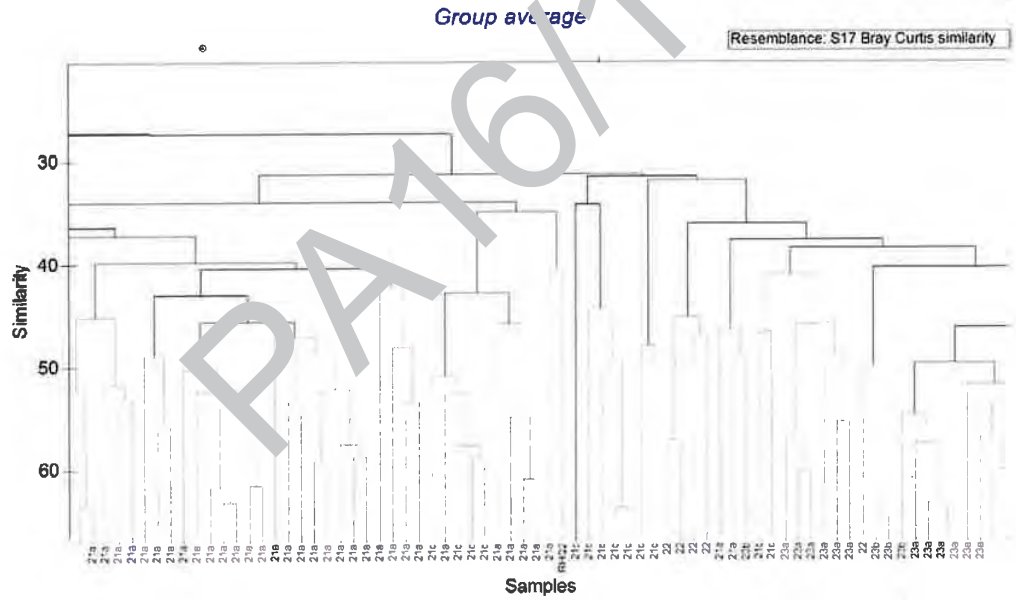
Graph 6-3: Relevant Portion of Classification Dendrogram Showing Relationship between RHQ2 and Gibson et al. (1994) FCTs



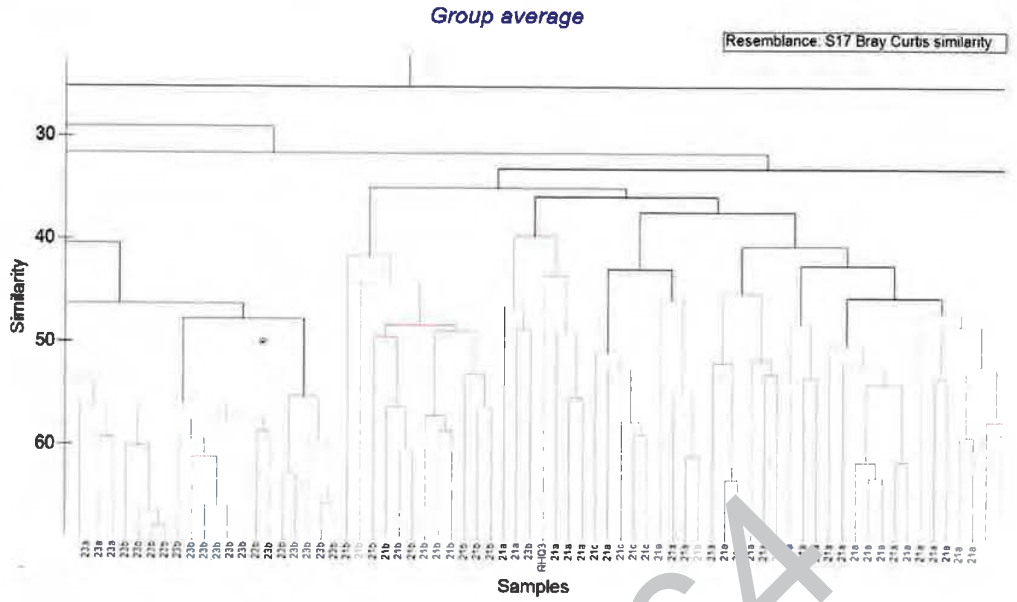
Graph 6-4: Relevant Portion of Classification Dendrogram Showing Relationship between RHQ3 and Gibson et al. (1994) FCTs



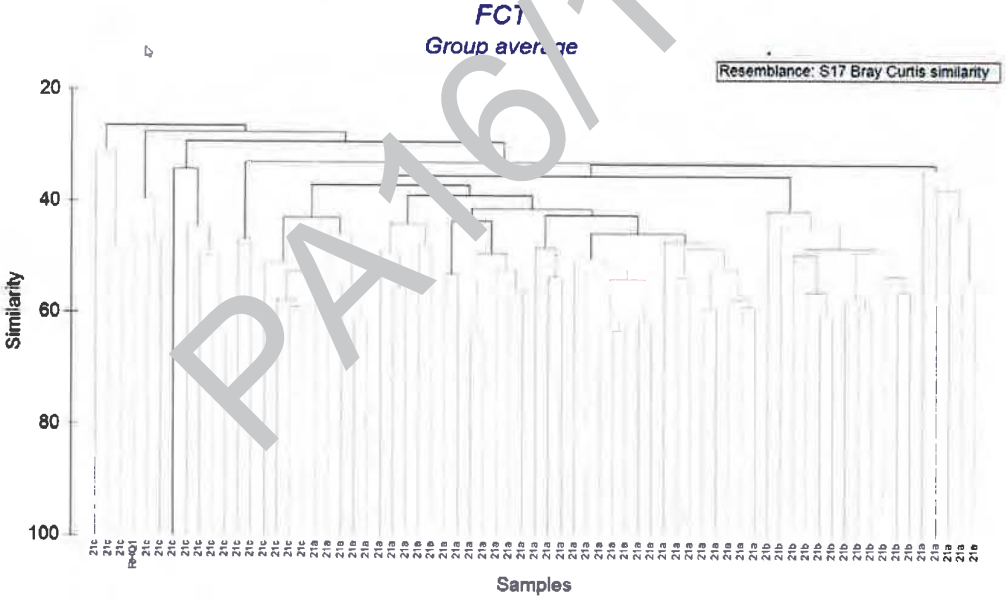
Graph 6-5: Relevant Portion of Classification Dendrogram Showing Relationship between RHQ1 and Gibson et al. (1994) Supergroup 3 FCTs



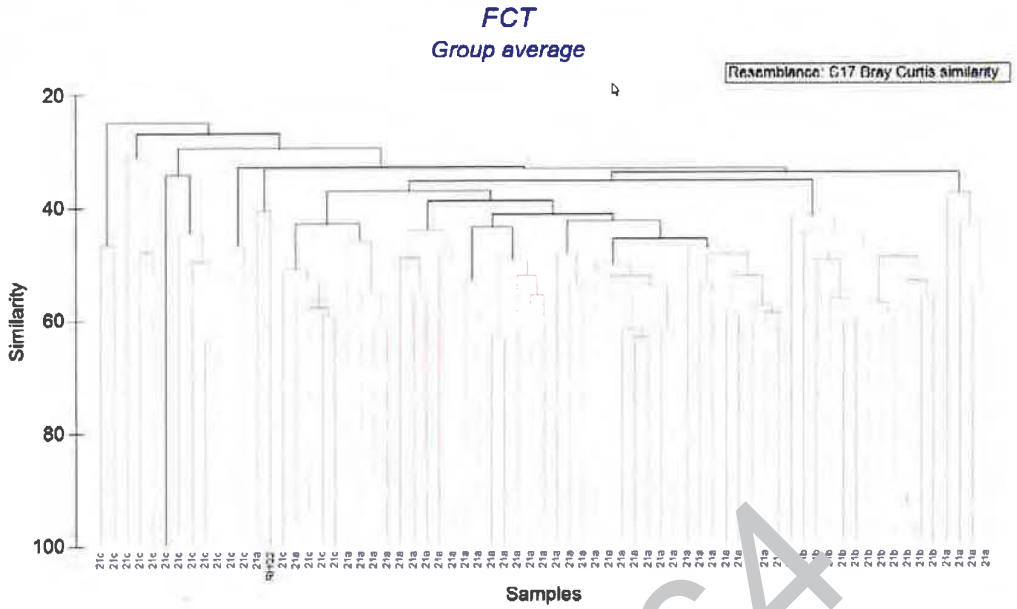
Graph 6-6: Relevant Portion of Classification Dendrogram Showing Relationship between RHQ2 and Gibson et al. (1994) Supergroup 3 FCTs



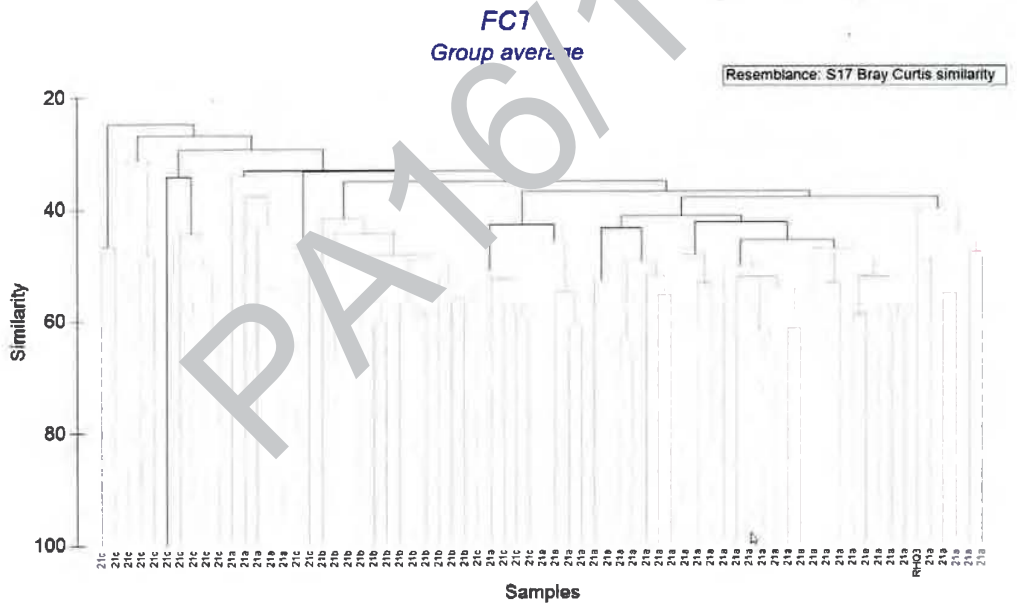
Graph 6-7: Relevant Portion of Classification Dendrogram Showing Relationship between RHQ3 and Gibson et al. (1994) Supergroup 3 FCTs



Graph 6-8: Classification Dendrogram Showing Relationship between RHQ1 and Gibson et al. (1994) FCT21a, FCT21b and FCT21c



Graph 6-9: Classification Dendrogram Showing Relationship between RHQ2 and Gibson et al. (1994) FCT21a, FCT21b and FCT21c



Graph 6-10: Classification Dendrogram Showing Relationship between RHQ3 and Gibson et al. (1994) FCT21a, FCT21b and FCT21c

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Lot 137 Punrak Road, Hopeland

for

M & C McAllister

TRANSPORT IMPACT STATEMENT

- Revision 2
- 05/01/17

TARSC Pty Ltd
13 Sopwith Elbow
MAYLANDS WA 6051
Tel: (08) 9471 9991
Fax: (08) 9471 9996
Email: admin@tarsc.com.au

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2	05/01/17		Tonnages changes to 250,000 t pa from Hanson

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1	1 (e-mail PDF)	1	Roberts Day
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1. Introduction

1.1 Purpose of This Report

This report was commissioned by Roberts Day on behalf of the landowners, Michelle and Craig McAllister, to document a Transport Impact Statement for the Shire of Serpentine-Jarrahdale for a proposed extractive industry (sand extraction) at Lot 137 Punrak Road in Hopeland.

As part of the approval processes a Transport Impact Statement format was considered required by the Shire of Serpentine-Jarrahdale to support the approval of the application.

1.2 Proposed Development

A 12.14Ha portion of Lot 137 Punrak Road in Hopeland is proposed to be developed into an extractive industries site catering for sand extraction.

Access to the proposed development for all vehicles is proposed via a single two-way 5m wide unsealed gravel roadway approximately 400m in length, which connects to Hopeland Road. Refer to **Appendix A** for plans showing the proposed development.

The entire site is presently used by an agistment business.

The development surrounding this proposed development, and proposed zoning, is predominantly rural with an Extractive Industry Licence granted and operating on the lot immediately to the south.

Refer to the locality plan in **Appendix B.**

2. Vehicle Access & Parking

2.1 Access to Site

As discussed in **Section 1.2**, access to the proposed development is proposed via a single crossover onto Hopeland Road. Approximately 300m of the 400m long driveway is built on a part of road reservation between Hopeland Road and Lot 137. However, this portion of road reservation only provides access to Lot 137 and is in effect a private driveway for all intents and purposes.

The 4m wide driveway consists of a 3m wide formed unsealed gravel roadway with 0.5m wide semi-formed shoulders either side of this. This driveway lies within a 13.5m wide section of fenced area within the 40m wide road reservation.

This roadway width and the non-sealed surface will be able to operate for approximately 50 to 100 vehicles per day.

Sight distances at the crossover, exceed the minimums required of the Australian Standard, *AS 2890.2-2002 Parking facilities Part 2: Off-street commercial vehicle facilities.* In this instance, for an 110km/h speed limit on Hopeland Road, a sight distance of 153m should be provided for a 5 second gap whilst 244m should be provided for a 8 second gap. The actual sight distance provided is approximately 500m to the north and south both significantly exceeding these requirements.

Given the essentially private use of the driveway by only Lot 137, it will be maintained by the quarry operator for the life of the operation of the quarry to a crushed limestone standard.

2.2 Parking Supply

All vehicles which access the site or are used on the site will be able to park within the site and not impact on the adjacent current use of the remainder of Lot 137.

2.3 Service Vehicles

Haulage vehicles accessing the site will park within the site whilst they are loaded with sand. The type of vehicles expected to access the site would not exceed the size of a semi-trailer sized vehicle (similar in size to a AV as per AS/NZS 2890.2-2002 *Parking facilities Part 2: Off-street commercial vehicle facilities*).

3. Daily traffic volumes and vehicle types

3.1 Current Traffic Flows

Traffic volumes of the adjacent road network of Hopeland road and Karnup Road were sourced through Main Roads traffic counts undertaken in 2010 and 2012.

Hopeland Road:	785 vpd with 14.0% heavy vehicles
	AM Peak: 24 northbound, 30 southbound
	PM Peak: 33 northbound, 32 southbound
Karnup Road:	2,500 vpd with 12.9% heavy vehicle
	AM Peak: 82 eastbound, 105 westbound
	PM Peak: 114 eastbound, 120 westbound
Current Driveway	10vpd with 0% heavy vehicle

3.2 Expected Traffic Flows

With the surrounding rural development, the current traffic volumes, especially on Hopeland Road, are expected to remain relatively constant. However, to allow a robust assessment it has been assumed that traffic volumes will increase by 5% per annum.

It is thus estimated that the expected traffic flows near the site in 10 years should be approximately:

- Hopeland Road: 1,275 vpd; and,
- Karnup Road: 4,070 vpd.

3.3 Trip Generation of Proposed Development

The traffic generation expected from the proposed development was based on the expected loads from the site. It is estimated that approximately 250,000 tonnes per annum will be extracted from the site. Based on a typical load for a loaded vehicle, the extraction will be undertaken at a rate requiring approximately between 20 to 40 loaded trips exiting the site per day with 20 to 40 empty trips entering the site per day. The total number of trips is thus approximately 64 trips in total for the entire site including staff working on the site, with the majority (approximately 90%) being heavy vehicles.

3.4 Trip Distribution

In discussion with the operator, the majority of the trips will be to and from the Kwinana Freeway via Hopeland Road and Karnup Road. There may be a smaller amount of trips to the south along Hopeland Road and to the east along Karnup Road. The proportion of trips to and from the site is thus assumed as below:

- Hopeland Road south 20%;
- Karnup Road west to Fwy 70%; and,

- Karnup Road east 10%.

3.5 Traffic Impact of Development

Both Hopeland Road and Karnup Road are expected to have traffic volumes significantly less than the maximum traffic flows for similar roads of their type. The capacities of Hopeland Road and Karnup Road are based on the current free-flow two-lane configuration with 14% and 12.9% heavy vehicles respectively with a target level of service no worse than D. The mid-block comparisons to maximum flows that these roads should carry are shown below in **Table 3.1**.

Table 3.1 – Expected Mid-Block Daily Flows

Road	Indicative Maximum Daily Fl (two-way)	Expected Daily Flow (two-way)
Hopeland Road	9,600	1,330
Karnup Road	10,[illegible]00	4,120
Driveway	100	75

Of this expected traffic, approximately 4% of the Hopeland Road traffic would likely be due to Lot 137 Punrak Road whilst approximately 1% of the Karnup Road traffic would be likewise due to Lot 137 Punrak Road. In terms of the heavy vehicle proportions, without the development the heavy vehicle proportions on Hopeland Road is expected to remain at 14.0% whilst Karnup Road is expected to remain at 12.9%. With the heavy vehicles due to the quarry operations added to the expected traffic volumes, the heavy vehicle proportions are expected to be 17.0% for Hopeland Road and 13.8% for Karnup Road.

The traffic flow on the 300m section of driveway between Hopeland Road and the quarry will typically only ever see one vehicle travelling in one direction at any one time. With an average of three trips to and from the site per hour (one entering every twenty minutes) and fifteen minutes to fill a semi-trailer, a fully laden vehicle should have left the site before the next empty vehicle enters. Based on the operating speed of the driveway of 20km/h, length of the driveway and number of trucks accessing and exiting the site, the probability of two trucks passing each other on the driveway is very low.

With regards to intersections, Table 2.4 from the Austroads publication, *Guide to Traffic Management Part 6 – Intersections, Interchanges and Crossings* provides advice as to intersection and crossover performance in peak flow conditions about possible further analysis. This is summarised in **Table 3.2**.

■ **Table 3.2 – Austroads Guidelines**

Major Road Type	Major Road Flow (vph, two-way)	Minor Road Flow (vph, two-way)
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	150	50
	2[illegible]00	25

Examining the expected traffic flows [illegible] crossover and nearby intersection for the proposed development **Table 3.3** is derived.

■ **Table 3.3 – Comparison to Austroads Guidelines**

Intersection	Major Road Flow (vph, two-way)	Minor Road Flow (vph, two-way)
Karnup[illegible]oad/Hop[illegible]and R[illegible]d	230	70

From the above it can be seen that the crossover and nearby intersection are expected to not exceed the above values given in **Table 3.2**. Thus, there is no need for the crossover and nearby intersection to be examined in further detail using such analysis software like Sidra Intersection. In these circumstances the level of service of the intersection and crossover is expected to be close to A in peak traffic flow conditions.

3.6 Level of Service Concepts

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

- *LOS A*: Primarily free flow operations at average travel speeds, usually about 90% of the FFS (free flow speed) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is less than 10 seconds. At non-signalised movements at intersections the average control delay is less than 10 seconds;

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

In addition to the above:

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

3.7 Traffic Impact of Development on Local Area

Based on the above assessment it is concluded that the development will have an acceptable impact on the surrounding roads and intersections with no required changes to either the road network or geometry of intersections.

4. Traffic management on the frontage streets

4.1 Hopeland Road

Hopeland Road is a single carriageway road (approximately 6.0m wide between road edges with varying 1m wide unsealed shoulders). It is not classified under the Metropolitan Region Scheme but is classified as Regional Distributor road under the Functional Road Hierarchy and subject to the 110km/h open road speed limit.

Ignoring intersections, Hopeland Road (between Karnup Road and Lakes Road) has had recorded 7 crashes in the five-years up until 31/12/2015. This equates to be approximately 0.27 crashes per million vehicle-kilometres (MVkm). This is notably less than network average for similar roads of 0.70 crashes per MVkm and suggests the road is generally safe.

4.2 Karnup Road

Karnup Road is a single carriageway road (approximately 7.0m wide between road edges with varying 1-2m wide sealed/unsealed shoulders). It is not classified under the Metropolitan Region Scheme near Hopeland Road, but is classified as a "Blue Road" near the Kwinana Freeway and is classified as Regional Distributor road under the Functional Road Hierarchy. It is subject to a sign-posted 100km/h speed limit between the Kwinana Freeway and Hopeland Road.

Near the intersection of Hopeland Road, Karnup Road widens on the north side of the roadway.

Restricted Access Vehicles (RAVs) up to 87.5t in weight and 27.5m length are permitted to utilise Karnup Road between the Kwinana Freeway and Hopeland Road.

Ignoring intersections, Karnup Road (between the Kwinana Freeway and Rapids Road) has had recorded 29 crashes in the five-years up until 31/12/2015. This equates to be approximately 0.59 crashes per million vehicle-kilometres (MVkm). This is slightly less than network average for similar roads of 0.70 crashes per MVkm and suggests the road is generally safe.

4.3 Intersection of Hopeland Road and Karnup Road

This intersection is a four-way junction controlled by Give Way signs on the Hopeland road approaches. There is no channelization of the intersection, but the Hopeland Road approaches do have traffic islands on each approach.

The sight distances at this intersection far exceed minimum sight distance requirements for an intersection in this speed environment.

This intersection has had 5 recorded crashes in the five-year period up until 31/12/2015 with 4 of those being right angle crashes all during daylight hours. This data was sourced from the Main Roads crash reporting system and based on Main Roads' assessment this number of crashes is within expected limits and thus is considered acceptable.

5. Safety Issues

As noted in **Section 4**, the current crash rates are typically below the network average for both Hopeland Road and Karnup Road. The intersection of Karnup Road and Hopeland Road has a crash rate within acceptable limits. There is minor channelisation on Karnup Road with traffic islands in Hopeland Road, both to allow vehicles to pass turning vehicles and to clearly define the terminating legs of Hopeland Road.

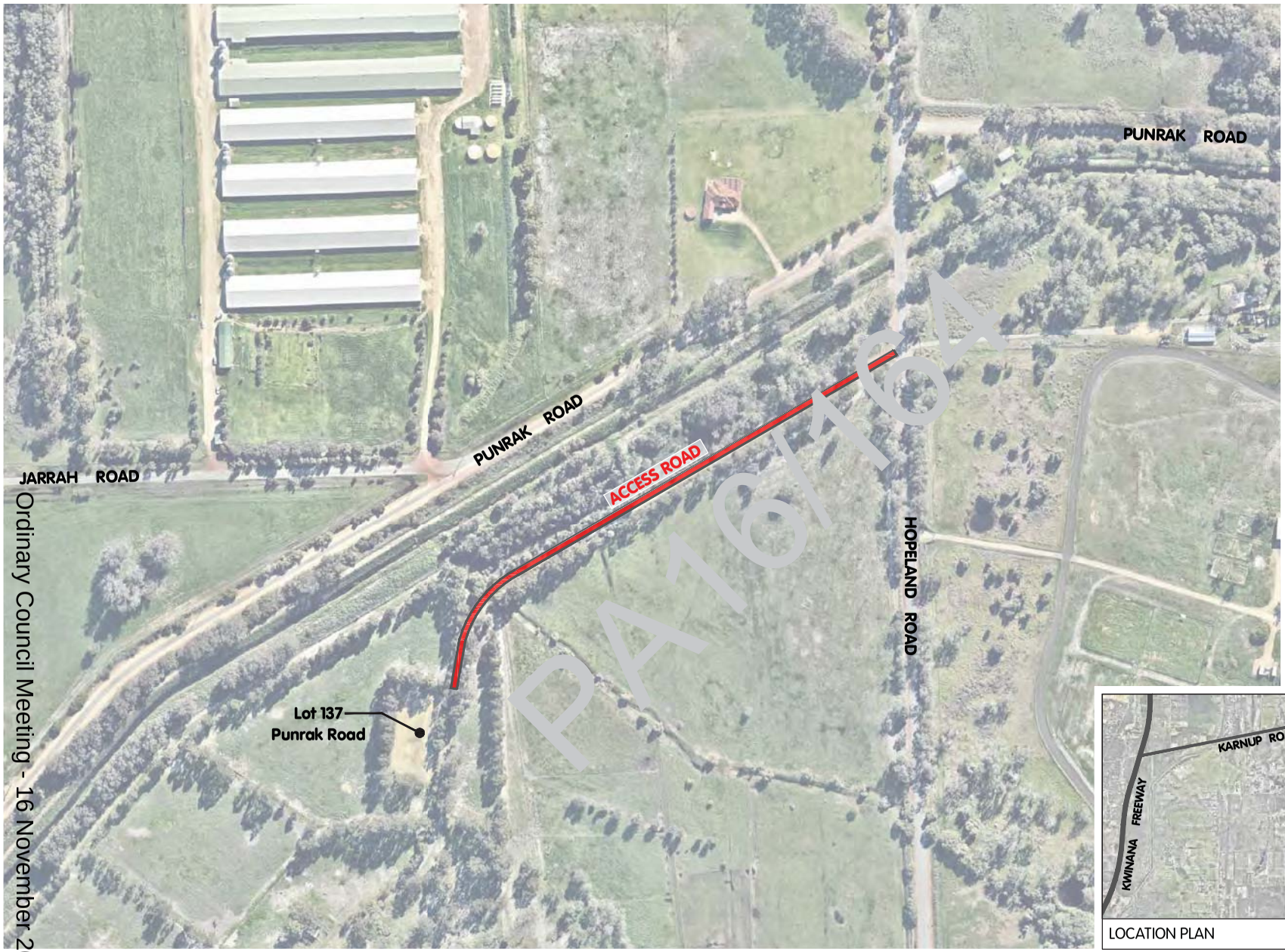
Sight distances at the exit from Lot 137 onto Hopeland Road far exceed the required minimums and thus the crossover is considered safe in its current format for the proposed use.

6. Findings, Conclusions & Recommendations

As a result of the traffic analysis undertaken for the proposed extractive industry at Lot 137 Punrak Road in Hopeland, the following findings were made:

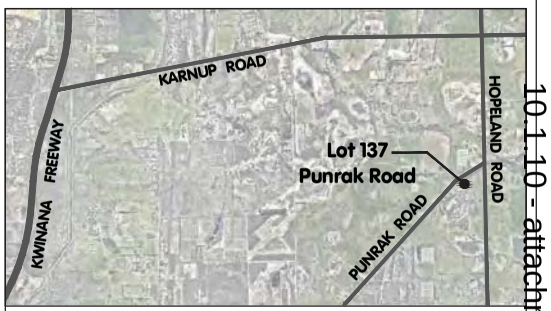
- The proposed development should generate in the order of 65 vehicular trips per day with 60 of these being truck movements on a typical day;
- The proportion of heavy vehicles due to the quarry operations is expected to increase from 14 to 17% on Hopeland Road and 12.9 to 13.8% on Karnup Road;
- The driveway will be maintained to a crushed limestone standard for the duration of the operations by the quarry operator;
- The impacts of the traffic volumes associated with the development on the road network are considered acceptable with the generated traffic being 1 to 4% of the ultimately expected traffic volume on Karnup Road and Hopeland Road respectively; and,
- Delays and queues at the nearby intersections and crossover are expected to be minimal with very good levels of service now and into the future.

Appendix A Proposed Development Plans



PA16/164

LEGEND
ACCESS ROAD



LOCATION PLAN

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CADASTRAL INFORMATION
SOURCE:
YYMMDD:
DWG REF:
PROJECTION:

AERIAL PHOTOGRAPHY
SOURCE: NEARMAP
YYMMDD: 160815

DRAFT

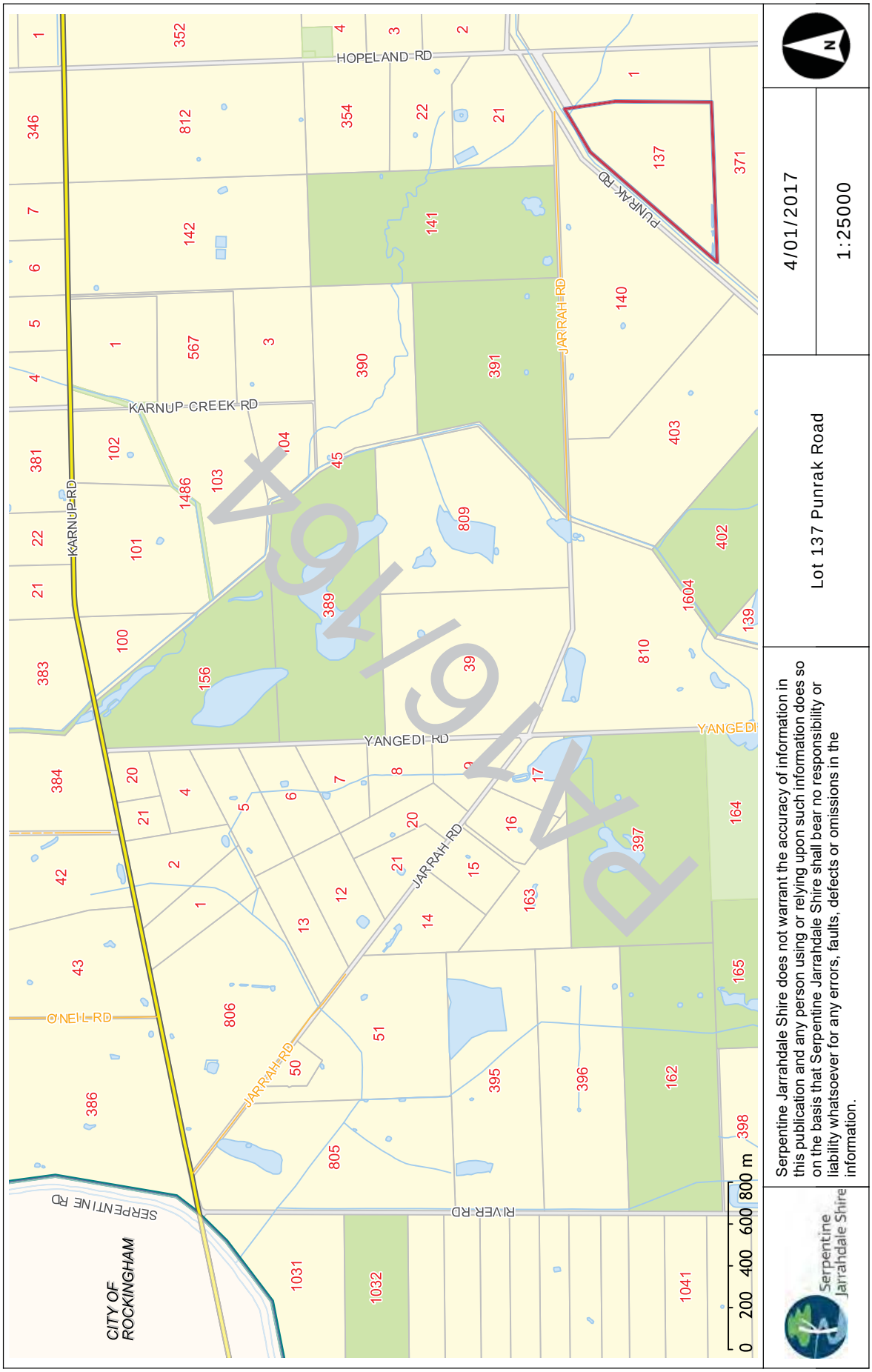
SIZE A3
1:2500
0 metres 25 50 75 100 125

REV	DESCRIPTION	YYMMDD	DRAWN	APP'D
A	BASE PLAN	160815	RF	MD

VEHICLE ACCESS PLAN
Lot 137 Punrak Road, Hopeland
Shire Serpentine Jarrahdale

REF NO.	DRAW NO.	REV.
HAN HOP	RD1 000	A

Appendix B Locality Plan


HOPELAND RD
KARNUP CREEK RD
KARNUP RD
JARRAH RD
PUNRAK RD
YANGEDI RD
O'NEIL RD
SERPENTINE RD
RIVER RD
CITY OF ROCKINGHAM
0 200 400 600 800 m
Lot 137 Punrak Road
4/01/2017
1:25000
Serpentine Jarrahdale Shire does not warrant the accuracy of information in this publication and any person using or relying upon such information does so on the basis that Serpentine Jarrahdale Shire shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.
Serpentine Jarrahdale Shire
PA76/194

Form 3

Shire of Serpentine-Jarrahdale

APPLICATION
FOR AN EXTRACTIVE INDUSTRY LICENCE

1. Name C + M McALLISTER (Applicant)
2. Address 8 STONE ST
MOSMAN PARK 6012
3. Telephone 0417 962 610 Fax —
4. Address and locality of proposed excavation site
394 HORECAND ROAD
HORECAND
5. Lot No 137 6. Location No.....
7. Plan or ~~Diagram~~ No. 152969
8. Certificate of Title Volume 1668 Folio 739
9. Owner of the land C + M McALLISTER
10. Address of owner of the land 8 STONE ST
MOSMAN PARK
11. Material to be excavated SAND
12. If the application covers land that is the subject of an existing licence:

Date of issue of that licence.....

Date of expiration of that licence.....

Conditions applicable to that licence.....

13. Term of licence sought.....

14. Submitted with this application are:

a) 3 copies of excavation site plans
b) 3 copies of works and excavation programme
c) 3 copies of rehabilitation and decommissioning programme
d) datum peg evidence
e) licensed surveyor's certificate certifying the correctness of (a) and (d)
f) evidence of compliance with clause 2.2 (1) and (2)
g) copies of all land use planning approvals
h) written consent of the owner of the excavation site
i) any other information that the local government has required
j) licence application fee of $.....

The applicant applies for a licence in respect of the proposed excavation site in accordance with and subject to the Shire of Serpentine-Jarrahdale Local Law relating to Extractive Industries.

Dated this 20 day of OCTOBER 19 20

.....
Signature of Applicant

.....
Signature of Owner of the land

.....
Signature of existing licensee
(if applicable)

Alternate Proposal

Legend

- Proposed Retention (0.33 ha)
- Proposed 20m buffer (0.94 ha)

0 15 30 60
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

eco logical AUSTRALIA
www.ecoaus.com.au

Prepared by: JL Date: 05/02/2018

Our ref: EEL15055.004

Level 2, 27-31 Troode Street
West Perth WA 6005
T +61 8 9211 1111

Date: 18 February 2019

Attn: Tim Trefry
Partner
Roberts Day
Level Two, 442 Murray Street
PERTH WA 6000

Dear Tim,

Lot 137 Punrak Road, Hopeland: Amendments to Hopeland's Management Plans and Reports

As requested for resubmission by Roberts Day of the amended Extractive Industry Licence (EIL) for planning approval, please find attached for the Shire's records, post the State Administrative Tribunal (SAT) decision (7 March 2018), the amended EIL and associated management plans relevant to the sand extraction within Lot 137 Punrak Road, Hopeland (the site).

The amendments to the EIL and management plans have been updated to accurately reflect the revised planning approval (PA16/164) conditions and the SAT decision.

In addition to the above, this letter has enclosed a Rehabilitation Management Plan (RMP), as required under Condition 20 of the planning approval.

Planning Approvals Context

The Shire of Serpentine-Jarrahdale approved a Development Application and Extractive Industry Licence (EIL) and Development Approval on 28 August 2017 (PA16/164; Appendix A). Additional management plans and technical assessments were prepared for the site as part of the above approvals, which include:

- Dust Management Plan (DMP) (Appendix B)
- Fire and Emergency Management Plan (FEMP) (Appendix C)
- Water Management Plan (WMP) (Appendix D), to be finalised as a condition of the EIL / DA (Appendix E)
- Acoustic Assessment (see EIL)
- Traffic Impact Assessment (see EIL)
- Level 2 Vegetation and Flora Survey (RPS 2017)
- Interface Plan with the neighbouring Extractive Industry Lot 371 Hopeland Road (see EIL).

The landowners and sand mining proponent (Hanson) applied for Conditions 2, 17 and 18 to be appealed and mediated under the Planning and Development Act 2005 by the SAT. The SAT determined the revised Conditions on 7 March 2018.

Our ref: EEL15055.004

In accordance with the SAT decision, the sand extraction area and staging plan has been amended to ensure the following outcomes:

1. No sand extraction within 0.94 ha proposed ecological retention and buffer area (as shown in Figure B).
2. Mining batters will be outside the 20 m ecological retention area buffer.
3. Prior to sand extraction within the ecological retention area stage, a fence will be installed around the 0.33 ha retained Banksia woodland area.

Amendments to Management Plans

The EIL and associated management plans have been amended to be consistent with the SAT decision and Shire of Serpentine-Jarrahdale's decision, as outlined in Table 1.

Table 1 Summary of Revisions to Hopeland's Management Plans and Report

Amendment	Location in Text
Extractive Industries Licence	
Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.	Summary 1.1 Overview
"The following key management plans and technical assessments"	
Excavation area = 11.2 ha	Summary and Table 1 1.1 Overview 1.2.1 Site Significance 1.3 Proposed Operations 5.0 Excavation Management 8.0 Conclusions
Four consecutive stages Stage 3 now excludes the 0.94 ha proposed ecological retention and buffer area	Summary and Table 1 1.3 Proposed Operations 1.3.3 Staging Plan 2.3 Flora and Vegetation 2.3.1.4 Vegetation Units 2.3.3.1 Banksia Woodlands of the Swan Coastal Plain 2.3.3.2 Conclusion 2.4.1.1 Black Cockatoo Habitat 5.1.2 Excavation Method 5.2.3 Site Infrastructure 6.2.1.4 Management Response
In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:	Summary 1.3 Proposed Operations

Amendment	Location in Text
There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as “proposed retention” and “proposed 20m buffer”. A batter must be constructed outside of the proposed 20m buffer to protect vegetation from extraction works; and Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20m buffer Inserted Figure A: Ecological Retention Plan	5.1.2 Excavation Method 6.2.1.4 Management Response
“Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works”.	As above and Table 5
Included paddocks as a land use for rehabilitation to support.	Summary 1.3 Proposed Operations 7.0 Decommissioning and Rehabilitation
Maximum mining extent year in the first 2 years = 7.9 ha	1.3 Proposed Operations 1.3.3 Staging Plan 4.1.2 Dust 6.4.2.4 Management Response
Work is not permitted on Sundays	Table 1
Exclusion of proposed ecological retention area, reduced excavation area and adjusted staging plan	Figures 1–13, after report text
Site access road alignment has been amended to be consistent with the approved Development Application	Figure 3

Amendment	Location in Text	
Dust Management Plan		
In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements: a. There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20m buffer". b. A batter must be constructed outside of the proposed 20m buffer to protect vegetation from extraction works; and c. Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20m buffer Inserted Figure A: Ecological Retention Plan	1.0	Introduction
Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.	1.0 2.0	Introduction The Works
Excavation area = 11.2 ha	As above and Table A	
Maximum mining extent year in the first 2 years = 7.9 ha	1.0 2.0 2.1 2.3.1 3.3.3.2	Introduction The Works Overview of Extraction Process Staging Plan Guidelines for the Prevention of Dust and Smoke Pollution
Four consecutive stages Stage 3 now excludes the 0.94 ha proposed ecological retention and buffer area	2.0 2.3.1	The Works Staging Plan
Size of extraction stages from 0.8 ha to 4.4 ha	2.1	Overview of Extraction Process
"Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works. The fencing will be maintained to the satisfaction of the Shire."		

Amendment	Location in Text
Sand extraction activities are anticipated to commence in 2018	2.0 The Works 2.3 Timing of Works 3.4.2 Liaison
Excluded proposed ecological retention area, reduced excavation area and adjusted staging plan	Figures 1–2, after report text
Fire and Emergency Management Plan	
Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.	1.0 Introduction
In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements: a. There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20m buffer". b. A batter must be constructed outside of the proposed 20 "m buffer to protect vegetation from extraction works; and c. Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20m buffer Inserted Figure A: Ecological Retention Plan	1.1 Purpose
Excavation area = 11.2 ha	1.2 Sand Quarry Operations and Table A
Sand extraction activities are anticipated to commence in 2018.	1.2 Sand Quarry Operations 1.9 Timing of Works
Work is not permitted on Sundays	Table A 1.3 Hours of Operation
Maximum mining extent year in the first 2 years = 7.9 ha	1.2.1 Staging Plan 1.2.2 Overview of Extraction Process
Four consecutive stages	1.2.1 Staging Plan
Size of extraction stages from 0.8 ha to 4.4 ha	1.2.2 Overview of Extraction Process

Amendment	Location in Text
"Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works. The fencing will be maintained to the satisfaction of the Shire".	
Excluded proposed ecological retention area, reduced excavation area and adjusted staging plan	Figures 1–3, after report text
Site access road alignment has been amended to be consistent with the approved Development Application	Figure 3
Water Management Plan	
Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.	Overview
Excavation area = 11.2 ha	Summary 1.1.2 Proposed Operations
In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements: a. There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer". b. A batter must be constructed outside of the proposed 20m buffer to protect vegetation from extraction works; and c. Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20m buffer Inserted Figure A: Ecological Retention Plan	
Included paddocks as a land use for rehabilitation to support.	
Maximum mining extent year in the first 2 years = 7.9 ha	1.1.2 Proposed Operations 1.1.5 Staging Plan
Four consecutive stages	1.1.1 Proposed Operations 1.1.5 Staging Plan
Excluded proposed ecological retention area, reduced excavation area and adjusted staging plan	5.1 Groundwater Level Monitoring and Figure A Figures 1–7, after report text

Our ref: EEL15055.004

Rehabilitation Management Plan

The RMP encompasses the entire Hopeland site and will be undertaken on a staging basis. The site will be revegetated in which the ecological retention area and buffer area will be retained and the remaining area will be returned to pastoral land suitable for horse agistment, in line with its rural zoning. The rehabilitation methodologies are detailed in a tabular format, to facilitate auditing compliance in accordance with Condition 16 of the planning approval.

The RMP is attached to this letter as Appendix G.

Concluding Comments

The EIL and management plans for the Hopeland site have been updated to ensure consistency with the Shire of Serpentine-Jarrahdale and the SAT's planning approval conditions.

Hanson is anticipating commencement of sand quarry work in the early April 2019.

If you have any questions or require any additional information, please do not hesitate to contact the undersigned.

Yours sincerely,
for RPS Australia West Pty Ltd

John Halleen
Technical Director
john.halleen@rpsgroup.com.au
+61 8 9288 0830

enc:

Appendix A	Shire of Serpentine-Jarrahdale Planning Approval
Appendix B	Dust Management Plan
Appendix C	Fire and Emergency Management Plan
Appendix D	Water Management Plan
Appendix E	Extractive Industries Licence Application
Appendix F	State Administrative Tribunal Decision
Appendix G	Rehabilitation Management Plan

RPS

Job Number: L1505504
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure A
Site Location

Our ref: EEL15055.004

APPENDIX A

Shire of Serpentine Jarrahdale

Sustainable. Connected. Thriving!

All enquiries to Planning Services on 9526 1111
Our ref: PA16/164: HM:bo

6 October 2017

Roberts Day Town Planning
GPO Box 6369
EAST PERTH WA 6892

Via email: mandy.pearce@robertsday.com.au

Dear Sir/Madam,

Proposed Extractive Industry (Sand Extraction)
Lot 137, 394 Hopeland Road, Hopeland

I refer to your application, received 18 August 2016, for approval to commence development on the aforementioned lot.

In accordance with the provisions of the Shire's Town Planning Scheme No. 2 and the authority delegated to Council under the provisions of the Metropolitan Region Scheme, your application to commence development has been approved. Attached is the Notice of Determination of Application for Development Approval stating the conditions with which the development is required to comply.

Should you be aggrieved by any of the decision or any conditions imposed, you have the right under the *Planning and Development Act 2005* to have the decision reviewed by the State Administrative Tribunal. Applications for review must be submitted to the Tribunal within 28 days of the date on the decision notice. Further information can be obtained by calling the Tribunal on (08) 9219 3111 or by visiting their website at www.sat.justice.wa.gov.au

Your attention is drawn to the fact that this consent constitutes planning approval only and that a Building Permit may be required from the Shire prior to the commencement of construction works. Where relevant, the nominated builder should be provided with a copy of conditions of the Notice of Determination on Application for Development Approval. The Building Permit application cannot be accepted until all relevant planning conditions are cleared by the Shire. Accordingly, please ensure that the drawings and information supplied to the Shire for a building permit address any conditions issued on the planning approval by the Shire to avoid delays in the issue of the Permit. Please note that any amendments proposed outside of the approved plans and conditions of development approval may result in the requirement for a new Planning Application to be submitted for assessment and determination.

Yours faithfully

Andre Schonfeldt
Director Planning

a 6 Paterson Street, Mundijong WA 6123 t 08 9526 1111 f 08 9525 5441 e info@sjshire.wa.gov.au www.sjshire.wa.gov.au

6 Paterson Street
Mundijong 6123
Western Australia

Shire of Serpentine Jarrahdale

Telephone: 9526 1111
Facsimile: 9525 5441
Web: www.sjshire.wa.gov.au
Email: info@sjshire.wa.gov.au

Planning and Development Act 2005
Shire of Serpentine Jarrahdale
Notice of Determination on Application for Development Approval

Property File:	A32100	Application No:	PA16/164
Location:	394 Hopeland Road, Hopeland		
Lot:	137	Plan/Diagram:	152967
Vol. No:	1668	Folio No:	739
Application Date:	18 August 2016	Received On:	18 August 2016

Description of Proposed Development: Extractive Industry (Sand Extraction)

Use Class: Industry Extractive

Date of Determination: 28 August 2017 – OCM115/08/17

That the Director Planning GRANTS Development Approval under Delegated Authority P035S pursuant to Clause 68(2) of the Deemed Provisions of *Planning and Development (Local Planning Schemes) Regulations 2015* for a Extractive Industry (Sand Extraction) subject to compliance with the following conditions:

1. The development is to be carried out in compliance with the plans and documentation listed below and endorsed with Council's stamp, except where amended by other conditions of this consent:

Plans and Specifications	Plans P1 – 12 received at the Shire's Offices on the 13 February 2017 Flora and Vegetation Survey received at the Shire's Offices on the 9 January 2017 Dust Management Plan received at the Shire's Offices on the 13 February 2017 Acoustic Assessment received at the Shire's Offices on the 13 February 2017 Water Management Plan received at the Shire's Offices on the 13 February 2017 Transport Impact Assessment received at the Shire's Offices on the 9 January 2017 Fire and Emergency Plan received at the Shire's Offices on the 13 February 2017

2. Stage three and an associated 20 metre buffer identified on plan 'figure 2' 'staging plan' does not form part of this approval as the clearing of native vegetation results in the removal of Banksia Woodland which is listed as endangered under the Environment Protection and Biodiversity Conservation Act 1999 and the Environmental Protection Act 1986.

3. The development complying with any details marked in red on the approved plans.

6 Paterson Street
Mundijong 6123
Western Australia

Shire of Serpentine Jarrahdale

Telephone: 9526 1111
Facsimile: 9525 5441
Web: www.sjshire.wa.gov.au
Email: info@sjshire.wa.gov.au

4. That the Chief Executive Officer forward a copy of the notice of determination to the Western Australian Planning Commission in accordance with RES 2015/01 resolution under Clause 32 of the Metropolitan Region Scheme for their consideration.

5. This approval is valid for a period of five years from the date of determination.

6. Operating hours shall be restricted to 7.00am to 5.00pm Monday to Saturday. Work is not permitted on Sundays or Public Holidays.

7. The applicant shall not undertake any washing of excavated material on the development site.

8. The applicant shall implement noise mitigation measures in accordance with the Noise Assessment Report prepared by Herring Storer Acoustics dated 17 November 2016 so that no unreasonable noise (as defined in Regulation 5 of the Environmental Protection (Noise) Regulations 1997 (WA).

9. The applicant shall implement dust management measures in accordance with the Dust Management Plan prepared by RPS dated 2 February 2017, so as to minimise dust emissions and ensure that visible dust is not emitted beyond the boundaries of the development site.

10. The applicant shall implement the water management measures detailed in the Water Management Plan prepared by RPS dated 2 February 2017 so that the development does not adversely affect groundwater or surface water quality in any manner.

11. All stormwater is to be disposed of within the property. Direct disposal of stormwater onto the road, neighbouring properties, water courses and drainage lines is prohibited.

12. The perimeter of the area to be worked must be pegged and clearly marked to ensure that all earthworks are contained within the approved area. No earthworks, including batters, shall intrude into any buffer areas described in the Water Management Plan prepared by RPS dated 2 February 2017.

13. The excavation area shall be progressively rehabilitated when final contour levels and grades for each stage are achieved and within six months of the closure of each stage, with such rehabilitation being in accordance with the Rehabilitation Management Plan.

14. The applicant shall implement suitable fire protection measures in accordance with the Fire Management Plan prepared by RPS dated 2 February 2017.

15. The applicant shall implement measures to minimise the risks of spills or leaks of chemicals including fuel, oil or other hydrocarbons in accordance with the Management Plan and shall ensure that no chemicals or potential liquid contaminants are disposed of on site.

16. The applicant shall submit an annual report to the Shire of Serpentine Jarrahdale by 31 March each year. The annual report shall include an internal compliance audit of all the development and licence approval conditions and Rehabilitations Management Plan requirements, to the satisfaction of the Shire. The annual report shall also provide details of complaints and complaint responses.

6 Paterson Street
Mundijong 6123
Western Australia

Shire of Serpentine Jarrahdale

Telephone: 9526 1111
Facsimile: 9525 5441
Web: www.sjshire.wa.gov.au
Email: info@sjshire.wa.gov.au

17. Prior to the commencement of works the developer shall make a substantial or complete contribution to the costs associated with the required upgrading of Hopeland Road and Karnup Road intersection. The contribution is to be negotiated with the Shire.

18. Prior to commencement of works the developer shall construct a 3m wide sealed road with 500mm shoulder on both sides and one passing lane for semi-trailers, within the unmade road reserve up to Hopeland Road. The pavement shall be built to the specification shown on Plan 17-4-42/100 (Rev A) dated June 2017 and prepared by Porter Consulting Engineers.

19. The landowner shall ensure that all loads leaving the premises with sand, soil or other particulate material, are to be enclosed or completely covered by a secured impermeable tarpaulin or some other effective mechanism used to prevent dust nuisance.

20. A Rehabilitation Management Plan shall be prepared by a suitably qualified person at the developer's cost and submitted for approval by the Shire and thereby implemented by the developer at the conclusion of each stage of extraction work prior to commencement of further extraction works.

21. At the completion of mining operations, the landowner shall ensure that all sand faces, non-operational stock piles and bund walls are safe and stable and must provide a report from a certified geotechnical Engineer.

NOTE 1: If the development the subject of this approval is not substantially commenced within a period of 2 years, or another period specified in the approval after the date of the determination, the approval will lapse and be of no further effect.

NOTE 2: Where an approval has so lapsed, no development must be carried out without the further approval of the local government having first been sought and obtained.

NOTE 3: If an applicant or owner is aggrieved by this determination there is a right of review by the State Administrative Tribunal in accordance with the *Planning and Development Act 2005* Part 14. An application must be made within 28 days of the determination.

NOTE 4: In relation to condition 1, the removal of Banksia Woodland does not comply with clause 7.13.6(c) of the Shire of Serpentine Jarrahdale Town Planning Scheme No.2. Removal of vegetation will impact on a threatened ecological community which is contrary to this clause.

Signed: Dated: 6 October 2017

For and on behalf of the Shire of Serpentine Jarrahdale

Our ref: EEL15055.004

APPENDIX B

DUST MANAGEMENT PLAN

Lot 137 Punrak Road, Hopelands

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:2

Version/Date: Rev 3, June 2018

Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Draft A	Draft for Client Review	RebDaw	JohHal	23.11.16	SN 01.12.16		
Rev 0	Final in Issue	RebDaw	JohHal	02.12.16	SN 02.12.16	J. Halleen	02.12.16
Rev 1	Final for Issue	RebDaw	JohHal	27.01.17	SN 27.01.17	J. Halleen	27.01.17
Rev 2	Final for Issue	RebDaw	JohHal	07.02.17	SN 09.02.17	C. Davies	10.02.17
Rev 3	Final for Issue	MarMcC	JohHal	21.06.18	DC 21.06.18	J. Halleen	21.06.18

Disclaimer

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FIGURES

(contained within report text)

Figure A: Ecological Retention Plan....2

(compiled at rear of report)

Figure 1: Site Location

Figure 2: Staging Plan

APPENDICES

APPENDIX 1 Site Classification Assessment Chart

APPENDIX 2 Dust Management Actions

1.0 INTRODUCTION

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

This Dust Management Plan (DMP) has been prepared to demonstrate that dust caused by sand extraction activities at 137 Punrak Road, Hopeland ("the site") can be effectively managed. The DMP supports the Development Approval (DA) and an Extractive Industry Licence (EIL) to extract the Bassendean sand from a 11.2 ha portion of the site. Sand extraction activities within this area will be staged, with a maximum of approximately 7.9 ha extracted in the first two years (Figure 2).

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:-

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as 'proposed retention' and 'proposed 20 m buffer'.

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

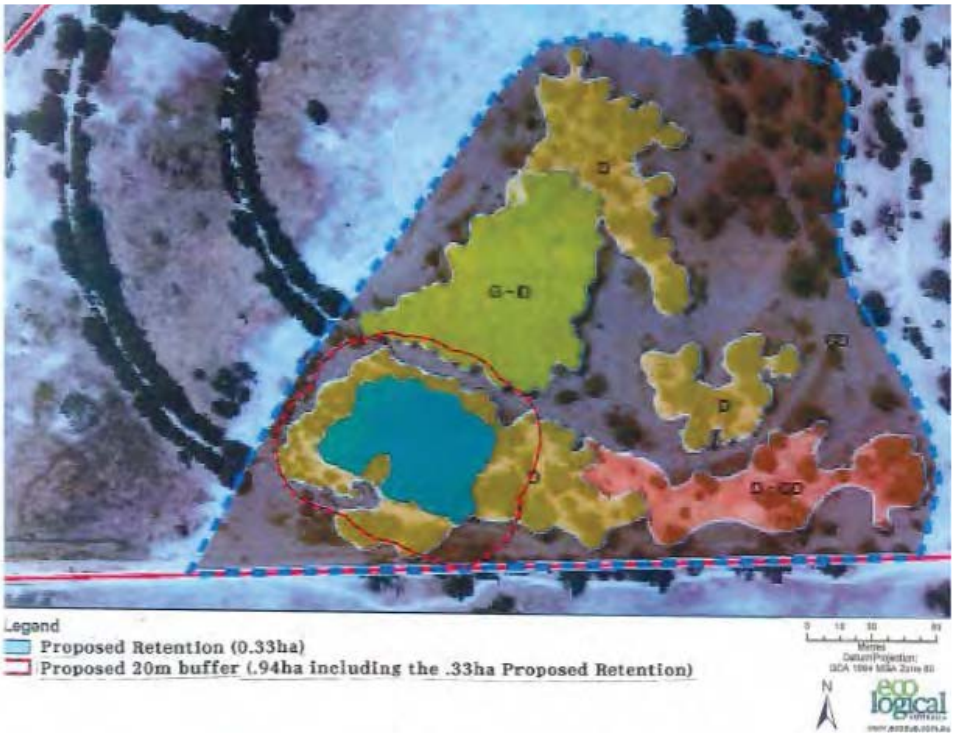

Figure A: Ecological Retention Plan

This management plan is set out as follows:

Section 2.0 The Works

Section 3.0 Dust Management Plan

Section 4.0 Conclusion

2.0 THE WORKS

The site is approximately 30 ha and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). Sand extraction activities are scheduled to commence in 2018 and will be undertaken in four consecutive stages, with approximately 7.9 ha extracted in the first two years. Sand extraction works will be undertaken by Hanson.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

It is also important to note the proposed sand screening will be subject to a Department of Environment Regulation (DER) works approval and registration under Part V of the *Environmental Protection Act 1986*.

The extent of the sand mining area is shown on Figure 1 and Table A provides an overview of the proposed sand extraction activities.

Table A: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Life of the project	Approximately three to five years
Sand Volumes	Approximately 1 million m^3
Dewatering requirements	Nil
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

Project Component	Proposal Characteristic
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Water Trucks	Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

2.1 Overview of Extraction Process

The excavation of sand will generally involve the following, to be undertaken in stages across the proposed sand extraction area as outlined in the staging plan (Figure 2):

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- Vegetation clearing will involve the use of wheel loader or excavator to push over the trees, before they are mulched. The mulch will be stockpiled for use within the site.

- Topsoil removal and stockpiling. Topsoil removal will comprise the first 100 mm to 300 mm of the soil being scraped and then stockpiled within the site for use as part of the decommissioning and rehabilitation process. Topsoil and overburden will be stored adjacent to the area of excavation, or will be returned directly being behind the advancing face of the extraction area.

- Each extraction stage of the sand excavation is expected to be approximately between 0.8 ha to 4.4 ha in size, with a cap of approximately 7.9 ha extracted in the first two years. Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

- Sand will be distributed from the site via road haulage. The primary haulage routes are expected to be north and south along Hopeland Road onto Karnup Road and Lakes Road respectively, and then east or west to and from the Kwinana Freeway or South Western Highway.

- Reforming of the land post-excavation is proposed to be undertaken using a wheel loader of excavator to push the topsoil into place. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three horizontal to vertical in accordance with Shire of Serpentine–Jarrahdale Extractive Industries Local Law 1999. Rehabilitation will progressively follow excavation wherever possible.

2.1.1 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road) to combine the two extraction areas to maximise the removal of the valuable sand resource both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

2.2 Primary Contacts

The sand mining contractor is the party responsible for the overall project. Any complaints in relation to dust nuisance should in the first instance be directed to the Site Supervisor.

2.3 Timing of Works

Works are scheduled to commence once all approvals are in place, anticipated to commence in 2018.

2.3.1 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2. A maximum of approximately 7.9 ha will be excavated in the first two years of sand mining. The purpose of this approach is to allow for up to 18 months of groundwater monitoring which provides site-specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation.

Any open areas in these first two years of sand mining will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

3.0 DUST MANAGEMENT PLAN

3.1 Responsibility

The landowner will enter an agreement with a sand mining contractor. The sand mining contractor will be responsible for the effective control of all dust, smoke and wind borne material emanating from the sand quarry.

The sand mining contractor and the landowner are both responsible for the full duration of the mining contract in accordance with the DA and EIL approval.

3.2 Smoke Nuisance

There will be no prescribed burning / fires within the site. Any clearing of vegetation will be in accordance with the Department of Environment Regulation Purpose Permit clearing approval.

It is considered that there is only a low risk of smoke nuisance principally because prescribed burning is prohibited on site.

3.3 Dust Nuisance

3.3.1 Dust Risk

Excessive dust has the potential to impact on both workers on site and the adjoining land users. Dust can originate from a number of operations and may impact on-site workers or travel off site. Potential dust impacts are addressed by reducing the dust generated from the quarrying, processing and transport operations.

The main risk from dust is not the sand, but rather the fine organic particles that are generated during land clearing and reinstatement, and most importantly the fine particles generated by transport along access roads and traffic areas.

The main risk is therefore from the fine organic matter in the topsoil, any clay within the sand or calcium carbonate that is broken down through tyre impacts or disturbance. There is also the risk from the tipping processes.

Dust has the potential to be generated during most phases of the quarrying operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions.

3.3.2 Climate and Soil Conditions

Through the winter months of May to September exclusive, there is little dust risk because rainfall exceeds evaporation. The rainfall is sufficient to wet the soil profile to depth, with excess water reaching the water table.

In summer, the soil profile dries and becomes more susceptible to disturbance from vehicles and winds.

In active areas that dry out, dust can be readily generated. Normal practice is to treat this with water, which maintains the moisture content of the soil and mitigates dust generation.

3.3.3 Relevant Guidelines

3.3.3.1 Draft Environmental Assessment Guidance (EAG) – Separation Distances Between Industrial and Sensitive Land Uses

Rural land uses occur adjacent to the site and sand extraction activities will need to ensure that these land uses are not impacted. This requires sufficient buffers to be provided between the surrounding land use and the extraction area.

Draft Environmental Assessment Guidance (EAG) – *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2015) states the generic buffer distance for sand quarries as 300–500 metres. A generic buffer relates to the distance at which there is unlikely to be any problems without further investigation and does not mean that smaller buffers are not acceptable. There are many examples within Perth's Metropolitan area where extractive industries operate compatibly within 300 metres of residential or industrial land uses. This outcome is in part due to the low-key nature of the sand extraction works and also the on-site management of issues such as dust.

The excavation area is largely surrounded by paddocks; therefore the majority of the surrounding sensitive premises are located at least 300 metres away from the excavation area which complies with EPA (2015).

The following dwellings are the exceptions:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring landholding.

3.3.3.2 Guidelines for the Prevention of Dust and Smoke Pollution

The Guidelines for the Prevention of Dust and Smoke Pollution published by the Department of Environmental Protection (1996) has been used to assess the classification of the site in relation to the potential for dust generation.

When making the assessments using the guideline there are several key points requiring consideration:

- Dust risk is generally only in the dry summer months.
- The sand readily crusts after wetting and becomes stabilised. It is only trafficked areas of the site that are likely to develop fine dust from the grinding of wheels.
- The perimeter bunds and any vegetation buffers will provide windbreaks and dust fence screening will provide additional screening to the surrounding properties. Existing screening vegetation is shown in Figure 1.
- Water trucks will be used to wet down the site frequently and manage dust risk.

Appendix A of this management plan contains the completed site classification assessment charts (Appendix 1 – Sheet 1). The method of assessment used produced a site classification of low risk as outlined in Table B, acknowledging that only 1 to 5 ha of the sand quarry will only be developed for a sand quarry at any one time, with approximately 7.9 ha being extracted in the first two years.

Table B: Site Classification

Description of Works	Site Classification Score	Site Classification
Bulk Earthworks	(Part A 22 / Part B 18) 396	Classification Site 2 (Low Risk)

3.3.3.3 A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities

The sand mining contractor shall comply with "A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" (DEC March 2011).

The specific measures for a Classification 2 Site (score between 200 and 399) is outlined below:

Provisions:

- The developer shall supply a contingency plan to the local government, which shall detail the activities to be undertaken should dust impacts occur.

Contingency arrangements:

- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust suppression.

- All areas of disturbed land should be stabilised to ensure that the disturbed area exposed at any time is kept to a practical minimum.

The above actions have been adopted in this Dust Management Plan.

3.3.4 Control Measures

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure level under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lots137.

Dust control methods that are available, and will be selected from, are listed below. The most effective by far is the use of water management from a water truck, sprinklers, water canon or other such mechanism.

3.3.4.1 Design and Site

- Minimising the amount of ground open at any one time.
- Minimising the amount of ground being subject to traffic.
- Locating access roads away from sensitive premises.
- Design of the pit to reduce wind speed and potential dust lift off.
- Maintaining effective setbacks.
- Construct perimeter bunds to reduce wind speed.
- Maintain tree/vegetation buffers.
- Providing windbreak fencing generally and on top of bunds as required.
- Maintaining a secure, fenced site, to prevent illegal access.
- Rehabilitate and stabilise all completed areas as soon as practicable.
- Clearing and replacing topsoil and overburden during wetter times – April to October.

3.3.4.2 Operations

- Locate active areas away from windy locations.
- Locate active areas away from sensitive premises.
- Working on the floor of the pit.
- Operate some parts of the pit only when conditions are suitable.
- Locating mobile plant and stockpiles in sheltered areas.

- Design staging to minimise dust risk.
- Conduct higher dust risk operations such as topsoil clearing and placement during more favourable conditions.
- Shut down equipment that is not required.

3.3.4.3 Access and Hardstand

- Constructing the access roads from hard materials that resist dust generation.
- Maintaining a water truck on site for road and other wetting down. Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
- Using a sealant such as a polymer, chemical or emulsified oil or bitumen on the access road to reduce water use.
- Using sprinklers and/or water canon on roads, traffic areas and stockpiles.

3.3.4.4 Processing

- Applying water sprays and additives to the screening cycles.
- Providing screening and shielding of mobile plant.
- Use and maintain filters on all suitable plant.
- Ensure regular appropriate emptying of filter collection devices.
- Face hoppers away from prevailing winds.
- Maintain reduced pressure in plant, hoppers and bins to prevent loss of dusty air.

3.3.4.5 Stockpiles

- Minimise the number of stockpiles.
- Maintain stockpiles in sheltered areas.
- Reduce the elevation of stockpiles.
- Limit the drop height to stockpiles and loading.
- Locate finer products inside or screened by stockpiles of coarse materials.

3.3.4.6 Transport

- Cover all loads.
- Ensure all trucks are dust free and not carrying pebbles and other materials outside the tray.
- Choose the best transport routes.
- Wet down or sweep the cross-over and access roads.

3.3.4.7 Health and Community

- Maintain air-conditioned cabins on all vehicles.
- Provide a readily auditable trigger of no visible dust to cross the property boundary in line with DER Licence and best practice in WA.
- Conduct effective site induction and awareness training for all staff.

- Training should include observation and mitigation where possible of all dust emissions.
- Providing a complaints investigation, mitigation and recording procedure.
- Liaising with the owners/operators of the two nearby sensitive premises.
- Ceasing operations when conditions are not favourable or when visible dust is crossing the boundary.
- Obtain the latest weather conditions to increase the awareness of dust risk.
- Cease operations during adverse weather conditions.
- Operate during wetter months or when the soils are moist.

Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation will be undertaken during the wetter months to reduce the generation of dust.

Completed sections of the quarry are to be stabilised and not subject to traffic as soon as practical to reduce the area of open ground and help reduce wind speed. In the event of dust management not being able to be achieved, and to minimise impact on adjoining landholders, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining landholders.

A record of all dust complaints will be retained together with the mitigation measures used to reduce the dust impacts.

3.3.5 Procedure for Dealing with Dust Complaints

It is intended that the following procedure be adopted in the event of a dust complaint (based on proof dust is being emitted from the extraction area):

1. It is proposed that all complaints received by kept in a "complaint register" and maintained by the sand mining contractor site supervisor.

2. It is likely that a complaint will be lodged with either the sand mining contractor or the Shire of Serpentine-Jarrahdale. Upon receiving the complaint the following information shall be recorded:
   a. Name and contact details of complainant.
   b. Date and time of complaint and date and time of occurrence of dust.
   c. Details of complaint and effect of dust on property.
   d. Investigations of the complaint.
   e. Results of the investigation.
   f. If the complaint is valid, any mitigation actions that result.
   g. Any communication with the complainant.

The below Table C is an example of the proposed Site Register of Complaints Received.

Table C: Site Register of Complaints Received

Complainant's Name	Address	Contact Details	Date and Time of Complaint	Date and Time of the Occurrence	Details of the Complaint and Effect on Property

At the time of receiving the complaint, the person receiving the complaint shall offer an explanation for the dust, if possible. If an explanation cannot be made the person receiving the complaint shall advise the resident that the matter will be investigated and the resident will be notified of the outcome or appropriate action taken or to be taken within 24 hours.

- Details of the complaint shall be forwarded to the sand mining contractor in the event that the complaint was received by the Shire of Serpentine-Jarrahdale. All complaints shall be forwarded even if the complainant seemed content with the explanation given for the occurrence of dust.

- The contractor will investigate the complaint through discussion with the complainant and agree a course of action. The contractor will record the course of action taken in the complaint register and covey the agreed action to the person who took the complaint who will in turn inform the complainant.

- The contractor will confirm with the Shire of Serpentine-Jarrahdale that the matter has been dealt with and resolved if required. The contractor shall also provide copies of any correspondence or documentation when requested to do so.

3.4 Dust Monitoring Program

The auditable condition for dust monitoring is visible dust crossing the boundary of the premises, which is the lot boundary. This is the condition used on Department of Environment Regulation Licences and all other sand quarries in Western Australia.

Specific management measures will include:

- review of complaints received in the past week and action taken

- review of status of any previously lodged complaints

- degree of compliance by the contractor with the contract conditions

- review of weather conditions and need or otherwise for additional water carts, temporary stabilisation, wind fencing, etc.

3.4.1 Visual Dust Monitoring

The trigger for dust management will be the generation of visual dust.

The sand contractor is responsible for site supervision of dust and are in two way radio contact with all mobile plant.

All operators on site will be instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues.

When trigger conditions are detected and/or alerted, relevant action will be taken such as additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment, etc.

3.4.2 Liaison

A liaison program will be commenced with nearby and adjoining residents. An advisory note will be sent to the landowners of:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring land holding[1].

The proposed advisory note is detailed below.

> **Advisory Notice to Residents**
>
> Excavation of sand of the above land is being planned. There will be progressive stages starting in 2018. The development is being carried out by a sand mining contractor and the works are scheduled to commence following all statutory approvals. A 20 metre buffer will be retained around the boundary of the property by the sand mining contractor in order to minimise inconvenience to residents.
>
> It is a requirement that this development must adopt adequate measures to prevent the generation of unacceptable levels of dust. You are advised that the landowner and the sand mining contractor have agreed to implement the provisions as outlined in the Department of Environmental Regulations publication "A guideline for the prevention of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" March 2011 (a copy of this guideline may be obtained from http://www.der.wa.gov.au/).

[1] RPS understands that House No. 514 is subject to an EIL Application, with the existing dwelling proposed to be used as a site office, and therefore the potential impacts relating to Amenity have been specifically assessed in relation to the dwellings located on House No. 446.

Should you feel that excessive dust is being generated due to this development, you are advised to contact the Site Supervisor for the sand mining contractor, (TBA) by telephoning (TBA) to discuss the issue.

A sign will be placed at the entrance to the site with contact phone numbers and email address of the sand mining contractor site supervisor to enable members of the community to contact the company in the event of a dust issue.

3.5 Procedure for Dealing with Disputes

In the event that an adjoining land user is dissatisfied with the outcomes of their dealings with the sand mining contractor, or if directed by the Shire of Serpentine Jarrahdale, the contractor shall inspect the alleged damage and, if there is proof that the dust originates from the site, make good any damage that is resulting from the release or escape of dust from their site

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4.0 CONCLUSION

It is not possible to guarantee absolutely that dust will not emanate from the site. However, it is considered the tight construction specification will minimise the potential for dust impacting on residences.

Prior to commencement of construction, the sand mining contractor will review the potential for dust, noise and vibration nuisance associated with the earthworks. Agreement as to how such nuisances shall be minimised will be reached as generally outlined in this document.

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5.0 REFERENCES

Department of Environment and Conservation. 2011b. A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities. Kensington: Western Australia.

Environmental Protection Authority. 2015. Draft Guidance Statement Separation Distances between Industrial and Sensitive Land Uses. Perth, Western Australia.

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RPS

FIGURES

RPS

Job Number: L1505503_DMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_DMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

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APPENDIX I

Site Classification Assessment Chart

APPENDIX 1: Site Classification Assessment Chart

Item	Score Options								Allocated Score
Part A – Nature of Site									
1. Nuisance potential of soil when disturbed	1	very low		Low	4	**Medium**	6	high	**4**
2. Topography and protection provided by undisturbed vegetation	1	sheltered & screened	6	medium screening	12	little screening	18	exposed & wind prone	**6**
3. Area of site disturbed by the works	1	under 1 ha	3	**1 ha to 5 ha**	6	5 ha to 10 ha	9	over 10 ha	**3**
4. Type of work being done	1	roads or shallow trenches	3	roads, drains and medium depth sewers	6	road, drains, sewers and partial earthworks	9	**bulk earthworks deep trenches**	**9**
Total score for Part A									**22**
Part B – Proximity of Site to Improvements									
1. Distance of other land users from site	1	over 1 km	6	1 km to 500 m	12	500 m to 100 m	18	under 100	**12**
2. Effect of prevailing winds (at time of construction) on other land users	1	not affected	6	isolated improvements affected by one wind direction	9	dense improvements affected by one wind direction	12	dense/sensitive improvements highly affected by prevailing winds	**6**
Total Score for Part B									**18**
Site Classification Score									**396**

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APPENDIX 2

Dust Management Actions

APPENDIX 2: Dust Management Actions

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
General				
Legislation	-	Comply with the provisions of the *Mines Safety and Inspection Act 1994* and Regulations 1995.	The sand mining contractor will comply with the Act and Regulations at all their pits.	-
Buffers	-	Maintain adequate buffers to sensitive premises.	Buffers are similar to existing operating limestone quarries. All residents within 500 metres will be consulted during the assessment process.	-
Landform	-	Locate activities behind natural barriers, landform and vegetation.	The design of the pit and staging has been selected to provide the best screening. Excavation is conducted below the land surface. Excavation will produce a significant void, up to six metres below natural ground level. The processing and stockpile facilities are to be located on the base of the pit below ground level.	-
Landform				
Landform	-	Work below natural ground level.	This is proposed. Excavation will produce a significant void, up to six metres below natural ground level.	-
		Push overburden and inter-burden dumps into positions where they can form screening barriers.	The bunds will be extended around the perimeter of the excavation area prior to extraction in each particular stage.	-
Staging	-	Design operational procedures and staging, to maximise the separation to sensitive premises.	The design of the pit and excavation has been determined to operate from the floor of the pit from the centre outwards, always behind the face and bunds.	-
Pit design	-	Design the excavation to provide enhanced landform and constructed dust screening.	See above	-
Screening/ Vegetation	-	Use landscape screening, windbreaks and tree belts.	Vegetation is in place around all perimeters. Interim seeding with grass will be used as a surface stabilisation option. On the periphery of the site trees will be planted	-

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Management				
Operation	-	Provide air conditioned closed cabins on plant	These are used on site for operational mobile plant.	-
Monitoring	-	Provide monitoring and supervision of the processing and other practices on site.	A monitoring system is proposed. See below “Trigger Conditions”.	-
Trigger conditions	-	Trigger conditions are used to determine when additional dust management is required.	Most dust generated from processing and vehicle movements has a very large visible component. Lesser risks emanate from excavation and opening new ground. The trigger for dust management is the generation of visual dust. The quarry manager and leading hands are ultimately responsible for site supervision of dust. A commitment is made that no visible dust will cross the lot boundaries. They travel around the operations and pit frequently and are in two-way radio contact with all mobile plant. All operators on site are instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues. When trigger conditions are detected and/or alerted relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc. as outlined in the Dust Management Plan.	-
Adverse weather	Moderate–Uncommon	When winds are sufficiently strong, or other weather conditions are unacceptable, to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.	Rare adverse conditions are more likely to occur during summer mornings and summer afternoon sea breezes. In winter, stronger winds are normally associated with rain and therefore carry a reduced dust risk. This policy is used to minimise impact on adjoining landholders/ dwellings and the urban areas.	Low
Equipment failure	Low–Uncommon	In the event of dust management not being able to be achieved through equipment failure operations will cease until full capability is restored.	This is committed to.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Training	-	Conduct training programs on dust minimisation practices.	The sand mining contractor will use on site induction and training to all personnel at all operations.	-
Complaints	-	Provide complaints recording, investigation, action and reporting procedure such as Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996.	All residents within 500 metres of the proposal will be consulted by the sand mining contractor during the assessment process. A record of all dust complaints is to be maintained together with the mitigation measures to be used to reduce the dust impacts. All complaints relating to dust are to be investigated immediately on receipt of a complaint. Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996, will form the basis of the methods on which a complaint on dust is dealt with. A record of complaints is maintained.	
Earthworks				
Land Clearing	Low – Once per year	Schedule activities such as vegetation removal or topsoil stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	Normally the opening of new ground and the subsequent use in rehabilitation is undertaken in the drier months when the soils are still moist enough to suppress dust but not wet. This is necessary to minimise the risk of dust generation and the spread of dieback spores if present. Nearby residents will be notified prior to large scale clearing that may generate significant environmental dust.	Low
Overburden removal	Low – Once per year	Schedule activities such as overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Overburden removal will be infrequent. Where possible overburden removal will be completed in wetter months or when winds are blowing away from sensitive premises.	Low
Construction of bunds	Low–High – Once per year		Construction of bunds can lead to dust generation if conducted in summer when the topsoils are dry. Where possible bunds will be constructed in drier months when the soils are still moist. If this is not possible water sprays and other wetting down will be used to reduce the potential for dust generation and movement. The bunds will be constructed prior to the excavation in each part of the pit. The bunds will be revegetated during the first winter following construction with local native trees and shrubs to assist in stabilising their surface.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Land Restoration	Low – Once per year.	Schedule activities such as ripping, overburden and topsoil spreading on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Land restoration will be infrequent and normally conducted only once per year. Where possible clearing will be completed in wetter months or when winds are blowing away from sensitive premises. Completed sections of the quarry are to be excluded from activity as soon as practical to reduce the area of active “uncrusted/stabilised” open ground. Stabilisation of the limestone will occur through lack of traffic, crusting from wetting down the limestone and using whatever dust management actions are appropriate, as listed above in the Dust Management Plan.	Low
Excavation				
Excavation	Low – Low level continuous activity	Excavate from the face using techniques that minimise the crushing of dry matter.	Excavation will be normally completed by bulldozer deep ripping and track rolling limestone. When freshly exposed at any time of year the limestone is normally moist and has less capability to generate dust. It is only when air-dried that dust becomes a greater issue. Limestone that is wetted or rained upon rapidly stabilises and forms a hardened crust. This is resistant to erosion until disturbed by traffic. A range of actions will be used on areas that are susceptible to dust lift-off such as sand and disturbed limestone. These will include watering, emulsion, windbreaks, and other stabilisation as required. A water truck is to be used as required to wet down the loading areas. The dust management actions listed above in the Dust Management Plan will be used as appropriate to minimise dust generation and lift-off. At the end of each day in summer the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active.	Low
Loading at Face	Low – Low level continuous activity	Ensure that products to be loaded are moist and that the hardstand on which the loading occurs is wetted down or moist.	This will occur on the floor of the pit. Excavation normally does not generate significant dust. The dust originates from the wheel movements. Air dried product will be wetted down with water canon or other methods. Operational hardstand will be wetted down when dry. Other contingencies will be used relating to operating times, additional water or sealant treatment and ceasing operations in adverse conditions. A water truck is to be used as required to wet down the loading areas. Water can also be applied from water cannon, or sprinklers	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Haulage	Moderate–Medium level continuous activity	Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	Haul roads are to be regularly graded and maintained. They are to be watered regularly and have speed limits imposed. Alternatively they may be treated with stabilisers to reduce the potential for dust. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift-off when the site is not active.	Low
		Reduce the length of the internal roads by maximising internal servicing efficiency.	The haul roads are designed to reduce travel distance to save maintenance costs and time and to maintain efficiency and minimise greenhouse gas emissions.	
		Providing speed management on hardstand and the road network.	This is used.	
		Provide air-conditioned closed cabins on plant.	All vehicles are air-conditioned.	
		Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat.	A dedicated water truck is to be maintained on site and used as required during the drier months.	
Plant – Processing				
Hardstand traffic	Low – Low key ongoing activities	Maintain hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades	The hardstand areas that are subject to traffic are limited in area but are able to be watered by the dedicated truck as required. Non-traffic areas rapidly crust and stabilise.	Low
Inactive periods	Low–Moderate	Leave the operations in a manner such that dust lift off is minimised.	The bunding and perimeter vegetation will reduce wind speed and increase screening. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active. Inactive areas readily crust and seal the surface. A comprehensive liaison with the closest residents and the caretaker will provide a means of monitoring for visual dust at times of inactivity.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Processing	Moderate–Continuous	Treat processing areas with water sprays, shields and dust extraction.	Effective maintenance of the hardstand combined with adequate water treatment is used to minimise dust. Water treatment is most commonly carried out by water truck. Crushing operations are to be watered as required to suppress dust. Dust covers and equipment shields are maintained on all static plant where they are practicable. Continuous visual monitoring of dust is used. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed in site operations.	Low
Mobile and static plant Operation	Moderate–Continuous	Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate.	Operators are instructed to visually monitor dust, report and treat any visible dust. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed. Dust management and monitoring forms part of the site induction programs. Faults are to be repaired promptly. Regular maintenance programs for all dust suppression equipment are proposed. Dust management and monitoring forms part of the site induction programs. See Processing, above.	Low
		Shut down equipment when not in use.	The sand mining contractor will adopt this measure to save fuel and maintenance costs in addition to noise minimisation.	
Loading and Stockpile Creation	Moderate–Continuous	Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	Low
		Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Transport				
		Maintain access roads in good condition (free of potholes, rills and product spillages).	The first 30 metres of road and cross over will be sealed. Effective maintenance of the hardstand and access road in addition to a sealed crossover will be used to minimise dust.	
Road condition	Low–Moderate	Water and/or treat access roads and paved areas using a water tanker or sprinkler system.	See above. Internal roads are regularly watered as often as necessary to minimize dust generation. A dedicated water truck is to be retained on site and used when dust lift off is a potential hazard.	Low
		Wet down or cover loads on trucks that are likely to blow during transport.	Trucks are required to be covered or wetted down prior to exiting the site as required when transporting sandy and other materials that can blow.	
Road Transport	Low–Frequent	Implement a site code outlining requirements for operators and drivers.	A site code and induction system is used.	Low
		Avoid spillages on roads and clean up promptly.	Covering and wetting down loads as required and instructs drivers to report and clean up spillages.	
		Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport.	This forms part of the sand mining contractor operational procedures.	
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	Low
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	
		Wet down stockpiles using water canon or sprinklers as required.	Stockpiles will be assessed for their dust lift off potential and are treated accordingly. Where required wetting down is to be used. Sprinklers and water canon are proposed where necessary. Limestone stockpiles readily form a crust that protects from dust lift off. Sand from stockpiles moves by saltation up to 1 metre off the ground and is unlikely to escape the quarry faces, as they will be located on the floor of the pit.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Stockpiles				
Stockpiles	Moderate	Locate stockpiles behind bunds/ windbreaks or other screening barriers	This is normal practice. There are perimeter vegetated bunds in place. Finer materials will be located where dust lift-off is minimised.	
		Reduce the height of stockpiles. Low flat stockpiles are less likely to be disturbed by wind than high conical ones.	The height of stockpiles is maintained at manageable levels that remain sheltered from the prevailing winds.	
		Wash crushed products where necessary.	The limestone products do not need washing.	
		Locate coarser products around fine materials to assist wind protection of the finer products that are more likely to blow or contain greater amounts of dust.	Not applicable to an operation such as this	
		In extreme conditions stockpiles can be covered although this is often not practical.	This is not normally practical and liftoff will be managed by wetting down and locating stockpiles on the floor of the pit.	
		Provide bunding, fencing and windbreaks around stockpiles and along the tops of bunds.	Perimeter buffer vegetation and bunding is in place	

Our ref: EEL15055.004

APPENDIX C

FIRE AND EMERGENCY MANAGEMENT PLAN

Lot 137 Punrak Road, Hopeland





FIRE AND EMERGENCY MANAGEMENT PLAN

Lot 137 Punrak Road, Hopeland

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:3

Version/Date: Rev 2, February 2019

QUALITY CONTROL CHECK LISTS

Technical Review Checklist

Editorial Review Checklist

These Check List Forms record information about the type of review, who completes it and any actions arising from the review. This is to be filled out by authors and reviewers throughout the reporting process.

These sheets are for internal review purposes only and will be removed from the report at the time of PDF, prior to sending to the client.

Documentation will save the Editorial and Technical Checklist forms as a PDF, back into the report folder for auditing purposes. The original check lists will remain in the Word document for future revisions. Please do not alter or remove any previous lines of text.

Responses are to be either Y for Yes, N for No, or NA. No further information is necessary.

Technical Review Checklist

Project No.:		Revision No.:		Date:	

Introduction / Background	
	Clearly describes the objectives of the report and the scope of work
	Makes a clear link between the objectives of the report to the scope of work
	Presents and shows only data that supports the objectives.

Methods / Approach	
	Approach or methods used to complete work clearly described
	Methods are current good practice and appropriate to objectives
	Confirm appropriate detail provided, e.g. date, time, figures showing all sites, sampling methods, preservation, analyses

Tables and Figures	
	Confirm error bars are shown if appropriate (summary stats shown, e.g. means)
	Correct units shown for both axes
	Map scale is correct
	Map geographic coordinate correct
	All items referred to in text are labelled, e.g. site names on maps

Text	
	Is the document language appropriate for the intended audience; not too much jargon
	Follow thread of logic from introduction and objectives, through approach and methods, to results and then discussion and conclusion (where these sections are used)
	Are interpretations valid and sufficient
	Units are appropriate and consistent throughout; use SI units where possible
	Make sure technical terms, species names, etc. are correct
	Statements, conclusions and discussion points based on reliable information and well referenced
	Data in text matches data in tables and figures and is consistent between sections

Conclusion / Summary	
	Check the Conclusions and /or Summary against the data and make sure the conclusion is reasonable
	Check conclusions address all objectives directly

Document Number: 200-QA-FRM-0049 | Rev 2 | Issued for use: 13/02/2019

Editorial Review Check List

1. Draft A (Internal Draft) Initial Drafting

Author: Giles Glasson Date: 28/11/16

Clarify client expectations around format, structure, content, authorship	y
Plan layout and content of report	y
Confirm target audience with Technical / Editorial Reviewer	y
Check readability, grammar, spelling and punctuation	y
Confirm objectives of report – refer to proposal, CTR	y
Consistent with client and RPS style guides	y
▪ Square bullet points for a report • Round bullet points for letters and memos Dot points have consistent tense and structure within and between lists	y
Check client details and report title are correct	y
If based on previous report, confirm text updated to reflect new purpose, e.g. client and vessel names	

2. Draft A (Internal Draft) Review

Reviewer: John Halleen Date: 28/11/16

Is agreed document structure followed	y
Does the Executive Summary address the objectives and conclusions	y
Report pitched to the target audience	y
Correct template used (client template vs. RPS template; letter vs. Report; memo vs. letter, etc.)	y
The report is succinct and easy to read	y
Sentence length not too long (generally <20 words)	y
Correct punctuation and spelling	y
Do sentences contain only one concept	y
Is verb tense consistent	y
Terminology used consistent with reader's ability and any jargon is explained	y
Paragraphs generally start with a "concept statement" or topic sentence	y
New concepts are presented in new paragraphs	y
Are all acronyms/abbreviations spelt out the first time used, or if acronyms table used is it complete	y
Are important concepts and/or supporting graphics kept together	y
Are all statements made using third party information referenced	y
Are all external references consistent between text and reference list	y
Are all figures, tables, plates and appendices correctly referenced in text	y

3. Draft B (Client Draft) Drafting

Author: Date:

All Draft A reviewer comments have been addressed	
Check readability, grammar, spelling and punctuation of edited sections and track changes	

4. Draft B (Client Draft) Review

Reviewer: Date:

Draft A reviewer's comments adequately addressed	
Check readability, grammar, spelling and punctuation of edited sections	
Check flow of document – i.e. edited sections fit with overall structure	

5. Documentation Review

Documentation Team: Date:

Formatting correct throughout document, including appendices.	
All appendices present as listed in the Table of Contents and included in the relevant job/reports directory	
All attachments (tables, figures, plates, etc.) present as listed in Table of Contents	
Confirm client security / access requirements with author	
Confirm client formatting requirements, if following client style/ format guide	
Check limitations on maximum file size of PDF with author	
Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Captions in the correct places and inserted using the Insert function on the toolbar to ensure it updates correctly in the table of contents.	
Tables easy to read and consistently formatted	
Watermark included if report is to be submitted to the Client for agreement to final changes	
Table of contents updated	
Document status table updated	

6. Post-formatting Review (prior to sending to client)

Author: Date:

Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Check all captions in the correct places and inserted using the Insert function on the toolbar to ensure it updates correctly in the table of contents.	
Check all tables and figures adjacent to the text where they are referred to	
Correct version of appendices, figures, plates, etc. included	
Check all Tables are easy to read and consistently formatted	

Check watermark is included if report is to be submitted to the Client for agreement to final changes	y
Check table of contents updated	y
Check document status table updated	y
Check formatting correct throughout, including appendices	y

Send PDF of report to the client for review

7. Response to Client Review

Author: Date:

Confirm all client review comments received	
Complete squad check sheet if required	
Ensure all client comments addressed	
Check readability, grammar, spelling and punctuation of edited sections and track changes	

8. Rev 0 (Final) Review

Author: John Halleen Date: 01/12/16

Confirm all comments from client have been addressed adequately	y
Response to major comments approved by client (meeting, squad check sheet, watermarked Rev 0)	y
Review new report information for readability, technical content and appropriateness	y
Overall layout of text blocks feel readable	y
Exec Summary reflects changes to document	-

9. Rev 0 (Final) Review

Reviewer: John Halleen Date: 01/12/16

Draft B reviewer's comments adequately addressed	y
Check readability, grammar, spelling and punctuation of edited sections	y
Check flow of document – i.e. edited sections fit with overall structure	y

10. Documentation Review (Rev 0)

Documentation Team: Date:

Formatting correct throughout document, including appendices.	
All appendices present as listed in the Table of Contents and included in the relevant job/reports directory	
All attachments (tables, figures, plates, etc.) present as listed in Table of Contents	

Confirm client security / access requirements with author	
Check limitations on maximum file size of PDF with author	
Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Captions in the correct places and inserted using the Insert function on the toolbar for TOC update	
Watermark removed and footers updated to reflect final status	
Table of contents updated	
Document status table updated	
Verification of copy numbers for printing	

11. Post-formatting Review Rev 0 (prior to printing and/or sending to client)

Author: Date:

Check PDF very thoroughly for any errors	
Correct version of appendices, figures, plates, etc. included	
Check table of contents updated	
Check document status table updated	
Check formatting correct throughout, including appendices	
Check library hard copy once printed to ensure no errors previously missed	

12. Rev 0 (Final) Sign-off

Principal/TD: Date:

Confirm checklist process has been followed closely at all steps	
Confirm both Editorial and Technical Review Checklists completed	
Document status table updated and signed	
Cover email / letter, completed	

13. Final Documentation Process (Rev 0)

Documentation Team: Date:

Transmittal form completed and PDF updated with signature	

Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Rev 0	Final for Issue	GilGla	JohHal	01.12.16	SN 05.12.16	J. Halleen	05.12.16
Rev 1	Final for Issue	RebDaw	JohHal	03.02.17	DC 09.02.17	C. Davies	10.02.17
Rev 2	Final for Issue	MarMcC	JohHal	12.02.19	AW 13.02.19	J. Halleen	12.02.19

Disclaimer

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FIGURES

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Figure A: Ecological Retention Plan....2

(compiled at rear of report)

Figure 1: Site Location

Figure 2: Staging Plan

Figure 3: Vehicle Access and Site Office

APPENDICES

APPENDIX 1: Firebreak Notice and Fuel Hazard Reduction Notice

APPENDIX 2: Total Fire Bans

1.0 INTRODUCTION

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

1.1 Purpose

This Fire and Emergency Management Plan (FEMP) has been prepared to provide for the safety of site personnel, the local community and the natural environment in relation to the proposed sand extraction activities.

The implementation of this FEMP will:

- Classify potential emergencies based upon level of likely impact.
- Identify potential emergency responses.
- Establish an emergency evacuation system.
- Manage fire risk in accordance with state and local government policies and procedures.
- Identify site safety and emergency management equipment.

A copy of the approved FEMP (including the evacuation plan) will be available to all site personnel and visitors and will be kept in the site office.

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the Figure 2 staging plan subject to the following requirements:

(a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

(b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works.

(c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

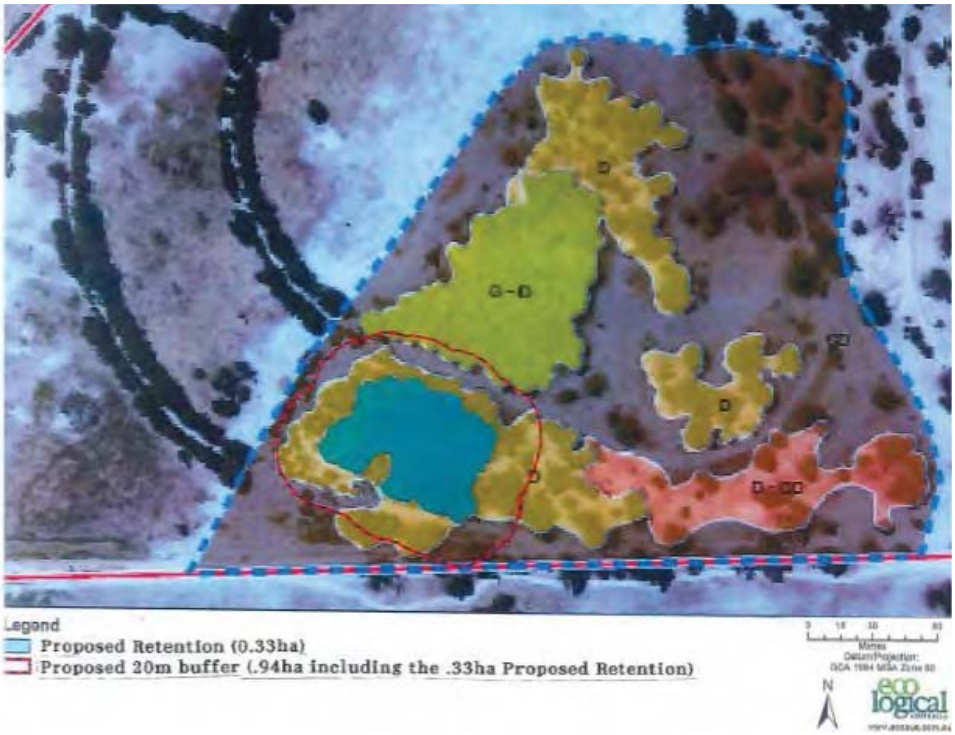

Figure A: Ecological Retention Plan

1.2 Sand Quarry Operations

The extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand), with sand extraction activities scheduled to commence in 2018.

The extent of the sand mining area is shown on Figure 1 and Table A provides an overview of the proposed sand extraction activities.

Table A: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Sand Volume	Approximately 1 million m^3
Life of the project	Approximately three to five years
Dewatering requirements	Nil
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

1.2.1 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2. Approximately 7.9 ha will be excavated in the first two years of sand mining. The purpose of this approach is to allow for up to 18 months of groundwater monitoring, to provide site specific groundwater levels which would inform a revised finished floor level of 2 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation.

Any open areas in these first two years of sand mining will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

1.2.2 Overview of Extraction Process

The excavation of sand will generally involve the following activities within the proposed sand extraction area:

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- Vegetation clearing will involve the use of a wheel loader or excavator to push over the trees, before they are mulched. The mulch will be stockpiled for use within the site.

- Topsoil removal and stockpiling. Topsoil removal will comprise the first 100 millimetres (mm) to 300 mm of the soil being scraped and then stockpiled within the site for use as part of the decommissioning and rehabilitation process. Topsoil and overburden will be stored adjacent to the area of excavation, or will be returned directly being behind the advancing face of the extraction area.

- Initial extraction pit will be designed to maintain a buffer of two metres between the maximum depth of excavation and the average annual maximum groundwater level. The final floor level, subject to groundwater monitoring and post-land use modelling and the Shire's approval of an updated Water Management Plan will be approximately 1.3 m consistent with the neighbouring sand quarry finish levels.

- Each extraction stage of the sand excavation is expected to be approximately 0.8 ha to 4.4 ha in size, with approximately 7.9 ha being extracted in the first two years. Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

- Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Sand will be distributed from the site via road haulage. The main haulage route is anticipated to be along Hopeland Road onto Karnup Road, which provides access to the Kwinana Freeway. Karnup Road is listed as a heavy vehicle route, with a maximum load of 87.5 tonnes and a maximum length of vehicle of 27.5 metres.

- Reforming of the land after excavation is proposed to be undertaken using a wheel loader of excavator to push the topsoil and overburden into place. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three vertical to horizontal in accordance with Shire of Serpentine–Jarrahdale *Extractive Industries Local Law 1999*.

1.3 Hours of Operation

The hours of operation will be 7.00 am to 5.00 pm Monday to Saturday.

1.4 Site Access

A gravel driveway is located off Hopeland Road and enters the landholding's north-east corner.

Vehicle access to the site will be through the gravel driveway via Hopeland Road and for authorised personnel only (Figure 3). Overnight and on weekends, vehicles will be kept within locked premises.

The unmade section of Hopeland Road which provides property access will be closed and ownership transferred to the private resident as a condition of approval. This will ensure the road is only open for local traffic.

Perimeter fencing will be maintained along the boundaries of the property. Property gates will be locked outside operating hours.

If the fencing and/or gate access within the site change as part of the operation of the facility, Figure 3 will be updated and provided to the Shire of Serpentine-Jarrahdale.

1.4.1 Haulage

The number of trucks entering the site will vary throughout the year depending upon the demand for the sand resource. However, it is anticipated that between two to four trucks per hour will access the site per day. Truck payload size will vary depending whether they are semitrailers or rigid wheeler trucks. Trucks will only be entering and exiting the site between the hours of 7.00 am and 5.00 pm.

1.5 Site Infrastructure

Site infrastructure for the Hopeland proposed sand extraction site will consist of the following:

- site office (existing house)
- vehicle / equipment compound
- toilet (within existing house)
- refuelling facility (5,000 litre maximum) self-bunded diesel above ground tank).

All site infrastructure will be located centrally within the landholding. A self-bunded fuel tank or an earth wall bund will be constructed around the designated refuelling facility in accordance with Water Quality Protection Note 56: *Tanks for Elevated Chemical Storage* (Department of Water 2006). Specific measures in regards to the above ground fuel tank include:

- The total tank storage volume shall not exceed 5,000 litres.

- There will be no underground pipework carrying fuel from the tank to facilities outside the compound. The storage tank will be self-bunded and located within a compound that effectively capture and contain any chemical spills.

- Minimum storage tanks and associated spill containment compounds will comply with the current Australian Standard 1940, the *Explosive and Dangerous Goods Act 1961* and any associated regulations.

1.6 Safety

1.6.1 Operations

All sand extraction activities and operational procedures will comply with the following legislation:

- *Explosive and Dangerous Goods Act 1961*
- *Mines Safety and Inspection Act 1994*
- Mines Safety and Inspections Regulations 1995
- *Occupational Health and Safety Act 1984*
- Occupational Health and Safety Regulations 1996
- Shire of Serpentine-Jarrahdale Extractive Industry Local Law.

All personnel are trained to industry standards. All personnel are provided with site induction, safety and environmental awareness training. All workers are required to wear full-time protective safety and high visibility work gear when on site.

1.6.2 Signage

In accordance with clause 6.2 of the Shire of Jarrahdale–Serpentine *Extractive Industry Local Law 1999*, a sign not less than 1.8 metres high and not less than one metre wide which states "Danger Excavations Keep Out" will be positioned at the boundary of the lot adjacent to Hopeland Road.

The signs will also indicate operation hours and contact details of the Site Supervisor.

1.7 Potential Hazards

Within the site, there is the potential for a range of hazards to impact on the health and safety of site personnel, the community and the environment. These hazards have been summarised below and include:

- nature disaster and fire. This is primarily related to bushfire from the areas of vegetation located directly north and south of the site. Fire may occur within the site from the sand extraction activities however the risk of this occurring is considered to be relatively low
- traffic incidents. These could be associated with vehicles within the site, or vehicles (primarily trucks) travelling to and from the site along Hopeland Road
- collapse of excavation area
- falls and impact incidents
- major hydrocarbon spills
- accidents involving electricity.

1.8 Primary Contacts

The sand mining contractor is the party responsible for the overall project. Upon commencement of operations, a Site Supervisor will be nominated for the site with this person responsible for the implementation of this FEMP, or as amended. The contact details for the Site Supervisor will be provided on signage, site induction material and to the Shire of Serpentine-Jarrahdale.

In case of an emergency, the Site Supervisor will be contactable at all times. All personnel will be responsible for managing works in accordance with this FEMP.

1.9 Timing of Works

Works are scheduled to commence once all approvals are in place, anticipated to commence in 2018.

1.10 Induction and Training

As part of operations, all personnel will undertake a site induction that will outline expectations with regard to managing health, safety and environmental requirements within the site. As a minimum, the induction will include:

- the requirement to wear full-time personal protective safety and high visibility work gear
- requirements under the various management plans for the operation of the facility, in particular the FEMP
- emergency communication protocols within the site
- location of on-site resources such as firefighting equipment, hydrocarbon spill kits and first aid kits
- location of the Emergency Assembly Area
- protection of vegetation outside the sand extraction area.

All personnel operating within the site will be trained in the use of on-site resources such firefighting equipment, hydrocarbon spill kits and first aid kits.

1.11 Emergency Response Strategy

1.11.1 Emergency Classification

Emergencies have been classified into three levels, with the levels based on the severity of the real and/or potential impact from the event and the extent of response that is required to manage the event to achieve the resumption of normal operations. The emergency classification levels are:

- **Level 1 Emergency** is non-life threatening or of minor consequences
  - is contained on site
  - controlled immediately with available resources
  - not expected to escalate.

- **Level 2 Emergency** poses a significant threat to life, nearby properties or the environment
  - is dependent on rapid response to bring under control or prevent escalation
  - may be unable to control immediately using on-site resources
  - require external assistance (i.e. police, fire or ambulance services)
  - have potential to escalate or extend beyond the site boundaries.

- **Level 3 Emergency** poses a significant threat to life, nearby properties or the environment and is highly likely to cause major disruption, impact on the community or environmental impact.

1.11.2 Emergency Notification

Emergencies will primary be communicated and responded to through two-way radios on a designated UHF channel. Emergency communication protocols will be included in all contractor site inductions (Section 1.10).

Mobile, fixed line telephones and audible alarms may also be employed during emergency situations (as appropriate).

If external assistance is required to attend to the emergency, the Site Supervisor will call 000 (or 112 if using a mobile) for assistance.

1.11.3 Emergency Command

The Site Supervisor will manage the emergency first response and will remain in control of the emergency until relieved by an emergency service department (i.e. fire, police or ambulance).

1.11.4 Emergency Evacuation

In the event of an emergency and a decision to evacuate, all instructions relating to the evacuation will come from the Site Supervisor. The Site Supervisor will check and contact all people under their control and inform them of the nature of the emergency and the route to be travelled to the designated emergency assembly area (adjacent to the site office).

Site occupants will not leave the emergency assembly area unless directed to do so by the Site Supervisor.

Evacuation of the site occupants from the emergency assembly area may be required for a Level 1 emergency and will likely be required for a Level 2 and 3 emergencies.

1.12 Fire Preparedness

1.12.1 Firebreak and Fuel Reduction Notices

Pursuant to the *Bushfires Act 1954*, the Shire of Serpentine-Jarrahdale publishes an annual Firebreak Notice and Fuel Hazard Reduction Notice (Appendix 1). The sand mining contractor will be responsible for ensuring that the site is managed in accordance with the Shire of Serpentine-Jarrahdale Firebreak Notices, which will include maintenance of the established fire breaks (as required).

The Site Supervisor will be responsible for ensuring compliance with the Shire of Serpentine-Jarrahdale Firebreak Notices as they relate to the sand extraction area.

1.12.2 Vegetation Management

Stored vegetation will be managed in accordance with Department of Fire and Emergency Services' (DFES) Information Note: *Bulk Green Waste Storage Fires* as follows:

- Stored vegetation within the site that is mulched will not be piled any closer than 24 metres from any existing vegetation or pile.
- Piled vegetation will not be greater than 50 metres long by 10 metres wide by five metres high.
- Piled vegetation will be located away from potential ignition sources.

1.12.3 Total Fire Bans

A Total Fire Ban (TFB) may be declared by DFES, in consultation with the Shire of Serpentine-Jarrahdale, because of extreme weather conditions or when widespread fires are seriously stretching firefighting resources (DFES 2016).

When a TFB is declared it prohibits the lighting of any fires in the open air and any other activities that may start a fire. The ban includes all open air fires for the purpose of cooking or camping. It also includes incinerators, welding, grinding, soldering or gas cutting (DFES 2016).

The Site Supervisor will be responsible for ensuring compliance with any TFBs declared within or including the Shire of Serpentine-Jarrahdale.

During a TFB, banned activities can be undertaken if an exemption has been granted. If required, the sand mining contractor will apply for an exemption. Where granted, the Site Supervisor will be responsible for ensuring that all conditions are complied with during the TFB.

Supplementary information relating to a TFB is provided in Appendix 2.

1.13 Resources and Equipment

Designated first aid and emergency response equipment will be available during construction, operation and decommissioning phases of the sand extraction process. Equipment will be maintained in accordance with manufacturer specifications and applicable safety standards including:

- fire extinguishers, located in the site office
- fire blankets and emergency first aid kits, located in all areas and vehicles
- shower and eyewash facility, located in the site office
- water tanks that can be used by fire vehicles in case of emergency will be stored in the vehicle / equipment compound
- spill kits, to be used for cleaning up hydrocarbon spills, will be stored in the vehicle/ equipment compound.

1.13.1 First Aid Kits

- Usage of all first aid kits will be reported with the kit returned in a "ready-to-use" state.
- List of required contents is to be included within all first aid kits.
- All first aid kits will be checked on a monthly basis by site first aid representatives to ensure that they are maintained in a "ready-to-use" state.
- Operators of vehicles will be required to check their vehicle's first aid kits during pre-start inspections.

1.14 Reporting

The sand mining contractor will provide an annual FEMP compliance report documenting Level 2 and 3 emergencies only (if they occur) to the Shire of Serpentine-Jarrahdale by 31 January after each calendar year of the mine's operation.

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2.0 REFERENCES

Department of Fire and Emergency Services. 2016. What is a Total Fire Ban? Accessed 29 November 2016. https://www.dfes.wa.gov.au/totalfirebans/Pages/whatisatfb.aspx.

Department of Water. 2006. Tanks for Elevated Chemical Storage. Accessed 28 November 2016 https://www.water.wa.gov.au/__data/assets/pdf_file/0010/5131/82577.pdf.

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RPS

FIGURES

RPS

Job Number: L1505503_FEMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_FEMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

RPS

Job Number: L1505503_EIL
Doc Number: 003
Date: 11.02.19
Scale: 1:3,545 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50
0 15 30 60 90 120 m

Figure 3

Vehicle Access and Site Office

RPS

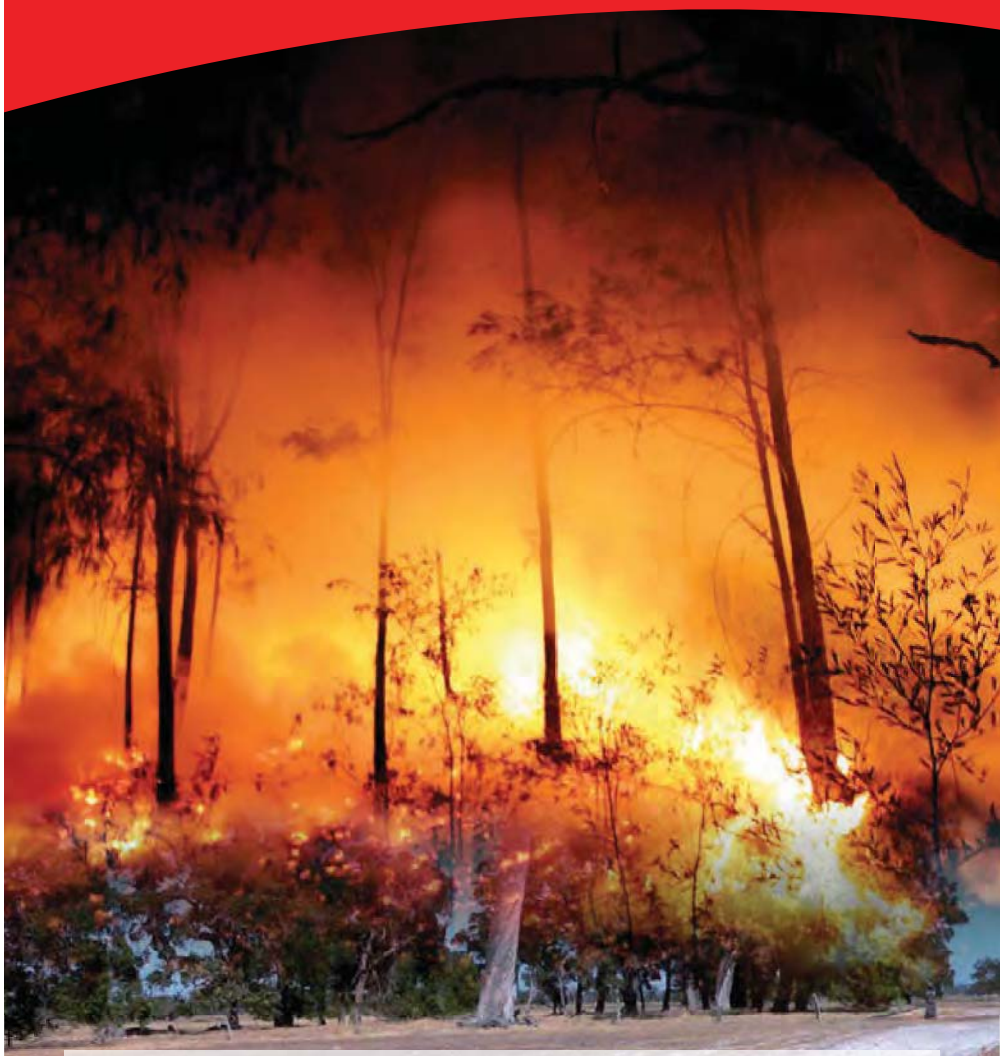
APPENDIX I

Firebreak Notice and Fuel Hazard Reduction Notice

Notice is hereby served to all residents and ratepayers of the Shire of Serpentine Jarrahdale

Firebreak Notice and Fuel Hazard Reduction Notice

Your legal responsibilities and fire safety information



Failure to install and maintain firebreaks in accordance with this notice may result in a $5,000 fine

This Notice and information has effect from 1 October 2016.
All previous Firebreak Notices are hereby cancelled.
By order of Council, Gary Clark,
Chief Executive Officer

Shire of Serpentine Jarrahdale

Contents

Important Dates .....Page 3
Firebreak Notice .....Page 4
Your Legal Requirements.....Page 6
Firebreak Installation Guide.....Page 12
Hazard Reduction.....Page 14
Asset Protection Zones .....Page 17
Hazard Separation Zones .....Page 18
Firebreak Variation Guidelines.....Page 20
Burning Information.....Page 23
Who to Call for a Permit.....Page 24
Garden Refuse .....Page 30

TO REPORT ANY FIRE:

DON'T COME HOME TO THIS...

Important dates

Restricted Burning Period commences* ..... 1 October

Variation to Firebreak Notice completed by ..... 31 October

Variation to Firebreak Notice, as approved by council, to be complied with by ..... 15 November

Firebreak Installed by ..... 30 November

Prohibited Burning Period commences* ..... 1 December

Maintenance of Firebreaks ..... 1 December to 31 May

Prohibited burning period ends as Restricted Burning Period commences* ..... 1 April

Restricted Burning Period finishes* ..... 31 May

**Subject to seasonal changes - check with the Shire of Serpentine Jarrahdale*

DIAL 000

...OR THIS

FIREBREAK NOTICE

Good firebreaks must be clear of everything - it may save a life.

BUSH FIRES ACT 1954
Shire of Serpentine Jarrahdale

PLEASE READ CAREFULLY
THESE ARE YOUR LEGAL REQUIREMENTS

Action is required by all property owners to comply with this notice.

Pursuant to the powers contained in Section 33 of the Bush Fires Act 1954 (as amended) all land owners/occupiers within the Shire of Serpentine Jarrahdale are hereby required in accordance with the following categories to maintain the land for such duration and in such positions/dimensions and specifications as required by this Notice or approved in writing by Council or its authorised officer.

FAILURE TO COMPLY MAY RESULT IN A $5,000 FINE

Definitions

“Firebreak” means a strip of land that has been cleared of all trees, bushes, grasses and any other object or thing or flammable vegetation material leaving clear bare mineral earth. This includes the trimming back of all overhanging trees, bushes, shrubs and any other object or thing over the fire break area.

“Flammable” means any bush, plant, tree, grass, vegetation, object, thing or material that may or is likely to catch fire and burn.

“Trafficable” means to be able travel from one point to another in a 4x4 fire vehicle on a firm and stable surface, unhindered without any obstruction that may endanger resources, no firebreak is to terminate without provision for egress to a safe place or a cleared turn around area of not less than a 21 meter radius (prior written approval from council is required).

“Vertical axis” means a continuous vertical uninterrupted line at a right angle to the horizontal line of the firebreak.

“Duration” means the period of time stipulated in categories 1-7 on the following pages.

YOUR LEGAL R

Category	Requirement
	(a)
1. All areas of land 4047m² (one acre) or less	• Have the entire land cleared of all flammable material by mowi other means. All grasses are to be maintained below 25mm in he • All trees, bushes, shrubs are to be trimmed back over driveway to all buildings to four (4) metres wide with a clear vertical axis o access for emergency services to all structures and points of the firebreaks as per category 2.
	Duration: Compliance required on or bef 31st May each and every year
2. All areas of land greater than 4047m² (one acre)	• Install trafficable, bare mineral earth firebreaks clear of all flam a minimum of three (3) metres wide immediately inside all extern immediately surrounding all buildings, sheds or groups of buildi the land. • All overhanging branches, trees and limbs are to be trimmed b wide with a clear vertical axis over the firebreak area. This includ access to all buildings on the land. • The maximum permissible width of a firebreak is five (5) metre approved in writing by Council or its duly authorised officer. Any development is to be sited not less than four (4) metres from fencing of the lot to allow installation and maintenance of the fire otherwise approved in writing by Council.
	Duration: Compliance required on or bef 31st May each and every year
3. Application to vary firebreak	• If you consider you cannot clear firebreaks as required by this apply in writing to Council on or before 31st day of October in an requesting permission to provide firebreaks in an alternative posi alternative action to comply with this Firebreak Notice. If Council officer does not grant permission for your variation or your variat you shall comply with the requirements of this Notice in its entire • Variations to the Firebreak Notice once approved will not be re applied for each subsequent year after granting. Variation to fireb approvals are provided to the property owner, not the land. • To apply for a Variation please call 9526 1111 and request a Va Firebreak Notice Kit.
	Duration: Compliance required on or bef 31st May each and every year

EQUIREMENTS

	Fuel Hazard Reduction	Dwellings, Out Buildings	More Info
	(b)	**(c)**	
ng and slashing or ight. 's and access ways ver it to afford property or provide	• Remove fuels as per 1(a).	• Maintain low fuel zones adjacent to all buildings and outbuildings. • Trim back all overhanging trees from buildings.	Pages 12-19
ore 30th November and maintained up to and including the			
mable material to al boundaries and ngs situated on ack four (4) metres es driveways and s unless otherwise the perimeter break area unless	• Keep grasses short. • Manage and maintain fuel loadings below 8 tonnes to the hectare.	• Maintain 20m low fuel zones adjacent to all buildings and outbuildings or in accordance with land category 7. • Provide firebreak around all buildings as per 2(a).	Pages 12-19
ore 30th November and maintained up to and including the			
Notice, you may y given year tion or take or its authorised ion is cancelled, ty. quired to be reak notice ariation to	• In accordance with your approved Variation to Firebreak Notice.	• In accordance with your approved Variation to Firebreak Notice.	Pages 20-22
ore 15th November and maintained up to and including the			

YOUR LEGAL R

Category	Requirement
	(a)
4. Plantations	• All plantations shall comply with Councils conditions of appro approved Bushfire Management Plan and this firebreak notice. • Install bare mineral earth trafficable firebreaks clear of all flamr a minimum of twenty (20) metres wide immediately inside all ext of the land with all overhanging branches, trees, limbs, etc to be clear vertical axis over the firebreak area. • Install bare mineral earth trafficable firebreaks to a minimum of metres wide immediately surrounding all buildings, sheds and h of buildings situated on the land. • All overhanging branches, trees, limbs etc. to be trimmed back axis over the firebreak area. • If a new structure is applied for then AS3959 applies.
	Duration: Compliance is required through
5. Fuel storage/hay stacks	• On all land where hydrocarbons (fuel) is stored or located or w whether containing fuel or not, are stored, clear firebreaks a mini metres wide with a clear vertical access around any pile, drum, ra drums. • The maximum permissible dimensions and firebreak size for s flammable materials (including hay mulch, vegetation, greenwast other flammable material), unless otherwise approved in writing b authorised officer are as follows (L x W x H): - Hay stacks: 25m x 10m x 5m – Bare, mineral earth firebreaks m width with a clear vertical access installed directly adjacent to eac all directions with an additional 5m low fuel area directly adjacen - Any other flammable material (including mulch, vegetation or g x 10m x 3m – Bare, mineral earth firebreaks minimum 10m in wi vertical access installed directly adjacent to each stack or pile in a **• The clearing of any standing vegetation (trees/substa to achieve firebreaks required in this land category will requisite planning approval from Council** • Where possible, additional low fuel zones outside of the firebre each individual pile of flammable material should be maintained. kept below 100mm in height within this low fuel zones. • The maximum permissible width of a firebreak required under is 20m unless otherwise approved in writing by Council or its au
	Duration: Compliance required on or befo 31st May each and every year

EQUIREMENTS

	Fuel Hazard Reduction	Dwellings, Out Buildings	More Info
	(b)	(c)	
val and/or the nable material to ernal boundaries trimmed back to a f twenty (20) aystacks or groups to a clear vertical	• Firebreaks to remain clear of all flammable material.	• Comply with AS3959. • Comply with approved conditions of approval and/or Bushfire Management Plan. • Maintain firebreaks clear to mineral earth as per 4(a). • Maintain all vegetation away from power lines.	N/A
hout the year, each and every year			
here fuel dumps, mum of four (4) ump or stack of storage of e, timber or any by Council or its inimum 5m in ch stack or pile in t to the firebreak. reen waste): 20m dth with a clear all directions. **ntive shrubs)** **require the** eak area around Grasses should be this land category thorized officer.	• As per 5(a).	• As per 5(a). • AS3959 applies to dwellings .	Pages 12-19
ore 30th November and maintained up to and including the			

YOUR LEGAL R

Category	Requirement
	(a)
6. Hazard reduction requirements	• In addition to the above firebreak requirements where Council Officer requires that additional fire prevention works be undertake property to reduce the hazard, Council or the Authorised Officer r writing the owner and/or occupier to comply with the required wo within the notice. • This may include hazard reduction works identified as part of a treatment plan derived from Council's Bushfire Risk Management
	Duration: Compliance is in accordance w
7. Does your property have a Bushfire or Emergency Management Plan?	• All properties with a bushfire management, emergency manage an approved Bushfire Attack Level (BAL) assessment approved as Planning Scheme, subdivision approval, development approval o for an individual or group of properties shall comply with the plar • A bushfire management plan's requirements are in addition to t of this notice. PENALTY: $5000.
	Duration: Compliance is required through
8. Exemptions	**COUNCIL DOES NOT ISSUE EXEMPTIONS.**

OTHER LEGAL R

Item	Legislation	Requirements
9. Restrictions on the burning of garden refuse.	Section 24G of the *Bush Fires Act 1954*	The following restrictio Serpentine Jarrahdale a • **Maximum of two g** • Maximum permissib • Only one pile may be • Only dry garden refus • 72 hours prior to the • Vegetation being bur • Duration: Complianc • Burning may not be u • Burning may not be u used in the pile. **Failure to comply w**

EQUIREMENTS

	Fuel Hazard Reduction	Dwellings, Out Buildings	More Info
	(b)	(c)	
or the Authorised en within the nay instruct in orks specified bushfire risk Plan.	• In accordance with 6(a). • Manage and maintain fuel loadings below 8 tonnes to the hectare.	• Additional hazard reduction as required by Council/ authorised officer.	Page 14
ith the written notice throughout the year.			
ement plan or s part of a Town r building permit n in its entirety. the requirements	• In accordance with your Bushfire Management/ Emergency Management Plan and/or Bushfire Attack Level assessment and this Firebreak Notice.	• In accordance with your Bushfire Management/ Emergency Management Plan and/or Bushfire Attack Level assessment and this Firebreak Notice.	N/A
out the year, each and every year.			
			N/A

REQUIREMENTS

	More Info
ns on the burning of garden refuse apply on all land within the Shire of pply: **garden refuse burns per calendar month per property** le size of a single pile of garden refuse is one cubic metre alight at any one time se (vegetation) may be burnt burn, adjoining residents must be notified nt must be from the property on which the burn is occurring e is required throughout the year, each and every year. ndertaken during the prohibited burning times ndertaken on Sundays or Public Holidays Accelerants must not be **ith these requirements carries a $3,000 penalty**	Page 30

ESINFO 01

Firebreak installation guide

The purpose of this guide is to give an understanding of the principle locations of firebreaks on properties. Council acknowledges that not all properties are the same and has introduced a variation to firebreak system. This allows property owners to apply for a variation to manage their properties responsibly within the environment they live in accordance with the Council firebreak notice. See ESINFO 03 Page 20.

Mowed firebreaks are not accepted as they are not considered mineral earth. Mowed firebreaks may endanger the lives of firefighters.

MOWED FIREBREAKS ARE NOT ACCEPTED

Additional information

Trees - live standing trees: Council does not expect you to remove large trees from or adjacent to boundaries so as to install the firebreak. The firebreak can simply detour around the tree so as to afford safe access. This procedure does not require a Variation to Firebreak Notice as long as the normal dimensions of the firebreak exist. If there is a requirement to detour around multiple trees then a Variation to Firebreak Notice will be required.

Roads, verges, bridle paths, footpaths, dual use access ways and reserves: None of the above can be classified as a firebreak for your property. **Firebreaks must be on your own property to conform to the Firebreak Notice.** However, any additional fire prevention activities on verges etc. is encouraged as long as it does not present a liability issue to Council. Removal of indigenous and substantive trees/vegetation requires council approval.

Emergency access ways: These are for Emergency Services vehicles only and are not to be considered as an escape route unless declared as such by the Incident Controller during an emergency.

Maintenance of firebreak, access and vegetation: Once your firebreaks, accesses and vegetation have been managed to meet your legal requirements of the Firebreak Notice, please ensure that these conditions are maintained all the way through until 31 May each year. It is fairly normal for regrowth to occur between December and May. Keep firebreaks and accesses mineral earth and free of obstructions such as fallen tree limbs, ensure vegetation is maintained to minimum levels.

Effective firebreaks: Firebreaks are there to provide safe access on your property to fire fighters. They need to be able to use the firebreak as a place of safety for themselves and their vehicles where the fire will not travel under their vehicles or underfoot. On days of strong winds or extreme conditions it is fully accepted that a

three metre firebreak will be unlikely to stop a wildfire. The more fire prevention work you undertake, the greater the chance of your family and property surviving the ravages of fire.

The installation of firebreaks is only one element of the fire prevention picture. Firebreaks are required to be installed and maintained from 30 November until 31 May each and every year. In some cases ***firebreaks may have to be reinstalled several times in one year.***

It is the property owner, not the contractor or lessee that is responsible for the standard and quality of the firebreaks installed and maintained.

Ploughing and grading: these methods can produce effective firebreaks, however, the areas need constant maintenance. Loose soil may erode in steep areas, particularly where there is high rainfall and strong winds. Stepping and grading the firebreak into the incline reduces this effect.

The installation of firebreaks needs to be in harmony with total fire prevention activities of which some are highlighted below;

How to do hazard reduction

Reduction of fuel does not have to be as drastic as removing all vegetation. Environmentally this would be disastrous and often trees and plants can provide you with some bushfire protection from strong winds, intense heat and flying embers.

Methods of hazard reduction:

- hand clearing
- mechanical clearing
- chemical spraying (should be undertaken from June – September)
- hazard reduction burning

In many circumstances, hand and mechanical clearing methods should be considered the best way to protect assets. These methods can be safer than burning, and easier to organise and maintain.

Manual removal of fine fuels: remove debris such as fallen leaves, twigs, grasses and bark on a regular basis.

Mowing grass: keep grass short, green and well watered.

Slashing and mulching: this is an economical method of fuel reduction. To be effective, the cut material must be removed or allowed to rot before summer starts. Slashing and mowing may leave cut grass in rows, increasing fuel in some places. Mulching, or turbo mowing, also mulches the vegetation leaving it to rot away.

Hazard reduction program

Autumn to winter (May - August)

- Tree Pruning - remove lower branches from the ground up to 2 metres; check that power lines are clear. Use a professional contractor.
- Reduce fuel levels around the house - clear long grass, leaves, twigs and flammable shrubs.
- Ensure petrol and other flammables are safely stored away from the main dwelling.
- Make sure your fire fighting equipment is in good working order and serviced where required.
- Make sure all residents are aware of your emergency plan including evacuation routes.
- Chemical spraying of firebreaks and low fuel zones – first and second applications (June to September).

Spring (September - November)

- Move woodpiles and stacked timber at least 20 metres away from the main dwelling.
- Keep grass short.
- Clean gutters and roof debris.
- Install firebreaks in accordance with this Firebreak Notice, your Variation to Firebreak Notice and/or take action to comply with your Bushfire Management Plan or Bushfire Attack Level assessment.
- Chemical spraying of firebreaks and low fuel zones – final applications and maintenance.
- Review your family's bushfire survival plan. Further information on bushfire planning can be found on the Department of Fire and Emergency Services website.
- Make sure you consider your specific circumstances, including pets and livestock in your bushfire preparation.
- Implement identified bushfire risk management treatments.

Summer (November - May)

- Water lawns, trees and shrubs near the buildings to keep them green.
- Re-check fire fighting equipment, screens, water supplies and that gutters remain clear.
- Maintain firebreaks in accordance with this Firebreak Notice, your approved Variation to Firebreak Notice and/or continue to take action to comply with your Bushfire Management Plan or Bushfire Attack Level assessment.
- Maintain identified bushfire risk management treatments.

Long term precautions

- Ensure firebreaks are prepared in accordance with the latest Firebreak Notice or any Variation to Firebreak Notice or Bushfire Management Plan approved by council.
- Ensure that any planting of wind breaks or trees is in accordance with this Firebreak Notice and will not be detrimental to fire suppression requirements in years to come.
- Make sure that the buildings are safe - fit metal fly screens and shutters, fill gaps into roof/wall spaces, fit fire screens to evaporative air conditioners and have them operable to provide a water only supply.
- Give consideration to installing external building sprinkler systems and back up power for emergencies.
- Ensure emergency water supplies have the correct fittings and that access is unobstructed and trafficable.
- Get basic training in fire fighting from your local Bush Fire Brigade or even join your local Brigade.
- Join or start a local Bushfire Ready Action Group.

Development in bushfire prone areas

Bushfire Prone Areas

In December 2015 the State Government announced reform to help protect life and property in the event of a bush-fire. Areas within the State were mapped and declared "Bushfire Prone". Approximately 97% of our Shire has been designated bushfire prone as part of State Government reform. You can check your property online using the following: https://maps.slip.wa.gov.au/landgate/bushfireprone2016/

The bushfire prone area map is used as a trigger to determine if additional construction requirements are required prior to the construction of your building. These additional requirements may include a Bushfire Attack Level (BAL) assessment and/or a Bushfire Management Plan in accordance with *State Planning Policy 3.7.*

Bushfire Attack Levels (BALs)

Bushfire Attack Level Assessments (BALs) are used as a means of measuring the likely impact of a bushfire on a structure and, in accordance with Australian Standard 3959 are used as the basis for establishing the additional requirements for construction to improve survival of buildings from attack by bushfire.

There are six BAL levels, split between BAL Low and BAL Flame Zone. Although there are no specific construction requirements for BAL Low it does not mean that your building is not at risk! Due to the unpredictable behaviour of fire, there can be no guarantee that a building will survive a bushfire event on every occasion.

The Community Resource Centre have a list of contractors who can assist in firebreak and fuel hazard reduction works and the provision of bushfire attack level assessments and fire management planning. These contractors provide landowners with assessments relating to their development. Please refer to the link below for this information or phone the Resource Centre on 9525 9999: http://serpentinevalley.com.au/app/webroot/js/tiny_mce/plugins/filemanager/files/Firebreak_Contractors.jpg

Bushfire Management Plans

A Bushfire Management Plan will generally be required when a subdivider receives subdivision approval from the Western Australian Planning Commission.

Bushfire Management Plans may incorporate specific conditions or requirements for your lot, including strategic firebreaks, access, water supplies, hardstands, gates and BAL assessments, which are in addition to the requirements contained within this Firebreak Notice. Lots which have had a Bushfire Management Plan prepared for them usually have a Section 70A notification on the certificate of title, and as a landowner you should be notified of this prior to purchasing the land. For further information or to find out if your lot is covered by a Bushfire Management Plan, contact the Shire of Serpentine Jarrahdale.

Asset Protection Zones

An asset protection zone is a low fuel area immediately surrounding a building and is designed to minimise the likelihood of flame contact with buildings and reduce the effect of radiant heat. Asset protection zones must be a minimum of 20 metres on flat land.

It is important to maintain asset protection zones by keeping fuel loads below 2 tonnes per hectare as per the Visual Fuel Loading Guide - Swan Coastal Plain and Darling Scarp available from the following link: https://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/VisualFuelLoadsPublications/Visual%20Fuel%20Load%20Guide%20Swan%20Coastal.pdf. This can be achieved through removal of long grasses and sedges, leaf litter, twigs and flammable shrubs.

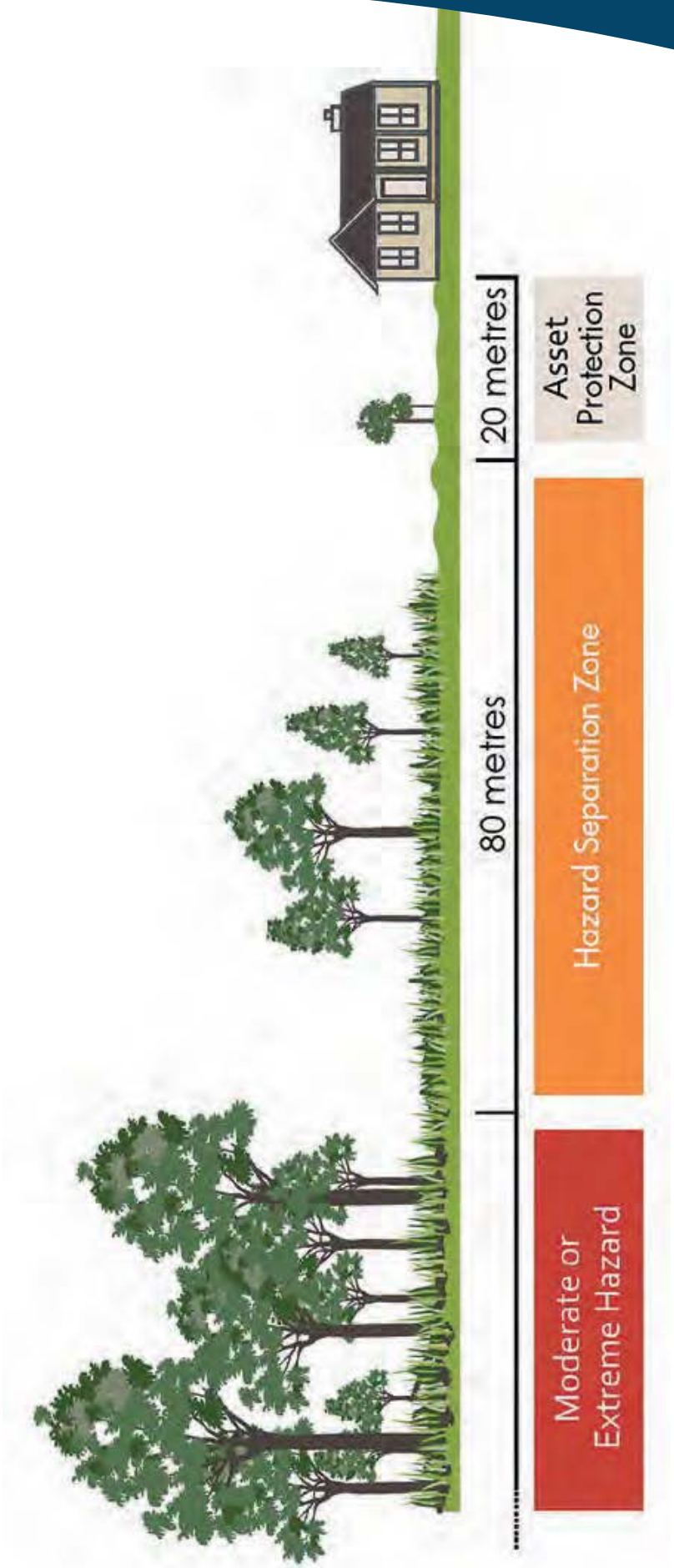
Trees in the asset protection zone should be under pruned to 2 metres high and if there are large trees within 20 metres of the house, consider having them pruned by a professional contractor. Trees overhanging buildings or assets within the asset protection zone should be trimmed back to provide 2 metres clearance between the structure and the tree. Where an asset protection zone is required as part of an approved Bushfire Attack Level (BAL) assessment it must be maintained all year round as prescribed in the BAL report.

Hazard Separation Zone

A Hazard separation zone is needed to provide additional fire protection by reducing the amount of available fuel between the buildings and the surrounding vegetation to reduce the impact of bush fires. A Hazard Separation Zone (HSZ) should extend for 80 metres beyond the asset protection zone or where the 80 metres cannot be achieved then the HSZ is to be to the lot boundary.

As the occurrence of bush fires in this locality is inevitable and will burn in accordance with the prevailing weather and fuel conditions at the time, it is essential that property owners maintain HSZs on their land to have any degree of safety. The following items provide a guide to maintain a HSZ:

- Bush fire fuels within the HSZ should be kept below 4-6 tonnes per ha. as per the Visual Fuel Load Guide for the Swan Coastal Plain and Darling Scarp.
- All grasses within the HSZ must be a maximum of 100mm in height.
- All accumulated litter, twigs, bark of trees, fallen tree branches and logs should be removed from the area on a regular basis prior to and during to the bushfire season.


Asset Protection Zone
20 metres
Hazard Separation Zone
80 metres
Moderate or Extreme Hazard

ESINFO 03

Firebreak variation guidelines

The following guidelines are acceptable categories for which a variation to firebreak may be applied for:

1. The topography/composition makes the normal placement or construction methods of a firebreak impractical or dangerous and alternative firebreak emergency access and fire prevention methods that meet the intention of the firebreak notice is provided and demonstrated.

2. An approved Bushfire Management Plan for the property is in place and being conformed to and meets the intention of the fire break order is provided and demonstrated.

3. The firebreak variation only applies to a portion of the property that is **reticulated lawn** that is **kept green** and it can be demonstrated that it is maintained regularly to **less than 25mm** from the 1st December through to the 31st May inclusive.

4. The firebreak variation only applies to a portion of the property that is **reticulated feed paddocks** that is **kept green** and it can be demonstrated that it is maintained regularly to **less than 100mm** from the 1st December through to the 31st May inclusive.

5. The variation only applies to the portion of the property that has **reticulated garden beds, lawn, orchard or other accepted sustained cultivation,** unless it is deemed by the Council or its Authorised Officer that the fuel type/loadings are a hazard, however, there must be in all cases, cleared access provided to enable emergency vehicular access to buildings and outbuildings and all parts of the property in accordance with Councils firebreak notice.

6. Where permission was previously granted to plant trees, where the firebreak would normally be placed, and placement of the firebreak is in an approved alternative position that affords proper emergency vehicular access and hazard management and prevention principles in accordance with Councils firebreak notice.

7. Firebreaks are provided in approved alternative locations to negate natural obstructions.

8. Constructed driveways may where authorised, substitute for fire breaks as long as it remains trafficable for the firebreak as a whole and is maintained clear of all obstructions and flammable materials at all times in accordance with Councils firebreak notice.

All requests must be made by the property owner or person authorised to act upon the owners behalf. **Individual requests** are required **for each property** and must be submitted on the approved document/ application form.

The authorising officer has the right to grant, refuse, alter or add any conditions to an application, where alterations or additions are applicable, failure to comply within the timescales provided by the authorised officer will result in the refusal of the application and prosecution as if a firebreak had not been installed in accordance with this Firebreak Notice.

Approved firebreak variations are perpetual to the owner unless there is:

- A change to any law or statute which has an effect on the variation
- Non-compliance with the variation
- A change in the ownership of the property”

Where refusal of an application takes place the owner has fourteen (14) days in which to conform to the normal requirements of the Councils firebreak notice.

Please note: You must have your variation in place and operational by the 15th November in the year you wish it to commence. It is your responsibility to demonstrate that the variation will be maintained from the 15th November through to the 31st May each year. Failure to demonstrate compliance and the ability to maintain the alternative solutions approved within the variation will automatically require total compliance with the firebreak order in its entirety.

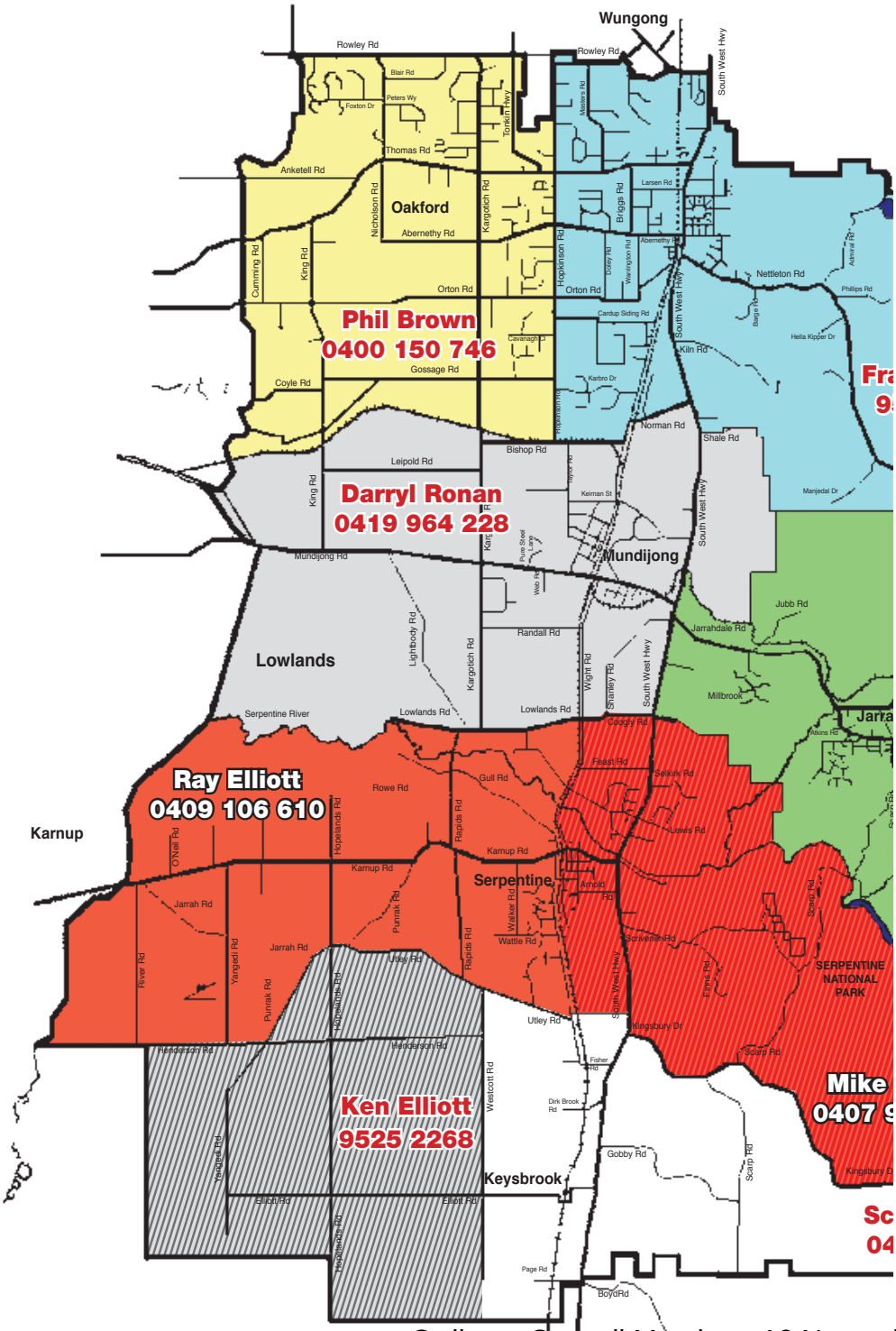
Example plan of alternate firebreak variations:

Burning information

	What can I burn?		
	1m by 1m Garden Refuse 6pm to 11pm	Wood and Solid Fuel Barbecue	Grass, Paddock, Bonfire, Bush
Restricted Burning Period 1 October to 30 November**	**Allowed** in accordance with conditions listed on pages 26 to 31	**Allowed** in accordance with conditions listed on pages 26 to 31	**Permit Required** Contact your local Fire Control Officer
Prohibited Burning Period 1 December to 31 March**	**Prohibited**	**Allowed** in accordance with conditions listed on pages 26	**Prohibited**
Restricted Burning Period 1 April to 31 May**	**Allowed** in accordance with conditions listed on pages 26 to 31	**Allowed** in accordance with conditions listed on pages 26 to 31	**Permit Required** Contact your local Fire Control Officer

**N.B: Subject to seasonal changes. Please check with Council.

Who to call for a permit



Volunteer Fire Control Officers

Frank Rankin 9525 1146
Areas: Byford, Darling Downs, Cardup and Karrakup

Phil Brown 0400 150 746
Areas: Oakford and north of railway line in Oldbury

Darryl Ronan 0419 964 228
Areas: Mundijong, Whitby and south of railway line in Oldbury and north of the Serpentine River and Lowlands Road in Mardella

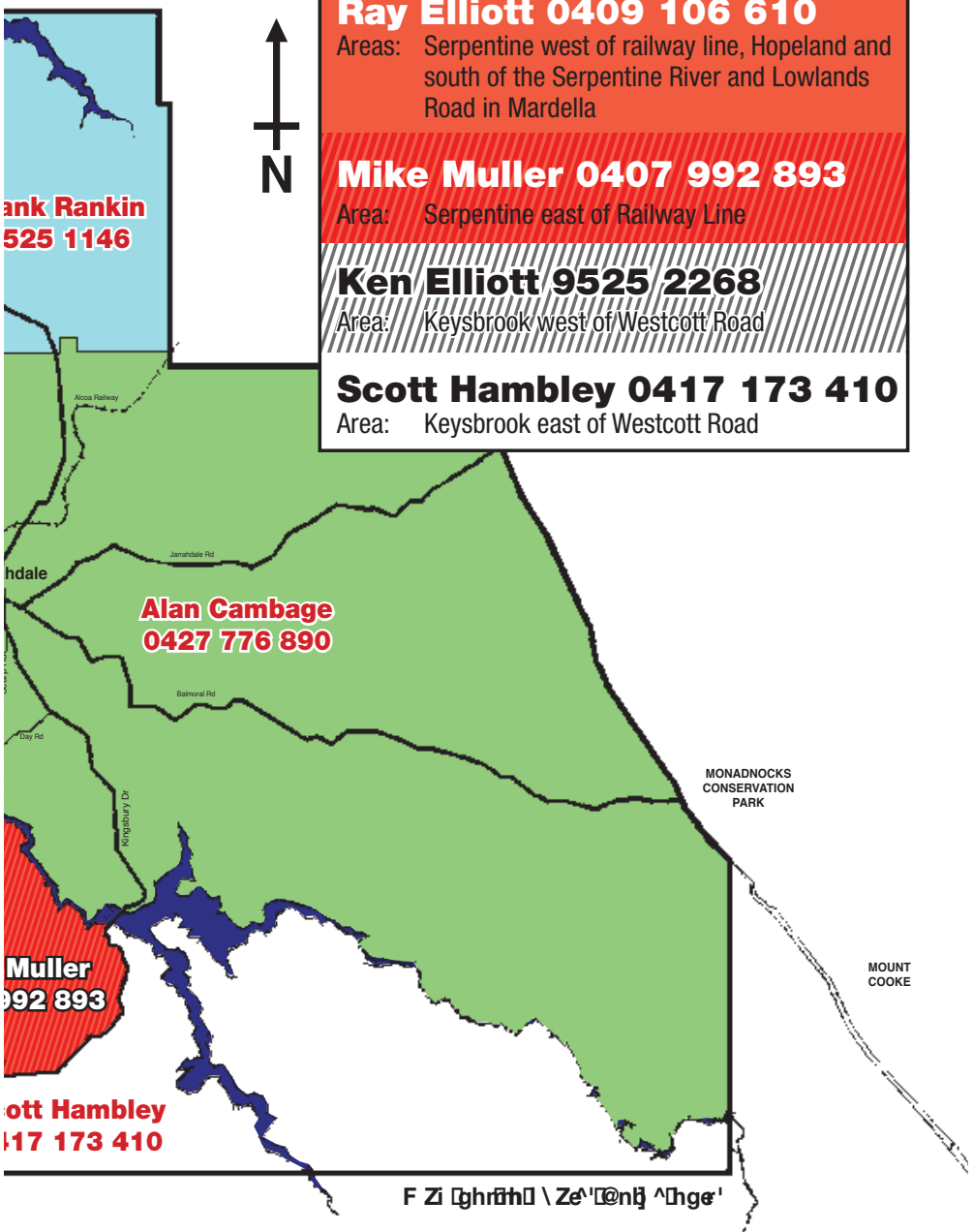
Alan Cambage 0427 776 890
Area: Jarrahdale

Ray Elliott 0409 106 610
Areas: Serpentine west of railway line, Hopeland and south of the Serpentine River and Lowlands Road in Mardella

Mike Muller 0407 992 893
Area: Serpentine east of Railway Line

Ken Elliott 9525 2268
Area: Keysbrook west of Westcott Road

Scott Hambley 0417 173 410
Area: Keysbrook east of Westcott Road



The following conditions apply to all burning and fires in the Shire during the restricted and prohibited burning periods:

- on any day where the Fire Danger Rating is 'very high', 'severe', 'extreme' or 'catastrophic', permits are automatically cancelled. In addition, any solid fuel fire for the purpose of camping or cooking and/or garden refuse burning (including, but not limited to: wood, solid fuel barbecues, pizza ovens, spit roasts, hangis, incinerators or Webers) are **NOT** permitted to be used under any circumstance.
- Where the conditions allow camping or cooking fires, bush and inflammable material must be cleared for three (3) metres around any cooking or camping fire prior to ignition.
- Due to unseasonable weather conditions the Restricted and/or Prohibited Burning Periods may be extended or shortened. Check with the Shire Office or your local Fire Control Officer to confirm the burning period.

The Fire Danger Rating can be found by calling the weather information line 1196. If in doubt or you cannot find out - call Council on 9526 1111 for further information, or do not burn.

What will I be fined if I don't comply?	
Failure to produce permit to burn	**$500**
Offences relating to lighting a fire in the open air	**$3,000**
Obstruction of an authorised officer	**$5,000**
Disposal of burning cigarettes etc.	**$5,000**
Failure of occupier to extinguish bush fire	**$10,000**
Setting fire to the bush during prohibited burning time	**$250,000 and 14 years imprisonment**

If Council's volunteer bush fire brigades attend a fire at any time of the year that is in the opinion of the attending officer deemed to be

- Illegal or;
- not under control or;
- not adequately controlled;

the owner or occupier of the property where that fire is burning may be liable to penalties imposed under Council's Annual Schedule of Fees and Charges up to $10,000, in addition to any infringements or penalties imposed under the Bush Fires Act 1954 (as amended).

Fire permit application

All persons wishing to set fire to the bush during the Restricted Burning Times must first obtain a written permit from a Bush Fire Control Officer for their relevant area.

"Bush" is defined as: any vegetation, trees, bushes, plants, stubble, scrub and undergrowth of all kinds whatsoever whether alive or dead and whether standing or not standing and also a part of a tree, plant or undergrowth and whether severed there from or not so severed.

Before you call a Fire Control Officer ensure you have the following information:

- Who will be the three able bodied persons in attendance at all times whilst the fire is alight including contact phone number?
- What is the address of the property for which the permit applies?
- What fire fighting equipment and resources will you have at the fire front and is it in good working order?
- What is the size of burn to take place?
- Are there firebreaks installed and can a fire unit get access to the area?
- Is the material you are burning vegetation that is dry enough to burn without creating a nuisance? Permits only apply to the burning of bush, so make sure any plastics, treated wood, tyres and other materials are removed from the burn area/pile. Burning these materials may be an offence under environmental legislation such as the *Environmental Protection Act.*

Validity of a permit

A permit is valid only for the day or days written on the permit. It is illegal for anyone who has been refused a permit or given a permit subject to special conditions to approach another Fire Control Officer for a permit concerning the same burn. Appeals can be lodged in writing to the Chief Bush Fire Control Officer of the Local Authority against the refusal of the permit or the conditions.

The Bush Fires Act and Regulations require that notification of the intention to set fire to the bush be given at least 4 days or not more than 28 days prior to burning to:

- The local bush fire control officer for the area.
- All neighbours.
- A Forest officer if the fire is to be lit within 3km of the State Forest.
- On the day of the burn, the Department of Fire and Emergency Services Communication Centre on 1800 198 140.

Notice can be verbal or written in such a way that the person to be notified is aware of the date and time that the burn will take place. In case where notice is given verbally, the period of notice may be determined by mutual agreement between all parties.

Please Note:

All hazard reduction burning over one acre in area which is being undertaken on behalf of a landowner for pecunary gain has the following conditions:

- Written permission and a valid "permit to set fire to the bush" must be obtained from the Shire of Serpentine Jarrahdale at least one week prior to the burn

- A copy of the prescription, including a site plan, traffic and smoke management plan, written permission from the landowner and details of the burn must be submitted as part of the written application

- The Shire and its authorised officer/s reserve the right to either approve, refuse, amend or request additional information in relation to any request to burn on a landowners behalf.

Note:

- At least three (3) able bodied persons and adequate fire suppression equipment or appliances must be in attendance at the fire until it is safe.
- The requirements for a fire to be "safe" is defined as all burning or smouldering debris to be completely extinguished for a distance of 30 metres within the perimeter of the burn area.
- The Fire Control Officer or Local Authority may endorse the permit to vary any conditions on the reverse of the permit.
- A fire may not be lit when the daily fire danger forecast for the area, issued by the Bureau of Meteorology, is very high, severe, extreme or catastrophic.
- The fire must be monitored to make sure smoke is not impacting on neighbours or causing a traffic hazard; if this is found to be the case, all fire must be extinguished as soon as possible.
- Local Government bans the lighting of fires on Sundays or Public Holidays except for brigades or Department of Parks and Wildlife.
- In all cases, the conditions written on the permit must be rigidly observed.
- If, in the opinion of a Fire Control Officer, the fire is considered to be not adequately controlled or is uncontrolled, you may be required to extinguish the fire or Council's Bush Fire Brigade(s) will extinguish the fire and fees may be charged in accordance with Council's Schedule of Fees and Charges.
- Failure to comply with the directions of a Fire Control Officer or obstructing a Fire Control Officer are offences under the *Bush Fires Act 1954* and carry penalties of $2,000 and $5,000 respectively.

Insurance before you burn

Please ensure you have appropriate insurance in place to cover you, your property and your public liability responsibilities before you begin to burn.

Environmental considerations

Does your property have specific environmental restrictions such as:

- threatened ecological communities
- environmentally sensitive areas
- noted as a bush forever site
- areas of native vegetation or specific areas of revegetation which may be prohibited from burning under legislation such as the *Environmental Protection Act 1986*
- previous development/subdivision approval conditions.

If the answer to any of these questions is yes, or you are not sure information is available by:

- accessing the Shire of Serpentine Jarrahdale's website
- contacting Councils office on 9526 1111

It is highly recommended that weed control be undertaken after burning, as weeds can actually increase the fuel loading after a burn. Contact SJ Landcare centre on 9526 0012 for further information.

Remember

It is the permit holder's responsibility to ensure that the fire remains under control. **In the event of any fire escaping beyond the boundaries of the area, the holder of the permit shall dial "000" immediately.** In accordance with Regulation 43 of the Bush Fires Regulations, notification must be made to the local government within seven (7) days reporting in full the circumstances causing the escape of the fire and any losses and equipment used to suppress the fire. Should a fire escape, the permit holder may be held responsible to damages caused to others.

Roadside (verge) burning: Please note it is an offence to set fire to Council road reserves/verges at any time of the year without an approved permit. Permits for this activity can only be obtained from the Council. Contact 9526 1111 to have the relevant paperwork sent to you for completion.

Penalties

The Bush Fires Act Regulations specifies penalties for breaches of these conditions. If a brigade has to attend your burn for suppression activities you could be liable for fines and/or costs.

Advice

Further information can be obtained from your local Fire Control Officer or from the Shire Office on 9526 1111.

Garden refuse

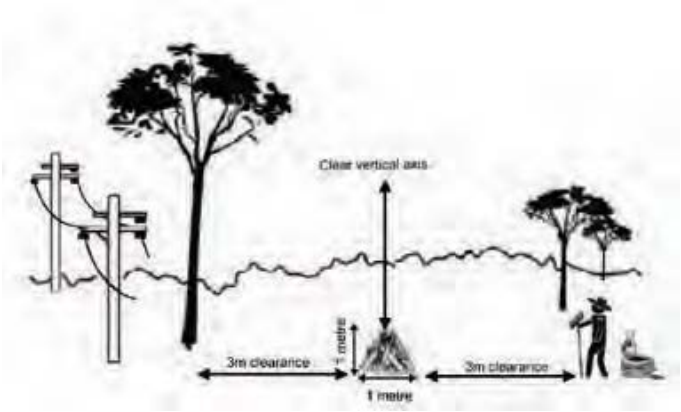
Burning of garden refuse is permitted during the restricted burning period as long as residents comply with this firebreak notice. If in doubt, check with your local Fire Control Officer or the Shire of Serpentine Jarrahdale.

Burning on any day with a fire danger of 'Very High', 'Severe', 'Extreme', or 'Catastrophic' is not permitted, and holds a penalty of $3,000.

As a courtesy, you must notify all residents who adjoin the site of the garden burn at least 72 hours prior to the burn. Where practicable, other residents who might be inconvenienced by the pile burn should also be notified. This allows residents with respiratory conditions to make alternative arrangements prior to the burning of garden refuse. The following requirements apply to all garden refuse burning:

- The pile must not exceed one cubic metre in size.
- Only dry garden refuse (vegetation) may be burnt. This means no household or building materials, plastics, pallets or cardboard may be burnt.
- Garden refuse being burnt must be from the property on which the burn is occurring. You may not burn garden refuse from other properties.
- At least one person must be in attendance during the entire duration of the burn.
- Three (3) metres must be cleared from the edge of the pile in all directions .
- Only one pile may be burnt at a time. If you wish to burn more than one pile at a time you will need a permit from a your local Fire Control Officer.
- All adjoining residents must be notified at least 72 hours prior to the burn. Notice can be either verbal or written.
- The fire cannot be lit before 6pm at night, additional vegetation may be added to a maximum of 1m in width and height until 11pm and the fire must be fully extinguished by midnight on the same night.
- **There is a maximum of two garden refuse burns per calendar month per property.**
- Accelerants must not be used in the pile.
- Penalties of up to $3,000 apply for burning garden refuse contrary to any of these conditions.

RIGHT ☑



Pile is the correct size and clearance. Burn pile clear of trees, fences, buildings and power lines

WRONG ⊗

More than one pile being burnt, piles are too big and are being burnt under trees.

YOU WOULD NOT WANT TO COME HOME TO THIS!

Imagine returning from work to find all your possessions gone, all the valuables, jewellery, treasured mementos from children and family, all your tools, machinery and vehicles burnt beyond recognition.

Could your family cope with being homeless? What about your pets and livestock? What if your family was injured or worse?

TAKE ACTION NOW

- **Know your neighbours, share information and practice your fire plan! (pages 34 and 35)**
- **Follow the Hazard Reduction Program (page 14-16)**
- **Have a bushfire action plan**
- **Have an evacuation plan, contingency plan and know where you will go in an emergency**

ARE YOU BUSHFIRE READY?

BUSHFIRE READY INFORMATION

There are a range of bushfire safety publications available from the following websites:

- www.dfes.wa.gov.au/safetyinformation
- www.areyouready.wa.gov.au
- www.redcross.org.au/prepare

These publications include:

- bushfire action plans and checklists
- information on preparing survival kits
- how to prepare pets and animals for emergencies
- understanding fire danger ratings and warnings

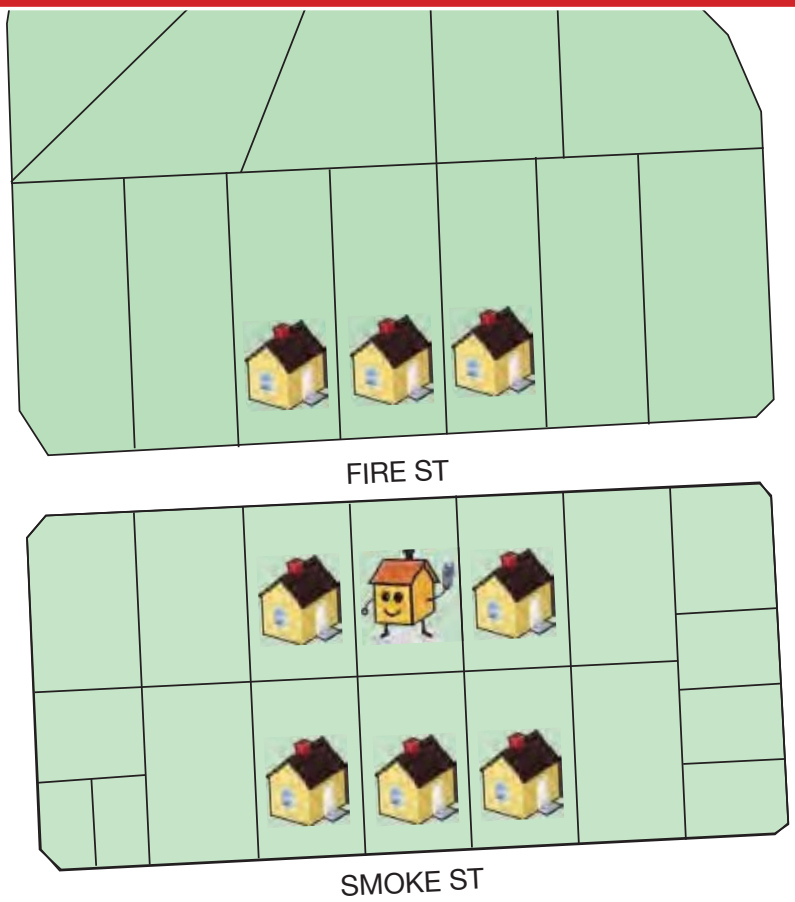
ALERTS AND WARNINGS

During a bushfire, alerts and warnings may be provided by the Department of Fire and Emergency Services or Parks and Wildlife through the following sources:

- www.dfes.wa.gov.au/alerts
- www.twitter.com/dfes_wa
- www.facebook.com/dfeswa
- 13 DFES (13 3337)
- www.dpaw.wa.gov.au/
- www.twitter.com/WAParksWildlife

Alerts, warnings and fire ban information is also broadcast on the local ABC radio station (720 AM).

"Be a mate to eight"



NEIGHBOUR CONTACT DETAILS

	Name	Address
1		
2		
3		
4		
5		
6		
7		
8		

IMPORTANT EMERGENCY CONTACTS

Name/Organisation	Contact Number
Fire / Police / Ambulance	000
State Emergency Service	132 500
DFES Public Information	13 33 37
Main Roads WA	138 138
Western Power	13 13 51
ATCO Gas	13 13 52
Water Corporation	13 13 75
Telstra	13 22 03
RSPCA WA	9209 9300
Wildcare Helpline	9474 9055
Local GP/Doctors	
Hospital	
Insurance Company	

Home Phone	Work Phone	Mobile Phone

Remember, report all fires to

000

**If firefighters can't get to you,
have you done enough to survive?**

Are you being a part of your community?
Join your local Volunteer Bushfire Brigade!
There are a lot of ways you can help, from
active and physical roles to brigade support roles.

Make a difference!
Call 9526 1111

Shire of
Serpentine
Jarrahdale

A 6 Paterson Street, Mundijong WA 6123
T (08) 9526 1111
F (08) 9525 5441
E info@sjshire.wa.gov.au

www.sjshire.wa.gov.au

RPS

APPENDIX 2

Total Fire Bans

Government of **Western Australia**
Department of **Fire & Emergency Services**

PREPARE. ACT. SURVIVE.

Total Fire Bans

Total Fire Bans affect everyone, whether you live near bush or in a built up area. They are a prevention measure to warn you of a day of predicted adverse fire weather. On these days you should be particularly careful not to cause a fire to start.

WHAT DOES A TOTAL FIRE BAN MEAN?

It means a person must not:

- light, maintain or use a fire in the open air
- carry out an activity in the open air that causes or is likely to cause a fire.

The ban includes:

- hot works (welding, grinding, soldering, gas cutting)
- all open solid fuel fires for the purpose of cooking or camping
- use of incinerators and other activities (as described in the 'What Can't I do on a Total Fire Ban day?' section).

WHEN WILL A TOTAL FIRE BAN BE DECLARED?

They are declared on days when fires will be difficult to control, are most likely to threaten lives and property, or when widespread fires are impacting the availability of resources.

The decision to put a ban in place is based on the weather forecast. DFES consults with the Bureau of Meteorology to determine when dangerous fire weather conditions are likely. DFES also consults with local govenments that will be affected.

The need for the ban to remain is assessed and may be revoked in the morning if weather conditions ease. The status of a ban should be checked after 6pm each day.

HOW LONG IS A TOTAL FIRE BAN IN PLACE FOR?

The ban will be in place from 12.01am to 11.59pm on the day declared.

HOW IS A TOTAL FIRE BAN DECLARED?

They are declared by the Minister for Emergency Services, or his authorised delegate, using the whole local government boundary.

HOW WILL I KNOW WHEN ONE HAS BEEN DECLARED?

You can check if your shire has a ban:

- on the DFES website at **www.dfes.wa.gov.au**
- by calling **1800 709 355**
- by listening to ABC local radio and other media outlets
- on roadside Fire Danger Rating signs
- subscribe to RSS or follow DFES on twitter **www.twitter.com/dfes_wa**

Total Fire Bans

WHAT ARE THE PENALTIES FOR IGNORING A TOTAL FIRE BAN?

You could be fined up to $25,000 and/or jailed for 12 months, if you ignore a ban.

CAN I GET AN EXEMPTION TO CARRY OUT WORK DURING A TOTAL FIRE BAN?

Some industries and activities may be given an exemption depending on the nature of their activity.

HOW CAN I GET AN EXEMPTION?

An exemption may be granted if you can show you are taking proper steps to prevent any fire spreading, and that you can control and put out any fire that may start.

Exemptions can cover specific times and locations, and can be changed or cancelled at any time.

You need to apply for an exemption in writing by completing an exemption application form, available at **www.dfes.wa.gov.au**

WHAT CAN'T I DO ON A TOTAL FIRE BAN DAY?

BBQs

Can I use my BBQ?

This depends on what type of BBQ or cooker you have, and where it is located. During a Total Fire Ban you cannot light or use a fire in the open air. Undercover areas such as patios, pergolas and huts that are open or partially open to the weather are deemed to be in the open air.

Solid fuel

No. You cannot use any BBQ or cooker that requires solid fuel such as wood or charcoal. This includes wood fired ovens or stoves, and Weber like BBQs.

Gas

Yes. You can use a gas BBQ for cooking if it has an enclosed flame and:

- All flammable material is cleared five metres away from around your BBQ.
- Your BBQ is never left unattended.
- BBQs with exposed flames cannot be used.

Electric

Yes. You can use an electric BBQ where there is no flame.

What happens if I don't have a five metre buffer zone for my BBQ?

In residential areas where there is not enough space to create your five metre buffer, due to a fence or building, you must:

- Ensure the area around your BBQ is free from flammable material.
- Ensure no burning or hot material escapes this area.
- Be in reach of a garden hose.
- Short green grass less than five centimetres in height, paving stones, bricks and reticulated gardens are not considered to be flammable.

Can I have a BBQ in my local park?

Yes. But only under strict conditions. If you are in a public space or park you must only cook in an area sign posted as a BBQ area. You can only use an electric or gas appliance that has an enclosed flame. All flammable material must be cleared five metres around the appliance. Short green grass less than five centimetres in height, paving stones, bricks and reticulated gardens are not considered to be flammable. You cannot use solid fuel such as wood or charcoal in the open air.

Can I use my wood fired pizza oven?

No. You cannot use solid fuel such as wood or charcoal in the open air this includes outdoor wood fired pizza ovens. Undercover areas such as patios, pergolas and huts that are open or partially open to the weather are deemed to be in the open air.

Tools and Equipment

Can I use a chainsaw, plant or grass trimmer, or lawn mower?

Yes. These activities can be undertaken in suburban or built up areas, but not in bush or other areas where their use is likely to cause a fire. If possible postpone this work as the risk of starting a fire is extremely high.

Can I use a generator?

Yes. This can be undertaken in suburban or built up areas, but not in bush or other areas where their use is likely to cause a fire. If possible postpone this work as the risk of starting a fire is extremely high.

PREPARE. ACT. SURVIVE.

Total Fire Bans

Can I use equipment and machinery (e.g. bobcats, excavators, bulldozers etc)?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government and not in the bush or other areas where their use is likely to cause a fire. If possible postpone this work as the risk of starting a fire is extremely high. Their use is permitted in suburban or built up areas where the area is sufficiently cleared of flammable material to prevent a fire escaping.

Can I do grinding, welding or other forms of 'hot works'?

These types of activities are not allowed in the open air at all unless you have an exemption.

Can I use an angle grinder, power tools or welder inside my shed?

This depends on the type of shed you are working from. You cannot use any of these if your shed has one or more open sides that are exposed to the weather. This is because of the risk of wind blowing through and causing sparks to land on flammable material starting a bushfire. You can use these tools inside your shed if it is fully enclosed on all sides, and has a door and roof to prevent sparks blowing outside. Please be aware of general safety risks when working inside enclosed spaces, including the risk of fumes.

Can I burn leaves, garden waste and grass cuttings, or use an incinerator?

No. During a Total Fire Ban it is illegal to:

- light, maintain or use a fire in the open air
- carry out any activity that causes or is likely to cause a fire in the open air

Camping and Recreation

Can I light a camp fire?

No. During a Total Fire Ban it is illegal to:

- light, maintain or use a fire in the open air
- carry out any activity that causes or is likely to cause a fire in the open air

Can I cook while camping outdoors?

No. You cannot:

- light a camp fire or maintain a fire in the open air
- use any solid fuel such as wood or charcoal for cooking
- carry out any activity that causes or is likely to cause a fire in the open air

If you are in a public space or park you must only cook in an area sign posted for the purpose. You can only use an electric or gas appliance that has an enclosed flame. All flammable material must be cleared five metres around the appliance.

Can I drive on to my bushland block and go camping?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government and the road, track and camping area used is sufficiently cleared of flammable material to prevent a fire escaping. You cannot light a camp fire see 'Can I cook while camping outdoors?' for details.

Can I ride my motorbike/motocross bike or quad bike in bush or on a paddock or track?

No. During a Total Fire Ban you cannot use a vehicle in bush or a paddock, unless it is for agricultural purposes. You can only use a vehicle on a road, track or in an area that has been sufficiently cleared of flammable material.

Can I use a dune buggy?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government and the road, track and camping area used is sufficiently cleared of flammable material to prevent a fire escaping.

Farming and Industry

Can I harvest my crop?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government. Additionally, check with your local government regarding any fire suppression equipment that may be required to be onsite while harvesting.

PREPARE. ACT. SURVIVE.

Total Fire Bans

Can I feed or water my stock in a paddock?

Yes. But only if a Vehicle Movement Ban has not been implemented by your local government. If one has been implemented, the immediate welfare of animals, such as urgent watering and feeding of stock has an automatic exemption.

However:

- you must ensure your vehicle is mechanically sound and the exhaust system is in good condition, free of gas leaks and/or has a spark arrester that is well maintained
- you must ensure all reasonable precautions have been taken to prevent a bushfire starting.

Can I operate or move an aeroplane or helicopter in a paddock?

Yes. But only if a Vehicle Movement Ban has not been implemented by your local government. Note however that the following conditions need to be met:

- you must ensure your aeroplane or helicopter is mechanically sound
- you must take all reasonable precautions to prevent a bushfire starting

What if both a Total Fire Ban and a Harvest and Vehicle Movement Ban are in place?

If both bans are in place for your local Shire then you cannot work or use a vehicle, equipment or machinery powered by an internal combustion engine on land covered by bush, crop, pasture or stubble as there is a chance it will start a fire. However the immediate welfare of animals, such as urgent watering and feeding of stock has an automatic exemption.

Can I work on a professional construction site near bushland, crops or pastures during a Total Fire Ban?

No. You cannot use power tools, including grinders and welders, or carry out any activity that causes or is likely to cause a fire in the open air, unless you have applied for and received an exemption.

Other

Can I use fireworks?

No. Any activity that causes or is likely to cause a fire in the open air is banned. Licensed pyrotechnics should seek further advice from DFES or their local shire council.

Can I use a hot air balloon?

No. Any activity that causes or is likely to cause a fire in the open air is banned.

Can I use blasting equipment or explosives?

There are too many variations with regard to this activity. If it is necessary to carry out this activity you should contact your local Chief Bushfire Control Officer at your local shire council or nearest DFES office.

Does the ban apply to cigarettes, cigars, tobacco and matches?

Throwing a burning cigarette, cigar, tobacco or match away in a situation that causes or is likely to cause a fire, including from a vehicle, is banned

Our ref: EEL15055.004

APPENDIX D

WATER MANAGEMENT PLAN

Lot 137 Punrak Road, Hopeland

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:4

Version/Date: Rev 1, June 2018

Document Status

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Draft A	*Draft for Client Review*	*RebDaw/CarDav*	*JohHal*	*16.12.16*	*SN 19.12.16*		
Draft B	*Draft for Client Review*	*RebDaw/CarDav*	*JohHal*	*09.01.17*	*DC 09.01.17*		
Draft C	*Draft for Client Review*	*RebDaw/CarDav*	*JohHal*	*27.01.17*	*SN 27.01.17*		
Rev 0	*Final for Issue*	*RebDaw*	*JohHal*	*03.02.17*	*SN 09.02.17*	*C. Davies*	*10.02.17*
Rev 1	*Final for Issue*	*MarMcC*	*JohHal*	*21.06.18*	*DC 21.06.18*	*J. Halleen*	*22.06.18*

Disclaimer

SUMMARY

As owners of Lot 137 Punrak Road, Hopeland ("the site"), the McAllister family is proposing to extract sand from a portion of their property. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works. The site is approximately 30 hectares (ha) and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). The site location is illustrated in Figure 1.

The key management plans and technical assessments that have previously been undertaken for the site include:

- Dust Management Plan
- Fire and Emergency Management Plan
- Acoustic Assessment
- Level 2 Vegetation and Flora Survey.

This Water Management Plan (WMP) aims to combine the management practices outlined in the documents above and which have been previously endorsed in the Industry Licence (EIL) Application by the Shire of Serpentine-Jarrahdale. The EIL application was also reviewed by (but not limited to) the Department of Water (DoW), Department of Planning (DoP), Department of Environment Regulation (DER) and Peel Harvey Catchment Council.

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/03/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works.

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer.

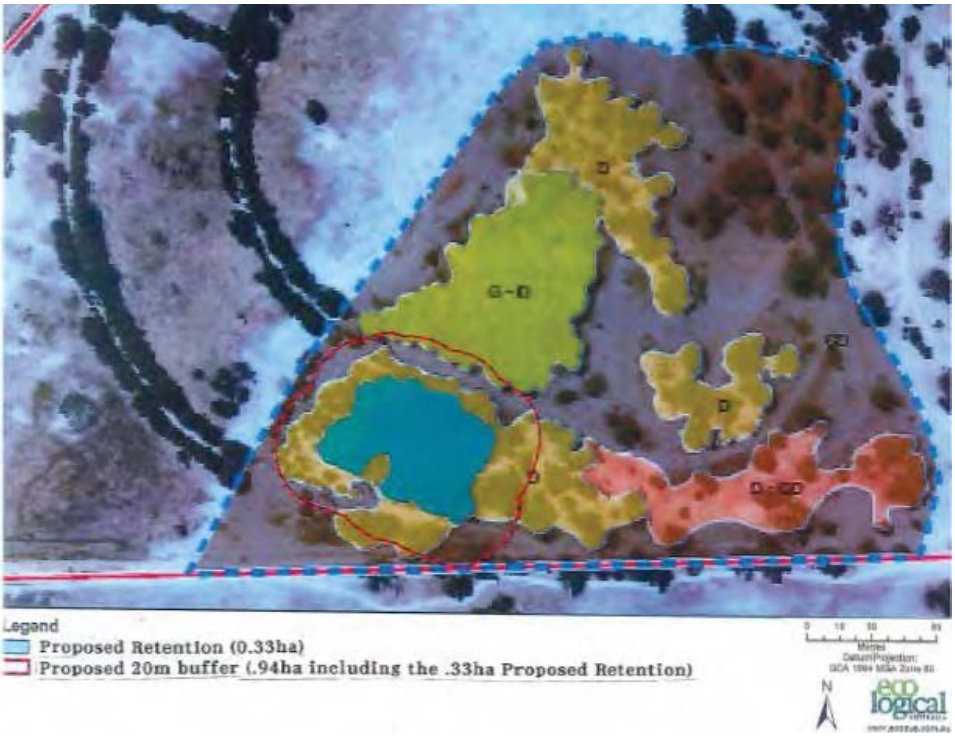

Figure A: Ecological Retention Plan

The extraction of sand meets the broader land use considerations of the Western Australian Planning Commission (WAPC) and the Shire of Serpentine Jarrahdale, by maximising the use of the valuable sand resource, while ensuring that the sand extraction will not adversely impact on the amenity of surrounding landholders or the environment.

Table 1 below provides a summary of the key elements outlined within this WMP.

Table 1: Summary of Key WMP Elements

Key WMP Elements	Details
Topography (Section 2.1)	▪ The topography falls from a high point of 25 m AHD in the south of the site in a north-westerly direction towards the landholding's western boundary with the Punrak Drain/ Road. ▪ The excavation area has a topographic range of approximately 18 m AHD to 25 m AHD
Geology (Section 2.2)	▪ Regional geology mapping indicates that the excavation area comprises white to pale grey sands at surface, yellow at depth, fine to medium-grained, moderately sorted sub-angular to sub-rounded minor heavy minerals of eolian origin.
Groundwater (Section 2.4)	▪ Extrapolation of AAMGL contours indicates that the AAMGL at the site, in particular the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area.

Key WMP Elements	Details
Surface Water Hydrology (Section 2.5)	▪ The closest surface water feature to the site is the Punrak Drain, which is located adjacent to the western boundary of Lot 137. The drain forms part of the local Hopeland surface water drainage network, which ultimately flows into the Serpentine River. No surface water features exist within the site. ▪ A small portion of land located in the north of the site is mapped as Resource Enhancement (RE) wetland (UFI15364) and a portion of mapped Multiple Use (MU) wetland (UFI 15785) extends along the site's western boundary.
Monitoring (Section 5)	▪ It is proposed to use the two existing bore and install two new ones to undertake groundwater level and quality monitoring at the site. ▪ Groundwater level monitoring will be undertaken monthly and groundwater quality monitoring will be undertaken on a biannual basis for the duration of sand extraction activities.
Groundwater Management (Section 6)	▪ The monthly groundwater elevation data will be used to set the final mine levels. The sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). This Water Management Plan will also be updated for approval by the Shire. ▪ The hydrological function of the site will be maintained by incorporating the below management and monitoring actions – Groundwater levels and quality will be monitored using the established monitoring bores for the duration of sand extraction activities. – The above ground fuel storage tank will be self-bunded to prevent any accidental loss of diesel fuel to the environment. – In the unlikely event of a spill occurring during refuelling of either vehicles or the screening plant, impacted soil will be immediately excavated to prevent any contamination of the underlying groundwater. – If any spillage of any material occurs within the excavation area or the haul routes the incident will be reported to the site manager for appropriate action. The site manager is responsible for immediately employing the necessary resources (labour, machinery and material) to clean the spill and recording and reporting of the incident (if applicable) to the DER and the Shire of Serpentine Jarrahdale). – There will be strict adherence to the initial two metre separation buffer and undertake monthly groundwater monitoring and ongoing survey and control of the excavation process to ensure separation distances are controlled.
Water Supply (Section 6.1.1)	▪ Drinking water will be supplied as bottled water for non-potable uses will be trucked to site in water carts or a groundwater licence pursuant to the *Rights in Irrigation and Water Act 1914* will be applied for.
Surface Water Management (Section 6.3)	▪ To manage the potential environmental impact of stormwater the following management practises will be implemented – Any tree stumps will be retained as long as practicable. – Riffle zones and contour sills will be used downslope of the run of the mine pad. – Spill response equipment will be provided at the site. – Bunds and V-drains will be established along the access road to contain run-off, in particular to prevent uncontrolled run-off entering the wetland. ▪ Hydrocarbon management measures will ensure that surface water contamination does not occur.

Conclusions from groundwater modelling undertaken for the proposed sand extraction activities at the site are summarised below:

- Even in extreme rainfall events, groundwater at the site is not expected to reach the surface.
- The expected rainfall rate is less than the infiltration rate at the site. Therefore, surface water run-off is expected to be minimal.

- Extracting sand to a depth of 1.28 m above ground water levels will not lead to an increase in groundwater evaporation.

- Post-extraction transpiration rates will not be significantly different to the pre-extraction rates.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Overview

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers. The sand extraction works will be undertaken by Hanson.

The 30.4 hectares (ha) site is located in Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is currently primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

1.1.2 Proposed Operations

The proposed sand extraction activities will occur within a 11.2 ha portion of the site (Figure 1). It is estimated that the site will support sand extraction activities for three to five years.

The sand is proposed to be excavated in four consecutive stages as illustrated in Figure 2.

It is also proposed through the staging of the sand extraction to limit the "open" extraction area in the first two years capped at a maximum of approximately 7.9 ha for two years. Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

Stage 3 (which has small area of Banksia woodland) will only be excavated upon approval of the Purpose Permit application from the Department of Environment Regulation (DER). In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the Figure 2 staging plan subject to the following requirements:

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/03/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works.

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

After the excavation activities, the staged excavation areas will be rehabilitated to support paddocks and horse training (or similar uses) in accordance with both the "Rural" zoning and the Rehabilitation Management Plan.

1.1.3 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road), to combine the two extraction areas to maximise the removal of the valuable sand resource, both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

Department of Water have reviewed and endorsed the above approach.

1.1.4 Finished Floor Levels

The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

1.1.5 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2.

Approximately 7.9 ha excavated in the first two years of sand mining.

The purpose of this approach is to allow for up to 18 months of groundwater monitoring to provide site-specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation. This would occur prior to any rehabilitation works being undertaken.

1.2 Planning Context

The proposed sand excavation activity is subject to and complies with the MRS and the Shire of Serpentine-Jarrahdale TPS No. 2. Additionally, the following state planning policies are relevant to the proposed sand excavation activity:

- State Planning Policy (SPP) 1 – *State Planning Framework Policy*
- SPP 2.1 – *The Peel Harvey Coastal Plain Catchment*
- SPP 2.4 – *Basic Raw Materials*
- SPP 4.1 – *State Industrial Buffer Policy*
- SPP 5.4 – *Road and Rail Transport Noise and Freight Considerations in Land Use Planning*.

1.2.1 Existing Management Plans

The key management plans and site assessments undertaken to support the proposed sand extraction activities include:

1. Dust Management Plan (included in the EIL).

2. Fire and Emergency Management Plan (included EIL).

3. Rehabilitation Management Plan (to be finalised as a condition of the EIL/ Development Application).

4. Acoustic assessment (included in the EIL).

5. Traffic Impact Assessment (included as part of the Development Application).

6. Level 2 Vegetation and Flora Survey (included in the EIL).

1.3 Objective

The primary objective of this Water Management Plan (WMP) is to define and outline the management measures that will be implemented throughout the construction, operation and rehabilitation of the sand mining operations at the site. These management measures will be implemented to ensure that there are no detrimental impacts to surface and groundwater within or surrounding the site.

This WMP includes details on the following in order to provide assurance that extractive activities will not negatively impact on the local water resources:

- changes in on-site loss of rainwater and impacts on run-off rates. The report will need to demonstrate that no additional flow is exiting the landholding up to and including the 100 year critical event

- impacts on the groundwater regime of reducing sand coverage – changes in groundwater gradient at boundary of property

- potential changes in contamination pathway and land use – reducing cover levels means that the nutrient pathway to receptors for any pollutant (nitrogen from horse manure) is reduced.

2.0 EXISTING ENVIRONMENT

2.1 Topography

The natural topography of the site falls from a high point (approximately 25 metres Australian Height Datum (m AHD)) in the south of the site in a north-westerly direction towards the landholding's western boundary with the Punrak Drain / Road.

The excavation area has a topographic range of approximately 18 m AHD to 25 m AHD (Figure 3).

2.2 Geology

Regional geology mapping shows geology at the site as comprising S8 and S10 sands (Figure 4). The S8 sands underlying the excavation area are described as 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.

2.3 Acid Sulfate Soils

The Western Australian Planning Commission (WAPC) in consultation with the DER has compiled Acid Sulfate Soil (ASS) risk maps that are based on surface geology mapping, and provide a broad scale indication of the risk of occurrence of ASS.

The ASS risk mapping indicates that the entire extent of the site is mapped as "Moderate to Low" risk of ASS occurring within three metres of the natural soil surface (Figure 5).

As the proposed excavation will be of dry sand above the water table it is not anticipated that further ASS investigations are required.

2.4 Hydrological Processes

2.4.1 Regional Groundwater Mapping

The site is not located within an area covered by the Department of Water's (DoW) *Perth Groundwater Atlas*, however there are a number of DoW long-term monitoring bores located in close proximity to the site (WIN ID 3077 and 3090). Both DoW sites have 42 years of continuous monitoring and provide reliable information on long-term groundwater levels and trends.

DoW groundwater information indicates that groundwater is moving in a north-westerly direction and the maximum groundwater level is generally 15.5 m AHD to 16.0 m AHD.

2.4.2 Site Groundwater Mapping

The neighbouring property has an EIL for the extraction of sand from their property. Groundwater monitoring and mapping of the average annual maximum groundwater level (AAMGL) was completed by Emerge Associates to support their EIL application (Appendix 1).

Extrapolation of these AAMGL contours indicates that the AAMGL at the site, in particular the excavation area (EA), is approximately 15 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area (Figure 6).

This equates to the AAMGL generally being approximately 3 m below ground level (mbgl) in the north-west and 5 mbgl in the south-east of the proposed extraction area. The greatest clearance to the AAMGL occurs in the south of the extraction area where the topographical contours peak at approximately 25 m AHD, which provides a clearance of approximately 9 m to the AAMGL of 16 m AHD.

The landholder of the site has completed on-site monitoring and recorded a maximum level of 14.7 m AHD. This level however is lower than the groundwater levels recorded by Emerge Associates and the nearby DoW monitoring sites. It is therefore proposed that the Emerge Associates' AAMGL mapping will be used to establish the excavation depth. These levels coincide with the nearby DoW monitoring data and are considered more appropriate to use than the landowner's monitoring.

2.5 Surface Water Hydrology and Wetlands

2.5.1 Surface Water

The closest surface water feature to the site is the Punrak Drain, which is located adjacent to the western boundary of Lot 137 (Figure 6). The drain forms part of the local Hopeland surface water drainage network, which ultimately flows into the Serpentine River. No surface water features exist within the site.

Incidental rainfall is likely to infiltrate through the highly permeable sandy soils, with minimal overland flow expected, with the exception being during major storm events. During these infrequent events, rainfall run-off is likely to flow overland in a north-westerly direction with surface flows ultimately discharging off site to the Punrak Drain.

2.5.2 Wetlands

A search of the DPaW's *Swan Coastal Plain Geomorphic Wetlands* database (DPaW-017) (27-08-2015 16:55:17) indicates that the majority of the site is not classified as a wetland. However, a small portion of land located in the north of the site is mapped as Resource Enhancement (RE) wetland (UFI15364) and a portion of mapped Multiple Use (MU) wetland (UFI 15785) extends along the site's western boundary (Figure 7).

RE wetland (UFI15364) and MU wetland (UFI 15785) are extensive wetlands that extend over the relatively low-lying surrounding landscape to the east and west of the site respectively. These mapped wetlands are broadly characterised by significant areas of agricultural paddocks and limited extents of native vegetation.

It is acknowledged in the draft *Guideline for the Determination of Wetland Buffer Requirements* (Department for Planning and Infrastructure 2005) that separation distances and management measures are recommended on the basis of potential to mitigate likely impacts of the surrounding land use. Separation measures are required to mitigate only those threats that are present.

The proposed area for sand extraction will be located outside the mapped extents of the wetlands (Figure 7). Best practice management measures will be implemented to ensure that the existing hydrological regimes of the mapped wetlands will not be altered by sand extraction activities.

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3.0 RAINFALL RUN-OFF

3.1 Run-off from Direct Rainfall

The soils at the site consist of medium grained Bassendean Sand, which are known to infiltrate rainfall readily. Recent infiltration testing by RPS on Bassendean Sand in the Kemerton area provided an average infiltration rate of 14.4 metres per day (m/d) for the four sample locations tested. This is similar to the average Bassendean Sand hydraulic conductivity (K) value provided by Davidson (1995) of 15 m/d, with an estimated range of 10 to 30 m/d.

A review of Bureau of Meteorology Intensity-Frequency-Duration (IFD) design rainfall for the Hopeland area shows that the rainfall rate is less than the Bassendean Sand infiltration rate for all 1% Annual Exceedance Probability (AEP)[1] events (Table 2). This shows that surface run-off both before and after sand extraction is expected to be minimal.

Table 2: Design Rainfall Rates

Duration	Exceedance per Year (EY)	Annual Exceedance Probability (AEP)		Rainfall Rate (m/d)		Groundwater Rise (mm)
	1EY	50%	10%	1%	NA	
1 min	1.9	2.1	3.1	4.6	6.6	23
2 min	3.3	3.6	5.3	7.4	5.3	37
3 min	4.4	4.9	7.1	10.1	4.8	51
4 min	5.4	5.9	8.7	12.5	4.5	63
5 min	6.1	6.7	10.1	14.6	4.2	73
10 min	8.8	9.8	14.8	21.9	3.2	110
15 min	10.6	11.8	17.9	26.4	2.5	132
30 min	14.1	15.6	23.5	34.5	1.7	173
1 hour	18.4	20.2	30	43.8	1.1	219
2 hour	23.8	25.9	38.2	56.4	0.68	282
3 hour	27.5	30	44.1	66.1	0.53	331
6 hour	35	38.1	56.7	87.7	0.35	439
12 hour	43.8	47.8	72.1	114.3	0.23	572
24 hour	53.5	58.5	88.7	140.6	0.14	703
48 hour	64.5	70.5	105.4	160.5	0.08	803
72 hour	72.5	79.1	116	170.2	0.06	851
96 hour	79.9	87	125.4	179	0.04	895
120 hour	87.2	94.9	134.9	189.1	0.04	946
144 hour	94.7	103	145.1	201.3	0.03	1,007
168 hour	102.7	111.6	156.1	216	0.03	1,080

Source: BOM (2016) except for rainfall rate and groundwater rise columns

[1] The 1% AEP event is synonymous with the 100 year event

3.2 Run-off from Groundwater Rise

Groundwater rise can be estimated as the product of the rainfall rate and specific yield[2] of the soil. A specific yield of 20% (Davidson 1995) would result in a groundwater rise that is five times the rainfall rate. The proposed minimum groundwater clearance of 1.28 m for the project exceeds the estimated groundwater rise for all duration 1% AEP design rainfall events (Table 2). This means that even in extreme rainfall events, groundwater at the site is not expected to reach the land surface and result in surface run-off.

[2] The specific yield is the volume of water that drains per unit volume of aquifer or soil material. For sands, it is similar to the void space.

4.0 IMPACTS TO WATER LEVELS BY REDUCING SAND COVERAGE

4.1 During Sand Extraction

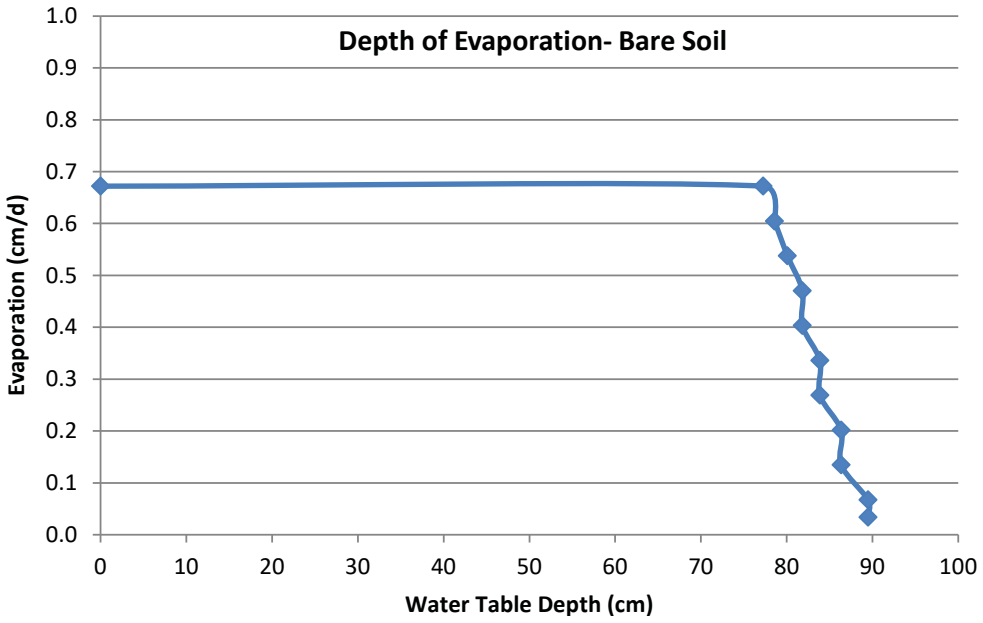
Evaporation of groundwater can extend beneath the land surface and its influence with depth is affected by factors such as land cover and soil type. Spreadsheet modelling was undertaken to estimate evaporation from bare sand (Bouwer 1978). The method included the following characteristics:

- Soil parameters provided by the Rosetta (Schaapp 2002) database for sand. The saturated K value in the database is 6.4 m/d, which is lower than typical for the Bassendean Sand. Hence the evaporation depth calculation will be conservatively large, because evaporation will generally extend to greater depth with finer soil size.

- The model is an iterative, finite difference method using the water table as a zero pressure boundary

- Use of the maximum pan evaporation rate of 0.84 cm/d in January measured at Medina Research Station, which is the closest BOM site. A pan factor of 0.8 was applied (Fetter 1993).

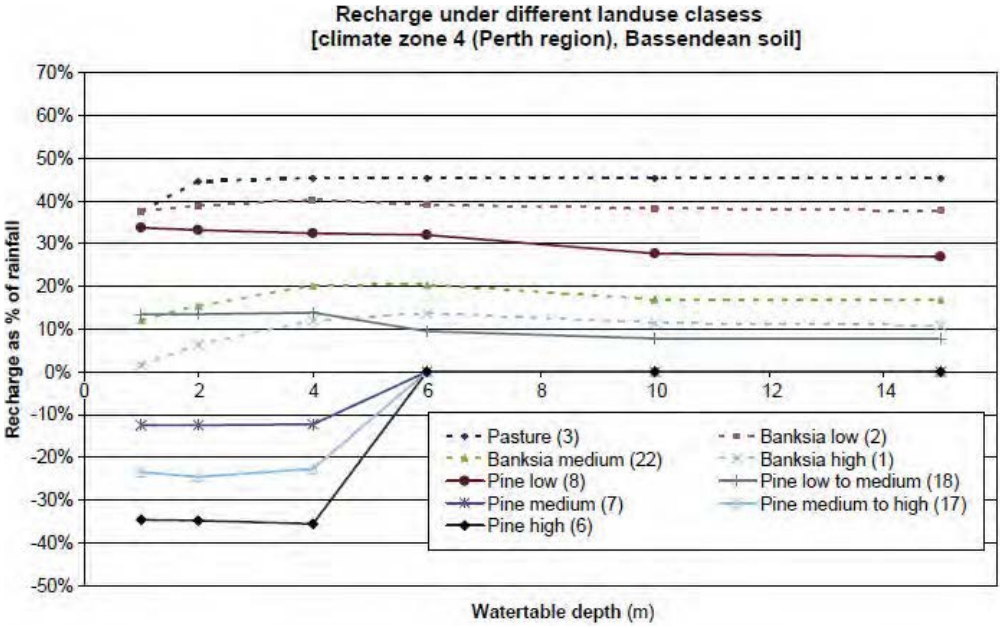
Model outputs (Graph A) show evaporation extends to a depth of 0.9 m. The proposed groundwater clearance of 2 m (to be amended to 1.28 m in the future) is greater than the depth that evaporation is estimated to extend, hence extracting sand to the designated level is not expected to increase evaporation.



Graph A: Evaporation Depth in Bare Sand

4.2 Post-sand Extraction

The post-extraction depth to groundwater of 1.28 m will exceed the pre-extraction depth to groundwater of ~ 8 m, and potential post-extraction increase in transpiration rates needs to be considered. Graph B shows groundwater recharge rates for various land uses over Bassendean Sand that were estimated from the Vertical Flux Model (VFM) for the Perth metropolitan area (Xu et al. 2008). These estimates take into account detailed processes such as unsaturated zone soil hydraulic properties and vegetation density. Recharge rates for water table depths between 1 and 8 m (which is the range of pre- and post-extraction water table depths at the site) are similar for the pre- and post-extraction land use (pasture). On this basis, post-extraction transpiration rates will not be significantly different from pre-extraction rates.



Source: Xu et al. (2008)

Graph B: Estimated Recharge for Various Land Use by WAVES (Bassendean Soil)

4.3 Impacts to Water Quality by Reducing Sand Coverage

The Bassendean Sand unit is known to have minimal nutrient retention capacity in relation to phosphorus and nitrogen. Hence the depth to groundwater in this unit is not the critical factor in terms of nutrient migration and management. Rather, on-site practices which reduce nutrient inputs should be the focus of nutrient management. To this end, no nutrients will be input at the site as part of extraction activities. The only potential source of nutrients is the on-site above ground portable toilet, which will be located as far up-hydraulic gradient as practically possible, and such that depth to groundwater is at least 2 m.

4.4 Water Balance Summary

The steady state water balance at the site can be summarised as follows:

$$G_I + R_I = G_O + ET_O$$

Where:
G_I = Groundwater input
R_I = Rainfall input
G_O = Groundwater output
ET_O = Evaporation from bare soil and post-extraction evapotranspiration

As discussed in previous sections of the report, the extraction activities will not result in significant changes to any of these water balance components. This is on the proviso that the separation distance to groundwater is maintained throughout the project. The following section provides the monitoring and management program to ensure the minimum groundwater separation is maintained.

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5.0 MONITORING

5.1 Groundwater Level Monitoring

Groundwater levels will be monitored using the two existing up-gradient monitoring bores (MB01 and MB02) and it is proposed to install an additional two down-gradient bores (MB04 and MB05), as shown on Figure B.

Figure B: Proposed Monitoring Bore Locations

Groundwater level monitoring will be undertaken on a monthly basis for the duration of sand extraction activities. There will be strict adherence to an initial 2 m groundwater separation buffer from the AAMGL with ongoing survey and control of the excavation process to ensure separation distances are controlled.

The ongoing monthly groundwater elevation data will be used to refine the AAMGL and set the final mine levels. The sand quarry finish floor level will be amended from 2 m to 1.28 m from the AAMGL, which is consistent with the neighbouring sand quarry site.

5.2 Groundwater Quality Monitoring

Groundwater quality at site will be monitored using the established and proposed monitoring bores for the duration of sand extraction activities.

Table 3 summarises the proposed monitoring program. The specifics of this monitoring program may be adjusted pending results over time.

Table 3: Proposed Groundwater Monitoring Program

Location	Analyte	Potential Source	Frequency
Bores MB01, MB02, MB04, MB05	Total Petroleum Hydrocarbons (TPH)	Hydrocarbon spill/ leak	Twice over water level monitoring period (winter high and summer low).
	pH	Acidic groundwater from regional area	
	Salinity (EC)	Reduced groundwater recharge	
	Nutrient suite (Total N, Total P, nitrogen oxides, reactive phosphorus, ammonium.	On-site toilet, groundwater from regional area	
	Water levels		Monthly

5.3 Contingency Actions

5.3.1 Water Levels

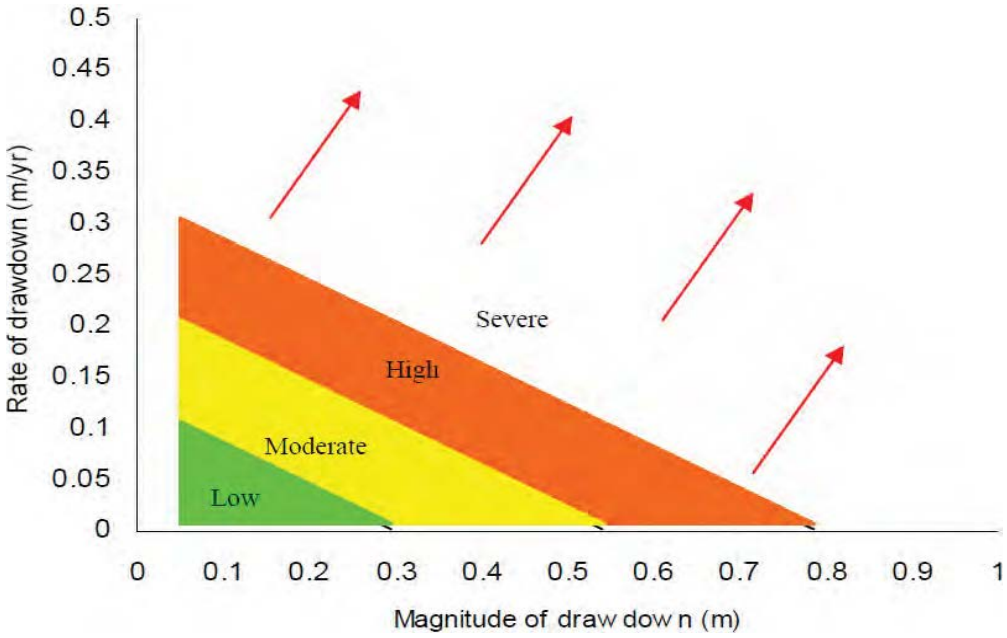
It is proposed to monitor baseline groundwater levels prior to sand extraction works to assess any impacts associated with the site activities. It is proposed that the following trigger be applied:

- water level decrease of 0.3 m over at least two successive monitoring events, after Froend and Loomes (2004) (Graph C).

The following contingency measures will be applied should water level triggers be exceeded:

- If decrease exceeds 0.3 m, assess in conjunction with the appropriate regulator, whether the decrease is due to regional groundwater variation (e.g. due to climate factors). If decrease is deemed due to natural regional variability, continue existing monitoring program.

- Assess environmental value of down-gradient groundwater dependent ecosystem (GDE) that may be affected, and remediate/modify site activities if required in conjunction with the relevant authority.



Graph C: Risk of Impact for Wetland Vegetation based on Magnitude of Groundwater Level Change (from Froend and Loomes 2004)

5.3.2 Water Quality

In conjunction with the water level monitoring, it is proposed to monitor baseline groundwater quality. The future groundwater quality resulting from the excavation works can then be compared with the baseline data to assess any impacts associated with the site activities. It is proposed that the following trigger be applied:

- water quality exceeding 50% of baseline levels over at least two successive monitoring events and/or exceedance of ANZECC (2000) guideline where relevant.

The following contingency measure will be applied should water quality triggers be exceeded:

- Conduct an assessment as to source of spill and/or water quality impact and remediate/modify if required in conjunction with the relevant authority.

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6.0 MANAGEMENT

6.1 Groundwater Levels

The following sections outline the measures proposed to ensure that, in line with the relevant policies, mining activities will not impact upon important water resources.

6.1.1 Water Supply

Water for construction and dust suppression will either be trucked to site in water carts or abstracted. If groundwater abstraction is required, a groundwater licence pursuant to the *Rights in Irrigation and Water Act 1914* will be applied for.

Drinking water will be supplied as bottled water.

6.1.2 Groundwater Clearance

Sufficient clearance above the water table will be maintained to ensure:

- Accidental fuel spills can be contained in the unsaturated zone for a reasonable period of time.

- Evaporation losses during mining and evapotranspiration losses after mine closure are minimised.

As discussed in Section 5, it is proposed to set a mine floor level that provides an initial 2 m clearance to the AAMGL. Once groundwater monitoring is completed, as per this report which has been developed with the Shire, the sand quarry finish floor level will be amended from 2 m to 1.28 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The groundwater monitoring data will be provided to the Shire prior to altering the finish floor levels. The landowners are committed to the following:

- implementing this Water Management Plan
- survey control of quarry floor to ensure accurate recording of separation distance
- monthly monitoring of the groundwater via the existing monitoring bore.

6.2 Groundwater Quality

Potential impacts to groundwater quality during site works are considered to be minor and include leaks and spills from hydrocarbons. Management measures proposed to maintain the hydrological functions at the site include:

- The above ground fuel storage tank will be self-bunded to prevent any accidental loss of diesel fuel to the environment.
- In the unlikely event of a spill occurring during refuelling of either vehicles or the screening plant, impacted soil will be immediately excavated to prevent any contamination of the underlying groundwater.
- If any spillage of any material occurs within the excavation area or the haul routes the incident will be reported to the site manager for appropriate action. The site manager is responsible for immediately employing the necessary resources (labour, machinery and material) to clean the spill and recording and reporting of the incident (if applicable) to the DER and the Shire of Serpentine Jarrahdale).
- There will be strict adherence to the initial two metre separation buffer and undertake monthly groundwater monitoring and ongoing survey and control of the excavation process to ensure separation distances are controlled.

6.3 Surface Water Management

Resource Enhancement Wetland UFI15364 is located to the north and east of the proposed excavation area. The site will be designed and operated to avoid disruption of surface water flows and ensure that potential contaminants are not released into the wetland. To further avoid impacts to the RE Wetland, a 50 m buffer will be maintained between the wetland and operational areas of the mine.

Punrak Drain is located along the north-west boundary of the site, approximately 200 m from the proposed excavation area. Consequently, impacts to the water quality of the drain are not anticipated.

To manage the potential environmental impacts to surface water, the following management practises will be implemented:

- Any tree stumps will be retained as long as practicable.
- Riffle zones and contour sills will be used downslope of the run of the mine pad.
- Spill response equipment will be provided at the site.

- Bunds and V-drains will be established along the access road to contain run-off, in particular to prevent uncontrolled run-off entering the wetland.

- Hydrocarbon management measures will ensure that surface water contamination does not occur. Contamination and spills management will be implemented as described below.

6.3.1 Fuel and Chemical Management

The proposed mining operation will address potential risks through minimising the storage of hydrocarbons on site. There will not be a fuel farm on site and machinery servicing will not occur on site. A fully contained mobile service truck will be used to bring fuel, oil, lubricant and coolant on site. The service truck has separate tanks for lubricants and a waste oil tank and evacuation pump. This will allow for the removal of all waste hydrocarbons from the site. No chemicals will be stored on site.

All site infrastructure will be located centrally within the landholding. A self-bunded fuel tank or an earth wall bund will be constructed around the designated refuelling facility in accordance with Water Quality Protection Note 56: *Tanks for Elevated Storage* (DoW 2006). Specific measures in regards to the above ground fuel tank include:

- The total tank storage volume shall not exceed 5,000 litres.

- There will be no underground pipework carrying fuel from the tank to facilities outside the compound. The storage tank will be self-bunded and located within a compound that effectively capture and contain any chemical spills.

- Minimum storage tanks and associated spill containment compounds will comply with the current Australian Standard 1940, the *Explosive and Dangerous Goods Act 1961* and any associated Regulations.

6.4 Waste Management

The existing on-site effluent system will be used and no connection to reticulated sewerage is required.

The management strategies that will be implemented to manage wastes are:

- Hydrocarbons and chemical containers, such as lubricants will be regularly removed from site for disposal at a licensed landfill facility.

- Instruction will be provided to site personnel on waste management.

- Mobile service vehicles will store any waste oil removed from machinery and remove it from site daily.

6.5 Acid Sulfate Soils

The site has a moderate to low risk of ASS and extraction activities have been planned to avoid the wetland areas which may have higher risk of ASS. Furthermore, extraction activities will not be undertaken below the water table. Consequently, the risk of disturbing ASS is low.

6.6 Dust Management

Excessive dust has the potential to impact on both workers on site and the adjoining land users. Dust has the potential to be generated during most phases of the quarrying operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions.

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure levels under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lot 137.

Dust control methods are outlined in the Dust Management Plan (RPS 2018) that has been prepared for the site (Appendix 2).

6.7 Rehabilitation

It is intended that the site will support sand excavation activities for up to five years, after which the following will be undertaken:

- The site will be rehabilitated to agricultural pasture.
- Upon completion of the sand extraction, all facilities and equipment will be removed from the site.
- Removal of the fuel tank will adhere to all safety practices to minimise the risk of contamination or spills. Remaining fuel will be emptied prior to moving.
- Access track removal will be dependent on their usefulness for future uses of the site. Some areas may require retention of access tracks while other areas may require removal.

The rehabilitation of the site is intended to return the land to a condition suitable to support, as a minimum, activities that are currently supported by the site which includes horse training.

A Rehabilitation Management Plan will be prepared as either a condition of the Extractive Industry Licence or Development Application.

6.7.1 Landform Reconstruction

As part of the rehabilitation process, the following actions will be undertaken:

- The final contours are anticipated to be visually comparable with the flatter parts of the site and suitable batters (no greater than one in three) will be created along the interface between excavation area and the 20 metre vegetated buffer along the site boundary.

- All final slopes will be similar to those in the local area and the excavation will be left in a safe manner in accordance with the *Mines Safety and Inspection Act 1994*.

- Batter areas will be stabilised through revegetation with native plant / pasture species to minimise erosion risk.

- Respread of topsoil stockpiled as part of clearing works to a depth of 100 mm and deep ripped to a depth of 300 mm to assist in the establishment of pasture species. Where required, seed for pasture species will be spared to maximise growth and ensure that 90% vegetation cover is achieved.

- A final minimum unsaturated clearance of 1.28 m will be consistent with Section 6.1.2.

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RPS

FIGURES

RPS

Job Number: L1505503_WMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_WMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

RPS

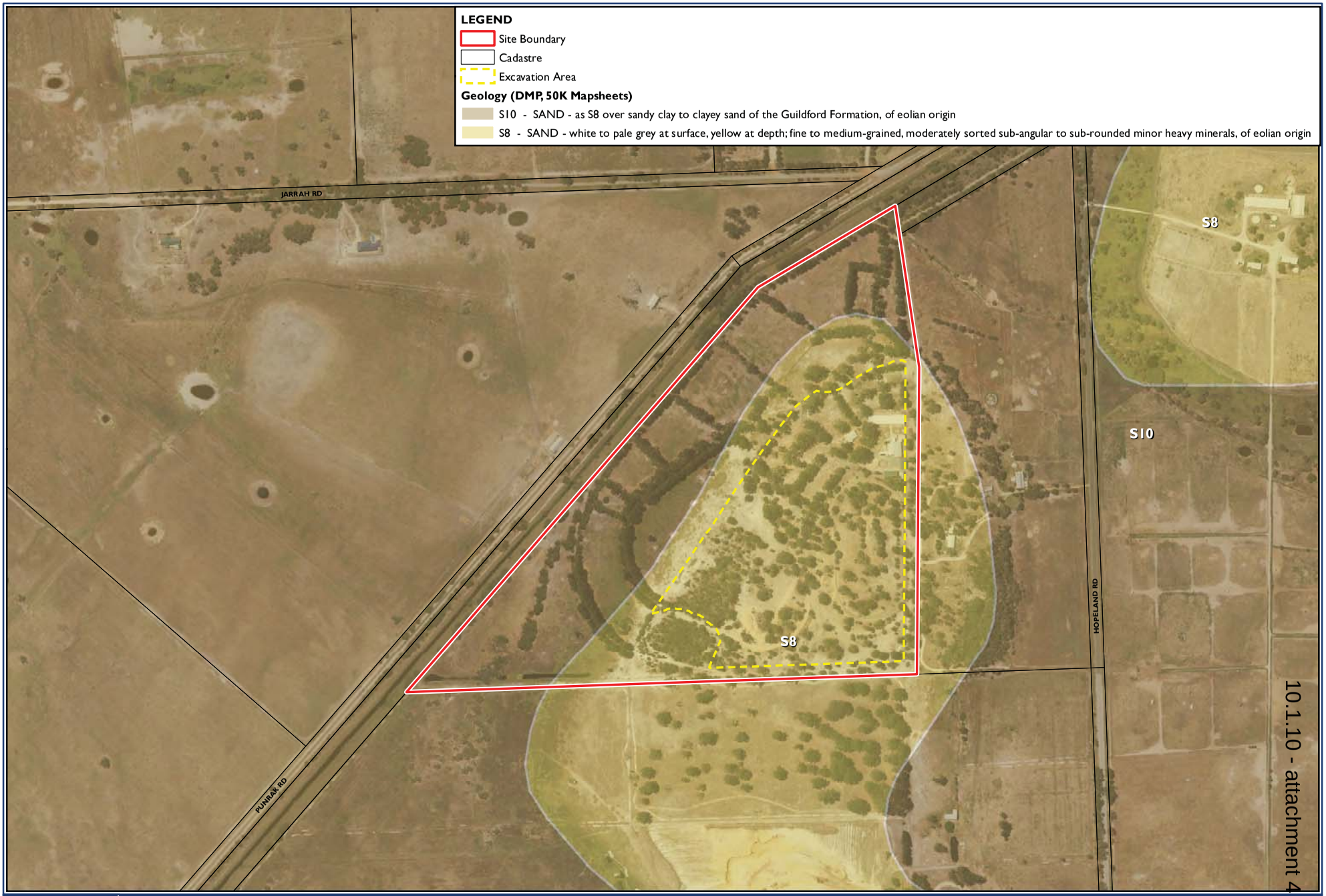
Job Number: L1505503_WMP
Doc Number: 003
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 1m Lidar contours - DoW, 2015

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 3

Topography



RPS

Job Number: L1505503_WMP
Doc Number: 004
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Scale: 1:5,000 @ A3
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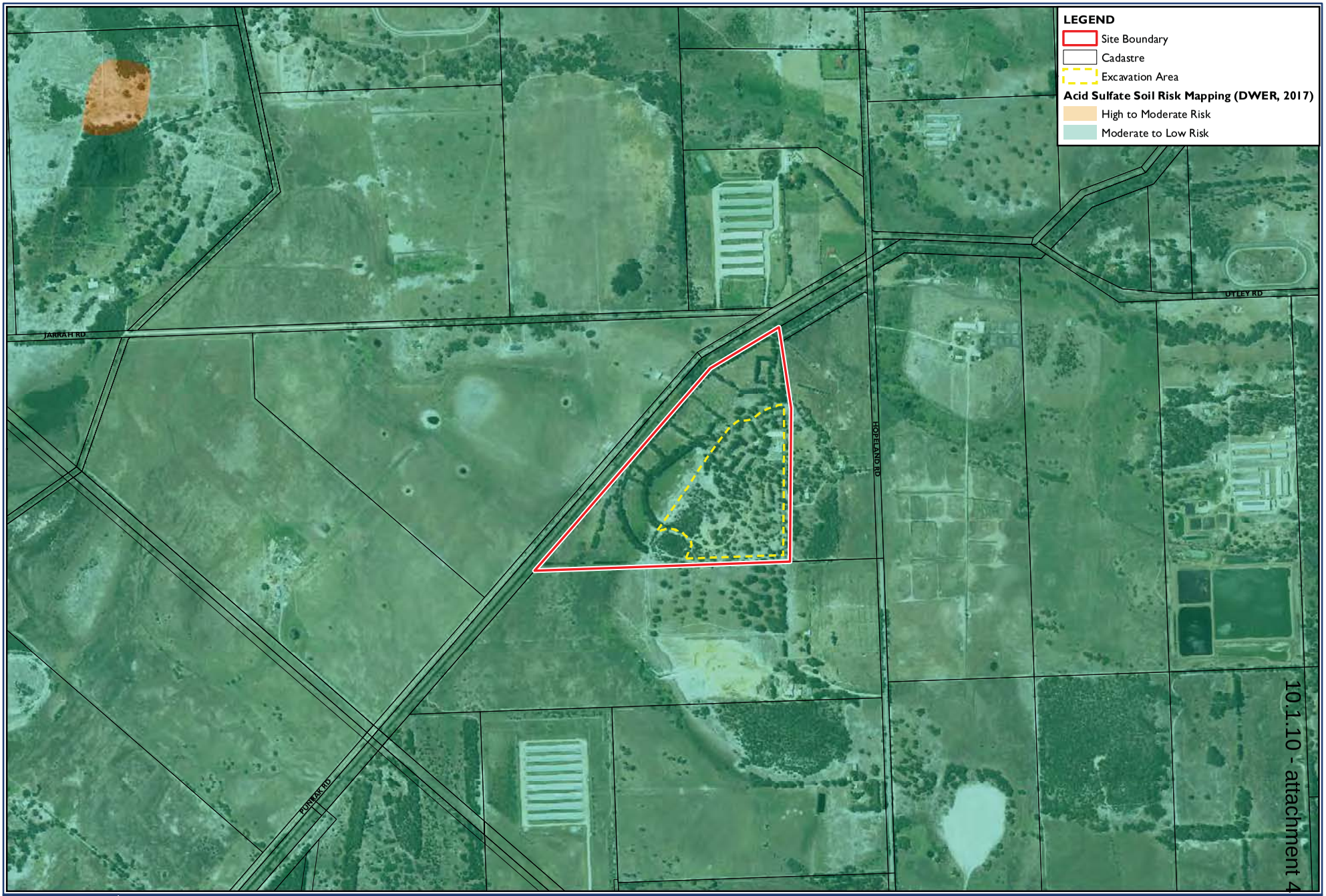
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 4

Geology



RPS

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Doc Number: 005
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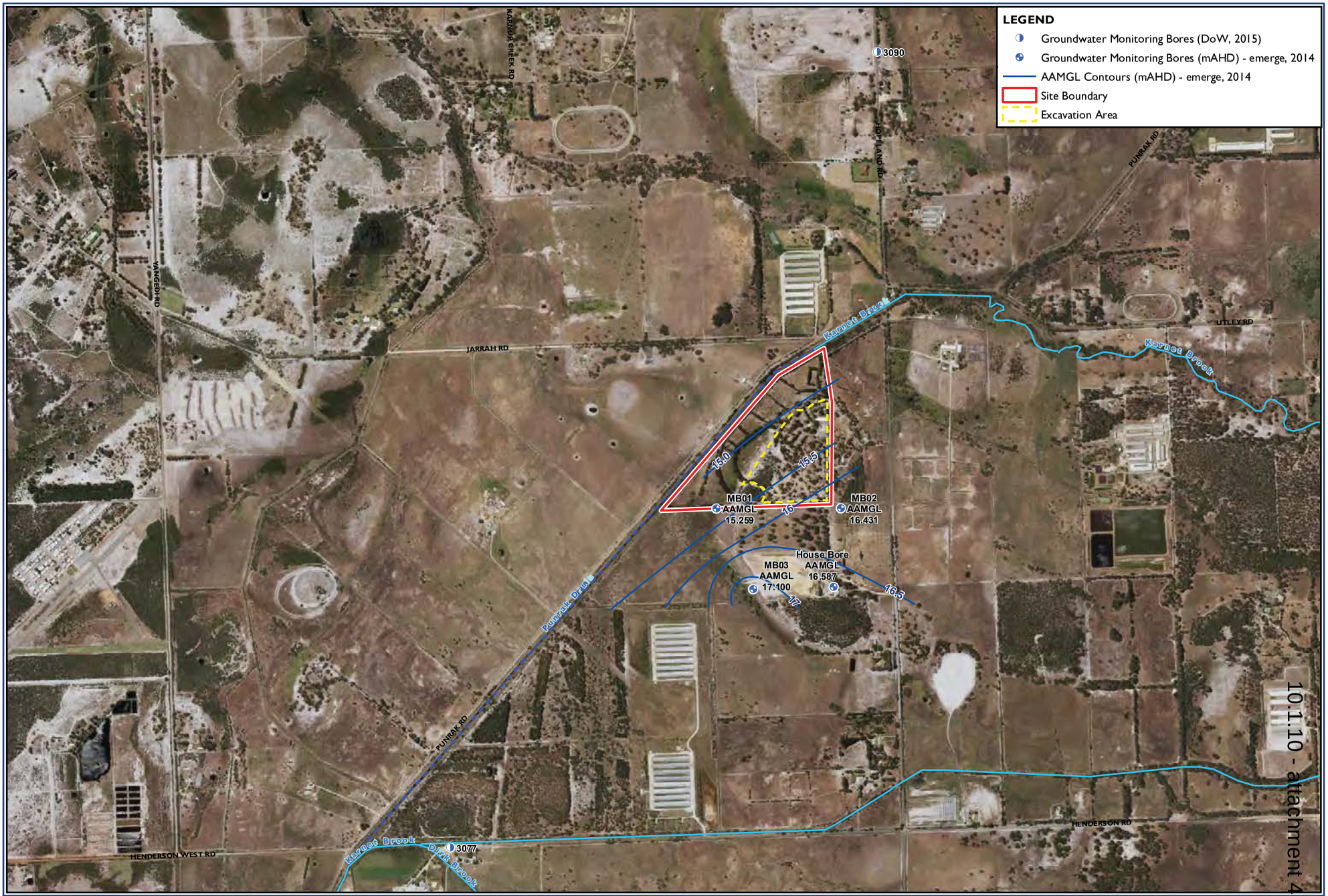
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 ASS Mapping - DWER, 2017

GDA 1994 MGA Zone 50

0 50 100 200 300 400 m

Figure 5

Acid Sulfate Soils Risk Mapping



RPS

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Created by: MA
Source: Cadastre - Landgate, 2015 Historical Contours - DoW, 2006 AAMGL Contours - emerge Ass, 2014 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50
0 62.5 125 250 375 500 m

Figure 6

Groundwater Contours

RPS

Job Number: L1505503_WMP
Doc Number: 007
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 Wetland Mapping - DPaW, 2017

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 7

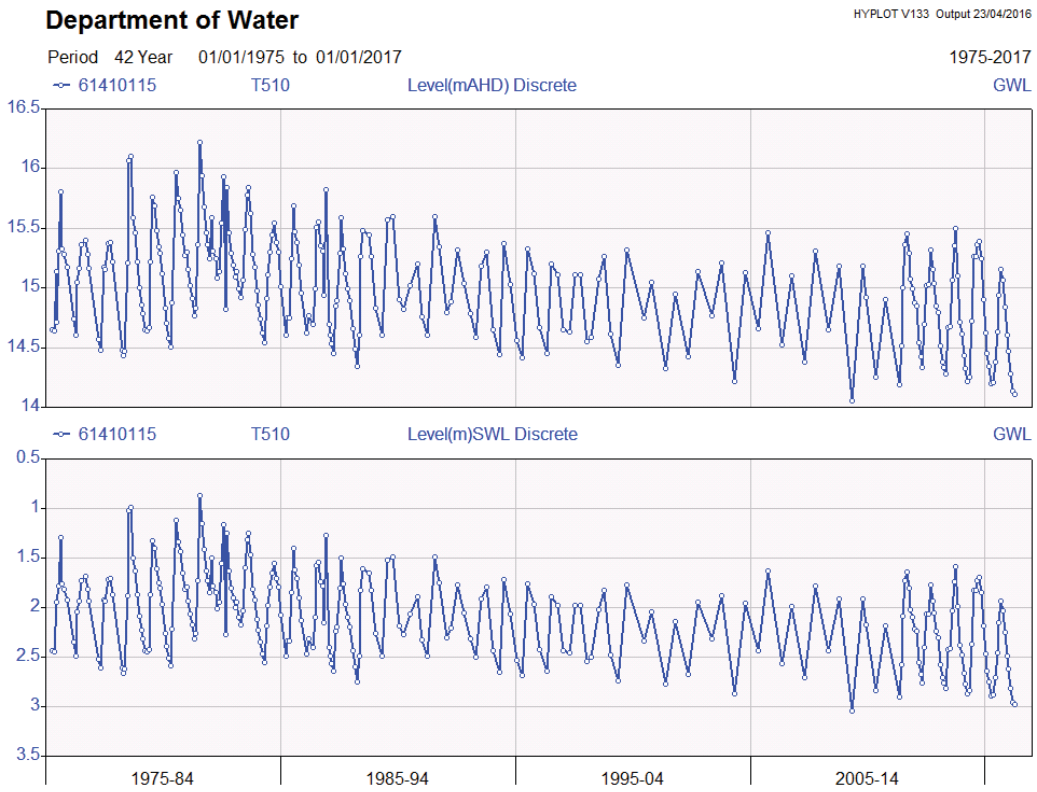
Wetland Mapping

RPS

APPENDIX I

Groundwater Data

APPENDIX 1: Groundwater Data



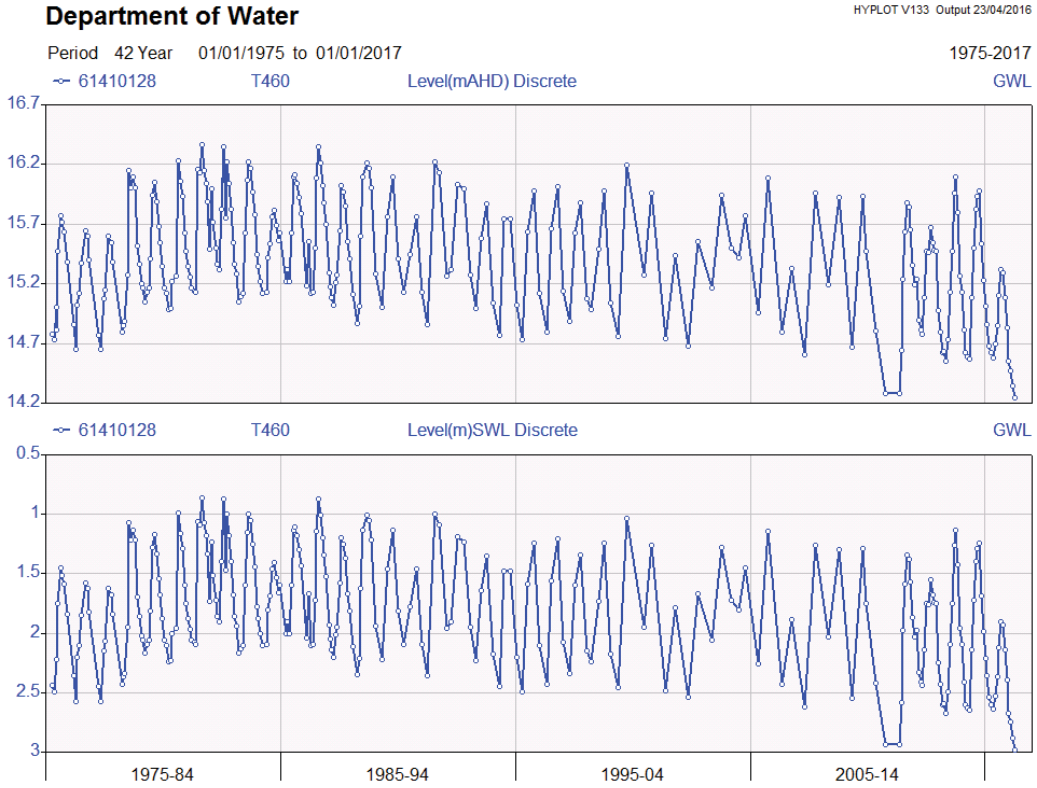


Figure 3:	Surface Water Features and AAMGL	Legend	Plan Number: EP14-057(01)--F10
Project:	Application for DA and EIL Lot 371 Hopeland Road Extractive Industry Licence Support	Site boundary AAMGL (m AHD) Monitoring bores Punrak Drain Sump	Drawn: GRO Date: 05/12/14 Approved: JDH Date: 12/12/14 Checked: KK Scale: 1:6,000@A4
Client:	Goodfeel Enterprises Pty Ltd		0 60 120 240 Metres

emerge ASSOCIATES
Integrated Science & Design

RPS

APPENDIX 2

Dust Management Plan (RPS 2018)

DUST MANAGEMENT PLAN

Lot 137 Punrak Road, Hopelands

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:2

Version/Date: Rev 3, June 2018

Document Status

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Draft A	Draft for Client Review	RebDaw	JohHal	23.11.16	SN 01.12.16		
Rev 0	Final in Issue	RebDaw	JohHal	02.12.16	SN 02.12.16	J. Halleen	02.12.16
Rev 1	Final for Issue	RebDaw	JohHal	27.01.17	SN 27.01.17	J. Halleen	27.01.17
Rev 2	Final for Issue	RebDaw	JohHal	07.02.17	SN 09.02.17	C. Davies	10.02.17
Rev 3	Final for Issue	MarMcC	JohHal	21.06.18	DC 21.06.18	J. Halleen	21.06.18

Disclaimer

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Figure 1: Site Location

Figure 2: Staging Plan

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APPENDIX 1 Site Classification Assessment Chart

APPENDIX 2 Dust Management Actions

1.0 INTRODUCTION

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

This Dust Management Plan (DMP) has been prepared to demonstrate that dust caused by sand extraction activities at 137 Punrak Road, Hopeland ("the site") can be effectively managed. The DMP supports the Development Approval (DA) and an Extractive Industry Licence (EIL) to extract the Bassendean sand from a 11.2 ha portion of the site. Sand extraction activities within this area will be staged, with a maximum of approximately 7.9 ha extracted in the first two years (Figure 2).

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:-

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as 'proposed retention' and 'proposed 20 m buffer'.

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

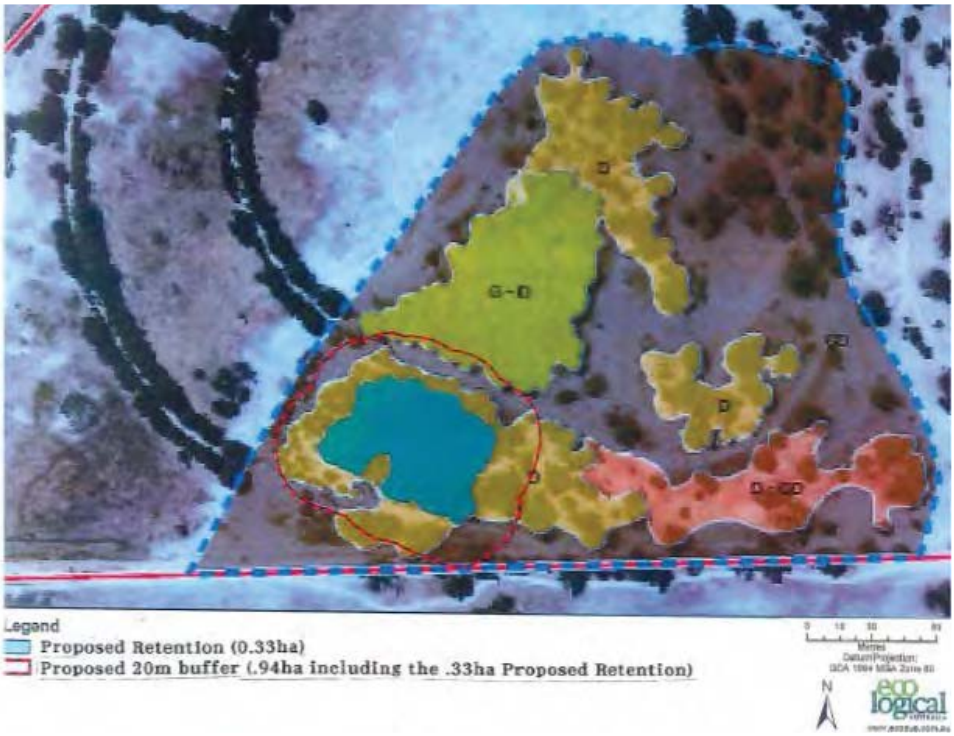

Figure A: Ecological Retention Plan

This management plan is set out as follows:

Section 2.0 The Works

Section 3.0 Dust Management Plan

Section 4.0 Conclusion

2.0 THE WORKS

The site is approximately 30 ha and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). Sand extraction activities are scheduled to commence in 2018 and will be undertaken in four consecutive stages, with approximately 7.9 ha extracted in the first two years. Sand extraction works will be undertaken by Hanson.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

It is also important to note the proposed sand screening will be subject to a Department of Environment Regulation (DER) works approval and registration under Part V of the *Environmental Protection Act 1986*.

The extent of the sand mining area is shown on Figure 1 and Table A provides an overview of the proposed sand extraction activities.

Table A: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Life of the project	Approximately three to five years
Sand Volumes	Approximately 1 million m^3
Dewatering requirements	Nil
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

Project Component	Proposal Characteristic
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Water Trucks	Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

2.1 Overview of Extraction Process

The excavation of sand will generally involve the following, to be undertaken in stages across the proposed sand extraction area as outlined in the staging plan (Figure 2):

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- Vegetation clearing will involve the use of wheel loader or excavator to push over the trees, before they are mulched. The mulch will be stockpiled for use within the site.

- Topsoil removal and stockpiling. Topsoil removal will comprise the first 100 mm to 300 mm of the soil being scraped and then stockpiled within the site for use as part of the decommissioning and rehabilitation process. Topsoil and overburden will be stored adjacent to the area of excavation, or will be returned directly being behind the advancing face of the extraction area.

- Each extraction stage of the sand excavation is expected to be approximately between 0.8 ha to 4.4 ha in size, with a cap of approximately 7.9 ha extracted in the first two years. Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

- Sand will be distributed from the site via road haulage. The primary haulage routes are expected to be north and south along Hopeland Road onto Karnup Road and Lakes Road respectively, and then east or west to and from the Kwinana Freeway or South Western Highway.

- Reforming of the land post-excavation is proposed to be undertaken using a wheel loader of excavator to push the topsoil into place. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three horizontal to vertical in accordance with Shire of Serpentine–Jarrahdale Extractive Industries Local Law 1999. Rehabilitation will progressively follow excavation wherever possible.

2.1.1 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road) to combine the two extraction areas to maximise the removal of the valuable sand resource both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

2.2 Primary Contacts

The sand mining contractor is the party responsible for the overall project. Any complaints in relation to dust nuisance should in the first instance be directed to the Site Supervisor.

2.3 Timing of Works

Works are scheduled to commence once all approvals are in place, anticipated to commence in 2018.

2.3.1 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2. A maximum of approximately 7.9 ha will be excavated in the first two years of sand mining. The purpose of this approach is to allow for up to 18 months of groundwater monitoring which provides site-specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation.

Any open areas in these first two years of sand mining will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

3.0 DUST MANAGEMENT PLAN

3.1 Responsibility

The landowner will enter an agreement with a sand mining contractor. The sand mining contractor will be responsible for the effective control of all dust, smoke and wind borne material emanating from the sand quarry.

The sand mining contractor and the landowner are both responsible for the full duration of the mining contract in accordance with the DA and EIL approval.

3.2 Smoke Nuisance

There will be no prescribed burning / fires within the site. Any clearing of vegetation will be in accordance with the Department of Environment Regulation Purpose Permit clearing approval.

It is considered that there is only a low risk of smoke nuisance principally because prescribed burning is prohibited on site.

3.3 Dust Nuisance

3.3.1 Dust Risk

Excessive dust has the potential to impact on both workers on site and the adjoining land users. Dust can originate from a number of operations and may impact on-site workers or travel off site. Potential dust impacts are addressed by reducing the dust generated from the quarrying, processing and transport operations.

The main risk from dust is not the sand, but rather the fine organic particles that are generated during land clearing and reinstatement, and most importantly the fine particles generated by transport along access roads and traffic areas.

The main risk is therefore from the fine organic matter in the topsoil, any clay within the sand or calcium carbonate that is broken down through tyre impacts or disturbance. There is also the risk from the tipping processes.

Dust has the potential to be generated during most phases of the quarrying operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions.

3.3.2 Climate and Soil Conditions

Through the winter months of May to September exclusive, there is little dust risk because rainfall exceeds evaporation. The rainfall is sufficient to wet the soil profile to depth, with excess water reaching the water table.

In summer, the soil profile dries and becomes more susceptible to disturbance from vehicles and winds.

In active areas that dry out, dust can be readily generated. Normal practice is to treat this with water, which maintains the moisture content of the soil and mitigates dust generation.

3.3.3 Relevant Guidelines

3.3.3.1 Draft Environmental Assessment Guidance (EAG) – Separation Distances Between Industrial and Sensitive Land Uses

Rural land uses occur adjacent to the site and sand extraction activities will need to ensure that these land uses are not impacted. This requires sufficient buffers to be provided between the surrounding land use and the extraction area.

Draft Environmental Assessment Guidance (EAG) – *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2015) states the generic buffer distance for sand quarries as 300–500 metres. A generic buffer relates to the distance at which there is unlikely to be any problems without further investigation and does not mean that smaller buffers are not acceptable. There are many examples within Perth's Metropolitan area where extractive industries operate compatibly within 300 metres of residential or industrial land uses. This outcome is in part due to the low-key nature of the sand extraction works and also the on-site management of issues such as dust.

The excavation area is largely surrounded by paddocks; therefore the majority of the surrounding sensitive premises are located at least 300 metres away from the excavation area which complies with EPA (2015).

The following dwellings are the exceptions:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring landholding.

3.3.3.2 Guidelines for the Prevention of Dust and Smoke Pollution

The Guidelines for the Prevention of Dust and Smoke Pollution published by the Department of Environmental Protection (1996) has been used to assess the classification of the site in relation to the potential for dust generation.

When making the assessments using the guideline there are several key points requiring consideration:

- Dust risk is generally only in the dry summer months.
- The sand readily crusts after wetting and becomes stabilised. It is only trafficked areas of the site that are likely to develop fine dust from the grinding of wheels.
- The perimeter bunds and any vegetation buffers will provide windbreaks and dust fence screening will provide additional screening to the surrounding properties. Existing screening vegetation is shown in Figure 1.
- Water trucks will be used to wet down the site frequently and manage dust risk.

Appendix A of this management plan contains the completed site classification assessment charts (Appendix 1 – Sheet 1). The method of assessment used produced a site classification of low risk as outlined in Table B, acknowledging that only 1 to 5 ha of the sand quarry will only be developed for a sand quarry at any one time, with approximately 7.9 ha being extracted in the first two years.

Table B: Site Classification

Description of Works	Site Classification Score	Site Classification
Bulk Earthworks	(Part A 22 / Part B 18) 396	Classification Site 2 (Low Risk)

3.3.3.3 A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities

The sand mining contractor shall comply with "A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" (DEC March 2011).

The specific measures for a Classification 2 Site (score between 200 and 399) is outlined below:

Provisions:

- The developer shall supply a contingency plan to the local government, which shall detail the activities to be undertaken should dust impacts occur.

Contingency arrangements:

- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust suppression.

- All areas of disturbed land should be stabilised to ensure that the disturbed area exposed at any time is kept to a practical minimum.

The above actions have been adopted in this Dust Management Plan.

3.3.4 Control Measures

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure level under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lots137.

Dust control methods that are available, and will be selected from, are listed below. The most effective by far is the use of water management from a water truck, sprinklers, water canon or other such mechanism.

3.3.4.1 Design and Site

- Minimising the amount of ground open at any one time.
- Minimising the amount of ground being subject to traffic.
- Locating access roads away from sensitive premises.
- Design of the pit to reduce wind speed and potential dust lift off.
- Maintaining effective setbacks.
- Construct perimeter bunds to reduce wind speed.
- Maintain tree/vegetation buffers.
- Providing windbreak fencing generally and on top of bunds as required.
- Maintaining a secure, fenced site, to prevent illegal access.
- Rehabilitate and stabilise all completed areas as soon as practicable.
- Clearing and replacing topsoil and overburden during wetter times – April to October.

3.3.4.2 Operations

- Locate active areas away from windy locations.
- Locate active areas away from sensitive premises.
- Working on the floor of the pit.
- Operate some parts of the pit only when conditions are suitable.
- Locating mobile plant and stockpiles in sheltered areas.

- Design staging to minimise dust risk.
- Conduct higher dust risk operations such as topsoil clearing and placement during more favourable conditions.
- Shut down equipment that is not required.

3.3.4.3 Access and Hardstand

- Constructing the access roads from hard materials that resist dust generation.
- Maintaining a water truck on site for road and other wetting down. Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
- Using a sealant such as a polymer, chemical or emulsified oil or bitumen on the access road to reduce water use.
- Using sprinklers and/or water canon on roads, traffic areas and stockpiles.

3.3.4.4 Processing

- Applying water sprays and additives to the screening cycles.
- Providing screening and shielding of mobile plant.
- Use and maintain filters on all suitable plant.
- Ensure regular appropriate emptying of filter collection devices.
- Face hoppers away from prevailing winds.
- Maintain reduced pressure in plant, hoppers and bins to prevent loss of dusty air.

3.3.4.5 Stockpiles

- Minimise the number of stockpiles.
- Maintain stockpiles in sheltered areas.
- Reduce the elevation of stockpiles.
- Limit the drop height to stockpiles and loading.
- Locate finer products inside or screened by stockpiles of coarse materials.

3.3.4.6 Transport

- Cover all loads.
- Ensure all trucks are dust free and not carrying pebbles and other materials outside the tray.
- Choose the best transport routes.
- Wet down or sweep the cross-over and access roads.

3.3.4.7 Health and Community

- Maintain air-conditioned cabins on all vehicles.
- Provide a readily auditable trigger of no visible dust to cross the property boundary in line with DER Licence and best practice in WA.
- Conduct effective site induction and awareness training for all staff.

- Training should include observation and mitigation where possible of all dust emissions.
- Providing a complaints investigation, mitigation and recording procedure.
- Liaising with the owners/operators of the two nearby sensitive premises.
- Ceasing operations when conditions are not favourable or when visible dust is crossing the boundary.
- Obtain the latest weather conditions to increase the awareness of dust risk.
- Cease operations during adverse weather conditions.
- Operate during wetter months or when the soils are moist.

Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation will be undertaken during the wetter months to reduce the generation of dust.

Completed sections of the quarry are to be stabilised and not subject to traffic as soon as practical to reduce the area of open ground and help reduce wind speed. In the event of dust management not being able to be achieved, and to minimise impact on adjoining landholders, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining landholders.

A record of all dust complaints will be retained together with the mitigation measures used to reduce the dust impacts.

3.3.5 Procedure for Dealing with Dust Complaints

It is intended that the following procedure be adopted in the event of a dust complaint (based on proof dust is being emitted from the extraction area):

1. It is proposed that all complaints received by kept in a "complaint register" and maintained by the sand mining contractor site supervisor.

2. It is likely that a complaint will be lodged with either the sand mining contractor or the Shire of Serpentine-Jarrahdale. Upon receiving the complaint the following information shall be recorded:
   a. Name and contact details of complainant.
   b. Date and time of complaint and date and time of occurrence of dust.
   c. Details of complaint and effect of dust on property.
   d. Investigations of the complaint.
   e. Results of the investigation.
   f. If the complaint is valid, any mitigation actions that result.
   g. Any communication with the complainant.

The below Table C is an example of the proposed Site Register of Complaints Received.

Table C: Site Register of Complaints Received

Complainant's Name	Address	Contact Details	Date and Time of Complaint	Date and Time of the Occurrence	Details of the Complaint and Effect on Property

At the time of receiving the complaint, the person receiving the complaint shall offer an explanation for the dust, if possible. If an explanation cannot be made the person receiving the complaint shall advise the resident that the matter will be investigated and the resident will be notified of the outcome or appropriate action taken or to be taken within 24 hours.

- Details of the complaint shall be forwarded to the sand mining contractor in the event that the complaint was received by the Shire of Serpentine-Jarrahdale. All complaints shall be forwarded even if the complainant seemed content with the explanation given for the occurrence of dust.

- The contractor will investigate the complaint through discussion with the complainant and agree a course of action. The contractor will record the course of action taken in the complaint register and covey the agreed action to the person who took the complaint who will in turn inform the complainant.

- The contractor will confirm with the Shire of Serpentine-Jarrahdale that the matter has been dealt with and resolved if required. The contractor shall also provide copies of any correspondence or documentation when requested to do so.

3.4 Dust Monitoring Program

The auditable condition for dust monitoring is visible dust crossing the boundary of the premises, which is the lot boundary. This is the condition used on Department of Environment Regulation Licences and all other sand quarries in Western Australia.

Specific management measures will include:

- review of complaints received in the past week and action taken

- review of status of any previously lodged complaints

- degree of compliance by the contractor with the contract conditions

- review of weather conditions and need or otherwise for additional water carts, temporary stabilisation, wind fencing, etc.

3.4.1 Visual Dust Monitoring

The trigger for dust management will be the generation of visual dust.

The sand contractor is responsible for site supervision of dust and are in two way radio contact with all mobile plant.

All operators on site will be instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues.

When trigger conditions are detected and/or alerted, relevant action will be taken such as additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment, etc.

3.4.2 Liaison

A liaison program will be commenced with nearby and adjoining residents. An advisory note will be sent to the landowners of:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring land holding[1].

The proposed advisory note is detailed below.

> **Advisory Notice to Residents**
>
> Excavation of sand of the above land is being planned. There will be progressive stages starting in 2018. The development is being carried out by a sand mining contractor and the works are scheduled to commence following all statutory approvals. A 20 metre buffer will be retained around the boundary of the property by the sand mining contractor in order to minimise inconvenience to residents.
>
> It is a requirement that this development must adopt adequate measures to prevent the generation of unacceptable levels of dust. You are advised that the landowner and the sand mining contractor have agreed to implement the provisions as outlined in the Department of Environmental Regulations publication "A guideline for the prevention of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" March 2011 (a copy of this guideline may be obtained from http://www.der.wa.gov.au/).

[1] RPS understands that House No. 514 is subject to an EIL Application, with the existing dwelling proposed to be used as a site office, and therefore the potential impacts relating to Amenity have been specifically assessed in relation to the dwellings located on House No. 446.

Should you feel that excessive dust is being generated due to this development, you are advised to contact the Site Supervisor for the sand mining contractor, (TBA) by telephoning (TBA) to discuss the issue.

A sign will be placed at the entrance to the site with contact phone numbers and email address of the sand mining contractor site supervisor to enable members of the community to contact the company in the event of a dust issue.

3.5 Procedure for Dealing with Disputes

In the event that an adjoining land user is dissatisfied with the outcomes of their dealings with the sand mining contractor, or if directed by the Shire of Serpentine Jarrahdale, the contractor shall inspect the alleged damage and, if there is proof that the dust originates from the site, make good any damage that is resulting from the release or escape of dust from their site

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4.0 CONCLUSION

It is not possible to guarantee absolutely that dust will not emanate from the site. However, it is considered the tight construction specification will minimise the potential for dust impacting on residences.

Prior to commencement of construction, the sand mining contractor will review the potential for dust, noise and vibration nuisance associated with the earthworks. Agreement as to how such nuisances shall be minimised will be reached as generally outlined in this document.

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5.0 REFERENCES

Department of Environment and Conservation. 2011b. A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities. Kensington: Western Australia.

Environmental Protection Authority. 2015. Draft Guidance Statement Separation Distances between Industrial and Sensitive Land Uses. Perth, Western Australia.

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RPS

FIGURES

RPS

Job Number: L1505503_DMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_DMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

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APPENDIX I

Site Classification Assessment Chart

APPENDIX 1: Site Classification Assessment Chart

Item	Score Options								Allocated Score
Part A – Nature of Site									
1. Nuisance potential of soil when disturbed	1	very low		Low	4	**Medium**	6	high	**4**
2. Topography and protection provided by undisturbed vegetation	1	sheltered & screened	6	medium screening	12	little screening	18	exposed & wind prone	**6**
3. Area of site disturbed by the works	1	under 1 ha	3	**1 ha to 5 ha**	6	5 ha to 10 ha	9	over 10 ha	**3**
4. Type of work being done	1	roads or shallow trenches	3	roads, drains and medium depth sewers	6	road, drains, sewers and partial earthworks	9	**bulk earthworks deep trenches**	**9**
Total score for Part A									**22**
Part B – Proximity of Site to Improvements									
1. Distance of other land users from site	1	over 1 km	6	1 km to 500 m	12	500 m to 100 m	18	under 100	**12**
2. Effect of prevailing winds (at time of construction) on other land users	1	not affected	6	isolated improvements affected by one wind direction	9	dense improvements affected by one wind direction	12	dense/sensitive improvements highly affected by prevailing winds	**6**
Total Score for Part B									**18**
Site Classification Score									**396**

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APPENDIX 2

Dust Management Actions

APPENDIX 2: Dust Management Actions

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
General				
Legislation	-	Comply with the provisions of the *Mines Safety and Inspection Act 1994* and Regulations 1995.	The sand mining contractor will comply with the Act and Regulations at all their pits.	-
Buffers	-	Maintain adequate buffers to sensitive premises.	Buffers are similar to existing operating limestone quarries. All residents within 500 metres will be consulted during the assessment process.	-
Landform	-	Locate activities behind natural barriers, landform and vegetation.	The design of the pit and staging has been selected to provide the best screening. Excavation is conducted below the land surface. Excavation will produce a significant void, up to six metres below natural ground level. The processing and stockpile facilities are to be located on the base of the pit below ground level.	-
Landform				
Landform	-	Work below natural ground level.	This is proposed. Excavation will produce a significant void, up to six metres below natural ground level.	-
		Push overburden and inter-burden dumps into positions where they can form screening barriers.	The bunds will be extended around the perimeter of the excavation area prior to extraction in each particular stage.	-
Staging	-	Design operational procedures and staging, to maximise the separation to sensitive premises.	The design of the pit and excavation has been determined to operate from the floor of the pit from the centre outwards, always behind the face and bunds.	-
Pit design	-	Design the excavation to provide enhanced landform and constructed dust screening.	See above	-
Screening/ Vegetation	-	Use landscape screening, windbreaks and tree belts.	Vegetation is in place around all perimeters. Interim seeding with grass will be used as a surface stabilisation option. On the periphery of the site trees will be planted	-

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Management				
Operation	-	Provide air conditioned closed cabins on plant	These are used on site for operational mobile plant.	-
Monitoring	-	Provide monitoring and supervision of the processing and other practices on site.	A monitoring system is proposed. See below “Trigger Conditions”.	-
Trigger conditions	-	Trigger conditions are used to determine when additional dust management is required.	Most dust generated from processing and vehicle movements has a very large visible component. Lesser risks emanate from excavation and opening new ground. The trigger for dust management is the generation of visual dust. The quarry manager and leading hands are ultimately responsible for site supervision of dust. A commitment is made that no visible dust will cross the lot boundaries. They travel around the operations and pit frequently and are in two-way radio contact with all mobile plant. All operators on site are instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues. When trigger conditions are detected and/or alerted relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc. as outlined in the Dust Management Plan.	-
Adverse weather	Moderate–Uncommon	When winds are sufficiently strong, or other weather conditions are unacceptable, to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.	Rare adverse conditions are more likely to occur during summer mornings and summer afternoon sea breezes. In winter, stronger winds are normally associated with rain and therefore carry a reduced dust risk. This policy is used to minimise impact on adjoining landholders/ dwellings and the urban areas.	Low
Equipment failure	Low–Uncommon	In the event of dust management not being able to be achieved through equipment failure operations will cease until full capability is restored.	This is committed to.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Training	-	Conduct training programs on dust minimisation practices.	The sand mining contractor will use on site induction and training to all personnel at all operations.	-
Complaints	-	Provide complaints recording, investigation, action and reporting procedure such as Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996.	All residents within 500 metres of the proposal will be consulted by the sand mining contractor during the assessment process. A record of all dust complaints is to be maintained together with the mitigation measures to be used to reduce the dust impacts. All complaints relating to dust are to be investigated immediately on receipt of a complaint. Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996, will form the basis of the methods on which a complaint on dust is dealt with. A record of complaints is maintained.	
Earthworks				
Land Clearing	Low – Once per year	Schedule activities such as vegetation removal or topsoil stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	Normally the opening of new ground and the subsequent use in rehabilitation is undertaken in the drier months when the soils are still moist enough to suppress dust but not wet. This is necessary to minimise the risk of dust generation and the spread of dieback spores if present. Nearby residents will be notified prior to large scale clearing that may generate significant environmental dust.	Low
Overburden removal	Low – Once per year	Schedule activities such as overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Overburden removal will be infrequent. Where possible overburden removal will be completed in wetter months or when winds are blowing away from sensitive premises.	Low
Construction of bunds	Low–High – Once per year		Construction of bunds can lead to dust generation if conducted in summer when the topsoils are dry. Where possible bunds will be constructed in drier months when the soils are still moist. If this is not possible water sprays and other wetting down will be used to reduce the potential for dust generation and movement. The bunds will be constructed prior to the excavation in each part of the pit. The bunds will be revegetated during the first winter following construction with local native trees and shrubs to assist in stabilising their surface.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Land Restoration	Low – Once per year.	Schedule activities such as ripping, overburden and topsoil spreading on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Land restoration will be infrequent and normally conducted only once per year. Where possible clearing will be completed in wetter months or when winds are blowing away from sensitive premises. Completed sections of the quarry are to be excluded from activity as soon as practical to reduce the area of active “uncrusted/stabilised” open ground. Stabilisation of the limestone will occur through lack of traffic, crusting from wetting down the limestone and using whatever dust management actions are appropriate, as listed above in the Dust Management Plan.	Low
Excavation				
Excavation	Low – Low level continuous activity	Excavate from the face using techniques that minimise the crushing of dry matter.	Excavation will be normally completed by bulldozer deep ripping and track rolling limestone. When freshly exposed at any time of year the limestone is normally moist and has less capability to generate dust. It is only when air-dried that dust becomes a greater issue. Limestone that is wetted or rained upon rapidly stabilises and forms a hardened crust. This is resistant to erosion until disturbed by traffic. A range of actions will be used on areas that are susceptible to dust lift-off such as sand and disturbed limestone. These will include watering, emulsion, windbreaks, and other stabilisation as required. A water truck is to be used as required to wet down the loading areas. The dust management actions listed above in the Dust Management Plan will be used as appropriate to minimise dust generation and lift-off. At the end of each day in summer the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active.	Low
Loading at Face	Low – Low level continuous activity	Ensure that products to be loaded are moist and that the hardstand on which the loading occurs is wetted down or moist.	This will occur on the floor of the pit. Excavation normally does not generate significant dust. The dust originates from the wheel movements. Air dried product will be wetted down with water canon or other methods. Operational hardstand will be wetted down when dry. Other contingencies will be used relating to operating times, additional water or sealant treatment and ceasing operations in adverse conditions. A water truck is to be used as required to wet down the loading areas. Water can also be applied from water cannon, or sprinklers	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Haulage	Moderate–Medium level continuous activity	Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	Haul roads are to be regularly graded and maintained. They are to be watered regularly and have speed limits imposed. Alternatively they may be treated with stabilisers to reduce the potential for dust. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift-off when the site is not active.	Low
		Reduce the length of the internal roads by maximising internal servicing efficiency.	The haul roads are designed to reduce travel distance to save maintenance costs and time and to maintain efficiency and minimise greenhouse gas emissions.	
		Providing speed management on hardstand and the road network.	This is used.	
		Provide air-conditioned closed cabins on plant.	All vehicles are air-conditioned.	
		Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat.	A dedicated water truck is to be maintained on site and used as required during the drier months.	
Plant – Processing				
Hardstand traffic	Low – Low key ongoing activities	Maintain hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades	The hardstand areas that are subject to traffic are limited in area but are able to be watered by the dedicated truck as required. Non-traffic areas rapidly crust and stabilise.	Low
Inactive periods	Low–Moderate	Leave the operations in a manner such that dust lift off is minimised.	The bunding and perimeter vegetation will reduce wind speed and increase screening. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active. Inactive areas readily crust and seal the surface. A comprehensive liaison with the closest residents and the caretaker will provide a means of monitoring for visual dust at times of inactivity.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Processing	Moderate–Continuous	Treat processing areas with water sprays, shields and dust extraction.	Effective maintenance of the hardstand combined with adequate water treatment is used to minimise dust. Water treatment is most commonly carried out by water truck. Crushing operations are to be watered as required to suppress dust. Dust covers and equipment shields are maintained on all static plant where they are practicable. Continuous visual monitoring of dust is used. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed in site operations.	Low
Mobile and static plant Operation	Moderate–Continuous	Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate.	Operators are instructed to visually monitor dust, report and treat any visible dust. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed. Dust management and monitoring forms part of the site induction programs. Faults are to be repaired promptly. Regular maintenance programs for all dust suppression equipment are proposed. Dust management and monitoring forms part of the site induction programs. See Processing, above.	Low
		Shut down equipment when not in use.	The sand mining contractor will adopt this measure to save fuel and maintenance costs in addition to noise minimisation.	
Loading and Stockpile Creation	Moderate–Continuous	Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	Low
		Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Transport				
		Maintain access roads in good condition (free of potholes, rills and product spillages).	The first 30 metres of road and cross over will be sealed. Effective maintenance of the hardstand and access road in addition to a sealed crossover will be used to minimise dust.	
Road condition	Low–Moderate	Water and/or treat access roads and paved areas using a water tanker or sprinkler system.	See above. Internal roads are regularly watered as often as necessary to minimize dust generation. A dedicated water truck is to be retained on site and used when dust lift off is a potential hazard.	Low
		Wet down or cover loads on trucks that are likely to blow during transport.	Trucks are required to be covered or wetted down prior to exiting the site as required when transporting sandy and other materials that can blow.	
Road Transport	Low–Frequent	Implement a site code outlining requirements for operators and drivers.	A site code and induction system is used.	Low
		Avoid spillages on roads and clean up promptly.	Covering and wetting down loads as required and instructs drivers to report and clean up spillages.	
		Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport.	This forms part of the sand mining contractor operational procedures.	
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	Low
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	
		Wet down stockpiles using water canon or sprinklers as required.	Stockpiles will be assessed for their dust lift off potential and are treated accordingly. Where required wetting down is to be used. Sprinklers and water canon are proposed where necessary. Limestone stockpiles readily form a crust that protects from dust lift off. Sand from stockpiles moves by saltation up to 1 metre off the ground and is unlikely to escape the quarry faces, as they will be located on the floor of the pit.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Stockpiles				
Stockpiles	Moderate	Locate stockpiles behind bunds/ windbreaks or other screening barriers	This is normal practice. There are perimeter vegetated bunds in place. Finer materials will be located where dust lift-off is minimised.	
		Reduce the height of stockpiles. Low flat stockpiles are less likely to be disturbed by wind than high conical ones.	The height of stockpiles is maintained at manageable levels that remain sheltered from the prevailing winds.	
		Wash crushed products where necessary.	The limestone products do not need washing.	
		Locate coarser products around fine materials to assist wind protection of the finer products that are more likely to blow or contain greater amounts of dust.	Not applicable to an operation such as this	
		In extreme conditions stockpiles can be covered although this is often not practical.	This is not normally practical and liftoff will be managed by wetting down and locating stockpiles on the floor of the pit.	
		Provide bunding, fencing and windbreaks around stockpiles and along the tops of bunds.	Perimeter buffer vegetation and bunding is in place	

Our ref: EEL15055.004

APPENDIX E

EXTRACTIVE INDUSTRIES LICENCE APPLICATION

Lot 137 Punrak Road, Hopeland

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003

Version/Date: Rev 3, February 2019

QUALITY CONTROL CHECK LISTS

Technical Review Checklist

Editorial Review Checklist

These Check List Forms record information about the type of review, who completes it and any actions arising from the review. This is to be filled out by authors and reviewers throughout the reporting process.

These sheets are for internal review purposes only and will be removed from the report at the time of PDF, prior to sending to the client.

Documentation will save the Editorial and Technical Checklist forms as a PDF, back into the report folder for auditing purposes. The original check lists will remain in the Word document for future revisions. Please do not alter or remove any previous lines of text.

Responses are to be either Y for Yes, N for No, or NA. No further information is necessary.

Technical Review Checklist

Project No.:		Revision No.:		Date:	

	Introduction / Background
	Clearly describes the objectives of the report and the scope of work
	Makes a clear link between the objectives of the report to the scope of work
	Presents and shows only data that supports the objectives.

	Methods / Approach
	Approach or methods used to complete work clearly described
	Methods are current good practice and appropriate to objectives
	Confirm appropriate detail provided, e.g. date, time, figures showing all sites, sampling methods, preservation, analyses

	Tables and Figures
	Confirm error bars are shown if appropriate (summary stats shown, e.g. means)
	Correct units shown for both axes
	Map scale is correct
	Map geographic coordinate correct
	All items referred to in text are labelled, e.g. site names on maps

	Text
	Is the document language appropriate for the intended audience; not too much jargon
	Follow thread of logic from introduction and objectives, through approach and methods, to results and then discussion and conclusion (where these sections are used)
	Are interpretations valid and sufficient
	Units are appropriate and consistent throughout; use SI units where possible
	Make sure technical terms, species names, etc. are correct
	Statements, conclusions and discussion points based on reliable information and well referenced
	Data in text matches data in tables and figures and is consistent between sections

	Conclusion / Summary
	Check the Conclusions and /or Summary against the data and make sure the conclusion is reasonable
	Check conclusions address all objectives directly

Document Number: 200-QA-FRM-0049 | Rev 3 | Issued for use: 13/02/2019

Editorial Review Check List

1. Draft A (Internal Draft) Initial Drafting

Author: Rebecca Dawson Date: 26/10/16

Clarify client expectations around format, structure, content, authorship	y
Plan layout and content of report	y
Confirm target audience with Technical / Editorial Reviewer	y
Check readability, grammar, spelling and punctuation	y
Confirm objectives of report – refer to proposal, CTR	y
Consistent with client and RPS style guides	y
▪ Square bullet points for a report • Round bullet points for letters and memos Dot points have consistent tense and structure within and between lists	y
Check client details and report title are correct	y
If based on previous report, confirm text updated to reflect new purpose, e.g. client and vessel names	

2. Draft A (Internal Draft) Review

Reviewer: John Halleen Date: 27/10/16

Is agreed document structure followed	y
Does the Executive Summary address the objectives and conclusions	y
Report pitched to the target audience	y
Correct template used (client template vs. RPS template; letter vs. Report; memo vs. letter, etc.)	y
The report is succinct and easy to read	y
Sentence length not too long (generally <20 words)	y
Correct punctuation and spelling	y
Do sentences contain only one concept	y
Is verb tense consistent	y
Terminology used consistent with reader's ability and any jargon is explained	y
Paragraphs generally start with a "concept statement" or topic sentence	y
New concepts are presented in new paragraphs	y
Are all acronyms/abbreviations spelt out the first time used, or if acronyms table used is it complete	y
Are important concepts and/or supporting graphics kept together	y
Are all statements made using third party information referenced	y
Are all external references consistent between text and reference list	y
Are all figures, tables, plates and appendices correctly referenced in text	y

3. Draft B (Client Draft) Drafting

Author: Date:

All Draft A reviewer comments have been addressed	
Check readability, grammar, spelling and punctuation of edited sections and track changes	

4. Draft B (Client Draft) Review

Reviewer: Date:

Draft A reviewer's comments adequately addressed	
Check readability, grammar, spelling and punctuation of edited sections	
Check flow of document – i.e. edited sections fit with overall structure	

5. Documentation Review

Documentation Team: Date:

Formatting correct throughout document, including appendices.	
All appendices present as listed in the Table of Contents and included in the relevant job/reports directory	
All attachments (tables, figures, plates, etc.) present as listed in Table of Contents	
Confirm client security / access requirements with author	
Confirm client formatting requirements, if following client style/ format guide	
Check limitations on maximum file size of PDF with author	
Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Captions in the correct places and inserted using the Insert function on the toolbar to ensure it updates correctly in the table of contents.	
Tables easy to read and consistently formatted	
Watermark included if report is to be submitted to the Client for agreement to final changes	
Table of contents updated	
Document status table updated	

6. Post-formatting Review (prior to sending to client)

Author: Date:

Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Check all captions in the correct places and inserted using the Insert function on the toolbar to ensure it updates correctly in the table of contents.	
Check all tables and figures adjacent to the text where they are referred to	
Correct version of appendices, figures, plates, etc. included	
Check all Tables are easy to read and consistently formatted	

Check watermark is included if report is to be submitted to the Client for agreement to final changes	
Check table of contents updated	
Check document status table updated	
Check formatting correct throughout, including appendices	

Send PDF of report to the client for review

7. Response to Client Review

Author: Date:

Confirm all client review comments received	
Complete squad check sheet if required	
Ensure all client comments addressed	
Check readability, grammar, spelling and punctuation of edited sections and track changes	

8. Rev 0 (Final) Review

Author: John Halleen Date: 08/12/16

Confirm all comments from client have been addressed adequately	-
Response to major comments approved by client (meeting, squad check sheet, watermarked Rev 0)	y
Review new report information for readability, technical content and appropriateness	y
Overall layout of text blocks feel readable	y
Exec Summary reflects changes to document	-

9. Rev 0 (Final) Review

Reviewer: John Halleen Date: 08/12/16

Draft B reviewer's comments adequately addressed	-
Check readability, grammar, spelling and punctuation of edited sections	y
Check flow of document – i.e. edited sections fit with overall structure	y

10. Documentation Review (Rev 0)

Documentation Team: Doris Clarke Date: 07/07/16

Formatting correct throughout document, including appendices.	Y
All appendices present as listed in the Table of Contents and included in the relevant job/reports directory	Y
All attachments (tables, figures, plates, etc.) present as listed in Table of Contents	Y

Confirm client security / access requirements with author	Y
Check limitations on maximum file size of PDF with author	Y
Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	Y
Captions in the correct places and inserted using the Insert function on the toolbar for TOC update	Y
Watermark removed and footers updated to reflect final status	Y
Table of contents updated	Y
Document status table updated	Y
Verification of copy numbers for printing	Y

11. Post-formatting Review Rev 0 (prior to printing and/or sending to client)

Author: Date:

Check PDF very thoroughly for any errors	
Correct version of appendices, figures, plates, etc. included	
Check table of contents updated	
Check document status table updated	
Check formatting correct throughout, including appendices	
Check library hard copy once printed to ensure no errors previously missed	

12. Rev 0 (Final) Sign-off

Principal/TD: John Halleen Date: 8/07/16

Confirm checklist process has been followed closely at all steps	
Confirm both Editorial and Technical Review Checklists completed	
Document status table updated and signed	Y
Cover email / letter, completed	

13. Final Documentation Process (Rev 0)

Documentation Team: Doris Clarke Date: 8/07/16

Transmittal form completed and PDF updated with signature	Y

Document Status

Version	*Purpose of Document*	*Orig*	*Review*	*Review Date*	*Format Review*	*RPS Release Approval*	*Issue Date*
Draft A	*Draft for Client Review*	*GilGla*	*JohHal*	*08.03.16*	*SN 26.05.16*		
Rev 0	*Final for Issue*	*JohHal*	*JohHal*	*07.07.16*	*DC 07.07.16*	*J. Halleen*	*08.07.16*
Rev 1	*Final for Issue*	*JohHal*	*JohHal*	*05.12.16*	*SN 05.12.16*	*J. Halleen*	*05.12.16*
Rev 2	*Final for Issue*	*RebDaw*	*JohHal*	*03.02.17*	*DC 09.02.17*	*S. Rolls*	*13.02.17*
Rev 3	*Final for Issue*	*MarMcC*	*JohHal*	*13.02.19*	*AW 13.02.19*	*J. Halleen*	*13.02.19*

Disclaimer

SUMMARY

As owners of the property at Lot 137 Punrak Road, Hopeland ("the site"), the McAllister family is proposing to extract sand from a portion of their property. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works. The sand extraction is a valuable raw material that is intended to be used for a variety of purposes in the land development and construction industry.

The site is approximately 30 hectares (ha) and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). The sand is proposed to be excavated in four consecutive stages (Figure 2). Stage 3 (which has small area of Banksia woodland) will only be excavated upon approval of the Purpose Permit application from the Department of Environment Regulation (DER). In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20m buffer".
b) A batter must be constructed outside of the proposed 20m buffer to protect vegetation from extraction works; and
c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20m buffer.

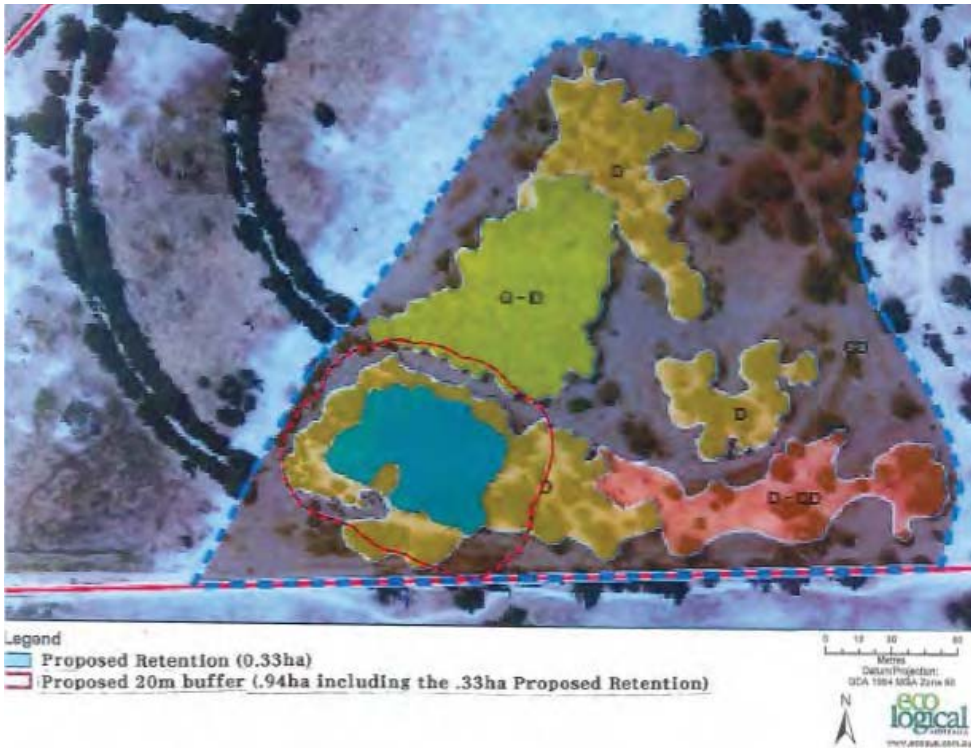

Figure A: Ecological Retention Plan

The existing buildings onsite will remain unless requested to be removed by the landowner.

Upon completion of the sand extraction, all facilities and equipment will be removed from the site and the excavation area will be rehabilitated to agricultural paddocks suitable for paddocks and horse training, or similar land use.

This Extractive Industry Licence (EIL) Application supports an application for:

- an EIL under the Shire of Serpentine-Jarrahdale Extractive Industries Local Law
- development approval under both the Metropolitan Region Scheme and the Shire of Serpentine-Jarrahdale Town Planning Scheme No. 2.

The extraction of sand meets the broader land use considerations of the Western Australian Planning Commission (WAPC) and the Shire of Serpentine Jarrahdale, by maximising the use of the valuable sand resource, while ensuring that the sand extraction will not adversely impact on the amenity of surrounding landholders or the environment.

The key management plans and technical assessments which have been developed in collaboration with the Shire and underpin this EIL application are:

1. Dust Management Plan (included in the EIL).
2. Fire and Emergency Management Plan (included EIL).
3. Water Management Plan (to be finalised as a condition of the EIL/Development Application).
4. Rehabilitation Management Plan (to be finalised as a condition of the EIL/Development Application).
5. Acoustic assessment (included in the EIL).
6. Traffic Impact Assessment (included as part of the Development Application)
7. Level 2 Vegetation and Flora Survey (provided separately to the Shire).
8. Interface Plan with the neighbouring extractive industry Lot 371 Hopeland Road (to be finalised prior to any sand excavation works within the 20 m buffer)

The extraction of sand at the site can be managed to avoid significant impacts on environmental attributes or nearby land uses as:

- It is proposed through the staging of the sand extraction to limit the "open" extraction area in the first two years to less than 5 ha per year.

- The site is has been historically modified for use as a horse training and agistment property. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent of predominately Banksia trees remain, which is within Stage 2 and 3 of the excavation area. Stage 3 which will only be excavated upon approval of the Purpose Permit application from the DER.

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- The hydrological processes and quality at the site will be maintained primarily through limiting the vertical extend of sand extraction will initially be a minimum of 2 m from the AAMGL to the base of the excavation pit. If in the future, once groundwater monitoring and fate modelling are completed, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site, Lot 371 Hopeland Road). The Water Management Plan will also be updated for approval by the Shire.

- The neighbouring property directly to the south has an approved EIL licence and is currently removing sand from their property. The location of the proposed sand extraction area associated with this EIL adjoins the neighbours pit, the intent is to align the two sand extraction areas to maximise the valuable sand resource.

- The surrounding land uses are rural based and include poultry farms to the north and north-east. Other agricultural land uses including horse agistment and cattle grazing are the predominant land uses in the broader area. The proposed sand extraction in not expected to impact surrounding landowners.

- The proposed sand screening will be subject to a DER works approval and registration under Part V of the *Environmental Protection Act 1986*.

Table 1 provides an overview of the proposed sand extraction activities.

Table 1: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Sand Volume	Approximately 1 million m^3 (majority of the sand in stages 1, 2 and 3)
Life of the project	Approximately three to five years
Dewatering requirements	Nil

Project Component	Proposal Characteristic
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table). If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

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1.0 INTRODUCTION

1.1 Overview

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent of remnant vegetation remaining.

The landowners are seeking Development Approval (DA) and an Extractive Industry Licence (EIL) to extract the Bassendean sand from a 11.2 ha portion of the site. The sand extraction works will be undertaken by Hanson.

The following key management plans and technical assessments underpinning this EIL application have been developed in collaboration with the Shire:

1. Dust Management Plan (included in the EIL).

2. Fire and Emergency Management Plan (included EIL).

3. Water Management Plan (to be finalised as a condition of the EIL/Development Application).

4. Rehabilitation Management Plan (to be finalised as a condition of the EIL/ Development Application).

5. Acoustic assessment (included in the EIL).

6. Traffic Impact Assessment (included as part of the Development Application).

7. Level 2 Vegetation and Flora Survey (provided separately to the Shire)

8. Interface Plan with the neighbouring extractive industry Lot 371 Hopeland Road (to be finalised prior to mining within the 20 m buffer).

It is also important to note the proposed sand screening will be subject to a Department of Environment Regulation (DER) works approval and registration under Part V of the *Environmental Protection Act 1986*.

1.2 Applicant and Owner Details

The site is owned by Craig and Michelle McAllister.

The key project contact is detailed below:

Contact person:	Michelle McAllister
Position:	Landowner
Phone:	0417 962 610

1.2.1 Site Significance

The amount of sand required to support Perth's land development industry has been steadily increasing over recent years due to the upturn in the construction of new residential and industrial estates in low-lying land and the intensification of housing density (infill development) within existing suburbs.

The establishment of sand extraction activities at the site will provide a much needed source of high quality sand for concrete manufacturing operators and land developers in Perth's southern and south-east corridor.

There is approximately one million cubic metres of sand within the 11.2 ha extraction area. The final volume will be adjusted throughout the life of the excavation works depending upon groundwater separation (initially it will be 2 m), the quality of the sand resource and market demand.

Sand deposits of the site's quality within the Perth's metropolitan area are not typically common and, resultantly, the site presents a unique opportunity to utilise an existing sand resource that is located in relatively close proximity to future land development projects.

The rural setting of the site ensures minimal impact to surrounding landowners and the environment.

1.3 Proposed Operations

The proposed sand extraction activities will occur within a 11.2ha portion of the site (Figure 1). It is estimated that the site will support sand extraction activities for three to five years.

The sand is proposed to be excavated in in the four consecutive stages as illustrated in Figure 2.

It is also proposed through the staging of the sand extraction to limit the "open" extraction area in the first two years to less than 5 ha per year and capped at a maximum of approximately 7.9 ha for two years. Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

Stage 3 (which has small area of Banksia woodland) will only be excavated upon approval of the Purpose Permit application from the Department of Environment Regulation (DER). In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer"

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

Post the excavation activities the staged excavation areas will be shaped to support horse training (or similar uses) in accordance with both the "Rural" zoning and the Rehabilitation Management Plan.

1.3.1 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road) to combine the two extraction areas to maximise the removal of the valuable sand resource both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

1.3.2 Finished Floor Levels

The excavation area currently has a topographic range of approximately 18 metres Australian Height Datum (m AHD) to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

1.3.3 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2.

A maximum of approximately 5 ha will be excavated as an open area per year with Approximately 7.9 ha excavated in the first two years of sand mining.

The purpose of this approach is to allow for up to 18 months of groundwater monitoring to provide site specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation. This would occur prior to any rehabilitation works being undertaken.

1.3.4 Site Access and Infrastructure Summary

Vehicle access to the site will be through the gravel driveway via Hopeland Road and for authorised personnel only.

The number of trucks entering the site will vary throughout the year depending upon the demand for the sand resource. However, it is anticipated that between two to four trucks per hour will access the site per day.

Site infrastructure for the Hopeland proposed sand extraction site will consist of the following:

- site office
- vehicle / equipment compound
- refuelling facility (5,000-litre maximum) self-bunded diesel above ground tank).

The proposed site infrastructure will be located within Stage 4. Figure 3 illustrates the site access route and office location.

The existing buildings on the property (located within Stage 4) will remain unless instructed to be removed by the owner.

1.4 Extractive Industries Local Law

This EIL Application report supports an application for:

- an EIL under the Shire of Serpentine-Jarrahdale Extractive Industries Local Law

- development approval under both the Metropolitan Region Scheme (MRS) and the Shire of Serpentine-Jarrahdale Town Planning Scheme (TPS) No. 2.

This EIL has been prepared to be in consideration of the Shire of Serpentine-Jarrahdale Extractive Industries Local Law and Info Note PS06 – Guidelines for Extractive Industries.

1.5 Part V of the *Environmental Protection Act 1986*

The landowner has consulted with the DER throughout 2016 and in accordance with their advice upon planning approval the following applications will be undertaken:

1. Purpose Permit clearing application – a Level 2 Flora and Vegetation Survey and Report has been undertaken (spring 2016) and a targeted flora assessment (as requested by DER). This Level 2 Flora and Vegetation Survey Report has been provided to the Shire.

2. A works approval and licence (screening).

1.6 Planning Context

The proposed sand excavation activity is subject to and complies with the MRS and the Shire of Serpentine-Jarrahdale TPS No. 2. Additionally, the following state planning policies are relevant to the proposed sand excavation activity:

- State Planning Policy (SPP) 1 – *State Planning Framework Policy*
- SPP 2.1 – *The Peel Harvey Coastal Plain Catchment*
- SPP 2.4 – *Basic Raw Materials*
- SPP 4.1 – *State Industrial Buffer Policy*
- SPP 5.4 – *Road and Rail Transport Noise and Freight Considerations in Land Use Planning*.

1.7 Permissibility

The site is zoned "Rural" under the MRS and, consistent with the MRS, "Rural" under the Shire of Serpentine Jarrahdale Town Planning Scheme (TPS) No. 2.

This EIL Application is considered to represent development for the purpose of "Extractive Industry", noting Industry: (b) Extractive is classified as an "AA" use in "Rural" zoned areas under TPS No. 2.

The classification of "AA" means that the Shire of Serpentine-Jarrahdale Council may at its discretion, permit this use.

2.0 LAND-THEMED FACTORS

2.1 Landforms

The natural topography falls from a high point (approximately 25 metres m AHD) in the south of the site in a north-westerly direction towards the landholding's western boundary with the Punrak Drain / Road. The excavation area has a topographic range of approximately 18 m AHD to 25 m AHD (Figure 4).

2.2 Terrestrial Environmental Quality

2.2.1 Geology

Regional geology mapping shows geology at the site as comprising of S8 and S10 sands (Figure 5). The S8 sands underlying the excavation area are described as 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.

2.2.1.1 Acid Sulfate Soils

The Western Australian Planning Commission (WAPC) in consultation with the DER has compiled Acid Sulfate Soil (ASS) risk maps that are based on surface geology mapping, and provide a broad scale indication of the risk of occurrence of ASS.

The ASS risk mapping indicates that the entire extent of the site is mapped as "Moderate to Low" risk of ASS occurring within three metres of the natural soil surface (Figure 6).

Generally, if ASS are present within a site it would occur beneath the lowest seasonal groundwater levels or within the extent of the mapped wetlands. The risk of unearthing ASS would only be presented when excavation or dewatering activities extend below the groundwater levels or where excavation is untaken within the mapped extent of the wetlands.

No excavation to the groundwater table is proposed. An initial 2 m separation from the groundwater table is proposed.

2.3 Flora and Vegetation

RPS and the Department of Environment Regulation (DER) – Native Vegetation Branch has undertaken a desktop assessment and a field survey in 2015 and a further flora and vegetation survey was undertaken in 2016.

The DER requested additional data relating to the potential presence of conservation significant flora (threatened ephemeral orchid species *Drakaea elastica* and *Caladenia huegelii*), and a Level 2 survey and statistical analysis to determine the Floristic Community Types (FCTs) present within the Banksia woodland vegetation area (i.e Stage 2 and 3 area).

In accordance with Technical Guide – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority (EPA) a botanist undertook an assessment comprised a desktop study and a two visit level 2 field survey, undertaken by experienced RPS Botanist. The initial survey was conducted on 19 and 20 September 2016, and the supplementary on 8 November 2016. The field survey included:

- targeted search for flora of conservation significance
- establishment and sampling of three floristic sites (quadrats) to characterise the flora and vegetation of the survey area
- identification of the conservation status of flora and vegetation communities present.

2.3.1 Flora

2.3.1.1 Flora Statistics

Eighty-two vascular plant taxa were recorded for the current survey, 11 of which were exotic (weed) species. These species were recorded for the intact bushland portion (the western half) of the survey area and were not recorded for remainder of the survey area. The eastern portion of the survey area, which has been subject to historical clearing of the native vegetation, consisted of numerous planted eastern-states Eucalypts and Acacias.

2.3.1.2 Threatened and Priority Flora

No Threatened species (i.e. *Drakaea elastica* and *Caladenia huegelii*), as listed under subsection (2) of Section 23F of the *Wildlife Conservation Act 1956* or Priority Flora species as listed by the Department of Parks and Wildlife (DPaW) were located within the excavation area.

No species governed by the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded within the survey area.

2.3.1.3 Introduced Flora (Weeds)

The 11 exotic (weed) species represented 13.4% of the total flora. One Weed of National Significance was recorded for the survey area – *Zantedeschia aethiopica (arum lily), also listed as a Declared Pest – s22(2) under the Biosecurity and Agriculture Management Act 2007. It is listed for C3 – Management for the whole of the state, meaning that it should be managed to alleviate the harmful impact of the species on the environment.

2.3.1.4 Vegetation Units

The majority of the excavation area has been historically cleared with replanting of native and exotics trees as wind breaks along fence lines and paddocks.

There is a small area of Banksia trees (approximately 2 ha in area) which is bisected by horse trails and fire breaks on the southern boundary. This area is mostly within Stage 3 of the excavation boundary.

There are two Vegetation Units identified by RPS and DER within the proposed sand excavation area as outlined in Table 2 (Figure 7).

Table 2: Vegetation Units

Vegetation Unit	Photograph
Em/Af.Ba.Bm – Banksia Woodland (approx. 2 ha in area, 1.67 ha is in "Degraded" condition however only 0.33 ha is in "Good" or better condition)	
Remnant and Planted Exotic Trees and Shrubs over Pasture	

2.3.1.5 Em/Af.Ba.Bm – Banksia Woodland

Scattered *Eucalyptus marginata* and *Allocasuarina fraseriana* over *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* Low Open Woodland to Low Open Forest over *Kunzea glabrescens* and *Adenanthos cygnorum* Tall Shrubland over *Hibbertia hypericoides* and *Leucopogon conostephioides* Low Open Shrubland over *Phlebocarya ciliata*, *Desmocladus flexuosus* and *Dasypogon bromeliifolius* Herbland.
The Em/Af.Ba.Bm vegetation unit is the only intact vegetation type within the survey area.

The Banksia Woodland vegetation was sampled at three quadrats. A total of 71 native taxa were recorded for this vegetation unit.

2.3.1.6 Remnant and Planted Trees and Shrubs over Pasture

Remnant and regrowth *Eucalyptus marginata, Xylomelum occidentale* and planted eastern-states *Eucalyptus* spp. over scattered planted eastern-states *Acacia* spp. over a Closed Grassland of exotic pasture grasses and herbs.

This vegetation unit does not represent a true floristic community, but rather a completely degraded and modified portion of the survey area. Scattered remnant and re-emergent native species recorded here included *Eucalyptus marginata*, *Xylomelum occidentale*, *Banksia menziesii*, *Hibbertia hypericoides*, *Macrozamia riedlei*, *Acacia ?sessilis* and *Stirlingia latifolia*, however most of the vegetation comprised planted non-indigenous tree and shrub species, and pasture grasses and weeds.

2.3.2 Multivariate Analysis of Floristic Data (Banksia Woodland Area)

The Banksia woodland within the survey area was found to be affiliated with several community types but in particular FCT21a and FCT21c which are described as follows:

FCT21a – Central *Banksia attenuata – Eucalyptus marginata* woodlands. This community type occurs in the central part of the coastal plain between Perth and Capel, on Bassendean and Spearwood dunes as well as alluvial soils. Species richness for this FCT is moderately high and weed frequency is relatively low. (Gibson et al. 1994).

FCT21c – Low-lying *Banksi*a attenuata woodlands or shrublands. This community type occurs sporadically between Gingin and Bunbury and is largely restricted to the Bassendean system. Species richness for this FCT is relatively low and it tends to occur on more low-lying and wetter sites (Gibson et al. 1994).

Based on the summary of results it is difficult to make a clear determination as to which FCT is represented by each test site within the Banksia woodland vegetation of the survey area. The analyses show that the vegetation has strong affinities to both FCT21a and FCT21c.

2.3.3 Vegetation Condition

The vegetation condition within the survey area ranged from Very Good to Good within portions of intact Banksia Woodland vegetation, to Completely Degraded along tracks and throughout the highly modified sections of the survey area.

The vegetation condition of the survey area is presented in Figure 8.

2.3.3.1 Banksia Woodlands of the Swan Coastal Plain

The approximate 2 ha area of intact Banksia Woodland mostly within Stage 3 has the following characteristics:

1. Approximately 0.34 ha of the Banksia Woodland meets the minimum condition thresholds for the ecological community as it is in Good or better condition, and therefore exceeds the minimum condition threshold of Good.

2. The Banksia Woodland within the survey area does not, however, meet the minimum patch size thresholds for the ecological community, as the patch in Very Good to Good condition is only 0.26 ha in size, and the patch in Good condition only 0.07 ha.

3. The areas for each condition grading within the Banksia Woodland in the survey area, and the minimum patch sizes required to satisfy this criterion (according to the Conservation Advice) are presented in Table 3.

Table 3: Vegetation Condition of the Banksia Woodland within the Survey Area and Minimum Patch Sizes for Different Condition Grades

Vegetation Condition (Keighery 1994)	Area (ha) within the Survey Area	Conservation Advice Minimum Patch Size (ha)
Excellent	0	0.5
Very Good	0.26	1
Good	0.07	2

The Banksia Woodland within the survey area does not satisfy the patch size requirement – it does not therefore have sufficient conservation value to be considered a Matter of National Environmental Significance. .

2.3.3.2 Conclusion

The DER Native Vegetation Branch will assess a future Purpose Permit Clearing Application subject to the lodgement of an EIL with the Shire. Noting, Stage 3 (small Banksia woodland area) in particular will not be excavated until DER approve a Purpose Permit clearing application.

The Rehabilitation Management Plan will be consistent with the DER's Purpose Permit clearing application assessment and applicable condition(s).

2.4 Terrestrial Fauna

Historic clearing of native vegetation has resulted in the loss of the majority of fauna habitat values from within the site. The remaining available habitat for native fauna species consists of the Banksia Woodland vegetation unit and remnant *E. marginata* trees, which may be of, at least, some value for avifauna species.

2.4.1 Database Searches

Searches of DPaW's *NatureMap* database and the Commonwealth Department of the Environment's (DotE) *Protected Matters Search Tool* undertaken to identify species of conservation significant fauna recorded / likely to occur within a 5 km radius of the site using the search coordinates 115°54'01"E, 32°23'56"S (Appendix 1).

Based on ecological requirements, known distributions and the type and quality of fauna habitats, the key species that could potentially be directly impacted by future sand extraction activities, include:

- forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*)
- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)
- Baudin's black cockatoo (*Calyptorhynchus baudinii*).

2.4.1.1 Black Cockatoo Habitat

0.33 ha of the Banksia woodland is in "Good" or better condition outside of Stage 3 is to be retained.

The majority of the trees outside of Stage 3 are exotics planted (with some *Eucalyptus marginate trees*) by the landowners as windbreaks.

The Banksia trees may be utilised opportunistically by black cockatoo species moving through the Hopeland landscape. Given that the NatureMap database has no records of black cockatoos occurring within 5 km of the site, and that better quality foraging habitat is located in Bush Forever sites in close proximity to the site, it is considered unlikely that this small vegetation area would be identified as significant black cockatoo habitat.

3.0 WATER-THEMED FACTORS

3.1 Hydrological Processes

3.1.1 Regional Groundwater Mapping

The site is not located within an area covered by the Department of Water's (DoW) *Perth Groundwater Atlas*, however there are a number of DoW long-term monitoring bores located in close proximity to the site (WIN ID 3077 and 3090). Both DoW sites have 42 years of continuous monitoring and provide reliable information on long-term groundwater levels and trends.

Hydrographs from DoW bores (WIN ID 3077 and 3090) are detailed in the Water Management Plan (Appendix 2) and their location is illustrated on Figure 9. DoW groundwater information indicates that groundwater is moving in a north-westerly direction and the maximum groundwater level is generally 15.5 m AHD to 16.0 m AHD.

3.1.2 Site Groundwater Mapping

The neighbouring property (Lot 371 Hopeland Road) has an approved EIL for the extraction of sand from 18.8 ha area within their property. Groundwater monitoring and mapping of the average annual maximum groundwater level (AAMGL) was completed by Emerge Associates to support this EIL application.

Extrapolation of these AAMGL contours indicates that the AAMGL at the site, in particular the excavation area (EA), is approximately 15 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area.

This equates to the AAMGL generally being approximately 3 m below ground level (mbgl) in the north-west and 5 mbgl in the south-east of the proposed extraction area. The greatest clearance to the AAMGL occurs in the south of the extraction area where the topographical contours peak at approximately 25 m AHD, which provides a clearance of approximately 9 m to the AAMGL of 16 m AHD.

The landholder of the site has completed on-site monitoring and recorded a maximum level of 14.7 m AHD. This level however is lower than the groundwater levels recorded by Emerge Associates and the nearby DoW monitoring sites. It is therefore proposed that the Emerge Associates' AAMGL mapping will be used to establish the excavation depth. These levels coincide with the nearby DoW monitoring data and are considered more appropriate to use than the landowner's monitoring.

3.1.3 Surface Water

The closest surface water feature to the site is the Punrak Drain, which is located adjacent to the western boundary of Lot 137. The drain forms part of the local Hopeland surface water drainage network, which ultimately flows into the Serpentine River (Figure 9). No surface water features exist within the site.

Incidental rainfall is likely to infiltrate through the highly permeable sandy soils, with minimal overland flow expected, with the exception being during major storm events. During these infrequent events, rainfall run-off is likely to flow overland in a north-westerly direction with surface flows ultimately discharging off site to the Punrak Drain.

3.1.4 Public Drinking Water Source Area

The site is not located within a proclaimed Public Drinking Water Source Area.

3.2 Inland Waters Environmental Quality

3.2.1 Groundwater Separation

It is proposed to set a mine floor level that provides an initial two-metre clearance to the AAMGL.

The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

3.2.2 Groundwater Level Monitoring

Groundwater levels will be monitored using the two existing up-gradient monitoring bores and it is proposed to install an additional two down-gradient bores, as shown in the Water Management Plan (Appendix 2).

Groundwater level monitoring will be undertaken on a monthly basis for the duration of sand extraction activities. There will be strict adherence to an initial 2 m groundwater separation buffer from the AAMGL with ongoing survey and control of the excavation process to ensure separation distances are controlled.

The ongoing monthly groundwater elevation data will be used to refine the AAMGL and set the final mine levels. The sand quarry finish floor level will be amended from 2 m to 1.28 m from the AAMGL, which is consistent with the neighbouring sand quarry site.

3.2.3 Wetlands

A search of the DPaW's *Swan Coastal Plain Geomorphic Wetlands* database (DPaW-017) (27-08-2015 16:55:17) indicates that the majority of the site is not classified as a wetland. However, a small portion of land located in the north of the site is mapped as Resource Enhancement (RE) wetland (UFI15364) and a portion of mapped Multiple Use (MU) wetland (UFI 15785) extends along the site's western boundary (Figure 10).

The RE wetland (UFI15364) and MU wetland (UFI 15785) are extensive wetlands that extend over the relatively low-lying surrounding landscape to the east and west of the site respectively. These mapped wetlands are broadly characterised by significant areas of agricultural paddocks and have limited extents of native vegetation.

Table 4 details the wetland management categories, which are assigned based on the level of significance of a wetland's attributes and provides guidance on the nature of the management and protection a wetland should be afforded.

Table 4: Wetland Management Categories

Management Category	General Description	Management Objectives
Conservation	Wetlands support a high level of ecological attributes and functions.	Highest priority wetlands. Objective is preservation of wetland attributes and functions through various mechanisms including: ▪ reservation in national parks, Crown reserves and state-owned land ▪ protection under Environmental Protection Policies ▪ wetland covenanting by landowners. These are the most valuable wetlands and the Commission will oppose any activity that may lead to further loss or degradation. No development.
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions.	Priority wetlands. Ultimate objective is for management, restoration and protection towards improving their conservation value. These wetlands have the potential to be restored to conservation category. This can be achieved by restoring wetland structure, function and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use	Wetlands with few important ecological attributes and functions remaining.	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through land care. Should be considered in strategic planning (e.g. drainage, town/ land use planning).

Source: Water and Rivers Commission 2001

It is acknowledged in the Draft *Guideline for the Determination of Wetland Buffer Requirements* (Department for Planning and Infrastructure 2005) that separation distances and management measures are recommended on the basis of potential to mitigate likely impacts of the surrounding land use. Separation measures are required to mitigate only those threats that are present.

The proposed area for sand extraction will be located 50 m outside the mapped extents of the RE wetlands (Figure 11) and will implement best practice management measures to ensure that the existing hydrological regimes of the mapped wetlands will not be altered by sand extraction activities.

4.0 PEOPLE-THEMED FACTORS

4.1 Amenity

Rural land uses occur adjacent to the site and sand extraction activities will need to ensure that these land uses are not impacted. This requires sufficient buffers to be provided between the surrounding land use and the extraction area.

Draft Environmental Assessment Guidance (EAG) – *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2015) states the generic buffer distance for sand and limestone pits as 300–500 metres. A generic buffer relates to the distance at which there is unlikely to be any problems without further investigation and does not mean that smaller buffers are not acceptable. There are many examples within Perth's metropolitan area where extractive industries operate compatibly within 300 metres of residential or industrial land uses. This outcome is in part due to the low-key nature of the sand extraction works and also the on-site management of issues such as dust and noise.

Sand extraction activities at the site do not propose blasting or the processing of the sand, other than separating organic matter from the sand on site.

The excavation area is largely surrounded by paddocks; therefore, the majority of the surrounding sensitive premises are located at least of 300 metres away from the excavation area which complies with EPA (2015).

The following dwellings are the exceptions:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring land holding[1].

The 300 m buffer is illustrated on Figure 11.

4.1.1 Noise

Noise can originate from a number of operations and impact on external sensitive premises. Noise impacts are addressed by reducing the noise generated from the sand excavation and processing operations. The closest noise sensitive premises are the dwellings located at House No. 446 to the east of the excavation site.

[1] RPS understands that House No. 514 is subject to an EIL Application, with the existing dwelling proposed to be used as a site office, and therefore the potential impacts relating to Amenity have been specifically assessed in relation to the dwellings located on House No. 446.

A noise assessment by Herring Storer conducted on the proposed sand extraction operation at Lot 137 concluded (Appendix 3):

- The applicable criterion for this assessment is 48 dB(A) for the nearest residential locations.
- Noise received at the residential premises has been determined, to be 40 dB(A) for the sand extraction operations, for the worst case operating scenario.
- The above noise levels have been considered to contain tonal characteristics, therefore contains a +5 dB(A) penalty. Thus, the assessable noise level at the worst-case receiver location would be 45 dB(A).
- Given these operating parameters, noise levels received at the nearest premises has been calculated to comply with the Environmental Protection (Noise) Regulations 1997 for the operating times.

4.1.2 Dust

Dust can be generated when the wind velocity and frequency is sufficiently strong enough to lift sand particles from the ground surface. The susceptibility of the soil particles to lift is a function of how exposed the ground surface is, which includes whether there is any ground cover, the level of compaction and the moisture content of the soil. Dust is measured as Total Suspended Particles, which refers to particles that can remain suspended in the atmosphere, but not necessarily be inhaled. The potential for dust generation may occur during topsoil stripping, sand extraction, stockpiling and sand transport.

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure level under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

Excavation activities will be undertaken in stages over the life of the mine as shown in the staging plan provided as Figure 2. The proposed staging of the sand extraction will limit the "open" extraction area in the first two years to less than 5 ha per year capped at a maximum of approximately 7.9 ha for two years. Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

A Dust Management Plan (DMP) has been prepared for to demonstrate that dust caused by sand extraction activities can be effectively managed. The DMP is provided at Appendix 4.

4.1.2.1 Key Dust Control Measures

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure level under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lots137.

Dust control methods that are available, and will be selected from, are listed below. The most effective by far is the use of water management from a water truck, sprinklers, water canon or other such mechanism.

Design and Site

- Minimising the amount of ground open at any one time.
- Minimising the amount of ground being subject to traffic.
- Locating access roads away from sensitive premises.
- Design of the pit to reduce wind speed and potential dust lift off.
- Maintaining effective setbacks.
- Construct perimeter bunds to reduce wind speed.
- Maintain tree/vegetation buffers.
- Providing windbreak fencing generally and on top of bunds as required.
- Maintaining a secure, fenced site, to prevent illegal access.
- Rehabilitate and stabilise all completed areas as soon as practicable.
- Clearing and replacing topsoil and overburden during wetter times – April to October.

Operations

- Locate active areas away from windy locations.
- Locate active areas away from sensitive premises.
- Working on the floor of the pit.
- Operate some parts of the pit only when conditions are suitable.
- Locating mobile plant and stockpiles in sheltered areas.
- Design staging to minimise dust risk.
- Conduct higher dust risk operations such as topsoil clearing and placement during more favourable conditions.
- Shut down equipment that is not required.

Access and Hardstand

- Constructing the access roads from hard materials that resist dust generation.
- Maintaining a water truck on site for road and other wetting down. Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
- Using a sealant such as a polymer, chemical or emulsified oil or bitumen on the access road to reduce water use.
- Using sprinklers and/or water canon on roads, traffic areas and stockpiles.

Processing

- Applying water sprays and additives to the screening cycles.
- Providing screening and shielding of mobile plant.
- Use and maintain filters on all suitable plant.
- Ensure regular appropriate emptying of filter collection devices.
- Face hoppers away from prevailing winds.
- Maintain reduced pressure in plant, hoppers and bins to prevent loss of dusty air.

Stockpiles

- Minimise the number of stockpiles.
- Maintain stockpiles in sheltered areas.
- Reduce the elevation of stockpiles.
- Limit the drop height to stockpiles and loading.
- Locate finer products inside or screened by stockpiles of coarse materials.

Transport

- Cover all loads.
- Ensure all trucks are dust free and not carrying pebbles and other materials outside the tray.
- Choose the best transport routes.
- Wet down or sweep the cross-over and access roads.

Health and Community

- Maintain air-conditioned cabins on all vehicles.
- Provide a readily auditable trigger of no visible dust to cross the property boundary in line with DER Licence and best practice in WA.
- Conduct effective site induction and awareness training for all staff.
- Training should include observation and mitigation where possible of all dust emissions.
- Providing a complaints investigation, mitigation and recording procedure.
- Liaising with the owners/operators of the two nearby sensitive premises.

- Ceasing operations when conditions are not favourable or when visible dust is crossing the boundary.
- Obtain the latest weather conditions to increase the awareness of dust risk.
- Cease operations during adverse weather conditions.
- Operate during wetter months or when the soils are moist.

Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation will be undertaken during the wetter months to reduce the generation of dust.

Completed sections of the quarry are to be stabilised and not subject to traffic as soon as practical to reduce the area of open ground and help reduce wind speed. In the event of dust management not being able to be achieved, and to minimise impact on adjoining landholders, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining landholders.

A record of all dust complaints will be retained together with the mitigation measures used to reduce the dust impacts.

4.1.3 Visual Amenity

The site is characterised by a significant number of shelter belts of trees which have been planted along the internal network of sand tracks and paddock fence lines. The shelter belts are located between the excavation area and Punrak Road and provide a vegetated screen of the excavation area from views from vehicles travelling along Punrak Road.

Remnant vegetation within House No. 446, which lies adjacent to the eastern boundary of the site, provides screening of the excavation area from views from vehicles travelling along Hopeland Road. Additionally, vegetation to the west of the dwellings in House No. 446 assists in obscuring the excavation area (Figure 12).

4.2 Heritage

4.2.1 European

A search of the Heritage Council and State Heritage Office's *InHerit* database on 12 October 2015 identified that no heritage places are located within the site.

4.2.2 Aboriginal

A search of the Department of Aboriginal Affairs' *Aboriginal Heritage Inquiry System* on 12 October 2015 identified that no Aboriginal heritage sites are located within the site.

4.3 Human Health

4.3.1 Potential Contamination

A search of the DER's *Contaminated Sites* database was undertaken on 12 October 2015 and no matches were recorded for the site.

5.0 EXCAVATION MANAGEMENT

The site contains Bassendean Sand deposits, which are suitable for use as construction and fill sand. Extraction of sand from site will facilitate the continued supply of specialised sand for projects in Perth's southern corridor. It is estimated that sand extraction activities, within the 11.2 ha excavation area, is likely to run for between three to five years over four consecutive of stages.

The existing buildings onsite will remain unless requested to be removed by the landowner.

Land based sand extraction involves a sequence of operations as follows:

1. Vegetation clearing (as required) in stages.
2. Topsoil removal.
3. Extraction operations.
4. Distribution.
5. Decommissioning and rehabilitation.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. It is proposed to commence the sand quarry operations with the 20 m buffer from the lot boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

The intent is to combine the two extraction areas to maximise the removal of the valuable sand resource. To achieve this outcome, which maximises the sand resource, both quarry operators will need to provide the following:

- Provide the Shire with a cross-section of the finish floor levels across the two sand quarries

- Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

- If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

5.1 Project Description

5.1.1 Pre-excavation Works

The site's historical use for horse training has resulted in the site being predominately cleared of native vegetation. The pre-excavation works will involve the clearing of the remnant native and exotic planted trees.

Clearing and topsoil removal will be conducted in one stage and will involve using a rake and wheeled loader. The topsoil removed from cleared areas will be retained for use in the rehabilitation program. The topsoil will be stockpiled in an appropriate area on site and then directly transferred to the completed excavation area as part of the rehabilitation works.

5.1.2 Excavation Method

Sand extraction is expected to commence in 2016 with the extraction works being undertaken to meet local demand for sand in Perth's southern and south-eastern corridors. Rehabilitation will commence after the sand extraction activities have been completed.

The excavation area will be designed to maintain an initial buffer of two metre between the maximum depth of excavation and the AAMGL. It is estimated that the site will support sand extraction activities for three to five years.

The sequence in the extraction of sand from the site is outlined below:

1. Excavation will commence in the south-west (Stage 1).

2. No clearing in Stage 3 will occur until a DER Purpose Permit approval is provided. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:

    a. There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

    b. A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

    c. Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

3. Prior to excavation, vegetation will be cleared and topsoil will be removed and stored for use in rehabilitation.

4. Overburden will be removed and stored for future land rehabilitation through backfill and placement, in accordance with a Rehabilitation Management Plan.

5. The sand resource is typically screened using a portable screening plant to remove any organic material and stockpiled prior to tipping directly into road trucks for transportation to stockpile areas. A DER works approval and screening licence will be obtained as required to undertake these works.

6. Reforming of the land is normally carried out using a loader to push the topsoil and overburden.

7. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three vertical to horizontal in accordance with Shire of Serpentine-Jarrahdale Extractive Industries Local Law.

8. Rehabilitation works to commence in accordance with an approved Rehabilitation Management Plan.

5.1.3 Finished Levels

Excavation proposes to lower natural surface topography to an initial finished floor level of approximately 17 m to 18 m AHD. The floor level complies with the two-metre separation required between the finished levels and the AAMGL (Figure 13).

If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.

In accordance with the *Mines Safety and Inspection Act 1994* regarding the final profile of the batters/faces used to integrate mined surfaces with the natural remaining topography of the site, the final batters will have a one in three vertical to horizontal or less, which also meets the Shire of Serpentine-Jarrahdale Extractive Industry Local Law requirements.

Working batters on the sand excavation / quarry face will be left in a slumped condition at the end of each day and over weekends for safety.

5.1.4 Hours of Operation

Hours of operation will be from 7.00 am to 5.00 pm, Monday to Saturday inclusive.

The flexibility of a six-day week operation is necessary to maintain efficiency because not all parts of the site can be excavated at all times of the year. Although the sand will be transported throughout the year, excavation will be discontinuous and dependent upon the demand for this particular sand type and requirement to avoid very wet conditions. It is more efficient to excavate sand material and produce on-site stockpiles from which sand can be transported in the intervening times, as this maximises the use of mobile plant equipment.

5.2 Infrastructure and Access

5.2.1 Site Access

A gravel driveway is located off Hopeland Road and enters the landholding's north-east corner (Figure 3).

Vehicle access to the site will be through the gravel driveway via Hopeland Road and for authorised personnel only. Overnight and at weekends, vehicles will be kept within locked premises.

Perimeter fencing will be maintained along the boundaries of the property. Property gates will be locked outside operating hours.

5.2.2 Haulage

The number of trucks entering the site will vary throughout the year depending upon the demand for the sand resource. However, it is anticipated that between two to four trucks per hour will access the site per day. Truck payload size will vary depending whether they are semitrailers or rigid wheeler trucks. Trucks will only be entering and exiting the site between the hours of 7.00 am and 5.00 pm.

The main haulage route is anticipated to be along Hopeland Road onto Karnup Road, which provides access to the Kwinana Freeway. Karnup Road is listed as a heavy vehicle route, with a maximum load of 87.5 tonnes and a maximum length of vehicle of 27.5 metres.

5.2.3 Site Infrastructure

Site infrastructure for the Hopeland proposed sand extraction site will consist of the following:

- site office (existing building)
- vehicle / equipment compound
- toilet (within existing building)
- refuelling facility (5,000-litre maximum) self-bunded diesel above ground tank).

All site infrastructure will be located centrally within the landholding. A self-bunded fuel tank or an earth wall bund will be constructed around the designated refuelling facility in accordance with Water Quality Protection Note 56: *Tanks for Elevated Storage* (DoW 2006). Specific measures in regards to the above ground fuel tank include:

- The total tank storage volume shall not exceed 5,000 litres.
- There will be no underground pipework carrying fuel from the tank to facilities outside the compound. The storage tank will be self-bunded and located within a compound that effectively capture and contain any chemical spills.
- Minimum storage tanks and associated spill containment compounds will comply with the current Australian Standard 1940, the *Explosive and Dangerous Goods Act 1961* and any associated regulations.

The proposed site infrastructure will be located within Stage 4. Figure 3 illustrates the site access route and office location.

The existing buildings on the property (located within Stage 4) will remain unless instructed to be removed by the owner.

5.3 Safety

5.3.1 Operations

All sand extraction activities and operational procedures will comply with the following legislation:

- *Explosive and Dangerous Goods Act 1961*
- *Mines Safety and Inspection Act 1994*
- Mines Safety and Inspections Regulations 1995
- *Occupational Health and Safety Act 1984*
- Occupational Health and Safety Regulations 1996
- Shire of Serpentine-Jarrahdale Extractive Industry Local Law.

All personnel are trained to industry standards. All personnel are provided with site induction, safety and environmental awareness training. All workers are required to wear full-time protective safety and high visibility work gear when on site.

All emergency management will be undertaken in accordance with the Fire and Emergency Management Plan (Appendix 5).

5.3.2 Signage

In accordance with clause 6.2 of the Shire of Jarrahdale–Serpentine Extractive Industry Local Law, a sign not less than 1.8 metres high and not less than one metre wide which states "Danger Excavations Keep Out" will be positioned at the boundary of the lot adjacent to Hopeland Road.

The signs will also indicate operation hours and contact details of the site manager.

6.0 POTENTIAL ENVIRONMENTAL IMPACT AND MANAGEMENT

6.1 Introduction

This section details potential environmental impacts and proposes management measures to address the identified impact. Each environmental factor is addressed in the same format, using a series of four sub-headings as follows:

Environmental Objective: States the EPA's objective for the identified environmental factor in accordance with EAG No. 8: *Environmental factors and objectives* (EPA 2013).

Applicable Legislation, Guidelines, Standards and Policies: The environmental factor is placed in context of the appropriate policy framework.

Potential Impacts: Describes the identified potential environmental impacts that might arise from sand mining activities.

Management Response: Details proposed environmental management responses to address the potential impacts.

6.2 Land-themed Factors

6.2.1 Flora and Vegetation

6.2.1.1 Environmental Objective

To maintain representation, diversity, viability and ecological function at the species, population and community level.

6.2.1.2 Applicable Legislation, Guidelines, Standards and Policies

- *Environment Protection and Biodiversity Conservation Act 1999*.
- *Wildlife Conservation Act 1950*.
- *Biosecurity and Agriculture Management Act 2007*.
- Position Statement No. 2: *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000).

6.2.1.3 Potential Impacts

The site's historical use for horse agistment and training has resulted in the site being predominately cleared of native vegetation. The extraction of sand from the site will result in the clearing of the Banksia trees and some scattered remnant native trees.

Sand extraction activities also have the potential to result in the spread of a C3 Declared Pest (arum lily) from the site and introduce *Phytophthora* dieback to the site / spread *Phytophthora* dieback from the site.

6.2.1.4 Management Response

A Purpose Permit Clearing Application will be submitted to DER to facilitate clearing of the vegetation within the excavation area. The DER has indicated during pre-submission liaison that the application will be progressed once planning approval has been obtained.

As part of managing clearing, the following actions will be implemented:

- no clearing in Stage 3 will occur until a DER Purpose Permit approval is provided. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements

    a. There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

    b. A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

    c. Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

- extent of the proposed excavation area will be clearly marked on site with survey pegs and flagging to ensure clearing is limited to the excavation area

- vegetation clearing on site will be mulched and stockpiled for use as part of the rehabilitation / dust suppression measures

- stockpiling of topsoil for use in rehabilitation after sand extraction has ceased

- implementation of additional weed control measures prior, during and post-sand extraction for arum lily to comply with the *Biosecurity and Agriculture Management Act 2007* including

- ensure machinery / equipment arrives on site free of soil and plant material or provide wash-down areas for vehicles that require cleaning
- incidents relating to a failure in hygiene processes will be reported investigated and rectified to prevent recurrence
- implement weed control program, which includes spraying during the spring flowering season and ongoing monitoring
- weed infestation status inspections will be conducted by the Site Manager as part of regular site inspections
- removal of any new weed populations that arise in the site as a result of the extraction works
- establishment of intra-project hygiene boundaries prevent the spread of weeds within the project area (if required). if required, these boundaries will be clearly demarcated on site and equipped with clean down facilities

- implementation of additional measures to mitigate the introduction or spread of *Phytophthora* dieback including
  - ensure machinery / equipment arrives on site free of soil and plant material or provide wash-down areas for vehicles that require cleaning
  - incidents relating to a failure in hygiene processes will be reported investigated and rectified to prevent recurrence
  - establishment of intra-project hygiene boundaries prevent the spread of *Phytophthora* dieback within the project area (if required). If required, these boundaries will be clearly demarcated on site and equipped with clean down facilities
  - during rehabilitation, purchase plant species from nurseries with Nursery Industry Accreditation.

6.2.2 Terrestrial Environmental Quality – Acid Sulfate Soils

6.2.2.1 Environmental Objective

To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.

6.2.2.2 Applicable Legislation, Guidelines, Standards and Policies

- Assessment Levels for Soil, Sediment and Water (Department of Environment and Conservation (DEC) 2010).

- Acid Sulfate Soils Guideline Series. Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DEC 2011a).

- Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DEC 2013).

6.2.2.3 Potential Impacts

ASS soils are stable when left undisturbed, but when they are exposed to air, during excavation or dewatering, this can set off a reaction resulting in acidity (sulfuric acid) being produced.

The potential impacts relate to the oxidation of excavated or in-situ ASS generating acidic conditions, and possibly releasing metals into groundwater.

6.2.2.4 Management Response

Given that sand extraction activities require a two-metre separation between the finished levels and the AAMGL no dewatering works are proposed, nor will there be any excavation within the mapped wetland areas. ASS are not expected to be encountered.

6.3 Water-themed Factors

6.3.1 Hydrological Processes

6.3.1.1 Environmental Objective

To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.

6.3.1.2 Applicable Legislation, Guidelines, Standards and Policies

- *Environmental Protection Act 1986*.
- *Rights in Water and Irrigation Act 1914*.

6.3.1.3 Potential Impacts

The site is not located within or nearby to priority drinking water source areas or other sensitive water resources and is not likely to affect the water balance or ecology of natural lakes, swamps or wetlands with conservation values. As outlined in Section 3, the proposed excavation area does not include any wetlands.

The Punrak Drain located along the sites north-western boundary will remain intact and not altered during the sand extraction operation. Due to the high porosity of the soils within the extraction area rainfall is expected to infiltrate, run-off and water ponding is expected to be limited and unlikely to contain potential contaminants.

Groundwater recharge within the site is not expected to increase significantly from the current conditions as a result of the limited clearing that is proposed. The site is already largely composed of cleared paddocks, which have limited impact on the surrounding groundwater levels.

The proposed excavation of sand is not expected to impact on surface or groundwater quality, or groundwater levels within the site, or the surrounding areas.

The hydrological function of the site will therefore be maintained by incorporating the below management actions.

6.3.1.4 Proposed Management

Monitor groundwater levels at site, using the established monitoring bores, on a monthly basis for the duration of sand extraction activities.

- preparing and implementing a Water Management Plan as reviewed by the Shire and the DoW

- Groundwater levels will be monitored using the two existing up-gradient monitoring bores and it is proposed to install an additional two down-gradient bores, as shown in the Water Management Plan. Groundwater level monitoring will be undertaken on a monthly basis for the duration of sand extraction activities. There will be strict adherence to an initial 2 m groundwater separation buffer from the AAMGL with ongoing survey and control of the excavation process to ensure separation distances are controlled.

- The following contingency measures will be applied should water level triggers be exceeded
  - if decrease exceeds 0.3 m, assess in conjunction with the appropriate regulator, whether the decrease is due to regional groundwater variation (e.g. due to climate factors). If decrease is deemed due to natural regional variability, continue existing monitoring program

  - assess environmental value of down-gradient groundwater dependent ecosystem (GDE) that may be affected, and remediate/modify site activities if required in conjunction with the relevant authority.

- if in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire

- survey control of quarry floor to ensure accurate recording of separation distance
- maintain all haul roads in good condition with suitable grades to minimise potential for erosion from rainfall.

6.3.2 Inland Waters Environmental Quality

6.3.2.1 Environmental Objective

To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.

6.3.2.2 Applicable Legislation, Guidelines, Standards and Policies

- Bulletin 686: *A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area* (EPA 1993).
- Position Statement No 4: *Environmental Protection of Wetlands* (EPA 2004b).
- Draft Guideline for the Determination of Wetland Buffer Requirements (WAPC 2005).

6.3.2.3 Potential Impacts

The identified key potential impacts include:

- reduction of groundwater quality from "point sources' such as fuel spills
- altered hydrological regimes in close proximity to mapped wetlands.

6.3.2.4 Management Response

Reduction of Groundwater Quality

Implement with sand quarry works in accordance with the approved Water Management Plan.

The above ground fuel storage tank will be self-bunded to prevent any accidental loss of diesel fuel to the environment.

Potential impacts to groundwater quality during site works are considered to be minor and include leaks and spills from hydrocarbons. Management measures proposed to maintain the hydrological functions at the site include:

- The above ground fuel storage tank will be self-bunded to prevent any accidental loss of diesel fuel to the environment.

- In the unlikely event of a spill occurring during refuelling of either vehicles or the screening plant, impacted soil will be immediately excavated to prevent any contamination of the underlying groundwater.

- If any spillage of any material occurs within the excavation area or the haul routes the incident will be reported to the site manager for appropriate action. The site manager is responsible for immediately employing the necessary resources (labour, machinery and material) to clean the spill and recording and reporting of the incident (if applicable) to the DER and the Shire of Serpentine Jarrahdale).

- There will be strict adherence to the initial two metre separation buffer and undertake monthly groundwater monitoring and ongoing survey and control of the excavation process to ensure separation distances are controlled.

Altered Hydrological Regimes

To manage the potential environmental impacts to surface water, the following management practises will be implemented:

- Any tree stumps will be retained as long as practicable.

- Riffle zones and contour sills will be used downslope of the run of the mine pad.

- Spill response equipment will be provided at the site

- Bunds and V-drains will be established along the access road to contain run-off, in particular to prevent uncontrolled run-off entering the wetland.

- Hydrocarbon management measures will ensure that surface water contamination does not occur.

- The proposed area for sand extraction will be located outside the minimum required 50-metre buffer for RE wetlands.

Groundwater levels at site will be monitored on a monthly basis, with contingency measures (if required).

6.4 People-themed Factors

6.4.1 Noise

6.4.1.1 Environmental Objective

To ensure that impacts to amenity are reduced as low as reasonably practicable.

6.4.1.2 Applicable Legislation, Guidelines, Standards and Policies

- Environmental Protection (Noise) Regulations 1997.
- EAG No. 13 – *Consideration of Environmental Impacts from Noise* (EPA 2014).
- Draft EAG – *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2015).
- SPP 4.1 – *State Industrial Buffer Policy.*
- SPP 5.4 – *Road and Rail Transport Noise and Freight Considerations in Land Use Planning.*
- Occupational Safety Regulations 1996.

6.4.1.3 Potential Impact

Noise associated with sand extraction activities and road traffic has the potential to impact the on-site workers and amenity of existing rural dwellings within close proximity to the site.

An acoustic assessment has been completed by Herring Storer (Appendix 3). The assessment concluded that noise levels received at the nearest sensitive dwelling has been calculated to comply with the Environmental Protection (Noise) Regulations 1997 for the operating times.

6.4.1.4 Management Response

As neighbouring rural dwellings are either located within 300 m of the proposed excavation area, the landowner has committed to the following environmental management actions to ensure that these surrounding land uses are not impacted:

- Comply with the Environmental Protection (Noise) Regulations 1997.
- Retain a 20 metre vegetated buffer between the excavation area and the site boundary to provide a physical separation distance between sand extraction activities and adjacent premises / surrounding road network.
- Maintain noise suppression devices in good condition on all operational machinery.
- Shut down equipment when not in use.
- Operate machinery within the designated hours of operation, 7.00 am to 5.00 pm, Monday to Saturday. Some operation may occur on a Sunday if required by project demand.

- Schedule activities to minimise the likelihood of noise nuisance.
- Use the dedicated transport route.
- Record and follow up any complaints received regarding noise disturbance immediately to minimise the cause, to the greatest possible extent.

6.4.2 Dust

6.4.2.1 Environmental Objective

To ensure that impacts to amenity are reduced as low as reasonably practicable.

6.4.2.2 Applicable Legislation, Guidelines, Standards and Policies

- National Environment Protection Measure (Ambient Air Quality) Measure.
- Draft State Environmental (Ambient Air) Policy 2009.
- Occupational Safety Regulations 1996.
- A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities (DEC 2011b).

6.4.2.3 Potential Impact

Dust associated with sand extraction activities, including stripping topsoil and sand excavation and stockpiling, and road traffic has the potential to impact the on-site workers and amenity of existing rural land uses within close proximity to the site.

6.4.2.4 Management Response

There are a number of management actions that can be taken to minimise dust generation or travel and these will be used whenever possible.

Implement the approved DMP (Appendix 4). Key dust management measures are outlined below.

- The proposed staging of the sand extraction will limit the "open" extraction area in the first two years to less than 5 ha per year capped at a maximum of approximately 7.9 ha for two years. Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

Dust from Traffic on Unsealed Roads

- Minimise the width and length of internal roads.
- Restrict vehicle movements to defined roads and operational areas.
- Avoiding disturbance of non-operational areas of the site.
- Use of water as appropriate to wet down roads and trafficked areas.
- Use of dust suppressants where appropriate (either mixed with water to enhance dust suppression and vegetation cover, or applied periodically to specific areas).
- Limit the speed of vehicles on the site.
- Maintain haul road surface in a good condition and with suitable grades.
- Ensure all sand transport vehicles leaving the site have covered loads.

Dust from Operational and Non-operational Areas of the Site

- Retain a 20 metre vegetated buffer between the excavation area and the site boundary to provide a physical separation distance between sand extraction activities and adjacent premises / surrounding road network.
- Dust control on stockpiles will be controlled using water sprays, drift fencing and daily inspections.
- Use of water carts to dampen dust prone areas.
- Retain vegetation on non-operational areas.
- Apply surface treatments (e.g. mulch, ground cover) to stabilise any bare areas which might be prone to wind erosion (if required).
- Minimise the area disturbed or open at any one time, as far as practicable.
- Define "no-go" buffer areas on the site to avoid any unnecessary disturbance of stabilised surfaces or vehicle traffic.
- Extract topsoil in months and conditions that minimise potential for dust generation.
- Push overburden dumps into positions where they can form screening barriers (i.e. bunds).
- Use screening fencing along the eastern Lot 137 boundary (if required).

6.4.3 Visual Amenity

6.4.3.1 Environmental Objective

To ensure that impacts to amenity are reduced as low as reasonably practicable.

6.4.3.2 Applicable Legislation, Guidelines, Standards and Policies

- Guidance Statement No. 33 – *Environmental Guidance for Planning and Development*.
- Visual Landscape Planning in Western Australia (WAPC 2007).

6.4.3.3 Potential Impact

The site is characterised by shelterbelts of trees which have been planted along the internal network of sand tracks and paddock fence lines. Additionally, remnant vegetation within House No. 446, which lies adjacent to the eastern boundary of the site, provides screening of the excavation area from views from vehicles travelling along Hopeland Road, whilst vegetation to the west of the dwellings in the neighbouring land holdings (House No. 446) assists in obscuring the excavation area (Figure 12).

Given that the excavation area is largely obscured by existing vegetation it is considered that the extraction of sand from the excavation area is unlikely to result in significant visual amenity impacts.

6.4.3.4 Management Response

The following additional management actions will be implemented to minimise the visual impact of sand extraction further:

- Retain a 20 metre vegetated buffer between the excavation area and the site boundary to provide a physical separation distance between sand extraction activities and adjacent premises / surrounding road network.
- Retain vegetation on non-operational areas.
- Minimise the amount of open ground at any one time.
- Push overburden dumps into positions where they can form screening barriers (i.e. bunds).

7.0 DECOMMISSIONING AND REHABILITATION

The landowners propose to return the excavation area to agricultural paddocks suitable for horse training or other land uses.

7.1 Decommissioning

Upon completion of the sand extraction, all sand excavation facilities and equipment will be removed from the site.

Removal of the fuel tank will adhere to all safety practices to minimise the risk of contamination or spills. Remaining fuel will be emptied prior to moving.

Access track removal will be dependent on their usefulness for future uses of the site. Some areas may require retention of access tracks while other areas may require removal.

7.2 Rehabilitation

The rehabilitation of the site is intended to return the land to a condition suitable to support, as a minimum, activities that are currently supported by the site which is primarily horse training.

As part of the rehabilitation process, the following actions will be undertaken:

- Prepare and implement a Rehabilitation Management Plan.

As part of the rehabilitation process, the following broad actions will be undertaken:

- The final contours are anticipated to be visually comparable with the flatter parts of the site and suitable batters (no greater than one in three) will be created along the interface between excavation area and the 20 metre vegetated buffer along the site boundary.

- All final slopes will be similar to those in the local area and the excavation will be left in a safe manner in accordance with the *Mines Safety and Inspection Act 1994*.

- Batter areas will be stabilised through revegetation with native plant / pasture species to minimise erosion risk.

- Respread of topsoil stockpiled as part of clearing works to a depth of 100 mm and deep ripped to a depth of 300 mm to assist in the establishment of pasture species. Where required, seed for pasture species will be spared to maximise growth and ensure that 90% vegetation cover is achieved.

- A final minimum unsaturated clearance of 1.28 m maintained.
- All final slopes will be similar to those in the local area and the excavation will be left in a safe manner in accordance with the *Mines Safety and Inspection Act 1994*.
- Batter areas will be stabilised through revegetation with native plant / pasture species to minimise erosion risk.
- Respread of topsoil stockpiled as part of clearing works to a depth of 100 mm and deep ripped to a depth of 300 mm to assist in the establishment of pasture species. Where required, seed for pasture species will be spared to maximise growth and ensure that 90% vegetation cover is achieved.

8.0 CONCLUSIONS

The site is located at Lot 137 Punrak Road, Hopeland and extends over a total area of 30.4 ha. Sand is proposed to be extracted from the 11.2 ha excavation area. The operations will include simple excavation, temporary stockpiling and loading onto transport trucks.

The size of the operation is relatively small and the need for sand in the construction and land development industry is in high demand. The site is zoned "Rural" under the MRS and Shire of Serpentine Jarrahdale Town Planning Scheme (TPS) No. 2. Under the "Rural" zone, sand extraction is considered to be "Industry – Extractive" and is a discretionary land use in "Rural" zoned areas.

The site is located in an area designated for poultry farms, with horse agistment, grazing and poultry farming the predominant land uses within the broader area.

There are no natural surface water features or wetlands located in to the sand extraction area and groundwater resources will be protected by limiting the vertical extent of sand extraction.

Following the sand extraction activities, the site will be rehabilitated and returned to use for horse agistment or a similar rural land use.

Overall the proposed extraction of sand will not impact adversely on the environment or amenity of surrounding landholders.

The key environmental management actions are outlined in Table 5.

Table 5: Key Environmental Management Actions

Environmental Factor	Management Action
Buffer	Retain a 20-metre vegetated buffer between the excavation area and the site boundary to provide a physical separation distance between sand extraction activities and adjacent premises / surrounding road network.
	Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.
	Maintain an approximate minimum 165 metre separation distance between the excavation area within the site and the closest dwelling within House No. 446. In the future should both landowners (Lot 371 Hopeland Road and Lot 137 Punrak Road) agree to combine the two sand quarry extraction areas to maximise the removal of the valuable sand resource, both quarry operators will need to provide the following: ▪ Provide the Shire with a cross-section of the finish floor levels across the two sand quarries. ▪ Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary. ▪ If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

Environmental Factor	Management Action
Topsoil	Topsoil will be removed and stored for use in rehabilitation.
Vegetation Clearing	Vegetation clearing onsite will be mulched and stockpiled for use as part of the rehabilitation / dust suppression measures.
Water Quality	Implement a Water Management Plan
	Fuel storage tank will be located within earth bund walls.
	Maintain the final land surface (depth of excavation) to provide a separation distance of initially 2 m to the AAMGL. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
	Maintain adequate buffers to the RE and MU wetlands.
Groundwater levels	Implement a Water Management Plan Monthly monitoring of groundwater levels.
Spillage	Fuel storage tank will be located within earth bund walls.
	Maintain an initial two metre vertical separation distance from the AAMGL at all times
Dust	Implement the DMP
	Minimise the width and length of internal roads and restrict vehicle movements to defined roads and operational areas.
	Avoid disturbance of non-operational areas of the site.
	Use of water carts to dampen dust prone areas.
	Limiting the speed of vehicles on the site.
	All vehicles leaving the site are required to have covered loads.
	Maintain haul road surface in a good condition and with suitable grades.
	Define "no-go" buffer areas of the site to avoid any unnecessary disturbance of stabilised surfaces or vehicle traffic.
Noise	Retain a 20 metre vegetated buffer between the excavation area and the site boundary to provide a physical separation distance between sand extraction activities and adjacent premises / surrounding road network.
	Noise suppression devices will be maintained in good condition on all operational machinery.
	Shut down equipment when not in use.
	Machinery will only operate within the designated hours of operation, 7.00 am to 5.00 pm, Monday to Saturday.
	Use the dedicated transport route to avoid unnecessary noise disturbance.
Visual Impacts	Prepare and implement a Rehabilitation Management Plan
	Retain a 20 metre vegetated buffer between the excavation area and the site boundary to provide a physical separation distance between sand extraction activities and adjacent premises / surrounding road network.

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RPS

FIGURES

RPS

Job Number: L1505503_EIL
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_EIL
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

RPS

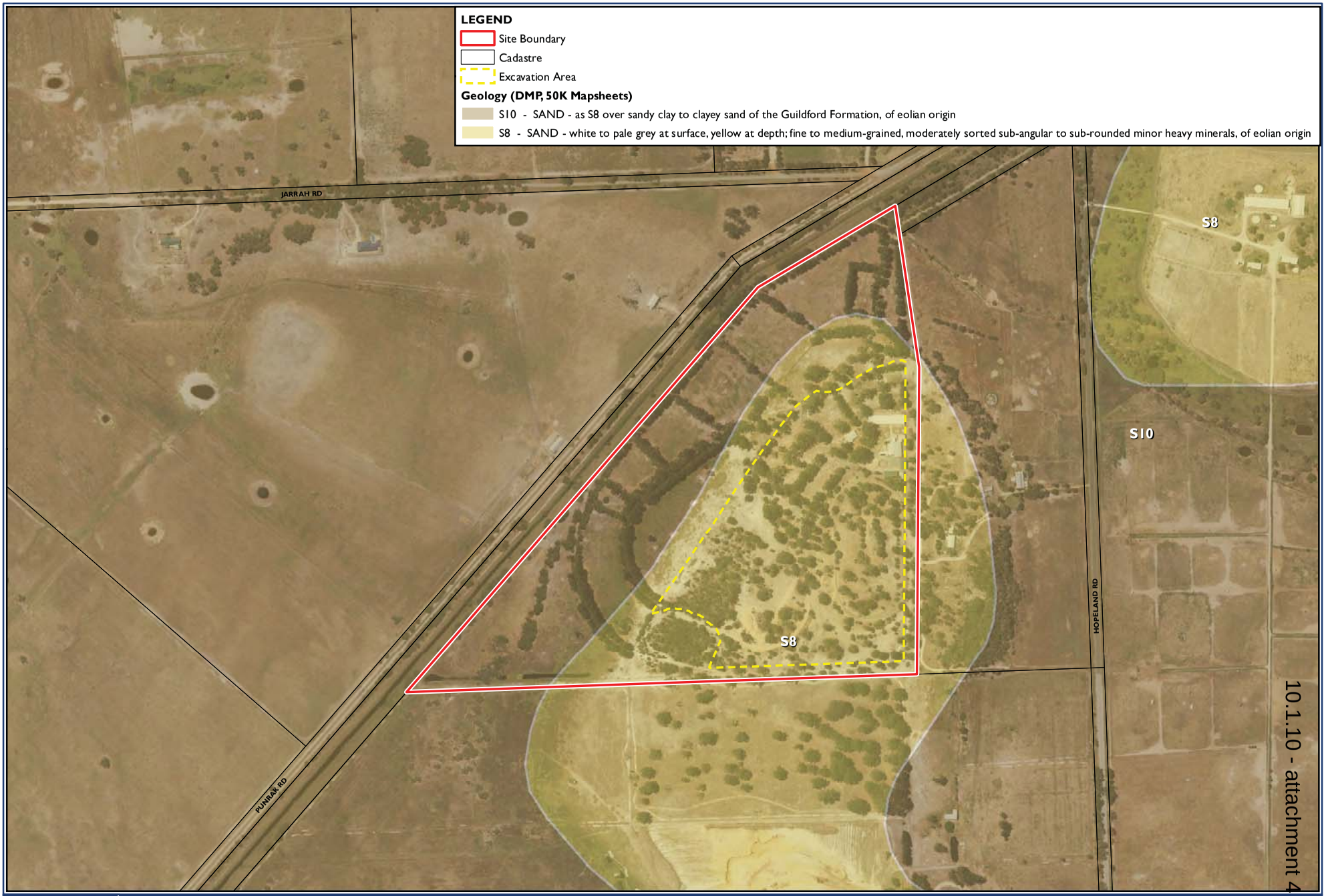
Job Number: L1505503_EIL
Doc Number: 003
Date: 11.02.19
Scale: 1:3,545 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50
0 15 30 60 90 120 m

Figure 3

Vehicle Access and Site Office


LEGEND
Contour (mAHD)
Site Boundary
Cadastre
Excavation Area
JARRAH RD
PUNRAK RD
ROBINSON
RPS
Job Number: L1505503_EIL
Doc Number: 004
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 1m Lidar contours - DoW, 2015
GDA 1994 MGA Zone 50
0 25 50 100 150 200 m
Figure 4
Topography



RPS

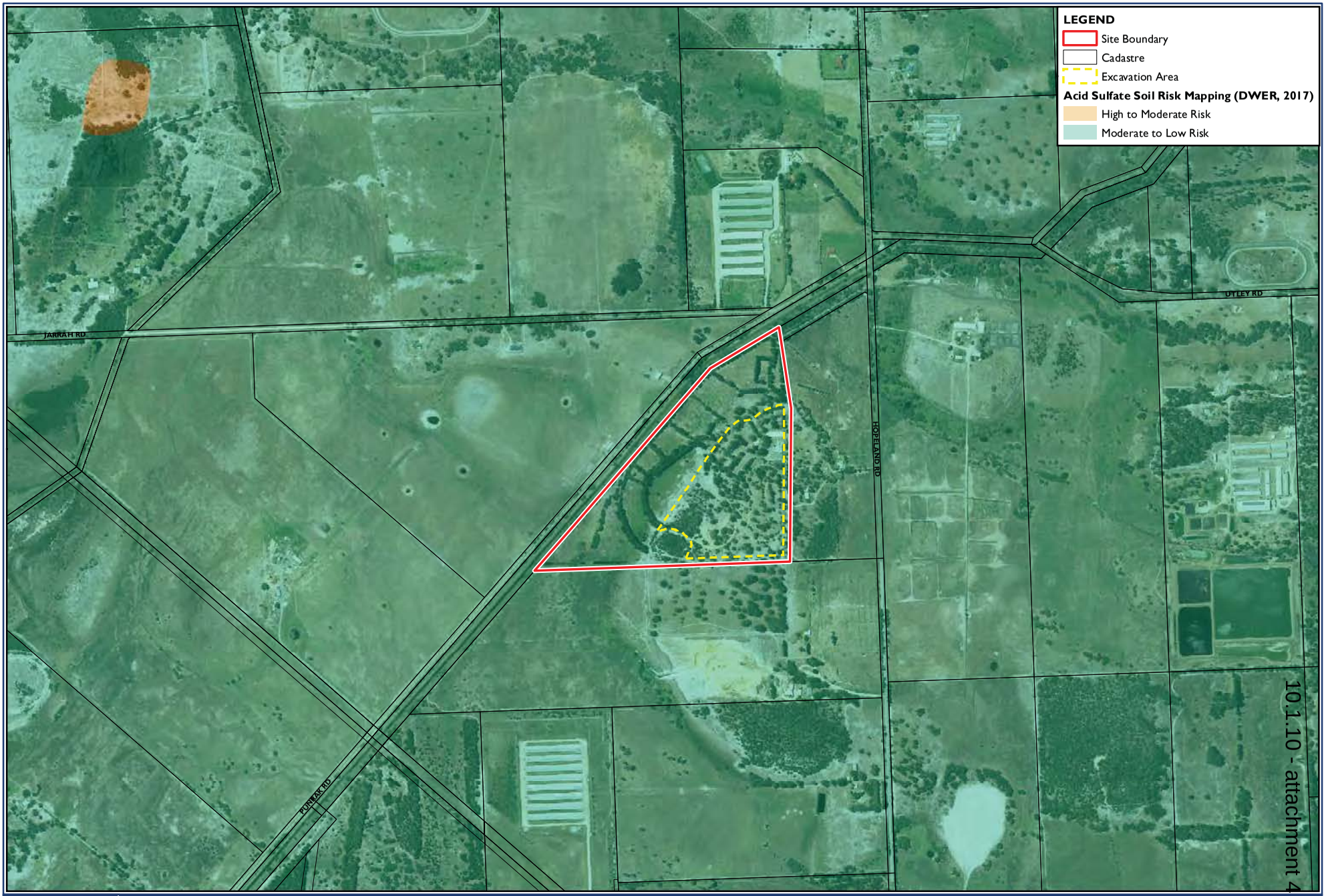
Job Number: L1505503_EIL
Doc Number: 005
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 5

Geology



RPS

Job Number: L1505503_EIL
Doc Number: 006
Date: 24.05.18
Scale: 1:10,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 ASS Mapping - DWER, 2017

GDA 1994 MGA Zone 50

0 50 100 200 300 400 m

Figure 6

Acid Sulfate Soils Risk Mapping

RPS

Job Number: L1505503_EIL
Doc Number: 007
Date: 29.05.18
Scale: 1:2,800 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 7

Vegetation Units

Vegetation Condition Scale (Keighery 1994)	
Condition	**Definition**
G - VG	**Good – Very Good** Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate is retained to Vegetation structure altered; obvious signs of disturbance
G	**Good** Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	**Degraded** Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
D - CD	**Degraded – Completely Degraded** Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management to Vegetation structure not intact; the area completely or almost completely without native species ("parkland cleared")
CD	**Completely Degraded** Vegetation structure not intact; the area completely or almost completely without native species ("parkland cleared")

RPS

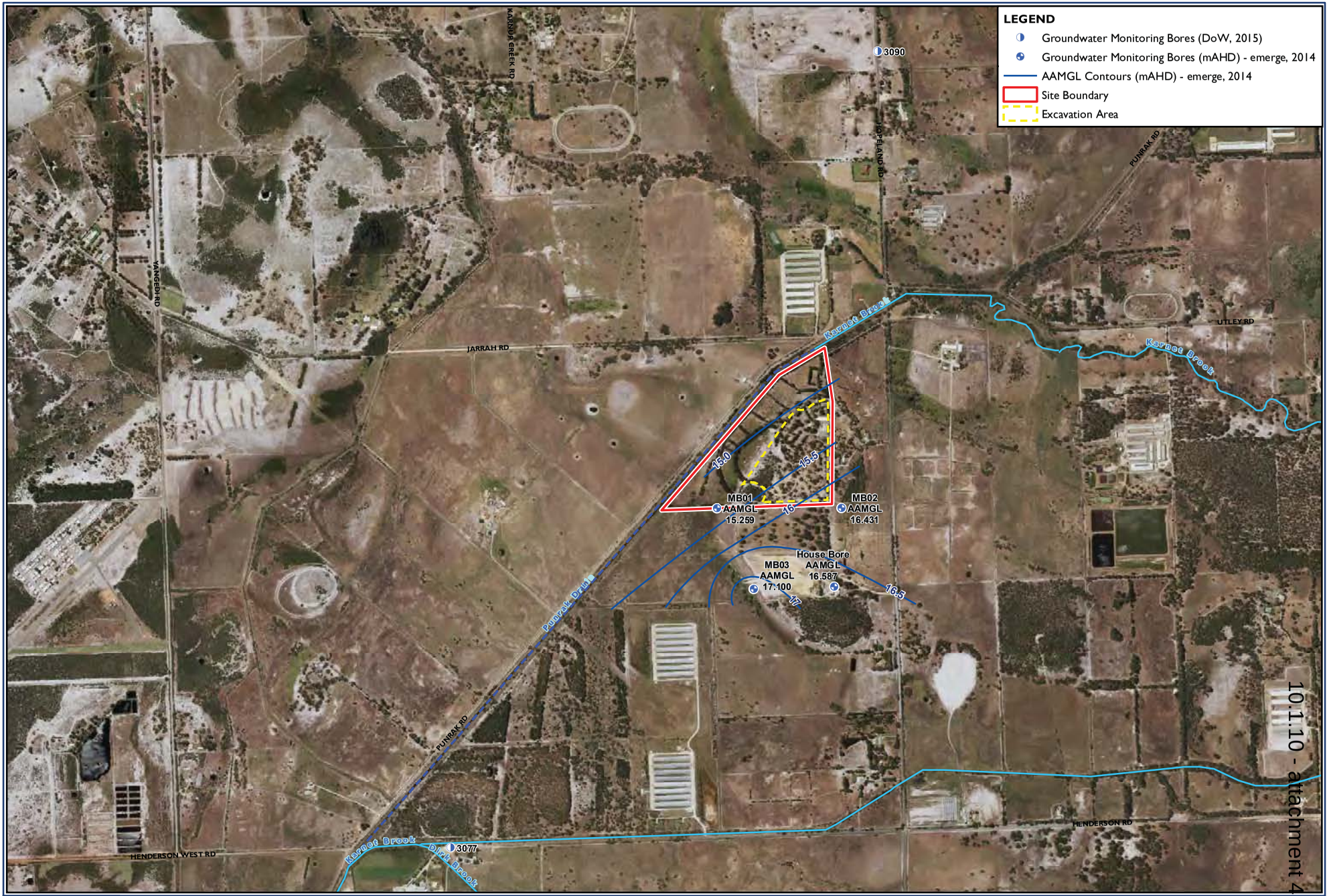
Job Number: L1505503_EIL
Doc Number: 008
Date: 29.05.18
Scale: 1:2,800 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 8

Vegetation Condition



Job Number: L1505503_EIL
Doc Number: 009
Date: 24.05.18
Scale: 1:15,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Historical Contours - DoW, 2006 AAMGL Contours - emerge Ass, 2014 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50
0 62.5 125 250 375 500 m

Figure 9

Groundwater Contours

RPS

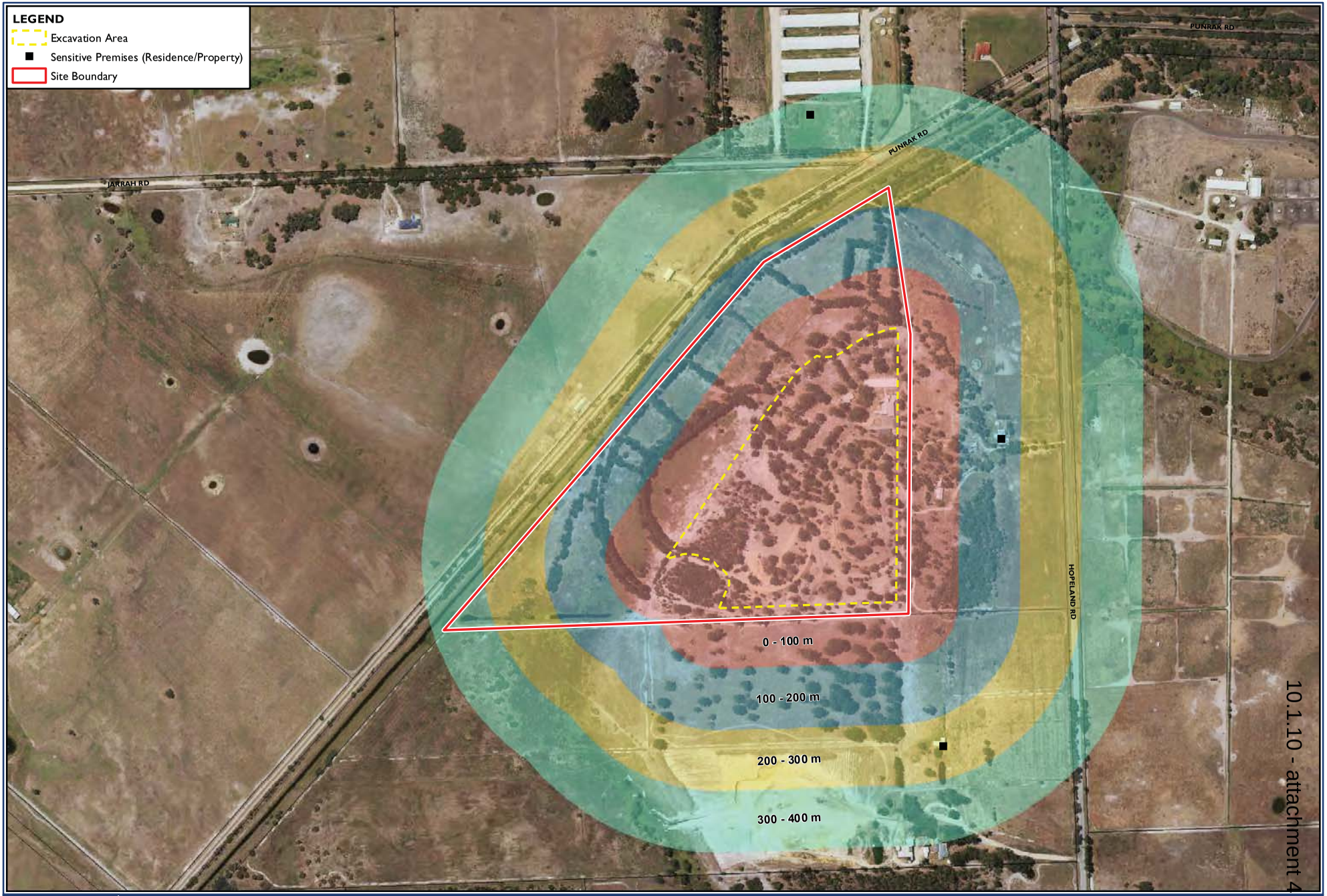
Job Number: L1505503_EIL
Doc Number: 010
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 Wetland Mapping - DPaW, 2017

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 10

Wetland Mapping



RPS

Job Number: L1505503_EIL
Doc Number: 011
Date: 24.05.18
Scale: 1:5,500 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan, 2018

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 11

Excavation Area and Proposed Buffers

RPS

Job Number: L1505503_EIL
Doc Number: 012
Date: 24.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 12

Existing Screening Vegetation

38 Station Street, Subiaco | T +61 8 92111111 | F +61 8 92111122 | www.rpsgroup.com.au

RPS

Job Number: L1505503-EIL
Doc Number: 013
Date: 28.05.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Aug 2016

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 13

Maximum Extent of Excavation

RPS

APPENDIX I

Data Searches

NatureMap
Mapping Western Australia's biodiversity

NatueMap 5km Search

Printed by Guest user on 14/10/2015

Query details : Current Names Only=Yes; Core Datasets Only=Yes; Method='By Circle'; Centre=115°54' 01" E,32°23' 56" S; Buffer=5km;

Search Results

Selected
- Selected Species

All Results
- Non-conservation taxon
- Priority 3
- Priority 4
- Priority 5
- Protected under international agreement
- Rare or likely to become extinct

Reference Layers

Major WA Towns

Major WA Towns

Major WA Towns

Railways

Roads
- Sealed
- Unsealed
- Track

State Borders

Australian Continent

Department of Parks and Wildlife · Western Australian Museum

NatureMap is a collaborative project of the Department of Parks and Wildlife, Western Australia, and the Western Australian Museum.

NatureMap Species Report

Created By Guest user on 14/10/2015

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°54' 01" E,32°23' 56" S
Buffer 5km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	69	171
Priority 3	1	3
Priority 4	1	2
Priority 5	1	3
Protected under international agreement	1	1
Rare or likely to become extinct	4	6
TOTAL	**77**	**186**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	18590	*Synaphea sp. Fairbridge Farm (D. Papenfus 696)*		T	
2.	30751	*Synaphea sp. Pinjarra Plain (A.S. George 17182)*		T	
3.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	
4.	1033	*Tetraria australiensis*		T	
Protected under international agreement					
5.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Priority 3					
6.	7756	*Stylidium longitubum (Jumping Jacks)*		P3	
Priority 4					
7.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
Priority 5					
8.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
Non-conservation taxon					
9.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
10.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
11.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
12.	24312	*Anas gracilis (Grey Teal)*			
13.	24316	*Anas superciliosa (Pacific Black Duck)*			
14.	24561	*Anthochaera carunculata (Red Wattlebird)*			
15.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
16.	24340	*Ardea novaehollandiae (White-faced Heron)*			
17.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
18.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
19.	24318	*Aythya australis (Hardhead)*			
20.	32080	*Banksia sessilis var. sessilis*			
21.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
22.	18497	*Bossiaea sp. Waroona (B.J. Keighery & N. Gibson 229)*			
23.	36520	*Callitris acuminata (Dwarf Cypress)*			
24.	24373	*Charadrius melanops (Black-fronted Dotterel)*			
25.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
26.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
27.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
28.	24399	*Columba livia (Domestic Pigeon)*	Y		
29.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
30.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
31.	25592	*Corvus coronoides (Australian Raven)*			
32.	25595	*Cracticus tibicen (Australian Magpie)*			
33.	25596	*Cracticus torquatus (Grey Butcherbird)*			
34.	3799	*Daviesia cordata (Bookleaf)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
35.	3131	*Drosera stolonifera (Leafy Sundew)*			
36.	11368	*Dysphania glomulifera subsp. glomulifera*			
37.	5688	*Eucalyptus laeliae (Darling Range Ghost Gum)*			
38.	25622	*Falco cenchroides (Australian Kestrel)*			
39.	25727	*Fulica atra (Eurasian Coot)*			
40.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
41.	25530	*Gerygone fusca (Western Gerygone)*			
42.	24443	*Grallina cyanoleuca (Magpie-lark)*			
43.	5153	*Hibbertia pachyrrhiza*			
44.	19412	*Leucopogon sp. Moore River (M. Hislop 1695)*			
45.	25661	*Lichmera indistincta (Brown Honeyeater)*			
46.	1228	*Lomandra hermaphrodita*			
47.	2838	*Macarthuria apetala*			
48.	25654	*Malurus splendens (Splendid Fairy-wren)*			
49.	17636	*Marianthus coeruleopunctatus (Blue-spotted Marianthus)*			
50.	17747	*Meeboldina decipiens*			
51.	25758	*Megalurus gramineus (Little Grassbird)*			
52.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
53.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
54.	25679	*Pachycephala pectoralis (Golden Whistler)*			
55.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
56.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
57.	24409	*Phaps chalcoptera (Common Bronzewing)*			
58.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
59.	4675	*Phyllanthus calycinus (False Boronia)*			
60.		*Phytophthora cinnamomi*			
61.	87	*Pinus pinaster (Pinaster Pine)*	Y		
62.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
63.	24703	*Pterodroma lessonii (White-headed Petrel)*			
64.	11341	*Rhagodia baccata subsp. baccata*			
65.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
66.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
67.	24329	*Stictonetta naevosa (Freckled Duck)*			
68.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
69.	33106	*Stylidium recurvum*			
70.	15532	*Synaphea spinulosa subsp. spinulosa*			
71.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
72.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
73.	20135	*Taxandria linearifolia*			
74.	24844	*Threskiornis molucca (Australian White Ibis)*			
75.		*Tillia davisae*			Y
76.	33418	*Trymalium odoratissimum subsp. odoratissimum*			
77.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

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.

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.

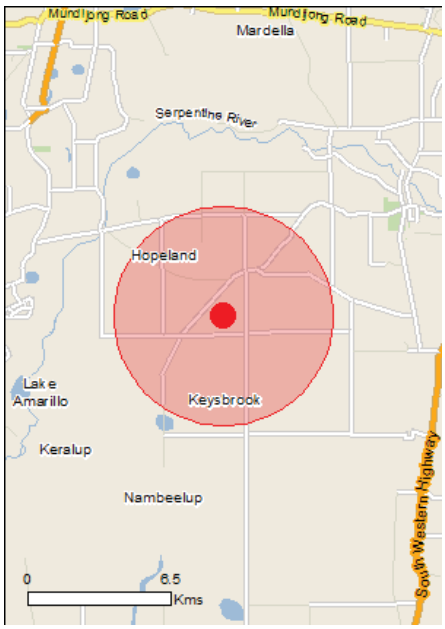
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

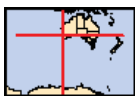
Report created: 14/10/15 16:33:28

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:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	6

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

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9
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:	None
Regional Forest Agreements:	None
Invasive Species:	35
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Peel-yalgorup system	10 - 20km upstream

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may 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	Species or species habitat likely 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 likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to 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
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
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 likely 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 likely to occur within area
Eucalyptus balanites Cadda Road Mallee, Cadda Mallee [24264]	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 known 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 may 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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

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]		Breeding known 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
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

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

Name	Status	Type of Presence 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 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
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
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Plants		
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
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		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

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

-32.39885 115.90052

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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
Forestry Corporation, 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

RPS

APPENDIX 2

Water Management Plan

WATER MANAGEMENT PLAN

Lot 137 Punrak Road, Hopeland

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:4

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Rev 1	*Final for Issue*	*MarMcC*	*JohHal*	*21.06.18*	*DC 21.06.18*	*J. Halleen*	*22.06.18*

Disclaimer

SUMMARY

As owners of Lot 137 Punrak Road, Hopeland ("the site"), the McAllister family is proposing to extract sand from a portion of their property. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works. The site is approximately 30 hectares (ha) and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). The site location is illustrated in Figure 1.

The key management plans and technical assessments that have previously been undertaken for the site include:

- Dust Management Plan
- Fire and Emergency Management Plan
- Acoustic Assessment
- Level 2 Vegetation and Flora Survey.

This Water Management Plan (WMP) aims to combine the management practices outlined in the documents above and which have been previously endorsed in the Industry Licence (EIL) Application by the Shire of Serpentine-Jarrahdale. The EIL application was also reviewed by (but not limited to) the Department of Water (DoW), Department of Planning (DoP), Department of Environment Regulation (DER) and Peel Harvey Catchment Council.

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/03/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works.

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer.

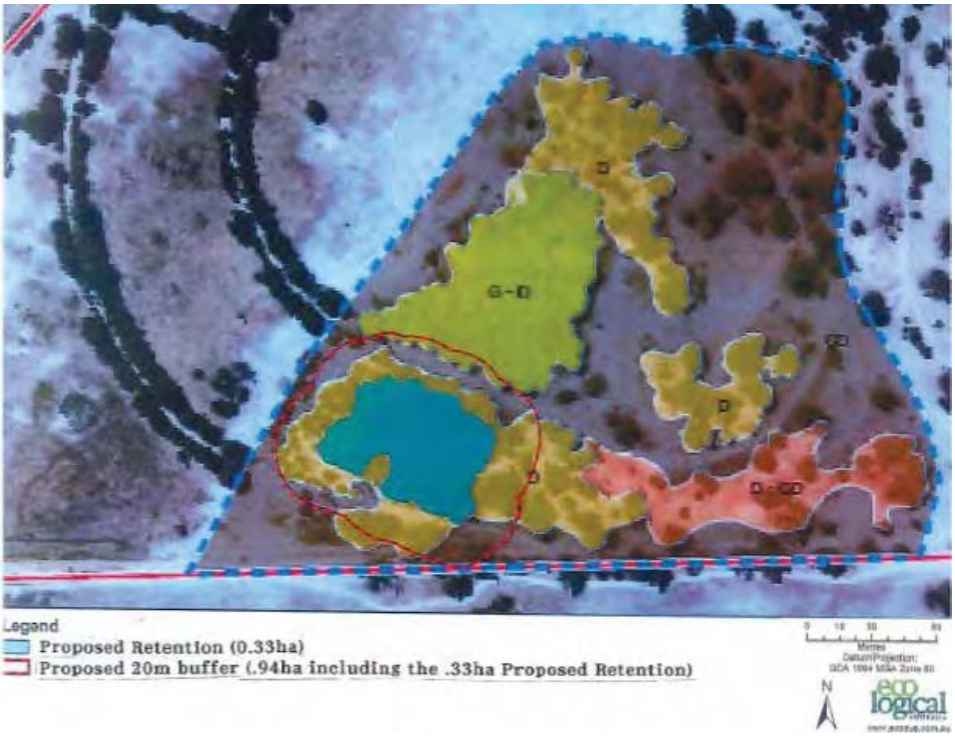

Figure A: Ecological Retention Plan

The extraction of sand meets the broader land use considerations of the Western Australian Planning Commission (WAPC) and the Shire of Serpentine Jarrahdale, by maximising the use of the valuable sand resource, while ensuring that the sand extraction will not adversely impact on the amenity of surrounding landholders or the environment.

Table 1 below provides a summary of the key elements outlined within this WMP.

Table 1: Summary of Key WMP Elements

Key WMP Elements	Details
Topography (Section 2.1)	▪ The topography falls from a high point of 25 m AHD in the south of the site in a north-westerly direction towards the landholding's western boundary with the Punrak Drain/ Road. ▪ The excavation area has a topographic range of approximately 18 m AHD to 25 m AHD
Geology (Section 2.2)	▪ Regional geology mapping indicates that the excavation area comprises white to pale grey sands at surface, yellow at depth, fine to medium-grained, moderately sorted sub-angular to sub-rounded minor heavy minerals of eolian origin.
Groundwater (Section 2.4)	▪ Extrapolation of AAMGL contours indicates that the AAMGL at the site, in particular the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area.

Key WMP Elements	Details
Surface Water Hydrology (Section 2.5)	▪ The closest surface water feature to the site is the Punrak Drain, which is located adjacent to the western boundary of Lot 137. The drain forms part of the local Hopeland surface water drainage network, which ultimately flows into the Serpentine River. No surface water features exist within the site. ▪ A small portion of land located in the north of the site is mapped as Resource Enhancement (RE) wetland (UFI15364) and a portion of mapped Multiple Use (MU) wetland (UFI 15785) extends along the site's western boundary.
Monitoring (Section 5)	▪ It is proposed to use the two existing bore and install two new ones to undertake groundwater level and quality monitoring at the site. ▪ Groundwater level monitoring will be undertaken monthly and groundwater quality monitoring will be undertaken on a biannual basis for the duration of sand extraction activities.
Groundwater Management (Section 6)	▪ The monthly groundwater elevation data will be used to set the final mine levels. The sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). This Water Management Plan will also be updated for approval by the Shire. ▪ The hydrological function of the site will be maintained by incorporating the below management and monitoring actions – Groundwater levels and quality will be monitored using the established monitoring bores for the duration of sand extraction activities. – The above ground fuel storage tank will be self-bunded to prevent any accidental loss of diesel fuel to the environment. – In the unlikely event of a spill occurring during refuelling of either vehicles or the screening plant, impacted soil will be immediately excavated to prevent any contamination of the underlying groundwater. – If any spillage of any material occurs within the excavation area or the haul routes the incident will be reported to the site manager for appropriate action. The site manager is responsible for immediately employing the necessary resources (labour, machinery and material) to clean the spill and recording and reporting of the incident (if applicable) to the DER and the Shire of Serpentine Jarrahdale). – There will be strict adherence to the initial two metre separation buffer and undertake monthly groundwater monitoring and ongoing survey and control of the excavation process to ensure separation distances are controlled.
Water Supply (Section 6.1.1)	▪ Drinking water will be supplied as bottled water for non-potable uses will be trucked to site in water carts or a groundwater licence pursuant to the *Rights in Irrigation and Water Act 1914* will be applied for.
Surface Water Management (Section 6.3)	▪ To manage the potential environmental impact of stormwater the following management practises will be implemented – Any tree stumps will be retained as long as practicable. – Riffle zones and contour sills will be used downslope of the run of the mine pad. – Spill response equipment will be provided at the site. – Bunds and V-drains will be established along the access road to contain run-off, in particular to prevent uncontrolled run-off entering the wetland. ▪ Hydrocarbon management measures will ensure that surface water contamination does not occur.

Conclusions from groundwater modelling undertaken for the proposed sand extraction activities at the site are summarised below:

- Even in extreme rainfall events, groundwater at the site is not expected to reach the surface.
- The expected rainfall rate is less than the infiltration rate at the site. Therefore, surface water run-off is expected to be minimal.

- Extracting sand to a depth of 1.28 m above ground water levels will not lead to an increase in groundwater evaporation.

- Post-extraction transpiration rates will not be significantly different to the pre-extraction rates.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Overview

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers. The sand extraction works will be undertaken by Hanson.

The 30.4 hectares (ha) site is located in Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is currently primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

1.1.2 Proposed Operations

The proposed sand extraction activities will occur within a 11.2 ha portion of the site (Figure 1). It is estimated that the site will support sand extraction activities for three to five years.

The sand is proposed to be excavated in four consecutive stages as illustrated in Figure 2.

It is also proposed through the staging of the sand extraction to limit the "open" extraction area in the first two years capped at a maximum of approximately 7.9 ha for two years. Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

Stage 3 (which has small area of Banksia woodland) will only be excavated upon approval of the Purpose Permit application from the Department of Environment Regulation (DER). In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the Figure 2 staging plan subject to the following requirements:

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/03/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works.

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

After the excavation activities, the staged excavation areas will be rehabilitated to support paddocks and horse training (or similar uses) in accordance with both the "Rural" zoning and the Rehabilitation Management Plan.

1.1.3 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road), to combine the two extraction areas to maximise the removal of the valuable sand resource, both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

Department of Water have reviewed and endorsed the above approach.

1.1.4 Finished Floor Levels

The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

1.1.5 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2.

Approximately 7.9 ha excavated in the first two years of sand mining.

The purpose of this approach is to allow for up to 18 months of groundwater monitoring to provide site-specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation. This would occur prior to any rehabilitation works being undertaken.

1.2 Planning Context

The proposed sand excavation activity is subject to and complies with the MRS and the Shire of Serpentine-Jarrahdale TPS No. 2. Additionally, the following state planning policies are relevant to the proposed sand excavation activity:

- State Planning Policy (SPP) 1 – *State Planning Framework Policy*
- SPP 2.1 – *The Peel Harvey Coastal Plain Catchment*
- SPP 2.4 – *Basic Raw Materials*
- SPP 4.1 – *State Industrial Buffer Policy*
- SPP 5.4 – *Road and Rail Transport Noise and Freight Considerations in Land Use Planning*.

1.2.1 Existing Management Plans

The key management plans and site assessments undertaken to support the proposed sand extraction activities include:

1. Dust Management Plan (included in the EIL).

2. Fire and Emergency Management Plan (included EIL).

3. Rehabilitation Management Plan (to be finalised as a condition of the EIL/ Development Application).

4. Acoustic assessment (included in the EIL).

5. Traffic Impact Assessment (included as part of the Development Application).

6. Level 2 Vegetation and Flora Survey (included in the EIL).

1.3 Objective

The primary objective of this Water Management Plan (WMP) is to define and outline the management measures that will be implemented throughout the construction, operation and rehabilitation of the sand mining operations at the site. These management measures will be implemented to ensure that there are no detrimental impacts to surface and groundwater within or surrounding the site.

This WMP includes details on the following in order to provide assurance that extractive activities will not negatively impact on the local water resources:

- changes in on-site loss of rainwater and impacts on run-off rates. The report will need to demonstrate that no additional flow is exiting the landholding up to and including the 100 year critical event

- impacts on the groundwater regime of reducing sand coverage – changes in groundwater gradient at boundary of property

- potential changes in contamination pathway and land use – reducing cover levels means that the nutrient pathway to receptors for any pollutant (nitrogen from horse manure) is reduced.

2.0 EXISTING ENVIRONMENT

2.1 Topography

The natural topography of the site falls from a high point (approximately 25 metres Australian Height Datum (m AHD)) in the south of the site in a north-westerly direction towards the landholding's western boundary with the Punrak Drain / Road.

The excavation area has a topographic range of approximately 18 m AHD to 25 m AHD (Figure 3).

2.2 Geology

Regional geology mapping shows geology at the site as comprising S8 and S10 sands (Figure 4). The S8 sands underlying the excavation area are described as 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.

2.3 Acid Sulfate Soils

The Western Australian Planning Commission (WAPC) in consultation with the DER has compiled Acid Sulfate Soil (ASS) risk maps that are based on surface geology mapping, and provide a broad scale indication of the risk of occurrence of ASS.

The ASS risk mapping indicates that the entire extent of the site is mapped as "Moderate to Low" risk of ASS occurring within three metres of the natural soil surface (Figure 5).

As the proposed excavation will be of dry sand above the water table it is not anticipated that further ASS investigations are required.

2.4 Hydrological Processes

2.4.1 Regional Groundwater Mapping

The site is not located within an area covered by the Department of Water's (DoW) *Perth Groundwater Atlas*, however there are a number of DoW long-term monitoring bores located in close proximity to the site (WIN ID 3077 and 3090). Both DoW sites have 42 years of continuous monitoring and provide reliable information on long-term groundwater levels and trends.

DoW groundwater information indicates that groundwater is moving in a north-westerly direction and the maximum groundwater level is generally 15.5 m AHD to 16.0 m AHD.

2.4.2 Site Groundwater Mapping

The neighbouring property has an EIL for the extraction of sand from their property. Groundwater monitoring and mapping of the average annual maximum groundwater level (AAMGL) was completed by Emerge Associates to support their EIL application (Appendix 1).

Extrapolation of these AAMGL contours indicates that the AAMGL at the site, in particular the excavation area (EA), is approximately 15 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area (Figure 6).

This equates to the AAMGL generally being approximately 3 m below ground level (mbgl) in the north-west and 5 mbgl in the south-east of the proposed extraction area. The greatest clearance to the AAMGL occurs in the south of the extraction area where the topographical contours peak at approximately 25 m AHD, which provides a clearance of approximately 9 m to the AAMGL of 16 m AHD.

The landholder of the site has completed on-site monitoring and recorded a maximum level of 14.7 m AHD. This level however is lower than the groundwater levels recorded by Emerge Associates and the nearby DoW monitoring sites. It is therefore proposed that the Emerge Associates' AAMGL mapping will be used to establish the excavation depth. These levels coincide with the nearby DoW monitoring data and are considered more appropriate to use than the landowner's monitoring.

2.5 Surface Water Hydrology and Wetlands

2.5.1 Surface Water

The closest surface water feature to the site is the Punrak Drain, which is located adjacent to the western boundary of Lot 137 (Figure 6). The drain forms part of the local Hopeland surface water drainage network, which ultimately flows into the Serpentine River. No surface water features exist within the site.

Incidental rainfall is likely to infiltrate through the highly permeable sandy soils, with minimal overland flow expected, with the exception being during major storm events. During these infrequent events, rainfall run-off is likely to flow overland in a north-westerly direction with surface flows ultimately discharging off site to the Punrak Drain.

2.5.2 Wetlands

A search of the DPaW's *Swan Coastal Plain Geomorphic Wetlands* database (DPaW-017) (27-08-2015 16:55:17) indicates that the majority of the site is not classified as a wetland. However, a small portion of land located in the north of the site is mapped as Resource Enhancement (RE) wetland (UFI15364) and a portion of mapped Multiple Use (MU) wetland (UFI 15785) extends along the site's western boundary (Figure 7).

RE wetland (UFI15364) and MU wetland (UFI 15785) are extensive wetlands that extend over the relatively low-lying surrounding landscape to the east and west of the site respectively. These mapped wetlands are broadly characterised by significant areas of agricultural paddocks and limited extents of native vegetation.

It is acknowledged in the draft *Guideline for the Determination of Wetland Buffer Requirements* (Department for Planning and Infrastructure 2005) that separation distances and management measures are recommended on the basis of potential to mitigate likely impacts of the surrounding land use. Separation measures are required to mitigate only those threats that are present.

The proposed area for sand extraction will be located outside the mapped extents of the wetlands (Figure 7). Best practice management measures will be implemented to ensure that the existing hydrological regimes of the mapped wetlands will not be altered by sand extraction activities.

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3.0 RAINFALL RUN-OFF

3.1 Run-off from Direct Rainfall

The soils at the site consist of medium grained Bassendean Sand, which are known to infiltrate rainfall readily. Recent infiltration testing by RPS on Bassendean Sand in the Kemerton area provided an average infiltration rate of 14.4 metres per day (m/d) for the four sample locations tested. This is similar to the average Bassendean Sand hydraulic conductivity (K) value provided by Davidson (1995) of 15 m/d, with an estimated range of 10 to 30 m/d.

A review of Bureau of Meteorology Intensity-Frequency-Duration (IFD) design rainfall for the Hopeland area shows that the rainfall rate is less than the Bassendean Sand infiltration rate for all 1% Annual Exceedance Probability (AEP)[1] events (Table 2). This shows that surface run-off both before and after sand extraction is expected to be minimal.

Table 2: Design Rainfall Rates

Duration	Exceedance per Year (EY)	Annual Exceedance Probability (AEP)		Rainfall Rate (m/d)		Groundwater Rise (mm)
	1EY	50%	10%	1%	NA	
1 min	1.9	2.1	3.1	4.6	6.6	23
2 min	3.3	3.6	5.3	7.4	5.3	37
3 min	4.4	4.9	7.1	10.1	4.8	51
4 min	5.4	5.9	8.7	12.5	4.5	63
5 min	6.1	6.7	10.1	14.6	4.2	73
10 min	8.8	9.8	14.8	21.9	3.2	110
15 min	10.6	11.8	17.9	26.4	2.5	132
30 min	14.1	15.6	23.5	34.5	1.7	173
1 hour	18.4	20.2	30	43.8	1.1	219
2 hour	23.8	25.9	38.2	56.4	0.68	282
3 hour	27.5	30	44.1	66.1	0.53	331
6 hour	35	38.1	56.7	87.7	0.35	439
12 hour	43.8	47.8	72.1	114.3	0.23	572
24 hour	53.5	58.5	88.7	140.6	0.14	703
48 hour	64.5	70.5	105.4	160.5	0.08	803
72 hour	72.5	79.1	116	170.2	0.06	851
96 hour	79.9	87	125.4	179	0.04	895
120 hour	87.2	94.9	134.9	189.1	0.04	946
144 hour	94.7	103	145.1	201.3	0.03	1,007
168 hour	102.7	111.6	156.1	216	0.03	1,080

Source: BOM (2016) except for rainfall rate and groundwater rise columns

[1] The 1% AEP event is synonymous with the 100 year event

3.2 Run-off from Groundwater Rise

Groundwater rise can be estimated as the product of the rainfall rate and specific yield[2] of the soil. A specific yield of 20% (Davidson 1995) would result in a groundwater rise that is five times the rainfall rate. The proposed minimum groundwater clearance of 1.28 m for the project exceeds the estimated groundwater rise for all duration 1% AEP design rainfall events (Table 2). This means that even in extreme rainfall events, groundwater at the site is not expected to reach the land surface and result in surface run-off.

[2] The specific yield is the volume of water that drains per unit volume of aquifer or soil material. For sands, it is similar to the void space.

4.0 IMPACTS TO WATER LEVELS BY REDUCING SAND COVERAGE

4.1 During Sand Extraction

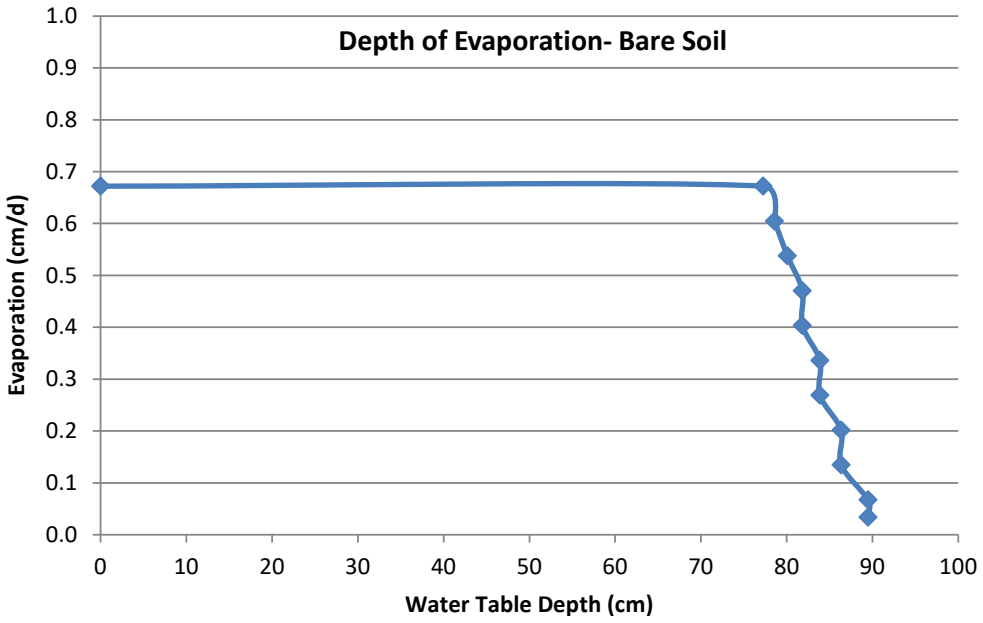
Evaporation of groundwater can extend beneath the land surface and its influence with depth is affected by factors such as land cover and soil type. Spreadsheet modelling was undertaken to estimate evaporation from bare sand (Bouwer 1978). The method included the following characteristics:

- Soil parameters provided by the Rosetta (Schaapp 2002) database for sand. The saturated K value in the database is 6.4 m/d, which is lower than typical for the Bassendean Sand. Hence the evaporation depth calculation will be conservatively large, because evaporation will generally extend to greater depth with finer soil size.

- The model is an iterative, finite difference method using the water table as a zero pressure boundary

- Use of the maximum pan evaporation rate of 0.84 cm/d in January measured at Medina Research Station, which is the closest BOM site. A pan factor of 0.8 was applied (Fetter 1993).

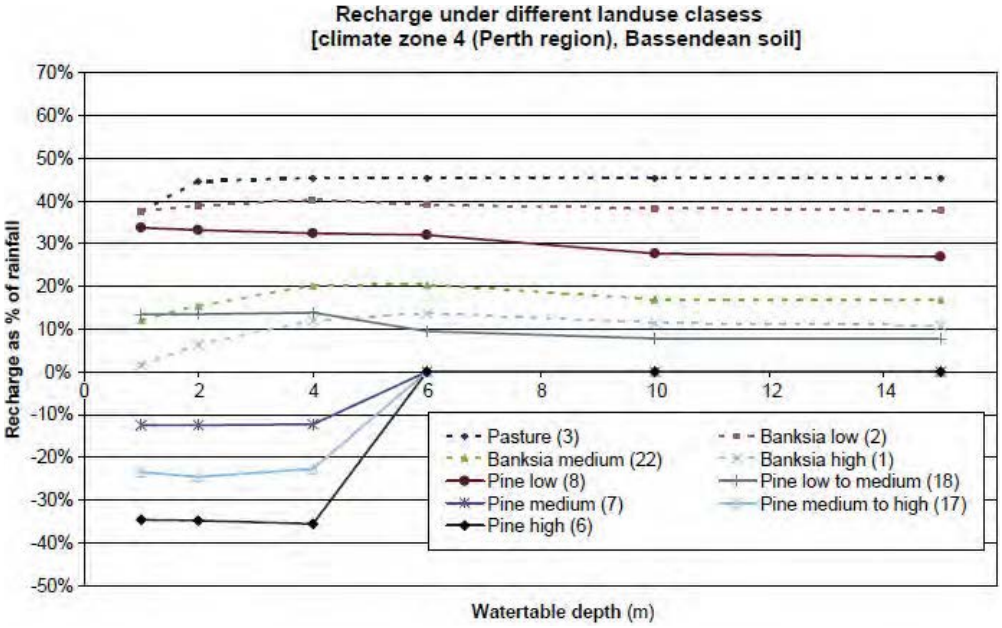
Model outputs (Graph A) show evaporation extends to a depth of 0.9 m. The proposed groundwater clearance of 2 m (to be amended to 1.28 m in the future) is greater than the depth that evaporation is estimated to extend, hence extracting sand to the designated level is not expected to increase evaporation.



Graph A: Evaporation Depth in Bare Sand

4.2 Post-sand Extraction

The post-extraction depth to groundwater of 1.28 m will exceed the pre-extraction depth to groundwater of ~ 8 m, and potential post-extraction increase in transpiration rates needs to be considered. Graph B shows groundwater recharge rates for various land uses over Bassendean Sand that were estimated from the Vertical Flux Model (VFM) for the Perth metropolitan area (Xu et al. 2008). These estimates take into account detailed processes such as unsaturated zone soil hydraulic properties and vegetation density. Recharge rates for water table depths between 1 and 8 m (which is the range of pre- and post-extraction water table depths at the site) are similar for the pre- and post-extraction land use (pasture). On this basis, post-extraction transpiration rates will not be significantly different from pre-extraction rates.



Source: Xu et al. (2008)

Graph B: Estimated Recharge for Various Land Use by WAVES (Bassendean Soil)

4.3 Impacts to Water Quality by Reducing Sand Coverage

The Bassendean Sand unit is known to have minimal nutrient retention capacity in relation to phosphorus and nitrogen. Hence the depth to groundwater in this unit is not the critical factor in terms of nutrient migration and management. Rather, on-site practices which reduce nutrient inputs should be the focus of nutrient management. To this end, no nutrients will be input at the site as part of extraction activities. The only potential source of nutrients is the on-site above ground portable toilet, which will be located as far up-hydraulic gradient as practically possible, and such that depth to groundwater is at least 2 m.

4.4 Water Balance Summary

The steady state water balance at the site can be summarised as follows:

$$G_I + R_I = G_O + ET_O$$

Where:
G_I = Groundwater input
R_I = Rainfall input
G_O = Groundwater output
ET_O = Evaporation from bare soil and post-extraction evapotranspiration

As discussed in previous sections of the report, the extraction activities will not result in significant changes to any of these water balance components. This is on the proviso that the separation distance to groundwater is maintained throughout the project. The following section provides the monitoring and management program to ensure the minimum groundwater separation is maintained.

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5.0 MONITORING

5.1 Groundwater Level Monitoring

Groundwater levels will be monitored using the two existing up-gradient monitoring bores (MB01 and MB02) and it is proposed to install an additional two down-gradient bores (MB04 and MB05), as shown on Figure B.

Figure B: Proposed Monitoring Bore Locations

Groundwater level monitoring will be undertaken on a monthly basis for the duration of sand extraction activities. There will be strict adherence to an initial 2 m groundwater separation buffer from the AAMGL with ongoing survey and control of the excavation process to ensure separation distances are controlled.

The ongoing monthly groundwater elevation data will be used to refine the AAMGL and set the final mine levels. The sand quarry finish floor level will be amended from 2 m to 1.28 m from the AAMGL, which is consistent with the neighbouring sand quarry site.

5.2 Groundwater Quality Monitoring

Groundwater quality at site will be monitored using the established and proposed monitoring bores for the duration of sand extraction activities.

Table 3 summarises the proposed monitoring program. The specifics of this monitoring program may be adjusted pending results over time.

Table 3: Proposed Groundwater Monitoring Program

Location	Analyte	Potential Source	Frequency
Bores MB01, MB02, MB04, MB05	Total Petroleum Hydrocarbons (TPH)	Hydrocarbon spill/ leak	Twice over water level monitoring period (winter high and summer low).
	pH	Acidic groundwater from regional area	
	Salinity (EC)	Reduced groundwater recharge	
	Nutrient suite (Total N, Total P, nitrogen oxides, reactive phosphorus, ammonium.	On-site toilet, groundwater from regional area	
	Water levels		Monthly

5.3 Contingency Actions

5.3.1 Water Levels

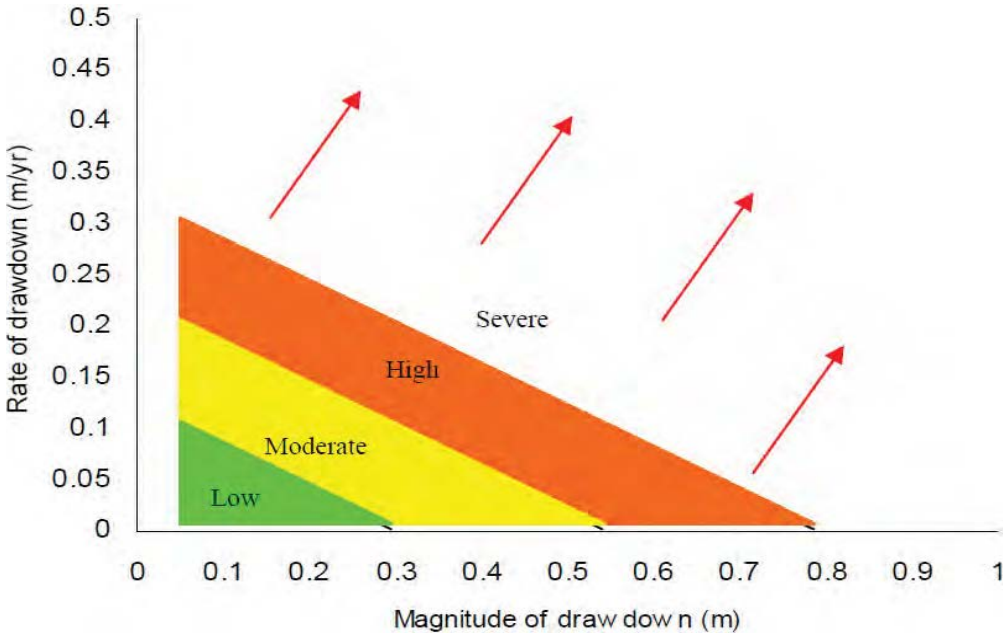
It is proposed to monitor baseline groundwater levels prior to sand extraction works to assess any impacts associated with the site activities. It is proposed that the following trigger be applied:

- water level decrease of 0.3 m over at least two successive monitoring events, after Froend and Loomes (2004) (Graph C).

The following contingency measures will be applied should water level triggers be exceeded:

- If decrease exceeds 0.3 m, assess in conjunction with the appropriate regulator, whether the decrease is due to regional groundwater variation (e.g. due to climate factors). If decrease is deemed due to natural regional variability, continue existing monitoring program.

- Assess environmental value of down-gradient groundwater dependent ecosystem (GDE) that may be affected, and remediate/modify site activities if required in conjunction with the relevant authority.



Graph C: Risk of Impact for Wetland Vegetation based on Magnitude of Groundwater Level Change (from Froend and Loomes 2004)

5.3.2 Water Quality

In conjunction with the water level monitoring, it is proposed to monitor baseline groundwater quality. The future groundwater quality resulting from the excavation works can then be compared with the baseline data to assess any impacts associated with the site activities. It is proposed that the following trigger be applied:

- water quality exceeding 50% of baseline levels over at least two successive monitoring events and/or exceedance of ANZECC (2000) guideline where relevant.

The following contingency measure will be applied should water quality triggers be exceeded:

- Conduct an assessment as to source of spill and/or water quality impact and remediate/modify if required in conjunction with the relevant authority.

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6.0 MANAGEMENT

6.1 Groundwater Levels

The following sections outline the measures proposed to ensure that, in line with the relevant policies, mining activities will not impact upon important water resources.

6.1.1 Water Supply

Water for construction and dust suppression will either be trucked to site in water carts or abstracted. If groundwater abstraction is required, a groundwater licence pursuant to the *Rights in Irrigation and Water Act 1914* will be applied for.

Drinking water will be supplied as bottled water.

6.1.2 Groundwater Clearance

Sufficient clearance above the water table will be maintained to ensure:

- Accidental fuel spills can be contained in the unsaturated zone for a reasonable period of time.

- Evaporation losses during mining and evapotranspiration losses after mine closure are minimised.

As discussed in Section 5, it is proposed to set a mine floor level that provides an initial 2 m clearance to the AAMGL. Once groundwater monitoring is completed, as per this report which has been developed with the Shire, the sand quarry finish floor level will be amended from 2 m to 1.28 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The groundwater monitoring data will be provided to the Shire prior to altering the finish floor levels. The landowners are committed to the following:

- implementing this Water Management Plan
- survey control of quarry floor to ensure accurate recording of separation distance
- monthly monitoring of the groundwater via the existing monitoring bore.

6.2 Groundwater Quality

Potential impacts to groundwater quality during site works are considered to be minor and include leaks and spills from hydrocarbons. Management measures proposed to maintain the hydrological functions at the site include:

- The above ground fuel storage tank will be self-bunded to prevent any accidental loss of diesel fuel to the environment.
- In the unlikely event of a spill occurring during refuelling of either vehicles or the screening plant, impacted soil will be immediately excavated to prevent any contamination of the underlying groundwater.
- If any spillage of any material occurs within the excavation area or the haul routes the incident will be reported to the site manager for appropriate action. The site manager is responsible for immediately employing the necessary resources (labour, machinery and material) to clean the spill and recording and reporting of the incident (if applicable) to the DER and the Shire of Serpentine Jarrahdale).
- There will be strict adherence to the initial two metre separation buffer and undertake monthly groundwater monitoring and ongoing survey and control of the excavation process to ensure separation distances are controlled.

6.3 Surface Water Management

Resource Enhancement Wetland UFI15364 is located to the north and east of the proposed excavation area. The site will be designed and operated to avoid disruption of surface water flows and ensure that potential contaminants are not released into the wetland. To further avoid impacts to the RE Wetland, a 50 m buffer will be maintained between the wetland and operational areas of the mine.

Punrak Drain is located along the north-west boundary of the site, approximately 200 m from the proposed excavation area. Consequently, impacts to the water quality of the drain are not anticipated.

To manage the potential environmental impacts to surface water, the following management practises will be implemented:

- Any tree stumps will be retained as long as practicable.
- Riffle zones and contour sills will be used downslope of the run of the mine pad.
- Spill response equipment will be provided at the site.

- Bunds and V-drains will be established along the access road to contain run-off, in particular to prevent uncontrolled run-off entering the wetland.

- Hydrocarbon management measures will ensure that surface water contamination does not occur. Contamination and spills management will be implemented as described below.

6.3.1 Fuel and Chemical Management

The proposed mining operation will address potential risks through minimising the storage of hydrocarbons on site. There will not be a fuel farm on site and machinery servicing will not occur on site. A fully contained mobile service truck will be used to bring fuel, oil, lubricant and coolant on site. The service truck has separate tanks for lubricants and a waste oil tank and evacuation pump. This will allow for the removal of all waste hydrocarbons from the site. No chemicals will be stored on site.

All site infrastructure will be located centrally within the landholding. A self-bunded fuel tank or an earth wall bund will be constructed around the designated refuelling facility in accordance with Water Quality Protection Note 56: *Tanks for Elevated Storage* (DoW 2006). Specific measures in regards to the above ground fuel tank include:

- The total tank storage volume shall not exceed 5,000 litres.

- There will be no underground pipework carrying fuel from the tank to facilities outside the compound. The storage tank will be self-bunded and located within a compound that effectively capture and contain any chemical spills.

- Minimum storage tanks and associated spill containment compounds will comply with the current Australian Standard 1940, the *Explosive and Dangerous Goods Act 1961* and any associated Regulations.

6.4 Waste Management

The existing on-site effluent system will be used and no connection to reticulated sewerage is required.

The management strategies that will be implemented to manage wastes are:

- Hydrocarbons and chemical containers, such as lubricants will be regularly removed from site for disposal at a licensed landfill facility.

- Instruction will be provided to site personnel on waste management.

- Mobile service vehicles will store any waste oil removed from machinery and remove it from site daily.

6.5 Acid Sulfate Soils

The site has a moderate to low risk of ASS and extraction activities have been planned to avoid the wetland areas which may have higher risk of ASS. Furthermore, extraction activities will not be undertaken below the water table. Consequently, the risk of disturbing ASS is low.

6.6 Dust Management

Excessive dust has the potential to impact on both workers on site and the adjoining land users. Dust has the potential to be generated during most phases of the quarrying operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions.

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure levels under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lot 137.

Dust control methods are outlined in the Dust Management Plan (RPS 2018) that has been prepared for the site (Appendix 2).

6.7 Rehabilitation

It is intended that the site will support sand excavation activities for up to five years, after which the following will be undertaken:

- The site will be rehabilitated to agricultural pasture.
- Upon completion of the sand extraction, all facilities and equipment will be removed from the site.
- Removal of the fuel tank will adhere to all safety practices to minimise the risk of contamination or spills. Remaining fuel will be emptied prior to moving.
- Access track removal will be dependent on their usefulness for future uses of the site. Some areas may require retention of access tracks while other areas may require removal.

The rehabilitation of the site is intended to return the land to a condition suitable to support, as a minimum, activities that are currently supported by the site which includes horse training.

A Rehabilitation Management Plan will be prepared as either a condition of the Extractive Industry Licence or Development Application.

6.7.1 Landform Reconstruction

As part of the rehabilitation process, the following actions will be undertaken:

- The final contours are anticipated to be visually comparable with the flatter parts of the site and suitable batters (no greater than one in three) will be created along the interface between excavation area and the 20 metre vegetated buffer along the site boundary.

- All final slopes will be similar to those in the local area and the excavation will be left in a safe manner in accordance with the *Mines Safety and Inspection Act 1994*.

- Batter areas will be stabilised through revegetation with native plant / pasture species to minimise erosion risk.

- Respread of topsoil stockpiled as part of clearing works to a depth of 100 mm and deep ripped to a depth of 300 mm to assist in the establishment of pasture species. Where required, seed for pasture species will be spared to maximise growth and ensure that 90% vegetation cover is achieved.

- A final minimum unsaturated clearance of 1.28 m will be consistent with Section 6.1.2.

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RPS

FIGURES

RPS

Job Number: L1505503_WMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_WMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

RPS

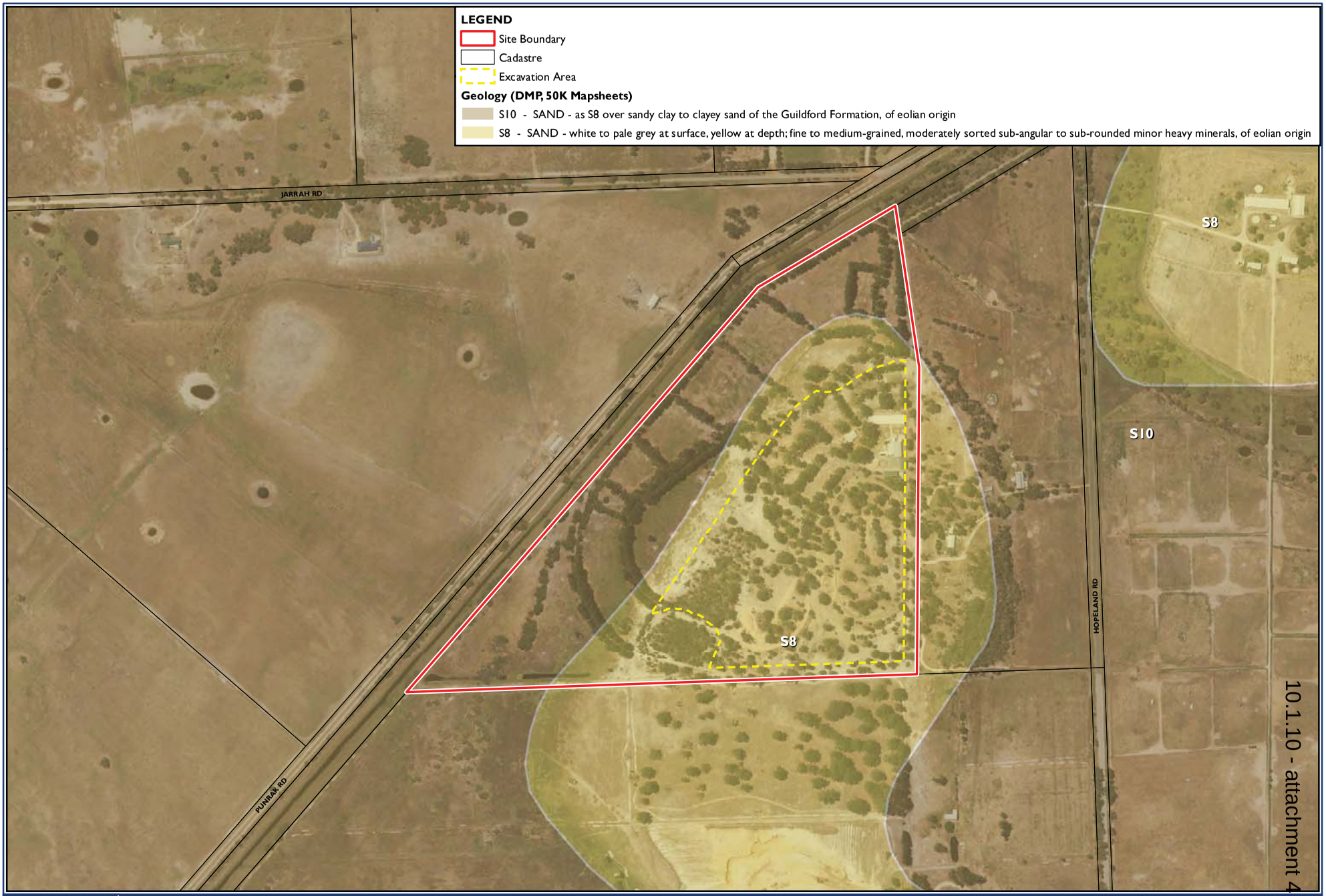
Job Number: L1505503_WMP
Doc Number: 003
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 1m Lidar contours - DoW, 2015

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 3

Topography



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Doc Number: 004
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Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

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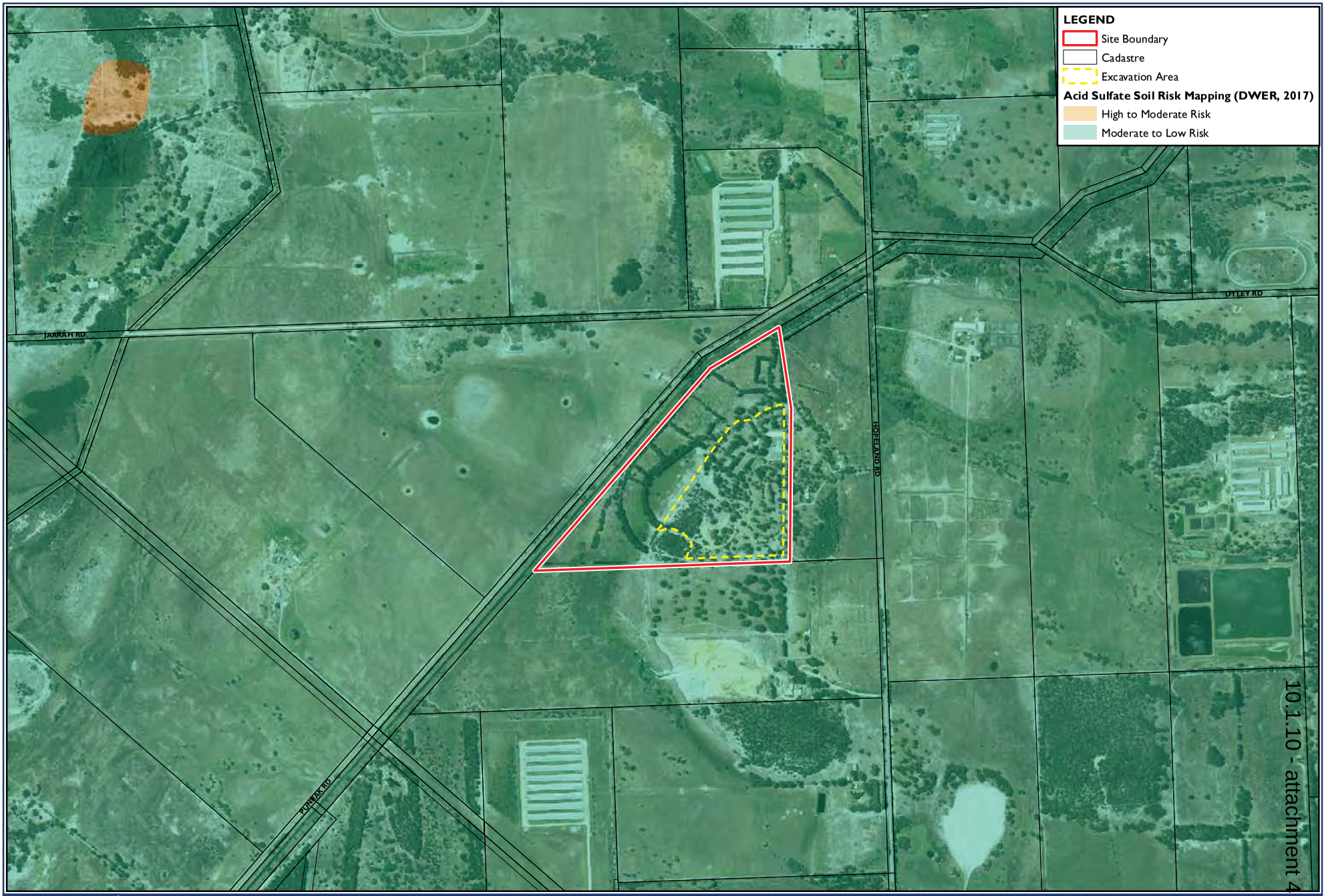
Figure 4

Geology



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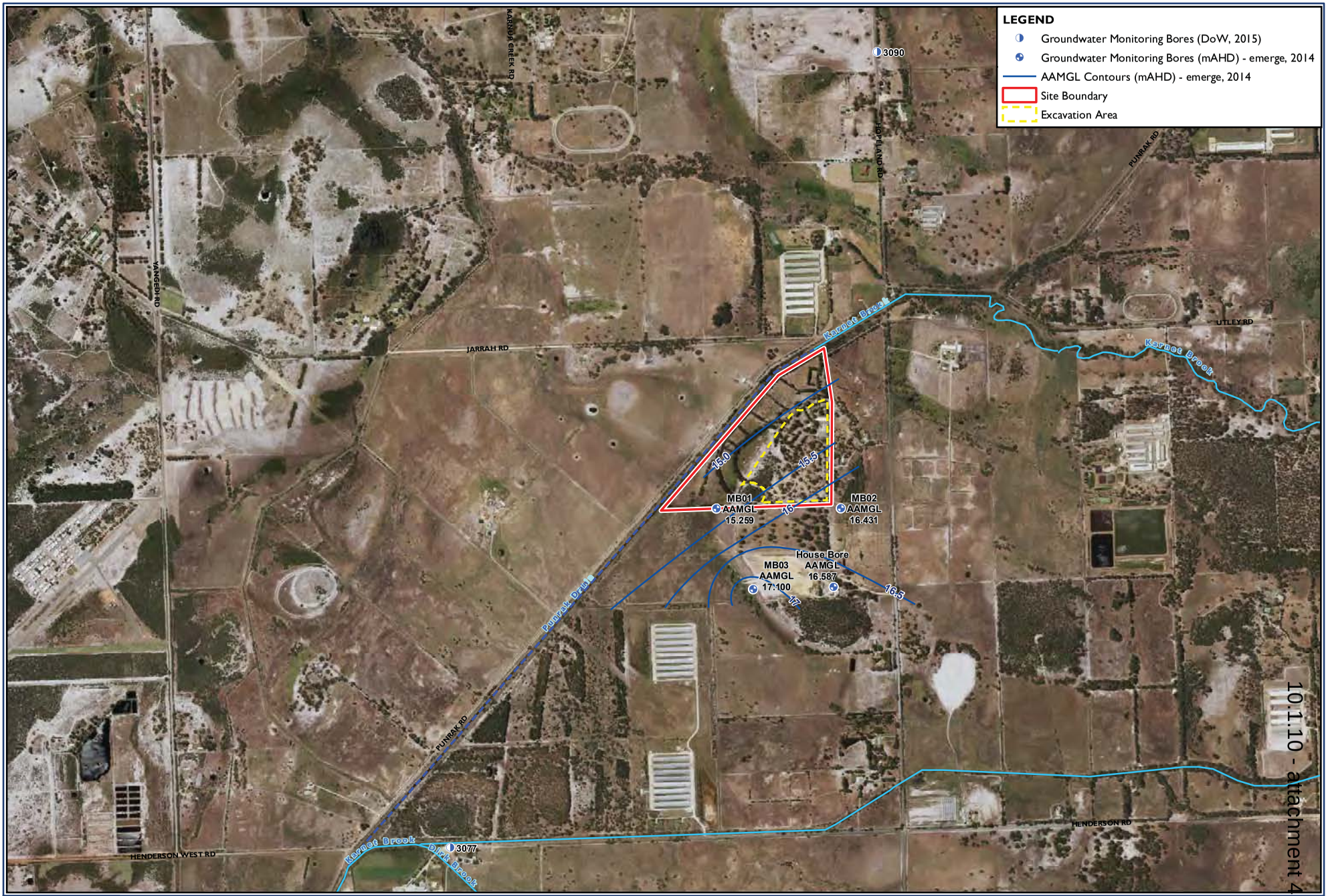
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 ASS Mapping - DWER, 2017

GDA 1994 MGA Zone 50

0 50 100 200 300 400 m

Figure 5

Acid Sulfate Soils Risk Mapping



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Source: Cadastre - Landgate, 2015 Historical Contours - DoW, 2006 AAMGL Contours - emerge Ass, 2014 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50
0 62.5 125 250 375 500 m

Figure 6

Groundwater Contours

RPS

Job Number: L1505503_WMP
Doc Number: 007
Date: 24.05.18
Scale: 1:5,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018 Wetland Mapping - DPaW, 2017

GDA 1994 MGA Zone 50

0 25 50 100 150 200 m

Figure 7

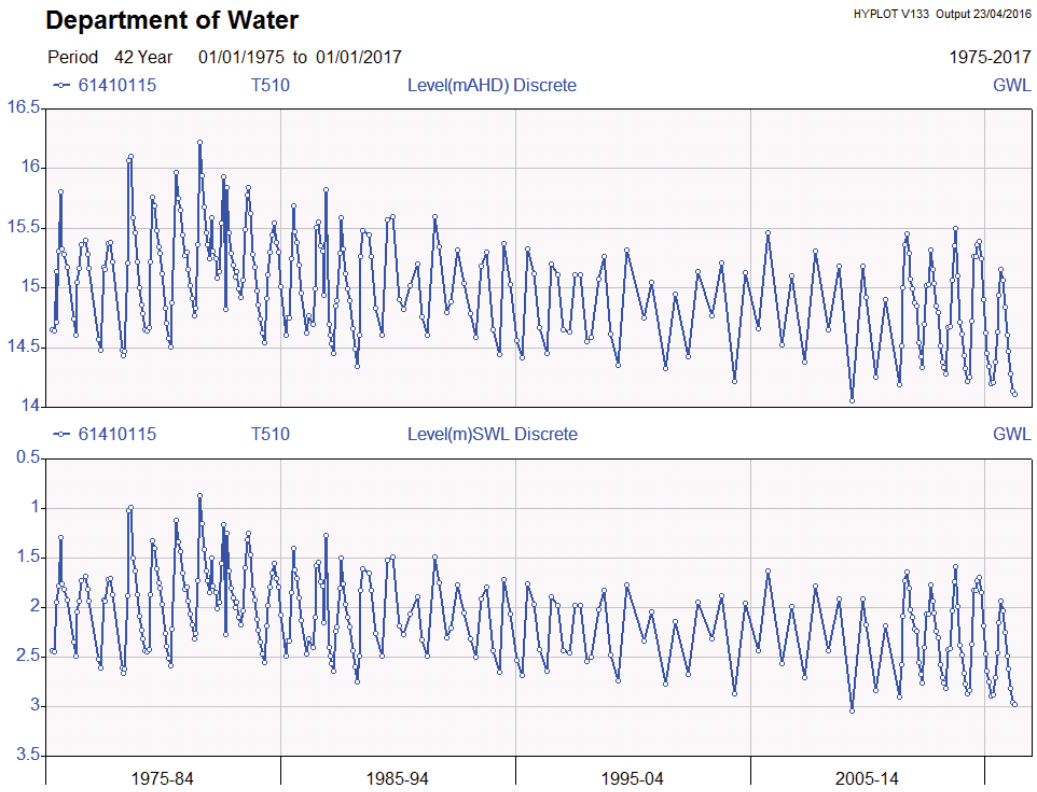
Wetland Mapping

RPS

APPENDIX I

Groundwater Data

APPENDIX 1: Groundwater Data



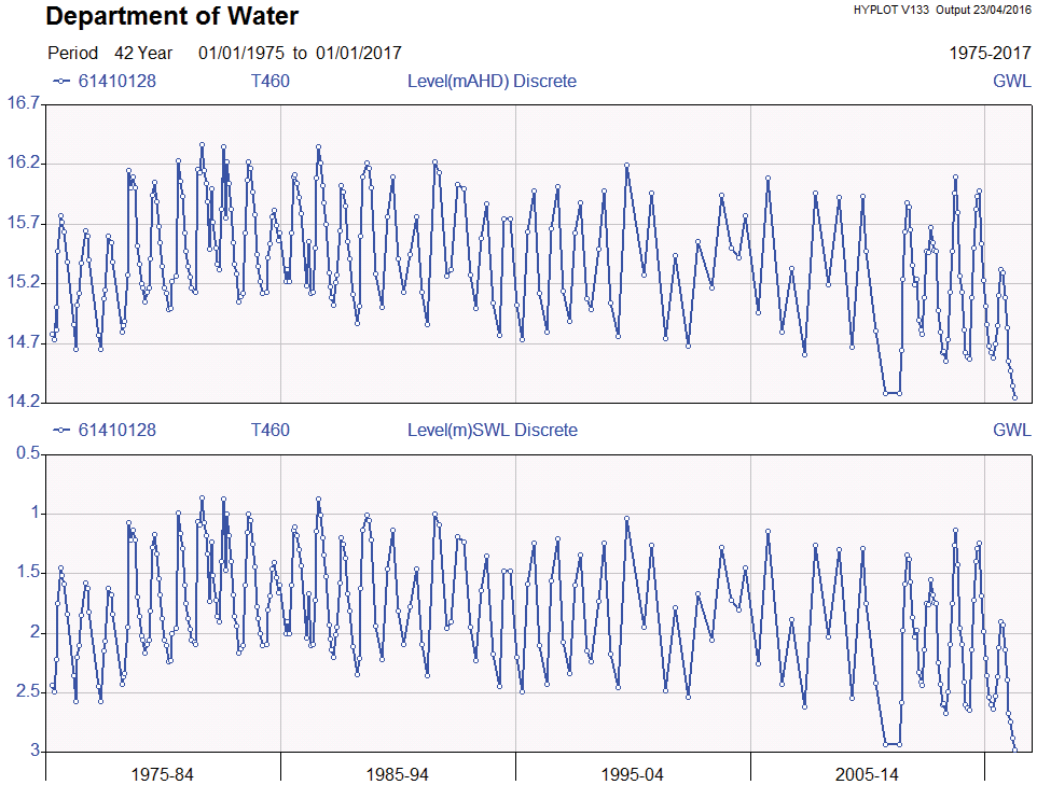


Figure 3:	Surface Water Features and AAMGL	Legend	Plan Number: EP14-057(01)--F10
Project:	Application for DA and EIL Lot 371 Hopeland Road Extractive Industry Licence Support	Site boundary AAMGL (m AHD) Monitoring bores Punrak Drain Sump	Drawn: GRO Date: 05/12/14 Approved: JDH Date: 12/12/14 Checked: KK Scale: 1:6,000@A4
Client:	Goodfeel Enterprises Pty Ltd		0 60 120 240 Metres

emerge ASSOCIATES
Integrated Science & Design

RPS

APPENDIX 2

Dust Management Plan (RPS 2018)

DUST MANAGEMENT PLAN

Lot 137 Punrak Road, Hopelands

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:2

Version/Date: Rev 3, June 2018

Document Status

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Draft A	Draft for Client Review	RebDaw	JohHal	23.11.16	SN 01.12.16		
Rev 0	Final in Issue	RebDaw	JohHal	02.12.16	SN 02.12.16	J. Halleen	02.12.16
Rev 1	Final for Issue	RebDaw	JohHal	27.01.17	SN 27.01.17	J. Halleen	27.01.17
Rev 2	Final for Issue	RebDaw	JohHal	07.02.17	SN 09.02.17	C. Davies	10.02.17
Rev 3	Final for Issue	MarMcC	JohHal	21.06.18	DC 21.06.18	J. Halleen	21.06.18

Disclaimer

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Figure 1: Site Location

Figure 2: Staging Plan

APPENDICES

APPENDIX 1 Site Classification Assessment Chart

APPENDIX 2 Dust Management Actions

1.0 INTRODUCTION

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

This Dust Management Plan (DMP) has been prepared to demonstrate that dust caused by sand extraction activities at 137 Punrak Road, Hopeland ("the site") can be effectively managed. The DMP supports the Development Approval (DA) and an Extractive Industry Licence (EIL) to extract the Bassendean sand from a 11.2 ha portion of the site. Sand extraction activities within this area will be staged, with a maximum of approximately 7.9 ha extracted in the first two years (Figure 2).

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:-

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as 'proposed retention' and 'proposed 20 m buffer'.

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

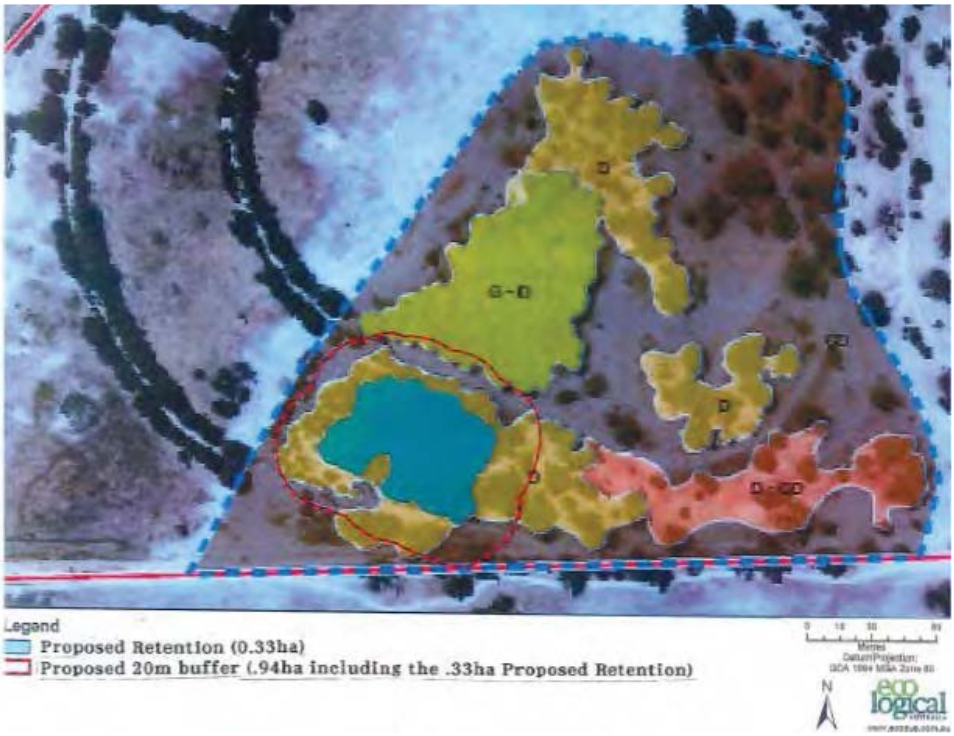

Figure A: Ecological Retention Plan

This management plan is set out as follows:

Section 2.0 The Works

Section 3.0 Dust Management Plan

Section 4.0 Conclusion

2.0 THE WORKS

The site is approximately 30 ha and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). Sand extraction activities are scheduled to commence in 2018 and will be undertaken in four consecutive stages, with approximately 7.9 ha extracted in the first two years. Sand extraction works will be undertaken by Hanson.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

It is also important to note the proposed sand screening will be subject to a Department of Environment Regulation (DER) works approval and registration under Part V of the *Environmental Protection Act 1986*.

The extent of the sand mining area is shown on Figure 1 and Table A provides an overview of the proposed sand extraction activities.

Table A: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Life of the project	Approximately three to five years
Sand Volumes	Approximately 1 million m^3
Dewatering requirements	Nil
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

Project Component	Proposal Characteristic
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Water Trucks	Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

2.1 Overview of Extraction Process

The excavation of sand will generally involve the following, to be undertaken in stages across the proposed sand extraction area as outlined in the staging plan (Figure 2):

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- Vegetation clearing will involve the use of wheel loader or excavator to push over the trees, before they are mulched. The mulch will be stockpiled for use within the site.

- Topsoil removal and stockpiling. Topsoil removal will comprise the first 100 mm to 300 mm of the soil being scraped and then stockpiled within the site for use as part of the decommissioning and rehabilitation process. Topsoil and overburden will be stored adjacent to the area of excavation, or will be returned directly being behind the advancing face of the extraction area.

- Each extraction stage of the sand excavation is expected to be approximately between 0.8 ha to 4.4 ha in size, with a cap of approximately 7.9 ha extracted in the first two years. Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

- Sand will be distributed from the site via road haulage. The primary haulage routes are expected to be north and south along Hopeland Road onto Karnup Road and Lakes Road respectively, and then east or west to and from the Kwinana Freeway or South Western Highway.

- Reforming of the land post-excavation is proposed to be undertaken using a wheel loader of excavator to push the topsoil into place. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three horizontal to vertical in accordance with Shire of Serpentine–Jarrahdale Extractive Industries Local Law 1999. Rehabilitation will progressively follow excavation wherever possible.

2.1.1 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road) to combine the two extraction areas to maximise the removal of the valuable sand resource both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

2.2 Primary Contacts

The sand mining contractor is the party responsible for the overall project. Any complaints in relation to dust nuisance should in the first instance be directed to the Site Supervisor.

2.3 Timing of Works

Works are scheduled to commence once all approvals are in place, anticipated to commence in 2018.

2.3.1 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2. A maximum of approximately 7.9 ha will be excavated in the first two years of sand mining. The purpose of this approach is to allow for up to 18 months of groundwater monitoring which provides site-specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation.

Any open areas in these first two years of sand mining will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

3.0 DUST MANAGEMENT PLAN

3.1 Responsibility

The landowner will enter an agreement with a sand mining contractor. The sand mining contractor will be responsible for the effective control of all dust, smoke and wind borne material emanating from the sand quarry.

The sand mining contractor and the landowner are both responsible for the full duration of the mining contract in accordance with the DA and EIL approval.

3.2 Smoke Nuisance

There will be no prescribed burning / fires within the site. Any clearing of vegetation will be in accordance with the Department of Environment Regulation Purpose Permit clearing approval.

It is considered that there is only a low risk of smoke nuisance principally because prescribed burning is prohibited on site.

3.3 Dust Nuisance

3.3.1 Dust Risk

Excessive dust has the potential to impact on both workers on site and the adjoining land users. Dust can originate from a number of operations and may impact on-site workers or travel off site. Potential dust impacts are addressed by reducing the dust generated from the quarrying, processing and transport operations.

The main risk from dust is not the sand, but rather the fine organic particles that are generated during land clearing and reinstatement, and most importantly the fine particles generated by transport along access roads and traffic areas.

The main risk is therefore from the fine organic matter in the topsoil, any clay within the sand or calcium carbonate that is broken down through tyre impacts or disturbance. There is also the risk from the tipping processes.

Dust has the potential to be generated during most phases of the quarrying operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions.

3.3.2 Climate and Soil Conditions

Through the winter months of May to September exclusive, there is little dust risk because rainfall exceeds evaporation. The rainfall is sufficient to wet the soil profile to depth, with excess water reaching the water table.

In summer, the soil profile dries and becomes more susceptible to disturbance from vehicles and winds.

In active areas that dry out, dust can be readily generated. Normal practice is to treat this with water, which maintains the moisture content of the soil and mitigates dust generation.

3.3.3 Relevant Guidelines

3.3.3.1 Draft Environmental Assessment Guidance (EAG) – Separation Distances Between Industrial and Sensitive Land Uses

Rural land uses occur adjacent to the site and sand extraction activities will need to ensure that these land uses are not impacted. This requires sufficient buffers to be provided between the surrounding land use and the extraction area.

Draft Environmental Assessment Guidance (EAG) – *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2015) states the generic buffer distance for sand quarries as 300–500 metres. A generic buffer relates to the distance at which there is unlikely to be any problems without further investigation and does not mean that smaller buffers are not acceptable. There are many examples within Perth's Metropolitan area where extractive industries operate compatibly within 300 metres of residential or industrial land uses. This outcome is in part due to the low-key nature of the sand extraction works and also the on-site management of issues such as dust.

The excavation area is largely surrounded by paddocks; therefore the majority of the surrounding sensitive premises are located at least 300 metres away from the excavation area which complies with EPA (2015).

The following dwellings are the exceptions:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring landholding.

3.3.3.2 Guidelines for the Prevention of Dust and Smoke Pollution

The Guidelines for the Prevention of Dust and Smoke Pollution published by the Department of Environmental Protection (1996) has been used to assess the classification of the site in relation to the potential for dust generation.

When making the assessments using the guideline there are several key points requiring consideration:

- Dust risk is generally only in the dry summer months.
- The sand readily crusts after wetting and becomes stabilised. It is only trafficked areas of the site that are likely to develop fine dust from the grinding of wheels.
- The perimeter bunds and any vegetation buffers will provide windbreaks and dust fence screening will provide additional screening to the surrounding properties. Existing screening vegetation is shown in Figure 1.
- Water trucks will be used to wet down the site frequently and manage dust risk.

Appendix A of this management plan contains the completed site classification assessment charts (Appendix 1 – Sheet 1). The method of assessment used produced a site classification of low risk as outlined in Table B, acknowledging that only 1 to 5 ha of the sand quarry will only be developed for a sand quarry at any one time, with approximately 7.9 ha being extracted in the first two years.

Table B: Site Classification

Description of Works	Site Classification Score	Site Classification
Bulk Earthworks	(Part A 22 / Part B 18) 396	Classification Site 2 (Low Risk)

3.3.3.3 A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities

The sand mining contractor shall comply with "A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" (DEC March 2011).

The specific measures for a Classification 2 Site (score between 200 and 399) is outlined below:

Provisions:

- The developer shall supply a contingency plan to the local government, which shall detail the activities to be undertaken should dust impacts occur.

Contingency arrangements:

- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust suppression.

- All areas of disturbed land should be stabilised to ensure that the disturbed area exposed at any time is kept to a practical minimum.

The above actions have been adopted in this Dust Management Plan.

3.3.4 Control Measures

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure level under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lots137.

Dust control methods that are available, and will be selected from, are listed below. The most effective by far is the use of water management from a water truck, sprinklers, water canon or other such mechanism.

3.3.4.1 Design and Site

- Minimising the amount of ground open at any one time.
- Minimising the amount of ground being subject to traffic.
- Locating access roads away from sensitive premises.
- Design of the pit to reduce wind speed and potential dust lift off.
- Maintaining effective setbacks.
- Construct perimeter bunds to reduce wind speed.
- Maintain tree/vegetation buffers.
- Providing windbreak fencing generally and on top of bunds as required.
- Maintaining a secure, fenced site, to prevent illegal access.
- Rehabilitate and stabilise all completed areas as soon as practicable.
- Clearing and replacing topsoil and overburden during wetter times – April to October.

3.3.4.2 Operations

- Locate active areas away from windy locations.
- Locate active areas away from sensitive premises.
- Working on the floor of the pit.
- Operate some parts of the pit only when conditions are suitable.
- Locating mobile plant and stockpiles in sheltered areas.

- Design staging to minimise dust risk.
- Conduct higher dust risk operations such as topsoil clearing and placement during more favourable conditions.
- Shut down equipment that is not required.

3.3.4.3 Access and Hardstand

- Constructing the access roads from hard materials that resist dust generation.
- Maintaining a water truck on site for road and other wetting down. Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
- Using a sealant such as a polymer, chemical or emulsified oil or bitumen on the access road to reduce water use.
- Using sprinklers and/or water canon on roads, traffic areas and stockpiles.

3.3.4.4 Processing

- Applying water sprays and additives to the screening cycles.
- Providing screening and shielding of mobile plant.
- Use and maintain filters on all suitable plant.
- Ensure regular appropriate emptying of filter collection devices.
- Face hoppers away from prevailing winds.
- Maintain reduced pressure in plant, hoppers and bins to prevent loss of dusty air.

3.3.4.5 Stockpiles

- Minimise the number of stockpiles.
- Maintain stockpiles in sheltered areas.
- Reduce the elevation of stockpiles.
- Limit the drop height to stockpiles and loading.
- Locate finer products inside or screened by stockpiles of coarse materials.

3.3.4.6 Transport

- Cover all loads.
- Ensure all trucks are dust free and not carrying pebbles and other materials outside the tray.
- Choose the best transport routes.
- Wet down or sweep the cross-over and access roads.

3.3.4.7 Health and Community

- Maintain air-conditioned cabins on all vehicles.
- Provide a readily auditable trigger of no visible dust to cross the property boundary in line with DER Licence and best practice in WA.
- Conduct effective site induction and awareness training for all staff.

- Training should include observation and mitigation where possible of all dust emissions.
- Providing a complaints investigation, mitigation and recording procedure.
- Liaising with the owners/operators of the two nearby sensitive premises.
- Ceasing operations when conditions are not favourable or when visible dust is crossing the boundary.
- Obtain the latest weather conditions to increase the awareness of dust risk.
- Cease operations during adverse weather conditions.
- Operate during wetter months or when the soils are moist.

Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation will be undertaken during the wetter months to reduce the generation of dust.

Completed sections of the quarry are to be stabilised and not subject to traffic as soon as practical to reduce the area of open ground and help reduce wind speed. In the event of dust management not being able to be achieved, and to minimise impact on adjoining landholders, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining landholders.

A record of all dust complaints will be retained together with the mitigation measures used to reduce the dust impacts.

3.3.5 Procedure for Dealing with Dust Complaints

It is intended that the following procedure be adopted in the event of a dust complaint (based on proof dust is being emitted from the extraction area):

1. It is proposed that all complaints received by kept in a "complaint register" and maintained by the sand mining contractor site supervisor.

2. It is likely that a complaint will be lodged with either the sand mining contractor or the Shire of Serpentine-Jarrahdale. Upon receiving the complaint the following information shall be recorded:
   a. Name and contact details of complainant.
   b. Date and time of complaint and date and time of occurrence of dust.
   c. Details of complaint and effect of dust on property.
   d. Investigations of the complaint.
   e. Results of the investigation.
   f. If the complaint is valid, any mitigation actions that result.
   g. Any communication with the complainant.

The below Table C is an example of the proposed Site Register of Complaints Received.

Table C: Site Register of Complaints Received

Complainant's Name	Address	Contact Details	Date and Time of Complaint	Date and Time of the Occurrence	Details of the Complaint and Effect on Property

At the time of receiving the complaint, the person receiving the complaint shall offer an explanation for the dust, if possible. If an explanation cannot be made the person receiving the complaint shall advise the resident that the matter will be investigated and the resident will be notified of the outcome or appropriate action taken or to be taken within 24 hours.

- Details of the complaint shall be forwarded to the sand mining contractor in the event that the complaint was received by the Shire of Serpentine-Jarrahdale. All complaints shall be forwarded even if the complainant seemed content with the explanation given for the occurrence of dust.

- The contractor will investigate the complaint through discussion with the complainant and agree a course of action. The contractor will record the course of action taken in the complaint register and covey the agreed action to the person who took the complaint who will in turn inform the complainant.

- The contractor will confirm with the Shire of Serpentine-Jarrahdale that the matter has been dealt with and resolved if required. The contractor shall also provide copies of any correspondence or documentation when requested to do so.

3.4 Dust Monitoring Program

The auditable condition for dust monitoring is visible dust crossing the boundary of the premises, which is the lot boundary. This is the condition used on Department of Environment Regulation Licences and all other sand quarries in Western Australia.

Specific management measures will include:

- review of complaints received in the past week and action taken

- review of status of any previously lodged complaints

- degree of compliance by the contractor with the contract conditions

- review of weather conditions and need or otherwise for additional water carts, temporary stabilisation, wind fencing, etc.

3.4.1 Visual Dust Monitoring

The trigger for dust management will be the generation of visual dust.

The sand contractor is responsible for site supervision of dust and are in two way radio contact with all mobile plant.

All operators on site will be instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues.

When trigger conditions are detected and/or alerted, relevant action will be taken such as additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment, etc.

3.4.2 Liaison

A liaison program will be commenced with nearby and adjoining residents. An advisory note will be sent to the landowners of:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring land holding[1].

The proposed advisory note is detailed below.

> **Advisory Notice to Residents**
>
> Excavation of sand of the above land is being planned. There will be progressive stages starting in 2018. The development is being carried out by a sand mining contractor and the works are scheduled to commence following all statutory approvals. A 20 metre buffer will be retained around the boundary of the property by the sand mining contractor in order to minimise inconvenience to residents.
>
> It is a requirement that this development must adopt adequate measures to prevent the generation of unacceptable levels of dust. You are advised that the landowner and the sand mining contractor have agreed to implement the provisions as outlined in the Department of Environmental Regulations publication "A guideline for the prevention of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" March 2011 (a copy of this guideline may be obtained from http://www.der.wa.gov.au/).

[1] RPS understands that House No. 514 is subject to an EIL Application, with the existing dwelling proposed to be used as a site office, and therefore the potential impacts relating to Amenity have been specifically assessed in relation to the dwellings located on House No. 446.

Should you feel that excessive dust is being generated due to this development, you are advised to contact the Site Supervisor for the sand mining contractor, (TBA) by telephoning (TBA) to discuss the issue.

A sign will be placed at the entrance to the site with contact phone numbers and email address of the sand mining contractor site supervisor to enable members of the community to contact the company in the event of a dust issue.

3.5 Procedure for Dealing with Disputes

In the event that an adjoining land user is dissatisfied with the outcomes of their dealings with the sand mining contractor, or if directed by the Shire of Serpentine Jarrahdale, the contractor shall inspect the alleged damage and, if there is proof that the dust originates from the site, make good any damage that is resulting from the release or escape of dust from their site

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4.0 CONCLUSION

It is not possible to guarantee absolutely that dust will not emanate from the site. However, it is considered the tight construction specification will minimise the potential for dust impacting on residences.

Prior to commencement of construction, the sand mining contractor will review the potential for dust, noise and vibration nuisance associated with the earthworks. Agreement as to how such nuisances shall be minimised will be reached as generally outlined in this document.

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5.0 REFERENCES

Department of Environment and Conservation. 2011b. A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities. Kensington: Western Australia.

Environmental Protection Authority. 2015. Draft Guidance Statement Separation Distances between Industrial and Sensitive Land Uses. Perth, Western Australia.

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RPS

FIGURES

RPS

Job Number: L1505503_DMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_DMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

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APPENDIX I

Site Classification Assessment Chart

APPENDIX 1: Site Classification Assessment Chart

Item	Score Options								Allocated Score
Part A – Nature of Site									
1. Nuisance potential of soil when disturbed	1	very low		Low	4	**Medium**	6	high	**4**
2. Topography and protection provided by undisturbed vegetation	1	sheltered & screened	6	medium screening	12	little screening	18	exposed & wind prone	**6**
3. Area of site disturbed by the works	1	under 1 ha	3	**1 ha to 5 ha**	6	5 ha to 10 ha	9	over 10 ha	**3**
4. Type of work being done	1	roads or shallow trenches	3	roads, drains and medium depth sewers	6	road, drains, sewers and partial earthworks	9	**bulk earthworks deep trenches**	**9**
Total score for Part A									**22**
Part B – Proximity of Site to Improvements									
1. Distance of other land users from site	1	over 1 km	6	1 km to 500 m	12	500 m to 100 m	18	under 100	**12**
2. Effect of prevailing winds (at time of construction) on other land users	1	not affected	6	isolated improvements affected by one wind direction	9	dense improvements affected by one wind direction	12	dense/sensitive improvements highly affected by prevailing winds	**6**
Total Score for Part B									**18**
Site Classification Score									**396**

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APPENDIX 2

Dust Management Actions

APPENDIX 2: Dust Management Actions

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
General				
Legislation	-	Comply with the provisions of the *Mines Safety and Inspection Act 1994* and Regulations 1995.	The sand mining contractor will comply with the Act and Regulations at all their pits.	-
Buffers	-	Maintain adequate buffers to sensitive premises.	Buffers are similar to existing operating limestone quarries. All residents within 500 metres will be consulted during the assessment process.	-
Landform	-	Locate activities behind natural barriers, landform and vegetation.	The design of the pit and staging has been selected to provide the best screening. Excavation is conducted below the land surface. Excavation will produce a significant void, up to six metres below natural ground level. The processing and stockpile facilities are to be located on the base of the pit below ground level.	-
Landform				
Landform	-	Work below natural ground level.	This is proposed. Excavation will produce a significant void, up to six metres below natural ground level.	-
		Push overburden and inter-burden dumps into positions where they can form screening barriers.	The bunds will be extended around the perimeter of the excavation area prior to extraction in each particular stage.	-
Staging	-	Design operational procedures and staging, to maximise the separation to sensitive premises.	The design of the pit and excavation has been determined to operate from the floor of the pit from the centre outwards, always behind the face and bunds.	-
Pit design	-	Design the excavation to provide enhanced landform and constructed dust screening.	See above	-
Screening/ Vegetation	-	Use landscape screening, windbreaks and tree belts.	Vegetation is in place around all perimeters. Interim seeding with grass will be used as a surface stabilisation option. On the periphery of the site trees will be planted	-

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Management				
Operation	-	Provide air conditioned closed cabins on plant	These are used on site for operational mobile plant.	-
Monitoring	-	Provide monitoring and supervision of the processing and other practices on site.	A monitoring system is proposed. See below “Trigger Conditions”.	-
Trigger conditions	-	Trigger conditions are used to determine when additional dust management is required.	Most dust generated from processing and vehicle movements has a very large visible component. Lesser risks emanate from excavation and opening new ground. The trigger for dust management is the generation of visual dust. The quarry manager and leading hands are ultimately responsible for site supervision of dust. A commitment is made that no visible dust will cross the lot boundaries. They travel around the operations and pit frequently and are in two-way radio contact with all mobile plant. All operators on site are instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues. When trigger conditions are detected and/or alerted relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc. as outlined in the Dust Management Plan.	-
Adverse weather	Moderate–Uncommon	When winds are sufficiently strong, or other weather conditions are unacceptable, to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.	Rare adverse conditions are more likely to occur during summer mornings and summer afternoon sea breezes. In winter, stronger winds are normally associated with rain and therefore carry a reduced dust risk. This policy is used to minimise impact on adjoining landholders/ dwellings and the urban areas.	Low
Equipment failure	Low–Uncommon	In the event of dust management not being able to be achieved through equipment failure operations will cease until full capability is restored.	This is committed to.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Training	-	Conduct training programs on dust minimisation practices.	The sand mining contractor will use on site induction and training to all personnel at all operations.	-
Complaints	-	Provide complaints recording, investigation, action and reporting procedure such as Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996.	All residents within 500 metres of the proposal will be consulted by the sand mining contractor during the assessment process. A record of all dust complaints is to be maintained together with the mitigation measures to be used to reduce the dust impacts. All complaints relating to dust are to be investigated immediately on receipt of a complaint. Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996, will form the basis of the methods on which a complaint on dust is dealt with. A record of complaints is maintained.	
Earthworks				
Land Clearing	Low – Once per year	Schedule activities such as vegetation removal or topsoil stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	Normally the opening of new ground and the subsequent use in rehabilitation is undertaken in the drier months when the soils are still moist enough to suppress dust but not wet. This is necessary to minimise the risk of dust generation and the spread of dieback spores if present. Nearby residents will be notified prior to large scale clearing that may generate significant environmental dust.	Low
Overburden removal	Low – Once per year	Schedule activities such as overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Overburden removal will be infrequent. Where possible overburden removal will be completed in wetter months or when winds are blowing away from sensitive premises.	Low
Construction of bunds	Low–High – Once per year		Construction of bunds can lead to dust generation if conducted in summer when the topsoils are dry. Where possible bunds will be constructed in drier months when the soils are still moist. If this is not possible water sprays and other wetting down will be used to reduce the potential for dust generation and movement. The bunds will be constructed prior to the excavation in each part of the pit. The bunds will be revegetated during the first winter following construction with local native trees and shrubs to assist in stabilising their surface.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Land Restoration	Low – Once per year.	Schedule activities such as ripping, overburden and topsoil spreading on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Land restoration will be infrequent and normally conducted only once per year. Where possible clearing will be completed in wetter months or when winds are blowing away from sensitive premises. Completed sections of the quarry are to be excluded from activity as soon as practical to reduce the area of active “uncrusted/stabilised” open ground. Stabilisation of the limestone will occur through lack of traffic, crusting from wetting down the limestone and using whatever dust management actions are appropriate, as listed above in the Dust Management Plan.	Low
Excavation				
Excavation	Low – Low level continuous activity	Excavate from the face using techniques that minimise the crushing of dry matter.	Excavation will be normally completed by bulldozer deep ripping and track rolling limestone. When freshly exposed at any time of year the limestone is normally moist and has less capability to generate dust. It is only when air-dried that dust becomes a greater issue. Limestone that is wetted or rained upon rapidly stabilises and forms a hardened crust. This is resistant to erosion until disturbed by traffic. A range of actions will be used on areas that are susceptible to dust lift-off such as sand and disturbed limestone. These will include watering, emulsion, windbreaks, and other stabilisation as required. A water truck is to be used as required to wet down the loading areas. The dust management actions listed above in the Dust Management Plan will be used as appropriate to minimise dust generation and lift-off. At the end of each day in summer the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active.	Low
Loading at Face	Low – Low level continuous activity	Ensure that products to be loaded are moist and that the hardstand on which the loading occurs is wetted down or moist.	This will occur on the floor of the pit. Excavation normally does not generate significant dust. The dust originates from the wheel movements. Air dried product will be wetted down with water canon or other methods. Operational hardstand will be wetted down when dry. Other contingencies will be used relating to operating times, additional water or sealant treatment and ceasing operations in adverse conditions. A water truck is to be used as required to wet down the loading areas. Water can also be applied from water cannon, or sprinklers	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Haulage	Moderate–Medium level continuous activity	Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	Haul roads are to be regularly graded and maintained. They are to be watered regularly and have speed limits imposed. Alternatively they may be treated with stabilisers to reduce the potential for dust. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift-off when the site is not active.	Low
		Reduce the length of the internal roads by maximising internal servicing efficiency.	The haul roads are designed to reduce travel distance to save maintenance costs and time and to maintain efficiency and minimise greenhouse gas emissions.	
		Providing speed management on hardstand and the road network.	This is used.	
		Provide air-conditioned closed cabins on plant.	All vehicles are air-conditioned.	
		Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat.	A dedicated water truck is to be maintained on site and used as required during the drier months.	
Plant – Processing				
Hardstand traffic	Low – Low key ongoing activities	Maintain hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades	The hardstand areas that are subject to traffic are limited in area but are able to be watered by the dedicated truck as required. Non-traffic areas rapidly crust and stabilise.	Low
Inactive periods	Low–Moderate	Leave the operations in a manner such that dust lift off is minimised.	The bunding and perimeter vegetation will reduce wind speed and increase screening. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active. Inactive areas readily crust and seal the surface. A comprehensive liaison with the closest residents and the caretaker will provide a means of monitoring for visual dust at times of inactivity.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Processing	Moderate–Continuous	Treat processing areas with water sprays, shields and dust extraction.	Effective maintenance of the hardstand combined with adequate water treatment is used to minimise dust. Water treatment is most commonly carried out by water truck. Crushing operations are to be watered as required to suppress dust. Dust covers and equipment shields are maintained on all static plant where they are practicable. Continuous visual monitoring of dust is used. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed in site operations.	Low
Mobile and static plant Operation	Moderate–Continuous	Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate.	Operators are instructed to visually monitor dust, report and treat any visible dust. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed. Dust management and monitoring forms part of the site induction programs. Faults are to be repaired promptly. Regular maintenance programs for all dust suppression equipment are proposed. Dust management and monitoring forms part of the site induction programs. See Processing, above.	Low
		Shut down equipment when not in use.	The sand mining contractor will adopt this measure to save fuel and maintenance costs in addition to noise minimisation.	
Loading and Stockpile Creation	Moderate–Continuous	Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	Low
		Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Transport				
		Maintain access roads in good condition (free of potholes, rills and product spillages).	The first 30 metres of road and cross over will be sealed. Effective maintenance of the hardstand and access road in addition to a sealed crossover will be used to minimise dust.	
Road condition	Low–Moderate	Water and/or treat access roads and paved areas using a water tanker or sprinkler system.	See above. Internal roads are regularly watered as often as necessary to minimize dust generation. A dedicated water truck is to be retained on site and used when dust lift off is a potential hazard.	Low
		Wet down or cover loads on trucks that are likely to blow during transport.	Trucks are required to be covered or wetted down prior to exiting the site as required when transporting sandy and other materials that can blow.	
Road Transport	Low–Frequent	Implement a site code outlining requirements for operators and drivers.	A site code and induction system is used.	Low
		Avoid spillages on roads and clean up promptly.	Covering and wetting down loads as required and instructs drivers to report and clean up spillages.	
		Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport.	This forms part of the sand mining contractor operational procedures.	
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	Low
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	
		Wet down stockpiles using water canon or sprinklers as required.	Stockpiles will be assessed for their dust lift off potential and are treated accordingly. Where required wetting down is to be used. Sprinklers and water canon are proposed where necessary. Limestone stockpiles readily form a crust that protects from dust lift off. Sand from stockpiles moves by saltation up to 1 metre off the ground and is unlikely to escape the quarry faces, as they will be located on the floor of the pit.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Stockpiles				
Stockpiles	Moderate	Locate stockpiles behind bunds/ windbreaks or other screening barriers	This is normal practice. There are perimeter vegetated bunds in place. Finer materials will be located where dust lift-off is minimised.	
		Reduce the height of stockpiles. Low flat stockpiles are less likely to be disturbed by wind than high conical ones.	The height of stockpiles is maintained at manageable levels that remain sheltered from the prevailing winds.	
		Wash crushed products where necessary.	The limestone products do not need washing.	
		Locate coarser products around fine materials to assist wind protection of the finer products that are more likely to blow or contain greater amounts of dust.	Not applicable to an operation such as this	
		In extreme conditions stockpiles can be covered although this is often not practical.	This is not normally practical and liftoff will be managed by wetting down and locating stockpiles on the floor of the pit.	
		Provide bunding, fencing and windbreaks around stockpiles and along the tops of bunds.	Perimeter buffer vegetation and bunding is in place	

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APPENDIX 3

Herring Storer Acoustic Assessment

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
Suite 34, 11 Preston Street, Como, W.A. 6152
P.O. Box 219, Como, W.A. 6952
Telephone: (08) 9367 6200
Facsimile: (08) 9474 2579
Email: hsa@hsacoustics.com.au

MICHELLE AND CRAIG MCALLISTER

SAND EXTRACTION OPERATIONS

LOT 137 HOPELAND ROAD, HOPELAND

ACOUSTIC ASSESSMENT

NOVEMBER 2016

OUR REFERENCE: 21103-1-16241

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ACOUSTIC ASSESSMENT
HOPELAND

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FOR

MICHELLE AND CRAIG MCALLISTER

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A Figure A1 – Site Layout

B Noise Contours

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Roberts Day, on behalf of Michelle and Craig McAllister to undertake an acoustic assessment of noise emissions from a proposed sand extraction operation site located at Lot 137 Hopeland Road, Hopeland.

The sand extraction component of the operation entails the usage of a front end loader and a screen.

This assessment takes into account the cumulative noise level of both the sand extraction and the transport of sand off site via semi-trailer. The assessment is provided to support the works approval process.

Operational hours for the site are proposed to be Monday to Friday 07:00 to 17:00 hours (excluding Public Holidays) and Saturday's 07:00 to12:00 hours.

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

- Identification of individual operations and the associated noise levels.
- Assess the predicted noise levels at the nearest surrounding noise sensitive premises for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, a locality plan is shown in Appendix A.

2. SUMMARY

Assessment has been conducted on the proposed sand extraction operation at Lot 137 Hopeland Road, Hopeland.

The applicable criterion for this assessment is 48 dB(A) for the nearest residential location.

Noise received at the nearest residential premises has been determined, to be 40 dB(A) for the sand extraction operations.

The above noise levels have been considered to contain tonal characteristics, therefore contain a +5 dB(A) penalty. Thus, the assessable noise level at the worst case receiver location (i.e. Location A) would be 45 dB(A).

Given these operating parameters, noise levels received at the nearest premises has been calculated to comply with the *Environmental Protection (Noise) Regulations 1997* for the operating times as outlined in this assessment.

3. CRITERIA

The allowable noise level at the surrounding locales is prescribed by the *Environmental Protection (Noise) Regulations 1997*. Regulations 7 & 8 stipulate maximum allowable external noise levels determined by the calculation of an influencing factor, which is then added to the base levels shown below. The influencing factor is calculated for the usage of land within two circles, having radii of 100m and 450m from the premises of concern.

TABLE 1 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Noise sensitive premises	0700 - 1900 hours Monday to Saturday (Day)	45 + IF	55 + IF	65 + IF
	0900 - 1900 hours Sunday and Public Holidays (Sunday / Public Holiday Day Period)	40 + IF	50 + IF	65 + IF
	1900 - 2200 hours all days (Evening)	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays (Night)	35 + IF	45 + IF	55 + IF
Industrial and Utility Premises	All Hours	65	80	90

Note: L_{A10} is the noise level exceeded for 10% of the time.
L_{A1} is the noise level exceeded for 1% of the time.
L_{Amax} is the maximum noise level.
IF is the influencing factor.

It is a requirement that received noise be free of annoying characteristics (tonality, modulation and impulsiveness), defined below as per Regulation 9.

"impulsiveness" means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax\ Slow}$ is more than 15 dB when determined for a single representative event;

"modulation" means a variation in the emission of noise that –

(a) is more than 3dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;
(b) is present for more at least 10% of the representative assessment period; and
(c) is regular, cyclic and audible;

"tonality" means the presence in the noise emission of tonal characteristics where the difference between –

(a) the A-weighted sound pressure level in any one-third octave band; and
(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

Where the noise emission is not music, if the above characteristics exist and cannot be practicably removed, then any measured level is adjusted according to Table 2 below.

TABLE 2 - ADJUSTMENTS TO MEASURED LEVELS

Where **tonality** is present	Where **modulation** is present	Where **impulsiveness** is present
+5 dB(A)	+5 dB(A)	+10 dB(A)

Note: These adjustments are cumulative to a maximum of 15 dB.

The nearest potential noise sensitive premises to the proposed development have been identified using the area map in Figure 1. Due to its proximity to the extractive industry, Location A's influencing factor has been assessed as 3 dB(A). All other noise sensitive premises have an influencing factor of 0 dB. It is noted that Location A appears to be have no permanent occupant, with occasional weekend horse related events occurring. In saying this, to provide a conservative assessment, this location has been treated as a noise sensitive premise.

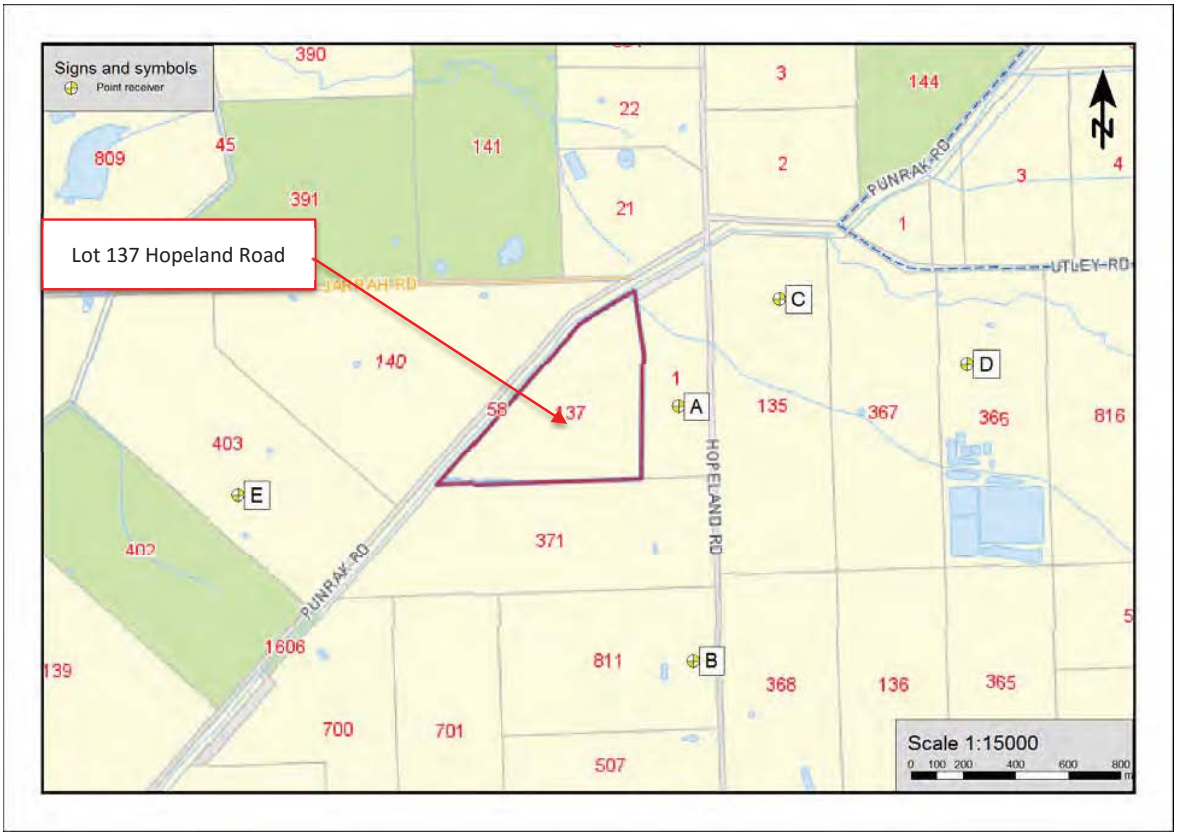


FIGURE 1 – RECEIVER LOCATIONS

Therefore, the assigned noise level is as noted in Table 3.

TABLE 3 - ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Location A	0700 - 1900 hours Monday to Saturday (Day)	48	58	68
Location B to E		45	55	65

4. CALCULATED NOISE LEVELS

Noise immissions[1] at the nearest neighbouring residential premises, due to noise associated with the proposed sand extraction operations, were modelled with the computer programme SoundPlan. Sound power levels used for the calculations are based on measured sound pressure levels of similar equipment proposed for use on site.

The modelling of noise levels has been based on noise sources and sound power levels shown in Table 4.

TABLE 4 – SOUND POWER LEVEL - NOISE SOURCES dB(A)

Element name	Unit	Frequency Hz										dB(A)
		31.5	63	125	250	500	1k	2k	4k	8k	16k	Sum
Screening Plant (McCloskey S190)	dB(A)/unit	66	80	84	90	93	95	95	95	87	-	101
Truck (Semi-trailer Tipper)	dB(A)/unit	42	60	62	66	72	81	85	90	70	62	95
		45	59	61	73	76	82	84	76	68	59	
		54	58	63	71	78	84	86	73	66	53	
Loader (WA430)	dB(A)/unit	46	72	73	80	86	93	90	87	82	69	105
		48	60	70	81	89	93	91	86	78	63	
		58	68	76	85	91	91	89	88	73	54	

Due to the nature of sand extraction operations, generally the screen and front end loader operate in the confines of a "pit". Whilst the pit tends to move with the operations, the barrier effect of the confines (pit walls and stockpile) is always present. For this operation, it is proposed that the sand extraction will start in the south east corner and extent towards the north west corner of the premise.

Based on noise emissions[2] from the above equipment, an overall, worst case operating scenario has been developed. This scenario allows for all equipment to be operating at the same time, within the centre of the proposed pit. The pit has been assumed to provide a barrier at around 3m in height. Figure 2 shows a typical operating screen and loader, with the surrounding barrier effect for a similar sand extraction operation.

FIGURE 2 – LOADING AND SCREENING OPERATIONS WITHIN A PIT (SIMILAR SAND EXTRACTION TO PROPOSED OPERATIONS)

1 Immissions – noise received at a source
2 Emissions – noise emanating from a source and / or location

The design layout and site configuration, including source location is shown in Appendix A, Figure 2.

This is understood to be representative of the maximum noise levels associated with the proposed sand extraction site.

The following input data was used in the calculations:

a) Provided backgrounds;

b) Sound Power Levels listed in Table 4; and

c) Ground contours and receiver point provided by client.

Weather conditions for modelling were as stipulated in the Environmental Protection Authority's "*Draft Guidance for Assessment of Environmental Factors No. 8 - Environmental Noise"* and for the day period are as listed in Table 5.

TABLE 5 – WEATHER CONDITIONS

Condition	Day
Temperature	20°C
Relative humidity	50%
Pasquill Stability Class	E
Wind speed	4 m/s*

* From sources, towards receivers.

5. RESULTS

Calculated noise levels associated with the noise emissions from the proposed sand extraction for the assumed scenario is summarised below in Table 6. Appendix B contains the noise contour plot.

TABLE 6 – CALCULATED NOISE LEVEL

Receiver	Scenario 1
	All Equipment Operating
A	40
B	32
C	34
D	25
E	28

6. ASSESSMENT

Based on calculated noise levels at the nearest premises, noise levels could be considered as being tonal in characteristics. Therefore, a +5 dB(A) penalty has been included to allow for a tonal component.

Hence, Table 7 summarises the applicable Assigned Noise Levels, and assessable noise level emissions, for the scenario considered.

TABLE 7 – ASSESSMENT OF NOISE LEVELS

Receiver	Scenario 1
	All Equipment Operating
A	40 (45)
B	32 (37)
C	34 (39)
D	25 (30)
E	28 (33)

( ) include a +5 dB(A) penalty for tonal characteristics.

Based on the assessable noise level above, comparison against the relevant assigned noise level is contained in Table 8.

TABLE 8 – ASSESSMENT OF NOISE LEVELS

Premises Receiving Noise	Assessable Noise Level dB(A)	Time of Day	Assigned Level (dB)	Compliance
A	45	0700 - 1900 hours Monday to Saturday (Day)	48	Complies
B	37		45	Complies
C	39			Complies
D	30			Complies
E	33			Complies

7. CONCLUSION

Assessment has been conducted on the proposed sand extraction operation at Lot 137 Hopeland Road, Hopeland.

The applicable criterion for this assessment is 48 dB(A) for the nearest residential locations.

Noise received at the residential premises has been determined, to be 40 dB(A) for the sand extraction operations, for the worst case operating scenario.

The above noise levels have been considered to contain tonal characteristics, therefore contains a +5 dB(A) penalty. Thus, the assessable noise level at the worst case receiver location (i.e. Location A) would be 45 dB(A).

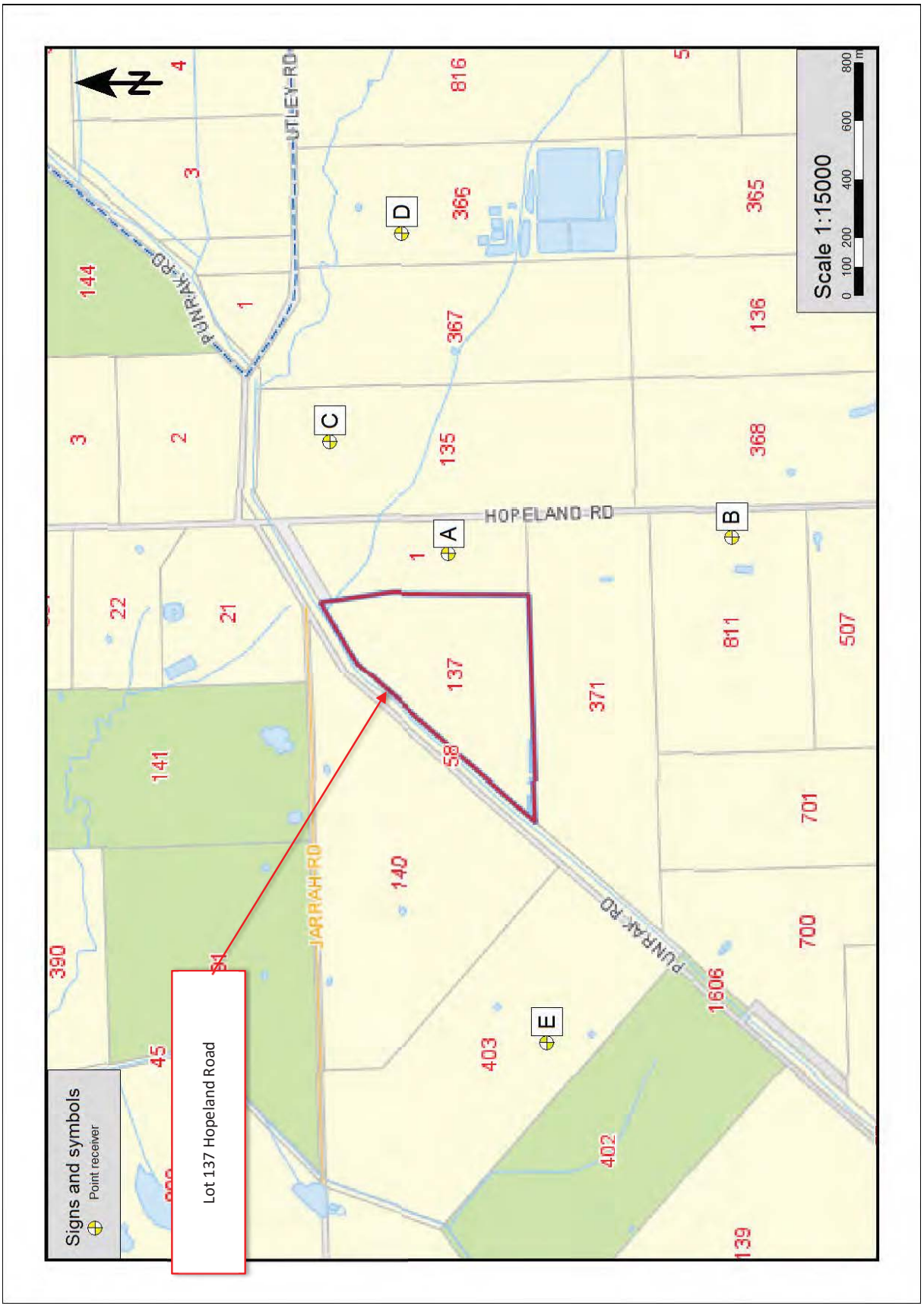
Given these operating parameters, noise levels received at the nearest premises has been calculated to comply with the *Environmental Protection (Noise) Regulations 1997* for the operating times as outlined in this assessment.

APPENDIX A

FIGURE A1 – LOCATION MAP
FIGURE A2 – RECEIVER LOCATION

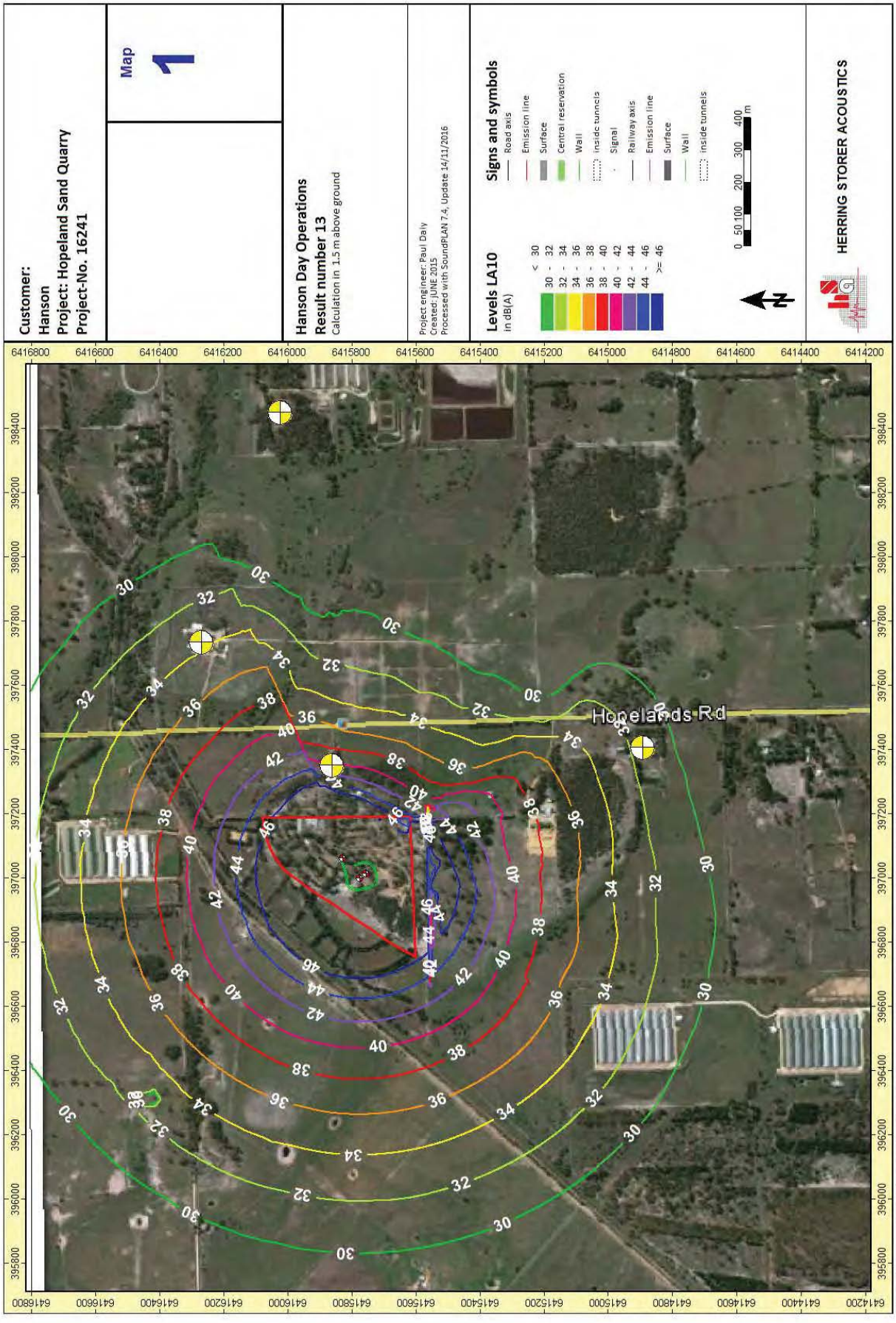
FIGURE A1 – SITE LAYOUT

FIGURE A2 – RECEIVER LOCATION



APPENDIX B

Noise Contours


Customer:
Hanson
Project: Hopeland Sand Quarry
Project-No. 16241
Map
1
Hanson Day Operations
Result number 13
Calculation in 1.5 m above ground
Project engineer: Paul Daly
Created: JUNE 2015
Processed with SoundPLAN 7.4, Update 14/11/2016
Levels LA10
in dB(A)
< 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
40 - 42
42 - 44
44 - 46
>= 46
Signs and symbols
Road axis
Emission line
Surface
Central reservation
Wall
inside tunnels
Signal
Railway axis
Emission line
Surface
Wall
inside tunnels
0 50 100 200 300 400 m
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Hopelands Rd
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RPS

APPENDIX 4

Dust Management Plan

DUST MANAGEMENT PLAN

Lot 137 Punrak Road, Hopelands

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:2

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Disclaimer

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(compiled at rear of report)

Figure 1: Site Location

Figure 2: Staging Plan

APPENDICES

APPENDIX 1 Site Classification Assessment Chart

APPENDIX 2 Dust Management Actions

1.0 INTRODUCTION

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

This Dust Management Plan (DMP) has been prepared to demonstrate that dust caused by sand extraction activities at 137 Punrak Road, Hopeland ("the site") can be effectively managed. The DMP supports the Development Approval (DA) and an Extractive Industry Licence (EIL) to extract the Bassendean sand from a 11.2 ha portion of the site. Sand extraction activities within this area will be staged, with a maximum of approximately 7.9 ha extracted in the first two years (Figure 2).

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the figure 2 staging plan subject to the following requirements:-

a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as 'proposed retention' and 'proposed 20 m buffer'.

b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works; and

c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

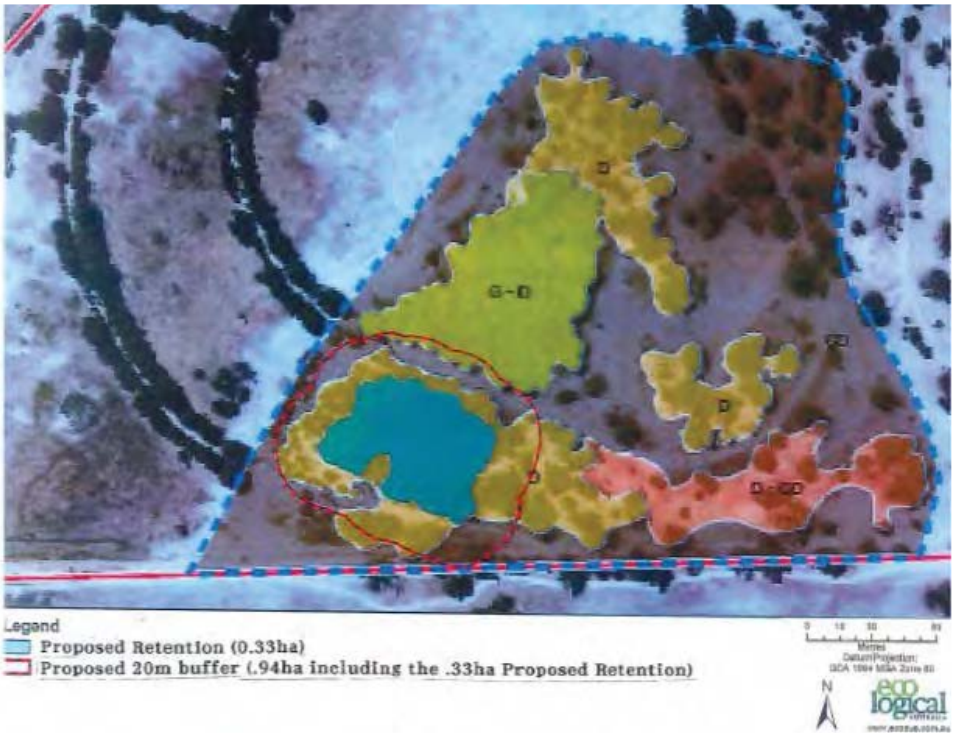

Figure A: Ecological Retention Plan

This management plan is set out as follows:

Section 2.0 The Works

Section 3.0 Dust Management Plan

Section 4.0 Conclusion

2.0 THE WORKS

The site is approximately 30 ha and the extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand). Sand extraction activities are scheduled to commence in 2018 and will be undertaken in four consecutive stages, with approximately 7.9 ha extracted in the first two years. Sand extraction works will be undertaken by Hanson.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

It is also important to note the proposed sand screening will be subject to a Department of Environment Regulation (DER) works approval and registration under Part V of the *Environmental Protection Act 1986*.

The extent of the sand mining area is shown on Figure 1 and Table A provides an overview of the proposed sand extraction activities.

Table A: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Life of the project	Approximately three to five years
Sand Volumes	Approximately 1 million m^3
Dewatering requirements	Nil
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.

Project Component	Proposal Characteristic
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Water Trucks	Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

2.1 Overview of Extraction Process

The excavation of sand will generally involve the following, to be undertaken in stages across the proposed sand extraction area as outlined in the staging plan (Figure 2):

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- Vegetation clearing will involve the use of wheel loader or excavator to push over the trees, before they are mulched. The mulch will be stockpiled for use within the site.

- Topsoil removal and stockpiling. Topsoil removal will comprise the first 100 mm to 300 mm of the soil being scraped and then stockpiled within the site for use as part of the decommissioning and rehabilitation process. Topsoil and overburden will be stored adjacent to the area of excavation, or will be returned directly being behind the advancing face of the extraction area.

- Each extraction stage of the sand excavation is expected to be approximately between 0.8 ha to 4.4 ha in size, with a cap of approximately 7.9 ha extracted in the first two years. Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

- Sand will be distributed from the site via road haulage. The primary haulage routes are expected to be north and south along Hopeland Road onto Karnup Road and Lakes Road respectively, and then east or west to and from the Kwinana Freeway or South Western Highway.

- Reforming of the land post-excavation is proposed to be undertaken using a wheel loader of excavator to push the topsoil into place. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three horizontal to vertical in accordance with Shire of Serpentine–Jarrahdale Extractive Industries Local Law 1999. Rehabilitation will progressively follow excavation wherever possible.

2.1.1 Interface Management with Lot 371 Hopeland Road

The directly neighbouring property to the south of the site (Lot 371 Hopeland Road) currently has an active EIL for the extraction of sand from their property. The proposed extraction area of the site will abut the extraction pit of the adjoining property.

The current extraction proposal in accordance with the Shire's Local Law incorporates a 20 m buffer from the neighbouring sand quarry boundary. The neighbouring sand quarry finish floor level is 1.282 m from the maximum annual average groundwater peak. The sand quarry within Lot 137 Punrak Road proposes an initial finish floor level of 2 m from the maximum annual average groundwater peak.

In the future, if agreed by both landowners (Lot 137 Punrak Road and Lot 371 Hopeland Road) to combine the two extraction areas to maximise the removal of the valuable sand resource both quarry operators will provide the following:

1. Provide the Shire with a cross-section of the finish floor levels across the two sand quarries.

2. Update the Rehabilitation Management Plan focus on a consistence interface treatment for both sand quarries at the boundary.

3. If Lot 137 sand quarry proposes to excavate below the 2 m from the maximum annual average groundwater peak (i.e. consistent with the neighbouring sand quarry of 1.282 m) then the Water Management Plan will need to be updated accordingly and approved by the Shire.

2.2 Primary Contacts

The sand mining contractor is the party responsible for the overall project. Any complaints in relation to dust nuisance should in the first instance be directed to the Site Supervisor.

2.3 Timing of Works

Works are scheduled to commence once all approvals are in place, anticipated to commence in 2018.

2.3.1 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2. A maximum of approximately 7.9 ha will be excavated in the first two years of sand mining. The purpose of this approach is to allow for up to 18 months of groundwater monitoring which provides site-specific groundwater levels which would inform a revised finished floor level of approximately 1.28 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation.

Any open areas in these first two years of sand mining will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

3.0 DUST MANAGEMENT PLAN

3.1 Responsibility

The landowner will enter an agreement with a sand mining contractor. The sand mining contractor will be responsible for the effective control of all dust, smoke and wind borne material emanating from the sand quarry.

The sand mining contractor and the landowner are both responsible for the full duration of the mining contract in accordance with the DA and EIL approval.

3.2 Smoke Nuisance

There will be no prescribed burning / fires within the site. Any clearing of vegetation will be in accordance with the Department of Environment Regulation Purpose Permit clearing approval.

It is considered that there is only a low risk of smoke nuisance principally because prescribed burning is prohibited on site.

3.3 Dust Nuisance

3.3.1 Dust Risk

Excessive dust has the potential to impact on both workers on site and the adjoining land users. Dust can originate from a number of operations and may impact on-site workers or travel off site. Potential dust impacts are addressed by reducing the dust generated from the quarrying, processing and transport operations.

The main risk from dust is not the sand, but rather the fine organic particles that are generated during land clearing and reinstatement, and most importantly the fine particles generated by transport along access roads and traffic areas.

The main risk is therefore from the fine organic matter in the topsoil, any clay within the sand or calcium carbonate that is broken down through tyre impacts or disturbance. There is also the risk from the tipping processes.

Dust has the potential to be generated during most phases of the quarrying operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions.

3.3.2 Climate and Soil Conditions

Through the winter months of May to September exclusive, there is little dust risk because rainfall exceeds evaporation. The rainfall is sufficient to wet the soil profile to depth, with excess water reaching the water table.

In summer, the soil profile dries and becomes more susceptible to disturbance from vehicles and winds.

In active areas that dry out, dust can be readily generated. Normal practice is to treat this with water, which maintains the moisture content of the soil and mitigates dust generation.

3.3.3 Relevant Guidelines

3.3.3.1 Draft Environmental Assessment Guidance (EAG) – Separation Distances Between Industrial and Sensitive Land Uses

Rural land uses occur adjacent to the site and sand extraction activities will need to ensure that these land uses are not impacted. This requires sufficient buffers to be provided between the surrounding land use and the extraction area.

Draft Environmental Assessment Guidance (EAG) – *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2015) states the generic buffer distance for sand quarries as 300–500 metres. A generic buffer relates to the distance at which there is unlikely to be any problems without further investigation and does not mean that smaller buffers are not acceptable. There are many examples within Perth's Metropolitan area where extractive industries operate compatibly within 300 metres of residential or industrial land uses. This outcome is in part due to the low-key nature of the sand extraction works and also the on-site management of issues such as dust.

The excavation area is largely surrounded by paddocks; therefore the majority of the surrounding sensitive premises are located at least 300 metres away from the excavation area which complies with EPA (2015).

The following dwellings are the exceptions:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring landholding.

3.3.3.2 Guidelines for the Prevention of Dust and Smoke Pollution

The Guidelines for the Prevention of Dust and Smoke Pollution published by the Department of Environmental Protection (1996) has been used to assess the classification of the site in relation to the potential for dust generation.

When making the assessments using the guideline there are several key points requiring consideration:

- Dust risk is generally only in the dry summer months.
- The sand readily crusts after wetting and becomes stabilised. It is only trafficked areas of the site that are likely to develop fine dust from the grinding of wheels.
- The perimeter bunds and any vegetation buffers will provide windbreaks and dust fence screening will provide additional screening to the surrounding properties. Existing screening vegetation is shown in Figure 1.
- Water trucks will be used to wet down the site frequently and manage dust risk.

Appendix A of this management plan contains the completed site classification assessment charts (Appendix 1 – Sheet 1). The method of assessment used produced a site classification of low risk as outlined in Table B, acknowledging that only 1 to 5 ha of the sand quarry will only be developed for a sand quarry at any one time, with approximately 7.9 ha being extracted in the first two years.

Table B: Site Classification

Description of Works	Site Classification Score	Site Classification
Bulk Earthworks	(Part A 22 / Part B 18) 396	Classification Site 2 (Low Risk)

3.3.3.3 A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities

The sand mining contractor shall comply with "A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" (DEC March 2011).

The specific measures for a Classification 2 Site (score between 200 and 399) is outlined below:

Provisions:

- The developer shall supply a contingency plan to the local government, which shall detail the activities to be undertaken should dust impacts occur.

Contingency arrangements:

- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust suppression.

- All areas of disturbed land should be stabilised to ensure that the disturbed area exposed at any time is kept to a practical minimum.

The above actions have been adopted in this Dust Management Plan.

3.3.4 Control Measures

Dust levels throughout the sand extraction process will be compliant with National Environmental Protection (Ambient Air Quality) Measure level under expected wind conditions. Sand extractions operations will cease in adverse wind conditions or exceedance of National Environmental Protection (Ambient Air Quality) Measure levels.

All proposed sand excavation works will be set back a minimum 20 metres from the boundary of Lots137.

Dust control methods that are available, and will be selected from, are listed below. The most effective by far is the use of water management from a water truck, sprinklers, water canon or other such mechanism.

3.3.4.1 Design and Site

- Minimising the amount of ground open at any one time.
- Minimising the amount of ground being subject to traffic.
- Locating access roads away from sensitive premises.
- Design of the pit to reduce wind speed and potential dust lift off.
- Maintaining effective setbacks.
- Construct perimeter bunds to reduce wind speed.
- Maintain tree/vegetation buffers.
- Providing windbreak fencing generally and on top of bunds as required.
- Maintaining a secure, fenced site, to prevent illegal access.
- Rehabilitate and stabilise all completed areas as soon as practicable.
- Clearing and replacing topsoil and overburden during wetter times – April to October.

3.3.4.2 Operations

- Locate active areas away from windy locations.
- Locate active areas away from sensitive premises.
- Working on the floor of the pit.
- Operate some parts of the pit only when conditions are suitable.
- Locating mobile plant and stockpiles in sheltered areas.

- Design staging to minimise dust risk.
- Conduct higher dust risk operations such as topsoil clearing and placement during more favourable conditions.
- Shut down equipment that is not required.

3.3.4.3 Access and Hardstand

- Constructing the access roads from hard materials that resist dust generation.
- Maintaining a water truck on site for road and other wetting down. Water trucks on site will have a volume of 10,000 L to 15,000 L, in accordance with the DER guideline requiring a capacity of 10,000 L for every 7.5 ha of disturbed area.
- Using a sealant such as a polymer, chemical or emulsified oil or bitumen on the access road to reduce water use.
- Using sprinklers and/or water canon on roads, traffic areas and stockpiles.

3.3.4.4 Processing

- Applying water sprays and additives to the screening cycles.
- Providing screening and shielding of mobile plant.
- Use and maintain filters on all suitable plant.
- Ensure regular appropriate emptying of filter collection devices.
- Face hoppers away from prevailing winds.
- Maintain reduced pressure in plant, hoppers and bins to prevent loss of dusty air.

3.3.4.5 Stockpiles

- Minimise the number of stockpiles.
- Maintain stockpiles in sheltered areas.
- Reduce the elevation of stockpiles.
- Limit the drop height to stockpiles and loading.
- Locate finer products inside or screened by stockpiles of coarse materials.

3.3.4.6 Transport

- Cover all loads.
- Ensure all trucks are dust free and not carrying pebbles and other materials outside the tray.
- Choose the best transport routes.
- Wet down or sweep the cross-over and access roads.

3.3.4.7 Health and Community

- Maintain air-conditioned cabins on all vehicles.
- Provide a readily auditable trigger of no visible dust to cross the property boundary in line with DER Licence and best practice in WA.
- Conduct effective site induction and awareness training for all staff.

- Training should include observation and mitigation where possible of all dust emissions.
- Providing a complaints investigation, mitigation and recording procedure.
- Liaising with the owners/operators of the two nearby sensitive premises.
- Ceasing operations when conditions are not favourable or when visible dust is crossing the boundary.
- Obtain the latest weather conditions to increase the awareness of dust risk.
- Cease operations during adverse weather conditions.
- Operate during wetter months or when the soils are moist.

Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation will be undertaken during the wetter months to reduce the generation of dust.

Completed sections of the quarry are to be stabilised and not subject to traffic as soon as practical to reduce the area of open ground and help reduce wind speed. In the event of dust management not being able to be achieved, and to minimise impact on adjoining landholders, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining landholders.

A record of all dust complaints will be retained together with the mitigation measures used to reduce the dust impacts.

3.3.5 Procedure for Dealing with Dust Complaints

It is intended that the following procedure be adopted in the event of a dust complaint (based on proof dust is being emitted from the extraction area):

1. It is proposed that all complaints received by kept in a "complaint register" and maintained by the sand mining contractor site supervisor.

2. It is likely that a complaint will be lodged with either the sand mining contractor or the Shire of Serpentine-Jarrahdale. Upon receiving the complaint the following information shall be recorded:
   a. Name and contact details of complainant.
   b. Date and time of complaint and date and time of occurrence of dust.
   c. Details of complaint and effect of dust on property.
   d. Investigations of the complaint.
   e. Results of the investigation.
   f. If the complaint is valid, any mitigation actions that result.
   g. Any communication with the complainant.

The below Table C is an example of the proposed Site Register of Complaints Received.

Table C: Site Register of Complaints Received

Complainant's Name	Address	Contact Details	Date and Time of Complaint	Date and Time of the Occurrence	Details of the Complaint and Effect on Property

At the time of receiving the complaint, the person receiving the complaint shall offer an explanation for the dust, if possible. If an explanation cannot be made the person receiving the complaint shall advise the resident that the matter will be investigated and the resident will be notified of the outcome or appropriate action taken or to be taken within 24 hours.

- Details of the complaint shall be forwarded to the sand mining contractor in the event that the complaint was received by the Shire of Serpentine-Jarrahdale. All complaints shall be forwarded even if the complainant seemed content with the explanation given for the occurrence of dust.

- The contractor will investigate the complaint through discussion with the complainant and agree a course of action. The contractor will record the course of action taken in the complaint register and covey the agreed action to the person who took the complaint who will in turn inform the complainant.

- The contractor will confirm with the Shire of Serpentine-Jarrahdale that the matter has been dealt with and resolved if required. The contractor shall also provide copies of any correspondence or documentation when requested to do so.

3.4 Dust Monitoring Program

The auditable condition for dust monitoring is visible dust crossing the boundary of the premises, which is the lot boundary. This is the condition used on Department of Environment Regulation Licences and all other sand quarries in Western Australia.

Specific management measures will include:

- review of complaints received in the past week and action taken

- review of status of any previously lodged complaints

- degree of compliance by the contractor with the contract conditions

- review of weather conditions and need or otherwise for additional water carts, temporary stabilisation, wind fencing, etc.

3.4.1 Visual Dust Monitoring

The trigger for dust management will be the generation of visual dust.

The sand contractor is responsible for site supervision of dust and are in two way radio contact with all mobile plant.

All operators on site will be instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues.

When trigger conditions are detected and/or alerted, relevant action will be taken such as additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment, etc.

3.4.2 Liaison

A liaison program will be commenced with nearby and adjoining residents. An advisory note will be sent to the landowners of:

- House No. 446 – the dwelling is located approximately 165 metres east from the excavation boundary within the neighbouring land holding.
- House No. 514 – the dwelling is located approximately 236 metres south-east from the excavation boundary within the neighbouring land holding[1].

The proposed advisory note is detailed below.

> **Advisory Notice to Residents**
>
> Excavation of sand of the above land is being planned. There will be progressive stages starting in 2018. The development is being carried out by a sand mining contractor and the works are scheduled to commence following all statutory approvals. A 20 metre buffer will be retained around the boundary of the property by the sand mining contractor in order to minimise inconvenience to residents.
>
> It is a requirement that this development must adopt adequate measures to prevent the generation of unacceptable levels of dust. You are advised that the landowner and the sand mining contractor have agreed to implement the provisions as outlined in the Department of Environmental Regulations publication "A guideline for the prevention of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities" March 2011 (a copy of this guideline may be obtained from http://www.der.wa.gov.au/).

[1] RPS understands that House No. 514 is subject to an EIL Application, with the existing dwelling proposed to be used as a site office, and therefore the potential impacts relating to Amenity have been specifically assessed in relation to the dwellings located on House No. 446.

Should you feel that excessive dust is being generated due to this development, you are advised to contact the Site Supervisor for the sand mining contractor, (TBA) by telephoning (TBA) to discuss the issue.

A sign will be placed at the entrance to the site with contact phone numbers and email address of the sand mining contractor site supervisor to enable members of the community to contact the company in the event of a dust issue.

3.5 Procedure for Dealing with Disputes

In the event that an adjoining land user is dissatisfied with the outcomes of their dealings with the sand mining contractor, or if directed by the Shire of Serpentine Jarrahdale, the contractor shall inspect the alleged damage and, if there is proof that the dust originates from the site, make good any damage that is resulting from the release or escape of dust from their site

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4.0 CONCLUSION

It is not possible to guarantee absolutely that dust will not emanate from the site. However, it is considered the tight construction specification will minimise the potential for dust impacting on residences.

Prior to commencement of construction, the sand mining contractor will review the potential for dust, noise and vibration nuisance associated with the earthworks. Agreement as to how such nuisances shall be minimised will be reached as generally outlined in this document.

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5.0 REFERENCES

Department of Environment and Conservation. 2011b. A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities. Kensington: Western Australia.

Environmental Protection Authority. 2015. Draft Guidance Statement Separation Distances between Industrial and Sensitive Land Uses. Perth, Western Australia.

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RPS

FIGURES

RPS

Job Number: L1505503_DMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_DMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

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APPENDIX I

Site Classification Assessment Chart

APPENDIX 1: Site Classification Assessment Chart

Item	Score Options								Allocated Score
Part A – Nature of Site									
1. Nuisance potential of soil when disturbed	1	very low		Low	4	**Medium**	6	high	**4**
2. Topography and protection provided by undisturbed vegetation	1	sheltered & screened	6	medium screening	12	little screening	18	exposed & wind prone	**6**
3. Area of site disturbed by the works	1	under 1 ha	3	**1 ha to 5 ha**	6	5 ha to 10 ha	9	over 10 ha	**3**
4. Type of work being done	1	roads or shallow trenches	3	roads, drains and medium depth sewers	6	road, drains, sewers and partial earthworks	9	**bulk earthworks deep trenches**	**9**
Total score for Part A									**22**
Part B – Proximity of Site to Improvements									
1. Distance of other land users from site	1	over 1 km	6	1 km to 500 m	12	500 m to 100 m	18	under 100	**12**
2. Effect of prevailing winds (at time of construction) on other land users	1	not affected	6	isolated improvements affected by one wind direction	9	dense improvements affected by one wind direction	12	dense/sensitive improvements highly affected by prevailing winds	**6**
Total Score for Part B									**18**
Site Classification Score									**396**

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APPENDIX 2

Dust Management Actions

APPENDIX 2: Dust Management Actions

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
General				
Legislation	-	Comply with the provisions of the *Mines Safety and Inspection Act 1994* and Regulations 1995.	The sand mining contractor will comply with the Act and Regulations at all their pits.	-
Buffers	-	Maintain adequate buffers to sensitive premises.	Buffers are similar to existing operating limestone quarries. All residents within 500 metres will be consulted during the assessment process.	-
Landform	-	Locate activities behind natural barriers, landform and vegetation.	The design of the pit and staging has been selected to provide the best screening. Excavation is conducted below the land surface. Excavation will produce a significant void, up to six metres below natural ground level. The processing and stockpile facilities are to be located on the base of the pit below ground level.	-
Landform				
Landform	-	Work below natural ground level.	This is proposed. Excavation will produce a significant void, up to six metres below natural ground level.	-
		Push overburden and inter-burden dumps into positions where they can form screening barriers.	The bunds will be extended around the perimeter of the excavation area prior to extraction in each particular stage.	-
Staging	-	Design operational procedures and staging, to maximise the separation to sensitive premises.	The design of the pit and excavation has been determined to operate from the floor of the pit from the centre outwards, always behind the face and bunds.	-
Pit design	-	Design the excavation to provide enhanced landform and constructed dust screening.	See above	-
Screening/ Vegetation	-	Use landscape screening, windbreaks and tree belts.	Vegetation is in place around all perimeters. Interim seeding with grass will be used as a surface stabilisation option. On the periphery of the site trees will be planted	-

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Management				
Operation	-	Provide air conditioned closed cabins on plant	These are used on site for operational mobile plant.	-
Monitoring	-	Provide monitoring and supervision of the processing and other practices on site.	A monitoring system is proposed. See below “Trigger Conditions”.	-
Trigger conditions	-	Trigger conditions are used to determine when additional dust management is required.	Most dust generated from processing and vehicle movements has a very large visible component. Lesser risks emanate from excavation and opening new ground. The trigger for dust management is the generation of visual dust. The quarry manager and leading hands are ultimately responsible for site supervision of dust. A commitment is made that no visible dust will cross the lot boundaries. They travel around the operations and pit frequently and are in two-way radio contact with all mobile plant. All operators on site are instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues. When trigger conditions are detected and/or alerted relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc. as outlined in the Dust Management Plan.	-
Adverse weather	Moderate–Uncommon	When winds are sufficiently strong, or other weather conditions are unacceptable, to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.	Rare adverse conditions are more likely to occur during summer mornings and summer afternoon sea breezes. In winter, stronger winds are normally associated with rain and therefore carry a reduced dust risk. This policy is used to minimise impact on adjoining landholders/ dwellings and the urban areas.	Low
Equipment failure	Low–Uncommon	In the event of dust management not being able to be achieved through equipment failure operations will cease until full capability is restored.	This is committed to.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Training	-	Conduct training programs on dust minimisation practices.	The sand mining contractor will use on site induction and training to all personnel at all operations.	-
Complaints	-	Provide complaints recording, investigation, action and reporting procedure such as Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996.	All residents within 500 metres of the proposal will be consulted by the sand mining contractor during the assessment process. A record of all dust complaints is to be maintained together with the mitigation measures to be used to reduce the dust impacts. All complaints relating to dust are to be investigated immediately on receipt of a complaint. Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996, will form the basis of the methods on which a complaint on dust is dealt with. A record of complaints is maintained.	
Earthworks				
Land Clearing	Low – Once per year	Schedule activities such as vegetation removal or topsoil stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	Normally the opening of new ground and the subsequent use in rehabilitation is undertaken in the drier months when the soils are still moist enough to suppress dust but not wet. This is necessary to minimise the risk of dust generation and the spread of dieback spores if present. Nearby residents will be notified prior to large scale clearing that may generate significant environmental dust.	Low
Overburden removal	Low – Once per year	Schedule activities such as overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Overburden removal will be infrequent. Where possible overburden removal will be completed in wetter months or when winds are blowing away from sensitive premises.	Low
Construction of bunds	Low–High – Once per year		Construction of bunds can lead to dust generation if conducted in summer when the topsoils are dry. Where possible bunds will be constructed in drier months when the soils are still moist. If this is not possible water sprays and other wetting down will be used to reduce the potential for dust generation and movement. The bunds will be constructed prior to the excavation in each part of the pit. The bunds will be revegetated during the first winter following construction with local native trees and shrubs to assist in stabilising their surface.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Land Restoration	Low – Once per year.	Schedule activities such as ripping, overburden and topsoil spreading on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	This is proposed. Land restoration will be infrequent and normally conducted only once per year. Where possible clearing will be completed in wetter months or when winds are blowing away from sensitive premises. Completed sections of the quarry are to be excluded from activity as soon as practical to reduce the area of active “uncrusted/stabilised” open ground. Stabilisation of the limestone will occur through lack of traffic, crusting from wetting down the limestone and using whatever dust management actions are appropriate, as listed above in the Dust Management Plan.	Low
Excavation				
Excavation	Low – Low level continuous activity	Excavate from the face using techniques that minimise the crushing of dry matter.	Excavation will be normally completed by bulldozer deep ripping and track rolling limestone. When freshly exposed at any time of year the limestone is normally moist and has less capability to generate dust. It is only when air-dried that dust becomes a greater issue. Limestone that is wetted or rained upon rapidly stabilises and forms a hardened crust. This is resistant to erosion until disturbed by traffic. A range of actions will be used on areas that are susceptible to dust lift-off such as sand and disturbed limestone. These will include watering, emulsion, windbreaks, and other stabilisation as required. A water truck is to be used as required to wet down the loading areas. The dust management actions listed above in the Dust Management Plan will be used as appropriate to minimise dust generation and lift-off. At the end of each day in summer the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active.	Low
Loading at Face	Low – Low level continuous activity	Ensure that products to be loaded are moist and that the hardstand on which the loading occurs is wetted down or moist.	This will occur on the floor of the pit. Excavation normally does not generate significant dust. The dust originates from the wheel movements. Air dried product will be wetted down with water canon or other methods. Operational hardstand will be wetted down when dry. Other contingencies will be used relating to operating times, additional water or sealant treatment and ceasing operations in adverse conditions. A water truck is to be used as required to wet down the loading areas. Water can also be applied from water cannon, or sprinklers	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Haulage	Moderate–Medium level continuous activity	Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	Haul roads are to be regularly graded and maintained. They are to be watered regularly and have speed limits imposed. Alternatively they may be treated with stabilisers to reduce the potential for dust. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift-off when the site is not active.	Low
		Reduce the length of the internal roads by maximising internal servicing efficiency.	The haul roads are designed to reduce travel distance to save maintenance costs and time and to maintain efficiency and minimise greenhouse gas emissions.	
		Providing speed management on hardstand and the road network.	This is used.	
		Provide air-conditioned closed cabins on plant.	All vehicles are air-conditioned.	
		Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat.	A dedicated water truck is to be maintained on site and used as required during the drier months.	
Plant – Processing				
Hardstand traffic	Low – Low key ongoing activities	Maintain hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades	The hardstand areas that are subject to traffic are limited in area but are able to be watered by the dedicated truck as required. Non-traffic areas rapidly crust and stabilise.	Low
Inactive periods	Low–Moderate	Leave the operations in a manner such that dust lift off is minimised.	The bunding and perimeter vegetation will reduce wind speed and increase screening. At the end of each day, in summer or as required, the pit and active areas will be thoroughly wetted to minimise dust lift off when the site is not active. Inactive areas readily crust and seal the surface. A comprehensive liaison with the closest residents and the caretaker will provide a means of monitoring for visual dust at times of inactivity.	Low

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Processing	Moderate–Continuous	Treat processing areas with water sprays, shields and dust extraction.	Effective maintenance of the hardstand combined with adequate water treatment is used to minimise dust. Water treatment is most commonly carried out by water truck. Crushing operations are to be watered as required to suppress dust. Dust covers and equipment shields are maintained on all static plant where they are practicable. Continuous visual monitoring of dust is used. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed in site operations.	Low
Mobile and static plant Operation	Moderate–Continuous	Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate.	Operators are instructed to visually monitor dust, report and treat any visible dust. Regular emptying of any dust collection devices and the renewal of any filter devices is programmed. Dust management and monitoring forms part of the site induction programs. Faults are to be repaired promptly. Regular maintenance programs for all dust suppression equipment are proposed. Dust management and monitoring forms part of the site induction programs. See Processing, above.	Low
		Shut down equipment when not in use.	The sand mining contractor will adopt this measure to save fuel and maintenance costs in addition to noise minimisation.	
Loading and Stockpile Creation	Moderate–Continuous	Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	Low
		Limit drop heights from conveyors and dump trucks.	This is used. It is a good safety and site management procedure.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Transport				
		Maintain access roads in good condition (free of potholes, rills and product spillages).	The first 30 metres of road and cross over will be sealed. Effective maintenance of the hardstand and access road in addition to a sealed crossover will be used to minimise dust.	
Road condition	Low–Moderate	Water and/or treat access roads and paved areas using a water tanker or sprinkler system.	See above. Internal roads are regularly watered as often as necessary to minimize dust generation. A dedicated water truck is to be retained on site and used when dust lift off is a potential hazard.	Low
		Wet down or cover loads on trucks that are likely to blow during transport.	Trucks are required to be covered or wetted down prior to exiting the site as required when transporting sandy and other materials that can blow.	
Road Transport	Low–Frequent	Implement a site code outlining requirements for operators and drivers.	A site code and induction system is used.	Low
		Avoid spillages on roads and clean up promptly.	Covering and wetting down loads as required and instructs drivers to report and clean up spillages.	
		Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport.	This forms part of the sand mining contractor operational procedures.	
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	Low
		Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	This forms part of the sand mining contractor operational procedures.	
		Wet down stockpiles using water canon or sprinklers as required.	Stockpiles will be assessed for their dust lift off potential and are treated accordingly. Where required wetting down is to be used. Sprinklers and water canon are proposed where necessary. Limestone stockpiles readily form a crust that protects from dust lift off. Sand from stockpiles moves by saltation up to 1 metre off the ground and is unlikely to escape the quarry faces, as they will be located on the floor of the pit.	

Activity	Possible Risk Severity and Frequency	Operational Procedures	Commitments on Activities Conducted on Site	Risk After Management
Stockpiles				
Stockpiles	Moderate	Locate stockpiles behind bunds/ windbreaks or other screening barriers	This is normal practice. There are perimeter vegetated bunds in place. Finer materials will be located where dust lift-off is minimised.	
		Reduce the height of stockpiles. Low flat stockpiles are less likely to be disturbed by wind than high conical ones.	The height of stockpiles is maintained at manageable levels that remain sheltered from the prevailing winds.	
		Wash crushed products where necessary.	The limestone products do not need washing.	
		Locate coarser products around fine materials to assist wind protection of the finer products that are more likely to blow or contain greater amounts of dust.	Not applicable to an operation such as this	
		In extreme conditions stockpiles can be covered although this is often not practical.	This is not normally practical and liftoff will be managed by wetting down and locating stockpiles on the floor of the pit.	
		Provide bunding, fencing and windbreaks around stockpiles and along the tops of bunds.	Perimeter buffer vegetation and bunding is in place	

RPS

APPENDIX 5

Fire and Emergency Management Plan

FIRE AND EMERGENCY MANAGEMENT PLAN

Lot 137 Punrak Road, Hopeland





FIRE AND EMERGENCY MANAGEMENT PLAN

Lot 137 Punrak Road, Hopeland

Prepared by:

RPS

Level 2, 27-31 Troode Street,
WEST PERTH WA 6005

PO Box 170, WEST PERTH WA 6872

T: +61 8 9211 1111

F: +61 8 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

MICHELLE AND CRAIG MCALLISTER

8 Stone Street

MOSMAN PARK WA 6012

Report No: EEL15055.003:3

Version/Date: Rev 2, February 2019

QUALITY CONTROL CHECK LISTS

Technical Review Checklist

Editorial Review Checklist

These Check List Forms record information about the type of review, who completes it and any actions arising from the review. This is to be filled out by authors and reviewers throughout the reporting process.

These sheets are for internal review purposes only and will be removed from the report at the time of PDF, prior to sending to the client.

Documentation will save the Editorial and Technical Checklist forms as a PDF, back into the report folder for auditing purposes. The original check lists will remain in the Word document for future revisions. Please do not alter or remove any previous lines of text.

Responses are to be either Y for Yes, N for No, or NA. No further information is necessary.

Technical Review Checklist

Project No.:		Revision No.:		Date:	

Introduction / Background	
	Clearly describes the objectives of the report and the scope of work
	Makes a clear link between the objectives of the report to the scope of work
	Presents and shows only data that supports the objectives.

Methods / Approach	
	Approach or methods used to complete work clearly described
	Methods are current good practice and appropriate to objectives
	Confirm appropriate detail provided, e.g. date, time, figures showing all sites, sampling methods, preservation, analyses

Tables and Figures	
	Confirm error bars are shown if appropriate (summary stats shown, e.g. means)
	Correct units shown for both axes
	Map scale is correct
	Map geographic coordinate correct
	All items referred to in text are labelled, e.g. site names on maps

Text	
	Is the document language appropriate for the intended audience; not too much jargon
	Follow thread of logic from introduction and objectives, through approach and methods, to results and then discussion and conclusion (where these sections are used)
	Are interpretations valid and sufficient
	Units are appropriate and consistent throughout; use SI units where possible
	Make sure technical terms, species names, etc. are correct
	Statements, conclusions and discussion points based on reliable information and well referenced
	Data in text matches data in tables and figures and is consistent between sections

Conclusion / Summary	
	Check the Conclusions and /or Summary against the data and make sure the conclusion is reasonable
	Check conclusions address all objectives directly

Document Number: 200-QA-FRM-0049 | Rev 2 | Issued for use: 13/02/2019

Editorial Review Check List

1. Draft A (Internal Draft) Initial Drafting

Author: Giles Glasson Date: 28/11/16

Clarify client expectations around format, structure, content, authorship	y
Plan layout and content of report	y
Confirm target audience with Technical / Editorial Reviewer	y
Check readability, grammar, spelling and punctuation	y
Confirm objectives of report – refer to proposal, CTR	y
Consistent with client and RPS style guides	y
▪ Square bullet points for a report • Round bullet points for letters and memos Dot points have consistent tense and structure within and between lists	y
Check client details and report title are correct	y
If based on previous report, confirm text updated to reflect new purpose, e.g. client and vessel names	

2. Draft A (Internal Draft) Review

Reviewer: John Halleen Date: 28/11/16

Is agreed document structure followed	y
Does the Executive Summary address the objectives and conclusions	y
Report pitched to the target audience	y
Correct template used (client template vs. RPS template; letter vs. Report; memo vs. letter, etc.)	y
The report is succinct and easy to read	y
Sentence length not too long (generally <20 words)	y
Correct punctuation and spelling	y
Do sentences contain only one concept	y
Is verb tense consistent	y
Terminology used consistent with reader's ability and any jargon is explained	y
Paragraphs generally start with a "concept statement" or topic sentence	y
New concepts are presented in new paragraphs	y
Are all acronyms/abbreviations spelt out the first time used, or if acronyms table used is it complete	y
Are important concepts and/or supporting graphics kept together	y
Are all statements made using third party information referenced	y
Are all external references consistent between text and reference list	y
Are all figures, tables, plates and appendices correctly referenced in text	y

3. Draft B (Client Draft) Drafting

Author: Date:

All Draft A reviewer comments have been addressed	
Check readability, grammar, spelling and punctuation of edited sections and track changes	

4. Draft B (Client Draft) Review

Reviewer: Date:

Draft A reviewer's comments adequately addressed	
Check readability, grammar, spelling and punctuation of edited sections	
Check flow of document – i.e. edited sections fit with overall structure	

5. Documentation Review

Documentation Team: Date:

Formatting correct throughout document, including appendices.	
All appendices present as listed in the Table of Contents and included in the relevant job/reports directory	
All attachments (tables, figures, plates, etc.) present as listed in Table of Contents	
Confirm client security / access requirements with author	
Confirm client formatting requirements, if following client style/ format guide	
Check limitations on maximum file size of PDF with author	
Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Captions in the correct places and inserted using the Insert function on the toolbar to ensure it updates correctly in the table of contents.	
Tables easy to read and consistently formatted	
Watermark included if report is to be submitted to the Client for agreement to final changes	
Table of contents updated	
Document status table updated	

6. Post-formatting Review (prior to sending to client)

Author: Date:

Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Check all captions in the correct places and inserted using the Insert function on the toolbar to ensure it updates correctly in the table of contents.	
Check all tables and figures adjacent to the text where they are referred to	
Correct version of appendices, figures, plates, etc. included	
Check all Tables are easy to read and consistently formatted	

Check watermark is included if report is to be submitted to the Client for agreement to final changes	y
Check table of contents updated	y
Check document status table updated	y
Check formatting correct throughout, including appendices	y

Send PDF of report to the client for review

7. Response to Client Review

Author: Date:

Confirm all client review comments received	
Complete squad check sheet if required	
Ensure all client comments addressed	
Check readability, grammar, spelling and punctuation of edited sections and track changes	

8. Rev 0 (Final) Review

Author: John Halleen Date: 01/12/16

Confirm all comments from client have been addressed adequately	y
Response to major comments approved by client (meeting, squad check sheet, watermarked Rev 0)	y
Review new report information for readability, technical content and appropriateness	y
Overall layout of text blocks feel readable	y
Exec Summary reflects changes to document	-

9. Rev 0 (Final) Review

Reviewer: John Halleen Date: 01/12/16

Draft B reviewer's comments adequately addressed	y
Check readability, grammar, spelling and punctuation of edited sections	y
Check flow of document – i.e. edited sections fit with overall structure	y

10. Documentation Review (Rev 0)

Documentation Team: Date:

Formatting correct throughout document, including appendices.	
All appendices present as listed in the Table of Contents and included in the relevant job/reports directory	
All attachments (tables, figures, plates, etc.) present as listed in Table of Contents	

Confirm client security / access requirements with author	
Check limitations on maximum file size of PDF with author	
Check all titling and numbering of pages, headers/footers, tables, figures, plates and appendices	
Captions in the correct places and inserted using the Insert function on the toolbar for TOC update	
Watermark removed and footers updated to reflect final status	
Table of contents updated	
Document status table updated	
Verification of copy numbers for printing	

11. Post-formatting Review Rev 0 (prior to printing and/or sending to client)

Author: Date:

Check PDF very thoroughly for any errors	
Correct version of appendices, figures, plates, etc. included	
Check table of contents updated	
Check document status table updated	
Check formatting correct throughout, including appendices	
Check library hard copy once printed to ensure no errors previously missed	

12. Rev 0 (Final) Sign-off

Principal/TD: Date:

Confirm checklist process has been followed closely at all steps	
Confirm both Editorial and Technical Review Checklists completed	
Document status table updated and signed	
Cover email / letter, completed	

13. Final Documentation Process (Rev 0)

Documentation Team: Date:

Transmittal form completed and PDF updated with signature	

Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Rev 0	Final for Issue	GilGla	JohHal	01.12.16	SN 05.12.16	J. Halleen	05.12.16
Rev 1	Final for Issue	RebDaw	JohHal	03.02.17	DC 09.02.17	C. Davies	10.02.17
Rev 2	Final for Issue	MarMcC	JohHal	12.02.19	AW 13.02.19	J. Halleen	12.02.19

Disclaimer

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Figure 1: Site Location

Figure 2: Staging Plan

Figure 3: Vehicle Access and Site Office

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APPENDIX 1: Firebreak Notice and Fuel Hazard Reduction Notice

APPENDIX 2: Total Fire Bans

1.0 INTRODUCTION

The sand resource at Lot 137 Punrak Road, Hopeland ("the site") is fine to medium-grained Bassendean sand, which is in high demand by concrete manufacturing operators and land developers located in Perth's south. Hanson Construction Materials Pty Ltd (Hanson) will be responsible for undertaking the sand extraction works.

The 30.4 hectares (ha) site is located in the suburb of Hopeland, approximately 60 kilometres (km) south of the Perth Central Business District in the Shire of Serpentine-Jarrahdale (Figure 1). The site is bordered by Punrak Road on its western and northern extents and by the landholdings of House Number (No.) 514 to the south and House No. 446 to the east.

The site is primarily used for horse training and agistment. This land use has resulted in the site being predominately cleared of native vegetation with only a small extent remaining intact.

1.1 Purpose

This Fire and Emergency Management Plan (FEMP) has been prepared to provide for the safety of site personnel, the local community and the natural environment in relation to the proposed sand extraction activities.

The implementation of this FEMP will:

- Classify potential emergencies based upon level of likely impact.
- Identify potential emergency responses.
- Establish an emergency evacuation system.
- Manage fire risk in accordance with state and local government policies and procedures.
- Identify site safety and emergency management equipment.

A copy of the approved FEMP (including the evacuation plan) will be available to all site personnel and visitors and will be kept in the site office.

The sand extraction activities will be carried out in accordance with the Shire of Serpentine-Jarrahdale's approved EIL and conditions of the DA. In accordance with the State Administrative Tribunal (SAT) decision, sand extraction is permitted within the Stage 3 extraction area shown on the Figure 2 staging plan subject to the following requirements:

(a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/3/2018, a copy of which is shown below as Figure A, as "proposed retention" and "proposed 20 m buffer".

(b) A batter must be constructed outside of the proposed 20 m buffer to protect vegetation from extraction works.

(c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20 m buffer

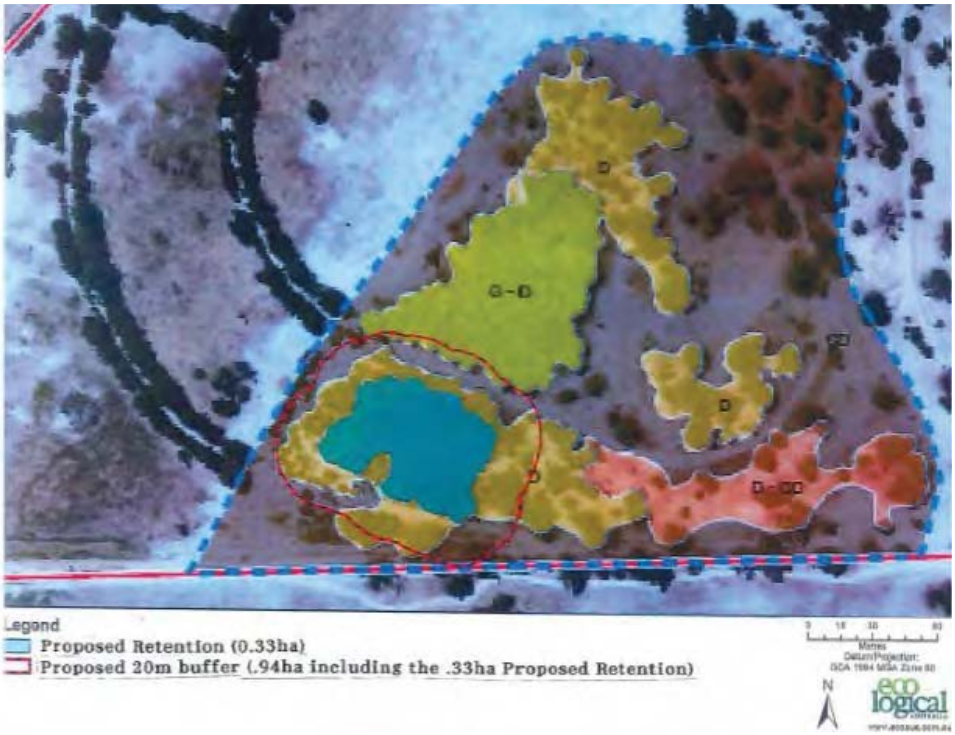

Figure A: Ecological Retention Plan

1.2 Sand Quarry Operations

The extraction of sand is proposed to occur within a 11.2 ha portion of the site and will continue over a three to five year period (depending on demand), with sand extraction activities scheduled to commence in 2018.

The extent of the sand mining area is shown on Figure 1 and Table A provides an overview of the proposed sand extraction activities.

Table A: Project Summary

Project Component	Proposal Characteristic
Excavation	
Total area of the site	30.4 hectares (ha)
Total area of extraction footprint	11.2 ha
Sand Volume	Approximately 1 million m^3
Life of the project	Approximately three to five years
Dewatering requirements	Nil
Maximum depth of excavation	Approximately 17 m to 18 m AHD (initially a 2 m separation to the groundwater table. If in the future, once groundwater monitoring and fate modelling are completed to the Shire's satisfaction, the sand quarry finish floor level will be amended from 2 m to 1.282 m from the maximum annual average groundwater peak (which is consistent with the neighbouring sand quarry site). The Water Management Plan will also be updated for approval by the Shire.
Finish Floor Levels	The excavation area currently has a topographic range of approximately 18.5 m AHD to 25 m AHD. AAMGL contours indicates that the AAMGL at the excavation area, is approximately 15.0 m AHD in the north-west of the site's proposed extraction area and 16 m AHD in the south-east of the extraction area. As a clearance to groundwater of 2 m is to be initially maintained, the extraction area finish floor will range between approximately 18 m AHD (25 m AHD topography) and 17 m AHD (from the 19 m AHD topography). The existing topography would therefore be initially lowered by between approximately 7 m and 2 m.
Processing	
Sand	Dry screening of sand only
Water requirements	Nil
Infrastructure	
Fuel storage	5,000 Litre above-ground (self-bunded) tank
Transport	
Truck movements	Variable but approximately 2–4 per hour
Workforce	
Hours of operation	7.00 am to 5.00 pm, Monday–Saturday.

1.2.1 Staging Plan

Excavation activities will be undertaken in four consecutive stages over the life of the mine as shown in the staging plan provided as Figure 2. Approximately 7.9 ha will be excavated in the first two years of sand mining. The purpose of this approach is to allow for up to 18 months of groundwater monitoring, to provide site specific groundwater levels which would inform a revised finished floor level of 2 m from the maximum annual average groundwater peak consistent with the neighbouring sand mining operation.

Any open areas in these first two years of sand mining will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

1.2.2 Overview of Extraction Process

The excavation of sand will generally involve the following activities within the proposed sand extraction area:

- Fencing and a batter will be constructed in accordance with the SAT decision to protect 0.33 ha of retained native vegetation from extractive works.

- Vegetation clearing will involve the use of a wheel loader or excavator to push over the trees, before they are mulched. The mulch will be stockpiled for use within the site.

- Topsoil removal and stockpiling. Topsoil removal will comprise the first 100 millimetres (mm) to 300 mm of the soil being scraped and then stockpiled within the site for use as part of the decommissioning and rehabilitation process. Topsoil and overburden will be stored adjacent to the area of excavation, or will be returned directly being behind the advancing face of the extraction area.

- Initial extraction pit will be designed to maintain a buffer of two metres between the maximum depth of excavation and the average annual maximum groundwater level. The final floor level, subject to groundwater monitoring and post-land use modelling and the Shire's approval of an updated Water Management Plan will be approximately 1.3 m consistent with the neighbouring sand quarry finish levels.

- Each extraction stage of the sand excavation is expected to be approximately 0.8 ha to 4.4 ha in size, with approximately 7.9 ha being extracted in the first two years. Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Any open areas in these first two years will be initially stabilised until a decision is made on the final finished levels (i.e. to be consistent with the neighbouring sand quarry) based on the groundwater monitoring (and associated additional works requested by the Shire). If it is decided not to proceed with this strategy, and no further excavation is undertaken, then the excavation area will be rehabilitated at the end of the two year period.

- Sand will be extracted using a wheel loader and/or excavator to excavate the sand resource.

- Sand will be distributed from the site via road haulage. The main haulage route is anticipated to be along Hopeland Road onto Karnup Road, which provides access to the Kwinana Freeway. Karnup Road is listed as a heavy vehicle route, with a maximum load of 87.5 tonnes and a maximum length of vehicle of 27.5 metres.

- Reforming of the land after excavation is proposed to be undertaken using a wheel loader of excavator to push the topsoil and overburden into place. On completion, the land surface will be graded to ensure the final slopes will not exceed one in three vertical to horizontal in accordance with Shire of Serpentine–Jarrahdale *Extractive Industries Local Law 1999*.

1.3 Hours of Operation

The hours of operation will be 7.00 am to 5.00 pm Monday to Saturday.

1.4 Site Access

A gravel driveway is located off Hopeland Road and enters the landholding's north-east corner.

Vehicle access to the site will be through the gravel driveway via Hopeland Road and for authorised personnel only (Figure 3). Overnight and on weekends, vehicles will be kept within locked premises.

The unmade section of Hopeland Road which provides property access will be closed and ownership transferred to the private resident as a condition of approval. This will ensure the road is only open for local traffic.

Perimeter fencing will be maintained along the boundaries of the property. Property gates will be locked outside operating hours.

If the fencing and/or gate access within the site change as part of the operation of the facility, Figure 3 will be updated and provided to the Shire of Serpentine-Jarrahdale.

1.4.1 Haulage

The number of trucks entering the site will vary throughout the year depending upon the demand for the sand resource. However, it is anticipated that between two to four trucks per hour will access the site per day. Truck payload size will vary depending whether they are semitrailers or rigid wheeler trucks. Trucks will only be entering and exiting the site between the hours of 7.00 am and 5.00 pm.

1.5 Site Infrastructure

Site infrastructure for the Hopeland proposed sand extraction site will consist of the following:

- site office (existing house)
- vehicle / equipment compound
- toilet (within existing house)
- refuelling facility (5,000 litre maximum) self-bunded diesel above ground tank).

All site infrastructure will be located centrally within the landholding. A self-bunded fuel tank or an earth wall bund will be constructed around the designated refuelling facility in accordance with Water Quality Protection Note 56: *Tanks for Elevated Chemical Storage* (Department of Water 2006). Specific measures in regards to the above ground fuel tank include:

- The total tank storage volume shall not exceed 5,000 litres.

- There will be no underground pipework carrying fuel from the tank to facilities outside the compound. The storage tank will be self-bunded and located within a compound that effectively capture and contain any chemical spills.

- Minimum storage tanks and associated spill containment compounds will comply with the current Australian Standard 1940, the *Explosive and Dangerous Goods Act 1961* and any associated regulations.

1.6 Safety

1.6.1 Operations

All sand extraction activities and operational procedures will comply with the following legislation:

- *Explosive and Dangerous Goods Act 1961*
- *Mines Safety and Inspection Act 1994*
- Mines Safety and Inspections Regulations 1995
- *Occupational Health and Safety Act 1984*
- Occupational Health and Safety Regulations 1996
- Shire of Serpentine-Jarrahdale Extractive Industry Local Law.

All personnel are trained to industry standards. All personnel are provided with site induction, safety and environmental awareness training. All workers are required to wear full-time protective safety and high visibility work gear when on site.

1.6.2 Signage

In accordance with clause 6.2 of the Shire of Jarrahdale–Serpentine *Extractive Industry Local Law 1999*, a sign not less than 1.8 metres high and not less than one metre wide which states "Danger Excavations Keep Out" will be positioned at the boundary of the lot adjacent to Hopeland Road.

The signs will also indicate operation hours and contact details of the Site Supervisor.

1.7 Potential Hazards

Within the site, there is the potential for a range of hazards to impact on the health and safety of site personnel, the community and the environment. These hazards have been summarised below and include:

- nature disaster and fire. This is primarily related to bushfire from the areas of vegetation located directly north and south of the site. Fire may occur within the site from the sand extraction activities however the risk of this occurring is considered to be relatively low
- traffic incidents. These could be associated with vehicles within the site, or vehicles (primarily trucks) travelling to and from the site along Hopeland Road
- collapse of excavation area
- falls and impact incidents
- major hydrocarbon spills
- accidents involving electricity.

1.8 Primary Contacts

The sand mining contractor is the party responsible for the overall project. Upon commencement of operations, a Site Supervisor will be nominated for the site with this person responsible for the implementation of this FEMP, or as amended. The contact details for the Site Supervisor will be provided on signage, site induction material and to the Shire of Serpentine-Jarrahdale.

In case of an emergency, the Site Supervisor will be contactable at all times. All personnel will be responsible for managing works in accordance with this FEMP.

1.9 Timing of Works

Works are scheduled to commence once all approvals are in place, anticipated to commence in 2018.

1.10 Induction and Training

As part of operations, all personnel will undertake a site induction that will outline expectations with regard to managing health, safety and environmental requirements within the site. As a minimum, the induction will include:

- the requirement to wear full-time personal protective safety and high visibility work gear
- requirements under the various management plans for the operation of the facility, in particular the FEMP
- emergency communication protocols within the site
- location of on-site resources such as firefighting equipment, hydrocarbon spill kits and first aid kits
- location of the Emergency Assembly Area
- protection of vegetation outside the sand extraction area.

All personnel operating within the site will be trained in the use of on-site resources such firefighting equipment, hydrocarbon spill kits and first aid kits.

1.11 Emergency Response Strategy

1.11.1 Emergency Classification

Emergencies have been classified into three levels, with the levels based on the severity of the real and/or potential impact from the event and the extent of response that is required to manage the event to achieve the resumption of normal operations. The emergency classification levels are:

- **Level 1 Emergency** is non-life threatening or of minor consequences
  - is contained on site
  - controlled immediately with available resources
  - not expected to escalate.

- **Level 2 Emergency** poses a significant threat to life, nearby properties or the environment
  - is dependent on rapid response to bring under control or prevent escalation
  - may be unable to control immediately using on-site resources
  - require external assistance (i.e. police, fire or ambulance services)
  - have potential to escalate or extend beyond the site boundaries.

- **Level 3 Emergency** poses a significant threat to life, nearby properties or the environment and is highly likely to cause major disruption, impact on the community or environmental impact.

1.11.2 Emergency Notification

Emergencies will primary be communicated and responded to through two-way radios on a designated UHF channel. Emergency communication protocols will be included in all contractor site inductions (Section 1.10).

Mobile, fixed line telephones and audible alarms may also be employed during emergency situations (as appropriate).

If external assistance is required to attend to the emergency, the Site Supervisor will call 000 (or 112 if using a mobile) for assistance.

1.11.3 Emergency Command

The Site Supervisor will manage the emergency first response and will remain in control of the emergency until relieved by an emergency service department (i.e. fire, police or ambulance).

1.11.4 Emergency Evacuation

In the event of an emergency and a decision to evacuate, all instructions relating to the evacuation will come from the Site Supervisor. The Site Supervisor will check and contact all people under their control and inform them of the nature of the emergency and the route to be travelled to the designated emergency assembly area (adjacent to the site office).

Site occupants will not leave the emergency assembly area unless directed to do so by the Site Supervisor.

Evacuation of the site occupants from the emergency assembly area may be required for a Level 1 emergency and will likely be required for a Level 2 and 3 emergencies.

1.12 Fire Preparedness

1.12.1 Firebreak and Fuel Reduction Notices

Pursuant to the *Bushfires Act 1954*, the Shire of Serpentine-Jarrahdale publishes an annual Firebreak Notice and Fuel Hazard Reduction Notice (Appendix 1). The sand mining contractor will be responsible for ensuring that the site is managed in accordance with the Shire of Serpentine-Jarrahdale Firebreak Notices, which will include maintenance of the established fire breaks (as required).

The Site Supervisor will be responsible for ensuring compliance with the Shire of Serpentine-Jarrahdale Firebreak Notices as they relate to the sand extraction area.

1.12.2 Vegetation Management

Stored vegetation will be managed in accordance with Department of Fire and Emergency Services' (DFES) Information Note: *Bulk Green Waste Storage Fires* as follows:

- Stored vegetation within the site that is mulched will not be piled any closer than 24 metres from any existing vegetation or pile.
- Piled vegetation will not be greater than 50 metres long by 10 metres wide by five metres high.
- Piled vegetation will be located away from potential ignition sources.

1.12.3 Total Fire Bans

A Total Fire Ban (TFB) may be declared by DFES, in consultation with the Shire of Serpentine-Jarrahdale, because of extreme weather conditions or when widespread fires are seriously stretching firefighting resources (DFES 2016).

When a TFB is declared it prohibits the lighting of any fires in the open air and any other activities that may start a fire. The ban includes all open air fires for the purpose of cooking or camping. It also includes incinerators, welding, grinding, soldering or gas cutting (DFES 2016).

The Site Supervisor will be responsible for ensuring compliance with any TFBs declared within or including the Shire of Serpentine-Jarrahdale.

During a TFB, banned activities can be undertaken if an exemption has been granted. If required, the sand mining contractor will apply for an exemption. Where granted, the Site Supervisor will be responsible for ensuring that all conditions are complied with during the TFB.

Supplementary information relating to a TFB is provided in Appendix 2.

1.13 Resources and Equipment

Designated first aid and emergency response equipment will be available during construction, operation and decommissioning phases of the sand extraction process. Equipment will be maintained in accordance with manufacturer specifications and applicable safety standards including:

- fire extinguishers, located in the site office
- fire blankets and emergency first aid kits, located in all areas and vehicles
- shower and eyewash facility, located in the site office
- water tanks that can be used by fire vehicles in case of emergency will be stored in the vehicle / equipment compound
- spill kits, to be used for cleaning up hydrocarbon spills, will be stored in the vehicle/ equipment compound.

1.13.1 First Aid Kits

- Usage of all first aid kits will be reported with the kit returned in a "ready-to-use" state.
- List of required contents is to be included within all first aid kits.
- All first aid kits will be checked on a monthly basis by site first aid representatives to ensure that they are maintained in a "ready-to-use" state.
- Operators of vehicles will be required to check their vehicle's first aid kits during pre-start inspections.

1.14 Reporting

The sand mining contractor will provide an annual FEMP compliance report documenting Level 2 and 3 emergencies only (if they occur) to the Shire of Serpentine-Jarrahdale by 31 January after each calendar year of the mine's operation.

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2.0 REFERENCES

Department of Fire and Emergency Services. 2016. What is a Total Fire Ban? Accessed 29 November 2016. https://www.dfes.wa.gov.au/totalfirebans/Pages/whatisatfb.aspx.

Department of Water. 2006. Tanks for Elevated Chemical Storage. Accessed 28 November 2016 https://www.water.wa.gov.au/__data/assets/pdf_file/0010/5131/82577.pdf.

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RPS

FIGURES

RPS

Job Number: L1505503_FEMP
Doc Number: 001
Date: 24.05.18
Scale: Map 1: 8000 Overview 1: 500,000 @ A4
Created by: MA
Source: Imagery - Landgate Jan 2018

GDA 1994 MGA Zone 50
0 45 90 180

Figure 1
Site Location

RPS

Job Number: L1505503_FEMP
Doc Number: 002
Date: 29.05.18
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure 2

Staging Plan

RPS

Job Number: L1505503_EIL
Doc Number: 003
Date: 11.02.19
Scale: 1:3,545 @ A3
Created by: MA
Source: Cadastre - Landgate, 2015 Orthophoto - Landgate, Jan 2018

GDA 1994 MGA Zone 50
0 15 30 60 90 120 m

Figure 3

Vehicle Access and Site Office

RPS

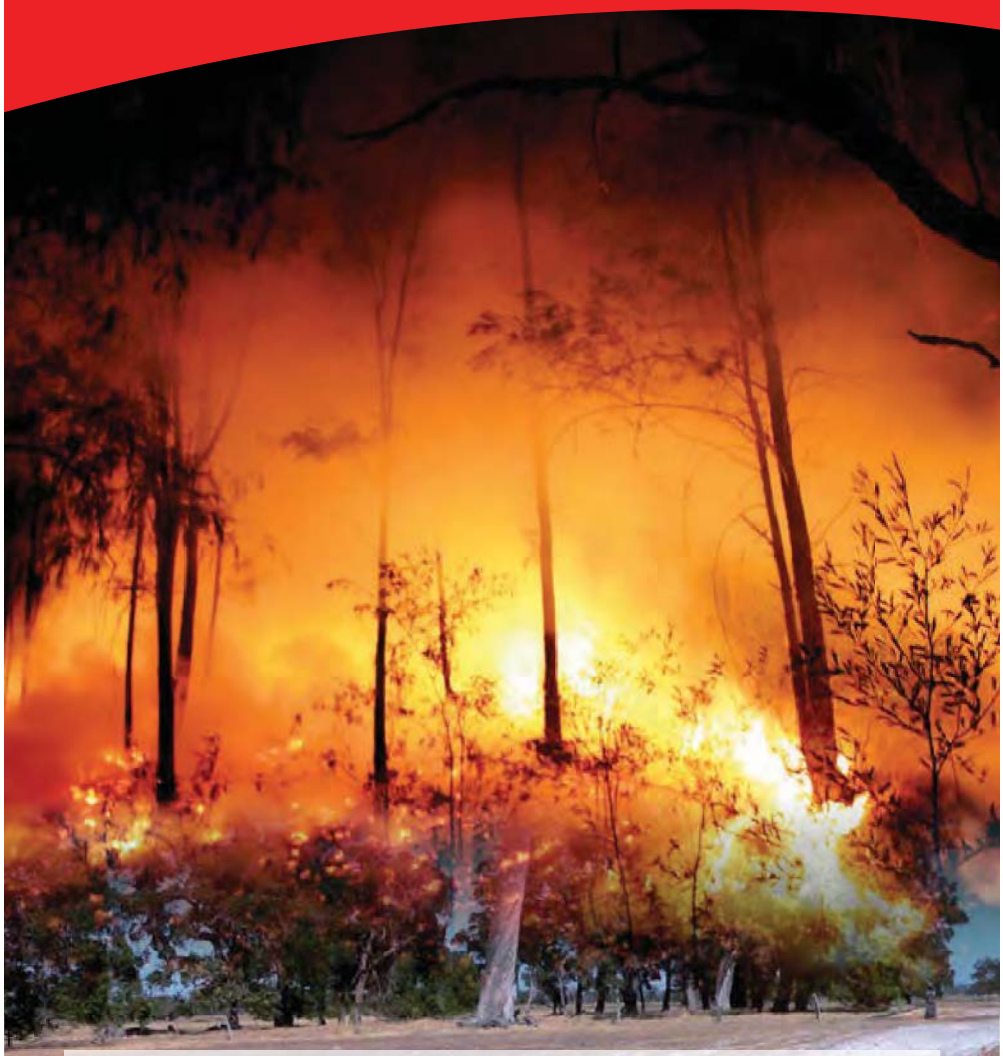
APPENDIX I

Firebreak Notice and Fuel Hazard Reduction Notice

Notice is hereby served to all residents and ratepayers of the Shire of Serpentine Jarrahdale

Firebreak Notice and Fuel Hazard Reduction Notice

Your legal responsibilities and fire safety information



Failure to install and maintain firebreaks in accordance with this notice may result in a $5,000 fine

This Notice and information has effect from 1 October 2016.
All previous Firebreak Notices are hereby cancelled.
By order of Council, Gary Clark,
Chief Executive Officer

Shire of Serpentine Jarrahdale

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Important Dates .....Page 3
Firebreak Notice .....Page 4
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Firebreak Installation Guide.....Page 12
Hazard Reduction.....Page 14
Asset Protection Zones .....Page 17
Hazard Separation Zones .....Page 18
Firebreak Variation Guidelines.....Page 20
Burning Information.....Page 23
Who to Call for a Permit.....Page 24
Garden Refuse .....Page 30

TO REPORT ANY FIRE:

DON'T COME HOME TO THIS...

Important dates

Restricted Burning Period commences* ..... 1 October

Variation to Firebreak Notice completed by ..... 31 October

Variation to Firebreak Notice, as approved by council, to be complied with by ..... 15 November

Firebreak Installed by ..... 30 November

Prohibited Burning Period commences* ..... 1 December

Maintenance of Firebreaks ..... 1 December to 31 May

Prohibited burning period ends as Restricted Burning Period commences* ..... 1 April

Restricted Burning Period finishes* ..... 31 May

**Subject to seasonal changes - check with the Shire of Serpentine Jarrahdale*

DIAL 000

...OR THIS

FIREBREAK NOTICE

Good firebreaks must be clear of everything - it may save a life.

BUSH FIRES ACT 1954
Shire of Serpentine Jarrahdale

PLEASE READ CAREFULLY
THESE ARE YOUR LEGAL REQUIREMENTS

Action is required by all property owners to comply with this notice.

Pursuant to the powers contained in Section 33 of the Bush Fires Act 1954 (as amended) all land owners/occupiers within the Shire of Serpentine Jarrahdale are hereby required in accordance with the following categories to maintain the land for such duration and in such positions/dimensions and specifications as required by this Notice or approved in writing by Council or its authorised officer.

FAILURE TO COMPLY MAY RESULT IN A $5,000 FINE

Definitions

“Firebreak” means a strip of land that has been cleared of all trees, bushes, grasses and any other object or thing or flammable vegetation material leaving clear bare mineral earth. This includes the trimming back of all overhanging trees, bushes, shrubs and any other object or thing over the fire break area.

“Flammable” means any bush, plant, tree, grass, vegetation, object, thing or material that may or is likely to catch fire and burn.

“Trafficable” means to be able travel from one point to another in a 4x4 fire vehicle on a firm and stable surface, unhindered without any obstruction that may endanger resources, no firebreak is to terminate without provision for egress to a safe place or a cleared turn around area of not less than a 21 meter radius (prior written approval from council is required).

“Vertical axis” means a continuous vertical uninterrupted line at a right angle to the horizontal line of the firebreak.

“Duration” means the period of time stipulated in categories 1-7 on the following pages.

YOUR LEGAL R

Category	Requirement
	(a)
1. All areas of land 4047m² (one acre) or less	• Have the entire land cleared of all flammable material by mowi other means. All grasses are to be maintained below 25mm in he • All trees, bushes, shrubs are to be trimmed back over driveway to all buildings to four (4) metres wide with a clear vertical axis o access for emergency services to all structures and points of the firebreaks as per category 2.
	Duration: Compliance required on or bef 31st May each and every year
2. All areas of land greater than 4047m² (one acre)	• Install trafficable, bare mineral earth firebreaks clear of all flam a minimum of three (3) metres wide immediately inside all extern immediately surrounding all buildings, sheds or groups of buildi the land. • All overhanging branches, trees and limbs are to be trimmed b wide with a clear vertical axis over the firebreak area. This includ access to all buildings on the land. • The maximum permissible width of a firebreak is five (5) metre approved in writing by Council or its duly authorised officer. Any development is to be sited not less than four (4) metres from fencing of the lot to allow installation and maintenance of the fire otherwise approved in writing by Council.
	Duration: Compliance required on or bef 31st May each and every year
3. Application to vary firebreak	• If you consider you cannot clear firebreaks as required by this apply in writing to Council on or before 31st day of October in an requesting permission to provide firebreaks in an alternative posi alternative action to comply with this Firebreak Notice. If Council officer does not grant permission for your variation or your variat you shall comply with the requirements of this Notice in its entire • Variations to the Firebreak Notice once approved will not be re applied for each subsequent year after granting. Variation to fireb approvals are provided to the property owner, not the land. • To apply for a Variation please call 9526 1111 and request a Va Firebreak Notice Kit.
	Duration: Compliance required on or bef 31st May each and every year

EQUIREMENTS

	Fuel Hazard Reduction	Dwellings, Out Buildings	More Info
	(b)	**(c)**	
ng and slashing or ight. 's and access ways ver it to afford property or provide	• Remove fuels as per 1(a).	• Maintain low fuel zones adjacent to all buildings and outbuildings. • Trim back all overhanging trees from buildings.	Pages 12-19
ore 30th November and maintained up to and including the			
mable material to al boundaries and ngs situated on ack four (4) metres es driveways and s unless otherwise the perimeter break area unless	• Keep grasses short. • Manage and maintain fuel loadings below 8 tonnes to the hectare.	• Maintain 20m low fuel zones adjacent to all buildings and outbuildings or in accordance with land category 7. • Provide firebreak around all buildings as per 2(a).	Pages 12-19
ore 30th November and maintained up to and including the			
Notice, you may y given year tion or take or its authorised ion is cancelled, ty. quired to be reak notice ariation to	• In accordance with your approved Variation to Firebreak Notice.	• In accordance with your approved Variation to Firebreak Notice.	Pages 20-22
ore 15th November and maintained up to and including the			

YOUR LEGAL R

Category	Requirement
	(a)
4. Plantations	• All plantations shall comply with Councils conditions of appro approved Bushfire Management Plan and this firebreak notice. • Install bare mineral earth trafficable firebreaks clear of all flamr a minimum of twenty (20) metres wide immediately inside all ext of the land with all overhanging branches, trees, limbs, etc to be clear vertical axis over the firebreak area. • Install bare mineral earth trafficable firebreaks to a minimum of metres wide immediately surrounding all buildings, sheds and h of buildings situated on the land. • All overhanging branches, trees, limbs etc. to be trimmed back axis over the firebreak area. • If a new structure is applied for then AS3959 applies.
	Duration: Compliance is required through
5. Fuel storage/hay stacks	• On all land where hydrocarbons (fuel) is stored or located or w whether containing fuel or not, are stored, clear firebreaks a mini metres wide with a clear vertical access around any pile, drum, ra drums. • The maximum permissible dimensions and firebreak size for s flammable materials (including hay mulch, vegetation, greenwast other flammable material), unless otherwise approved in writing b authorised officer are as follows (L x W x H): - Hay stacks: 25m x 10m x 5m – Bare, mineral earth firebreaks m width with a clear vertical access installed directly adjacent to eac all directions with an additional 5m low fuel area directly adjacen - Any other flammable material (including mulch, vegetation or g x 10m x 3m – Bare, mineral earth firebreaks minimum 10m in wi vertical access installed directly adjacent to each stack or pile in a **• The clearing of any standing vegetation (trees/substa to achieve firebreaks required in this land category will requisite planning approval from Council** • Where possible, additional low fuel zones outside of the firebre each individual pile of flammable material should be maintained. kept below 100mm in height within this low fuel zones. • The maximum permissible width of a firebreak required under is 20m unless otherwise approved in writing by Council or its au
	Duration: Compliance required on or befo 31st May each and every year

EQUIREMENTS

	Fuel Hazard Reduction	Dwellings, Out Buildings	More Info
	(b)	(c)	
val and/or the nable material to ernal boundaries trimmed back to a f twenty (20) aystacks or groups to a clear vertical	• Firebreaks to remain clear of all flammable material.	• Comply with AS3959. • Comply with approved conditions of approval and/or Bushfire Management Plan. • Maintain firebreaks clear to mineral earth as per 4(a). • Maintain all vegetation away from power lines.	N/A
hout the year, each and every year			
here fuel dumps, mum of four (4) ump or stack of storage of e, timber or any by Council or its inimum 5m in ch stack or pile in t to the firebreak. reen waste): 20m dth with a clear all directions. **ntive shrubs)** **require the** eak area around Grasses should be this land category thorized officer.	• As per 5(a).	• As per 5(a). • AS3959 applies to dwellings .	Pages 12-19
ore 30th November and maintained up to and including the			

YOUR LEGAL R

Category	Requirement
	(a)
6. Hazard reduction requirements	• In addition to the above firebreak requirements where Council Officer requires that additional fire prevention works be undertake property to reduce the hazard, Council or the Authorised Officer r writing the owner and/or occupier to comply with the required wo within the notice. • This may include hazard reduction works identified as part of a treatment plan derived from Council's Bushfire Risk Management
	Duration: Compliance is in accordance w
7. Does your property have a Bushfire or Emergency Management Plan?	• All properties with a bushfire management, emergency manage an approved Bushfire Attack Level (BAL) assessment approved as Planning Scheme, subdivision approval, development approval o for an individual or group of properties shall comply with the plar • A bushfire management plan's requirements are in addition to t of this notice. PENALTY: $5000.
	Duration: Compliance is required through
8. Exemptions	**COUNCIL DOES NOT ISSUE EXEMPTIONS.**

OTHER LEGAL R

Item	Legislation	Requirements
9. Restrictions on the burning of garden refuse.	Section 24G of the *Bush Fires Act 1954*	The following restrictio Serpentine Jarrahdale a • **Maximum of two g** • Maximum permissib • Only one pile may be • Only dry garden refus • 72 hours prior to the • Vegetation being bur • Duration: Complianc • Burning may not be u • Burning may not be u used in the pile. **Failure to comply w**

EQUIREMENTS

	Fuel Hazard Reduction	Dwellings, Out Buildings	More Info
	(b)	(c)	
or the Authorised en within the nay instruct in orks specified bushfire risk Plan.	• In accordance with 6(a). • Manage and maintain fuel loadings below 8 tonnes to the hectare.	• Additional hazard reduction as required by Council/ authorised officer.	Page 14
ith the written notice throughout the year.			
ement plan or s part of a Town r building permit n in its entirety. the requirements	• In accordance with your Bushfire Management/ Emergency Management Plan and/or Bushfire Attack Level assessment and this Firebreak Notice.	• In accordance with your Bushfire Management/ Emergency Management Plan and/or Bushfire Attack Level assessment and this Firebreak Notice.	N/A
out the year, each and every year.			
			N/A

REQUIREMENTS

	More Info
ns on the burning of garden refuse apply on all land within the Shire of pply: **garden refuse burns per calendar month per property** le size of a single pile of garden refuse is one cubic metre alight at any one time se (vegetation) may be burnt burn, adjoining residents must be notified nt must be from the property on which the burn is occurring e is required throughout the year, each and every year. ndertaken during the prohibited burning times ndertaken on Sundays or Public Holidays Accelerants must not be **ith these requirements carries a $3,000 penalty**	Page 30

ESINFO 01

Firebreak installation guide

The purpose of this guide is to give an understanding of the principle locations of firebreaks on properties. Council acknowledges that not all properties are the same and has introduced a variation to firebreak system. This allows property owners to apply for a variation to manage their properties responsibly within the environment they live in accordance with the Council firebreak notice. See ESINFO 03 Page 20.

Mowed firebreaks are not accepted as they are not considered mineral earth. Mowed firebreaks may endanger the lives of firefighters.

MOWED FIREBREAKS ARE NOT ACCEPTED

Additional information

Trees - live standing trees: Council does not expect you to remove large trees from or adjacent to boundaries so as to install the firebreak. The firebreak can simply detour around the tree so as to afford safe access. This procedure does not require a Variation to Firebreak Notice as long as the normal dimensions of the firebreak exist. If there is a requirement to detour around multiple trees then a Variation to Firebreak Notice will be required.

Roads, verges, bridle paths, footpaths, dual use access ways and reserves: None of the above can be classified as a firebreak for your property. **Firebreaks must be on your own property to conform to the Firebreak Notice.** However, any additional fire prevention activities on verges etc. is encouraged as long as it does not present a liability issue to Council. Removal of indigenous and substantive trees/vegetation requires council approval.

Emergency access ways: These are for Emergency Services vehicles only and are not to be considered as an escape route unless declared as such by the Incident Controller during an emergency.

Maintenance of firebreak, access and vegetation: Once your firebreaks, accesses and vegetation have been managed to meet your legal requirements of the Firebreak Notice, please ensure that these conditions are maintained all the way through until 31 May each year. It is fairly normal for regrowth to occur between December and May. Keep firebreaks and accesses mineral earth and free of obstructions such as fallen tree limbs, ensure vegetation is maintained to minimum levels.

Effective firebreaks: Firebreaks are there to provide safe access on your property to fire fighters. They need to be able to use the firebreak as a place of safety for themselves and their vehicles where the fire will not travel under their vehicles or underfoot. On days of strong winds or extreme conditions it is fully accepted that a

three metre firebreak will be unlikely to stop a wildfire. The more fire prevention work you undertake, the greater the chance of your family and property surviving the ravages of fire.

The installation of firebreaks is only one element of the fire prevention picture. Firebreaks are required to be installed and maintained from 30 November until 31 May each and every year. In some cases ***firebreaks may have to be reinstalled several times in one year.***

It is the property owner, not the contractor or lessee that is responsible for the standard and quality of the firebreaks installed and maintained.

Ploughing and grading: these methods can produce effective firebreaks, however, the areas need constant maintenance. Loose soil may erode in steep areas, particularly where there is high rainfall and strong winds. Stepping and grading the firebreak into the incline reduces this effect.

The installation of firebreaks needs to be in harmony with total fire prevention activities of which some are highlighted below;

How to do hazard reduction

Reduction of fuel does not have to be as drastic as removing all vegetation. Environmentally this would be disastrous and often trees and plants can provide you with some bushfire protection from strong winds, intense heat and flying embers.

Methods of hazard reduction:

- hand clearing
- mechanical clearing
- chemical spraying (should be undertaken from June – September)
- hazard reduction burning

In many circumstances, hand and mechanical clearing methods should be considered the best way to protect assets. These methods can be safer than burning, and easier to organise and maintain.

Manual removal of fine fuels: remove debris such as fallen leaves, twigs, grasses and bark on a regular basis.

Mowing grass: keep grass short, green and well watered.

Slashing and mulching: this is an economical method of fuel reduction. To be effective, the cut material must be removed or allowed to rot before summer starts. Slashing and mowing may leave cut grass in rows, increasing fuel in some places. Mulching, or turbo mowing, also mulches the vegetation leaving it to rot away.

Hazard reduction program

Autumn to winter (May - August)

- Tree Pruning - remove lower branches from the ground up to 2 metres; check that power lines are clear. Use a professional contractor.
- Reduce fuel levels around the house - clear long grass, leaves, twigs and flammable shrubs.
- Ensure petrol and other flammables are safely stored away from the main dwelling.
- Make sure your fire fighting equipment is in good working order and serviced where required.
- Make sure all residents are aware of your emergency plan including evacuation routes.
- Chemical spraying of firebreaks and low fuel zones – first and second applications (June to September).

Spring (September - November)

- Move woodpiles and stacked timber at least 20 metres away from the main dwelling.
- Keep grass short.
- Clean gutters and roof debris.
- Install firebreaks in accordance with this Firebreak Notice, your Variation to Firebreak Notice and/or take action to comply with your Bushfire Management Plan or Bushfire Attack Level assessment.
- Chemical spraying of firebreaks and low fuel zones – final applications and maintenance.
- Review your family's bushfire survival plan. Further information on bushfire planning can be found on the Department of Fire and Emergency Services website.
- Make sure you consider your specific circumstances, including pets and livestock in your bushfire preparation.
- Implement identified bushfire risk management treatments.

Summer (November - May)

- Water lawns, trees and shrubs near the buildings to keep them green.
- Re-check fire fighting equipment, screens, water supplies and that gutters remain clear.
- Maintain firebreaks in accordance with this Firebreak Notice, your approved Variation to Firebreak Notice and/or continue to take action to comply with your Bushfire Management Plan or Bushfire Attack Level assessment.
- Maintain identified bushfire risk management treatments.

Long term precautions

- Ensure firebreaks are prepared in accordance with the latest Firebreak Notice or any Variation to Firebreak Notice or Bushfire Management Plan approved by council.
- Ensure that any planting of wind breaks or trees is in accordance with this Firebreak Notice and will not be detrimental to fire suppression requirements in years to come.
- Make sure that the buildings are safe - fit metal fly screens and shutters, fill gaps into roof/wall spaces, fit fire screens to evaporative air conditioners and have them operable to provide a water only supply.
- Give consideration to installing external building sprinkler systems and back up power for emergencies.
- Ensure emergency water supplies have the correct fittings and that access is unobstructed and trafficable.
- Get basic training in fire fighting from your local Bush Fire Brigade or even join your local Brigade.
- Join or start a local Bushfire Ready Action Group.

Development in bushfire prone areas

Bushfire Prone Areas

In December 2015 the State Government announced reform to help protect life and property in the event of a bush-fire. Areas within the State were mapped and declared "Bushfire Prone". Approximately 97% of our Shire has been designated bushfire prone as part of State Government reform. You can check your property online using the following: https://maps.slip.wa.gov.au/landgate/bushfireprone2016/

The bushfire prone area map is used as a trigger to determine if additional construction requirements are required prior to the construction of your building. These additional requirements may include a Bushfire Attack Level (BAL) assessment and/or a Bushfire Management Plan in accordance with *State Planning Policy 3.7.*

Bushfire Attack Levels (BALs)

Bushfire Attack Level Assessments (BALs) are used as a means of measuring the likely impact of a bushfire on a structure and, in accordance with Australian Standard 3959 are used as the basis for establishing the additional requirements for construction to improve survival of buildings from attack by bushfire.

There are six BAL levels, split between BAL Low and BAL Flame Zone. Although there are no specific construction requirements for BAL Low it does not mean that your building is not at risk! Due to the unpredictable behaviour of fire, there can be no guarantee that a building will survive a bushfire event on every occasion.

The Community Resource Centre have a list of contractors who can assist in firebreak and fuel hazard reduction works and the provision of bushfire attack level assessments and fire management planning. These contractors provide landowners with assessments relating to their development. Please refer to the link below for this information or phone the Resource Centre on 9525 9999: http://serpentinevalley.com.au/app/webroot/js/tiny_mce/plugins/filemanager/files/Firebreak_Contractors.jpg

Bushfire Management Plans

A Bushfire Management Plan will generally be required when a subdivider receives subdivision approval from the Western Australian Planning Commission.

Bushfire Management Plans may incorporate specific conditions or requirements for your lot, including strategic firebreaks, access, water supplies, hardstands, gates and BAL assessments, which are in addition to the requirements contained within this Firebreak Notice. Lots which have had a Bushfire Management Plan prepared for them usually have a Section 70A notification on the certificate of title, and as a landowner you should be notified of this prior to purchasing the land. For further information or to find out if your lot is covered by a Bushfire Management Plan, contact the Shire of Serpentine Jarrahdale.

Asset Protection Zones

An asset protection zone is a low fuel area immediately surrounding a building and is designed to minimise the likelihood of flame contact with buildings and reduce the effect of radiant heat. Asset protection zones must be a minimum of 20 metres on flat land.

It is important to maintain asset protection zones by keeping fuel loads below 2 tonnes per hectare as per the Visual Fuel Loading Guide - Swan Coastal Plain and Darling Scarp available from the following link: https://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/VisualFuelLoadsPublications/Visual%20Fuel%20Load%20Guide%20Swan%20Coastal.pdf. This can be achieved through removal of long grasses and sedges, leaf litter, twigs and flammable shrubs.

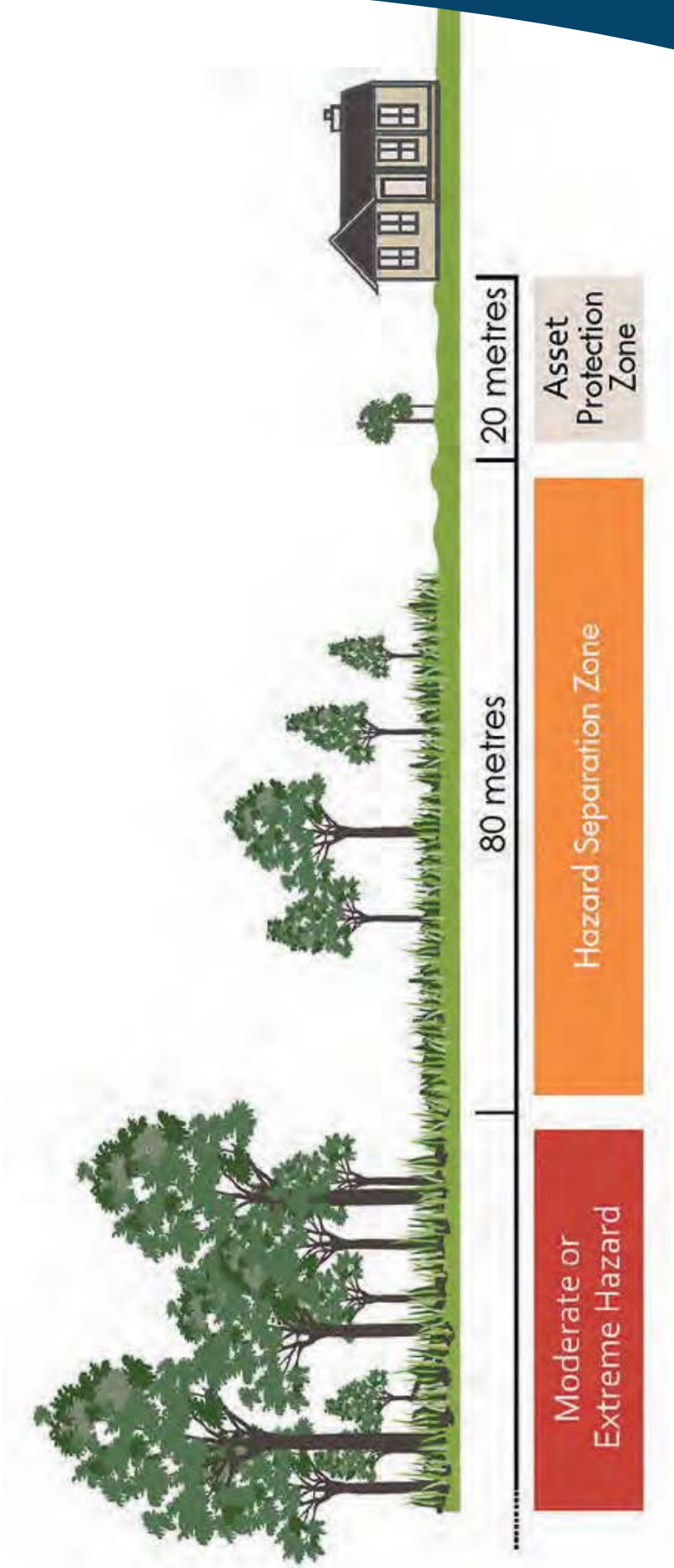
Trees in the asset protection zone should be under pruned to 2 metres high and if there are large trees within 20 metres of the house, consider having them pruned by a professional contractor. Trees overhanging buildings or assets within the asset protection zone should be trimmed back to provide 2 metres clearance between the structure and the tree. Where an asset protection zone is required as part of an approved Bushfire Attack Level (BAL) assessment it must be maintained all year round as prescribed in the BAL report.

Hazard Separation Zone

A Hazard separation zone is needed to provide additional fire protection by reducing the amount of available fuel between the buildings and the surrounding vegetation to reduce the impact of bush fires. A Hazard Separation Zone (HSZ) should extend for 80 metres beyond the asset protection zone or where the 80 metres cannot be achieved then the HSZ is to be to the lot boundary.

As the occurrence of bush fires in this locality is inevitable and will burn in accordance with the prevailing weather and fuel conditions at the time, it is essential that property owners maintain HSZs on their land to have any degree of safety. The following items provide a guide to maintain a HSZ:

- Bush fire fuels within the HSZ should be kept below 4-6 tonnes per ha. as per the Visual Fuel Load Guide for the Swan Coastal Plain and Darling Scarp.
- All grasses within the HSZ must be a maximum of 100mm in height.
- All accumulated litter, twigs, bark of trees, fallen tree branches and logs should be removed from the area on a regular basis prior to and during to the bushfire season.


Asset Protection Zone
20 metres
Hazard Separation Zone
80 metres
Moderate or Extreme Hazard

ESINFO 03

Firebreak variation guidelines

The following guidelines are acceptable categories for which a variation to firebreak may be applied for:

1. The topography/composition makes the normal placement or construction methods of a firebreak impractical or dangerous and alternative firebreak emergency access and fire prevention methods that meet the intention of the firebreak notice is provided and demonstrated.

2. An approved Bushfire Management Plan for the property is in place and being conformed to and meets the intention of the fire break order is provided and demonstrated.

3. The firebreak variation only applies to a portion of the property that is **reticulated lawn** that is **kept green** and it can be demonstrated that it is maintained regularly to **less than 25mm** from the 1st December through to the 31st May inclusive.

4. The firebreak variation only applies to a portion of the property that is **reticulated feed paddocks** that is **kept green** and it can be demonstrated that it is maintained regularly to **less than 100mm** from the 1st December through to the 31st May inclusive.

5. The variation only applies to the portion of the property that has **reticulated garden beds, lawn, orchard or other accepted sustained cultivation,** unless it is deemed by the Council or its Authorised Officer that the fuel type/loadings are a hazard, however, there must be in all cases, cleared access provided to enable emergency vehicular access to buildings and outbuildings and all parts of the property in accordance with Councils firebreak notice.

6. Where permission was previously granted to plant trees, where the firebreak would normally be placed, and placement of the firebreak is in an approved alternative position that affords proper emergency vehicular access and hazard management and prevention principles in accordance with Councils firebreak notice.

7. Firebreaks are provided in approved alternative locations to negate natural obstructions.

8. Constructed driveways may where authorised, substitute for fire breaks as long as it remains trafficable for the firebreak as a whole and is maintained clear of all obstructions and flammable materials at all times in accordance with Councils firebreak notice.

All requests must be made by the property owner or person authorised to act upon the owners behalf. **Individual requests** are required **for each property** and must be submitted on the approved document/ application form.

The authorising officer has the right to grant, refuse, alter or add any conditions to an application, where alterations or additions are applicable, failure to comply within the timescales provided by the authorised officer will result in the refusal of the application and prosecution as if a firebreak had not been installed in accordance with this Firebreak Notice.

Approved firebreak variations are perpetual to the owner unless there is:

- A change to any law or statute which has an effect on the variation
- Non-compliance with the variation
- A change in the ownership of the property”

Where refusal of an application takes place the owner has fourteen (14) days in which to conform to the normal requirements of the Councils firebreak notice.

Please note: You must have your variation in place and operational by the 15th November in the year you wish it to commence. It is your responsibility to demonstrate that the variation will be maintained from the 15th November through to the 31st May each year. Failure to demonstrate compliance and the ability to maintain the alternative solutions approved within the variation will automatically require total compliance with the firebreak order in its entirety.

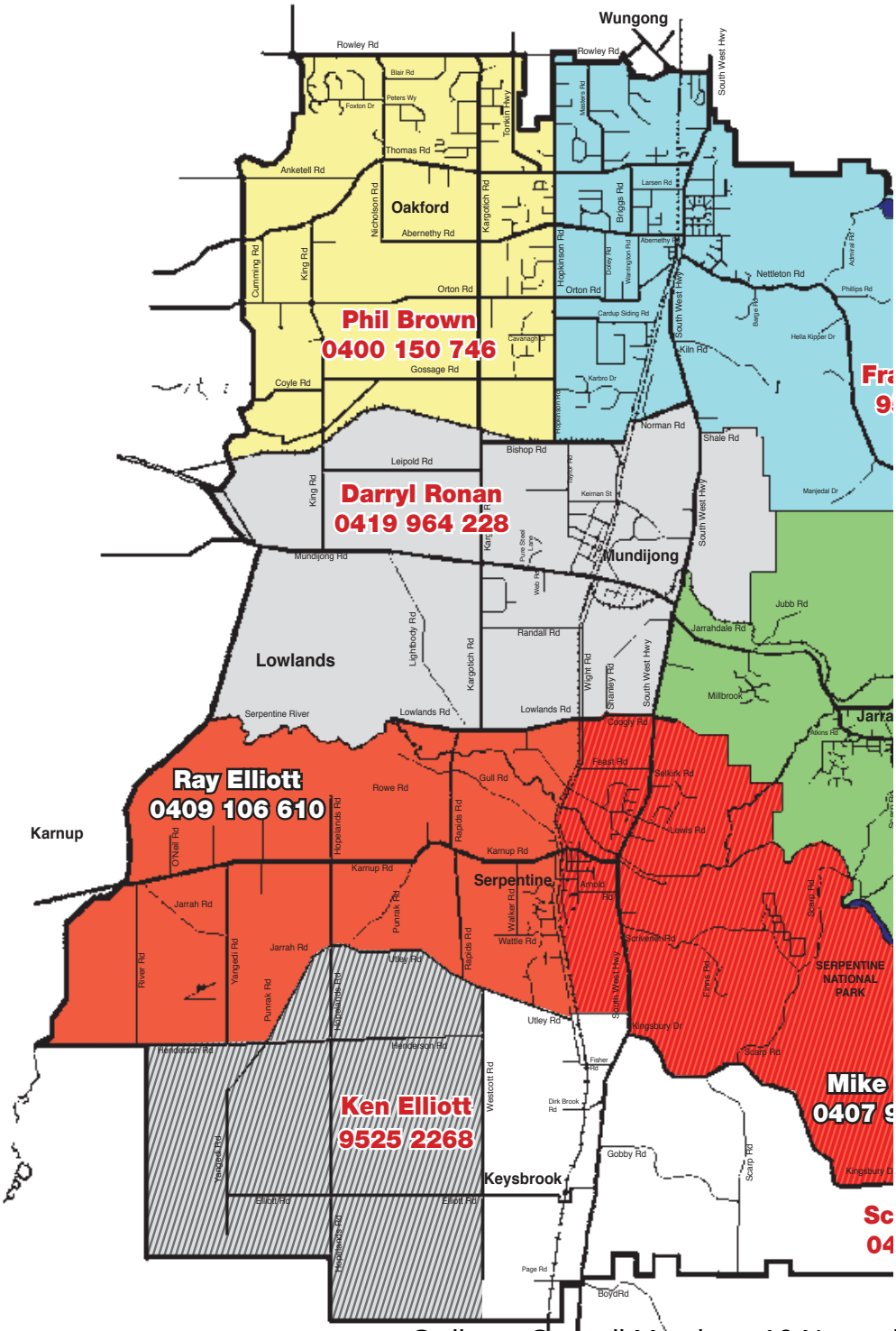
Example plan of alternate firebreak variations:

Burning information

	What can I burn?		
	1m by 1m Garden Refuse 6pm to 11pm	Wood and Solid Fuel Barbecue	Grass, Paddock, Bonfire, Bush
Restricted Burning Period 1 October to 30 November**	**Allowed** in accordance with conditions listed on pages 26 to 31	**Allowed** in accordance with conditions listed on pages 26 to 31	**Permit Required** Contact your local Fire Control Officer
Prohibited Burning Period 1 December to 31 March**	**Prohibited**	**Allowed** in accordance with conditions listed on pages 26	**Prohibited**
Restricted Burning Period 1 April to 31 May**	**Allowed** in accordance with conditions listed on pages 26 to 31	**Allowed** in accordance with conditions listed on pages 26 to 31	**Permit Required** Contact your local Fire Control Officer

**N.B: Subject to seasonal changes. Please check with Council.

Who to call for a permit



Volunteer Fire Control Officers

Frank Rankin 9525 1146
Areas: Byford, Darling Downs, Cardup and Karrakup

Phil Brown 0400 150 746
Areas: Oakford and north of railway line in Oldbury

Darryl Ronan 0419 964 228
Areas: Mundijong, Whitby and south of railway line in Oldbury and north of the Serpentine River and Lowlands Road in Mardella

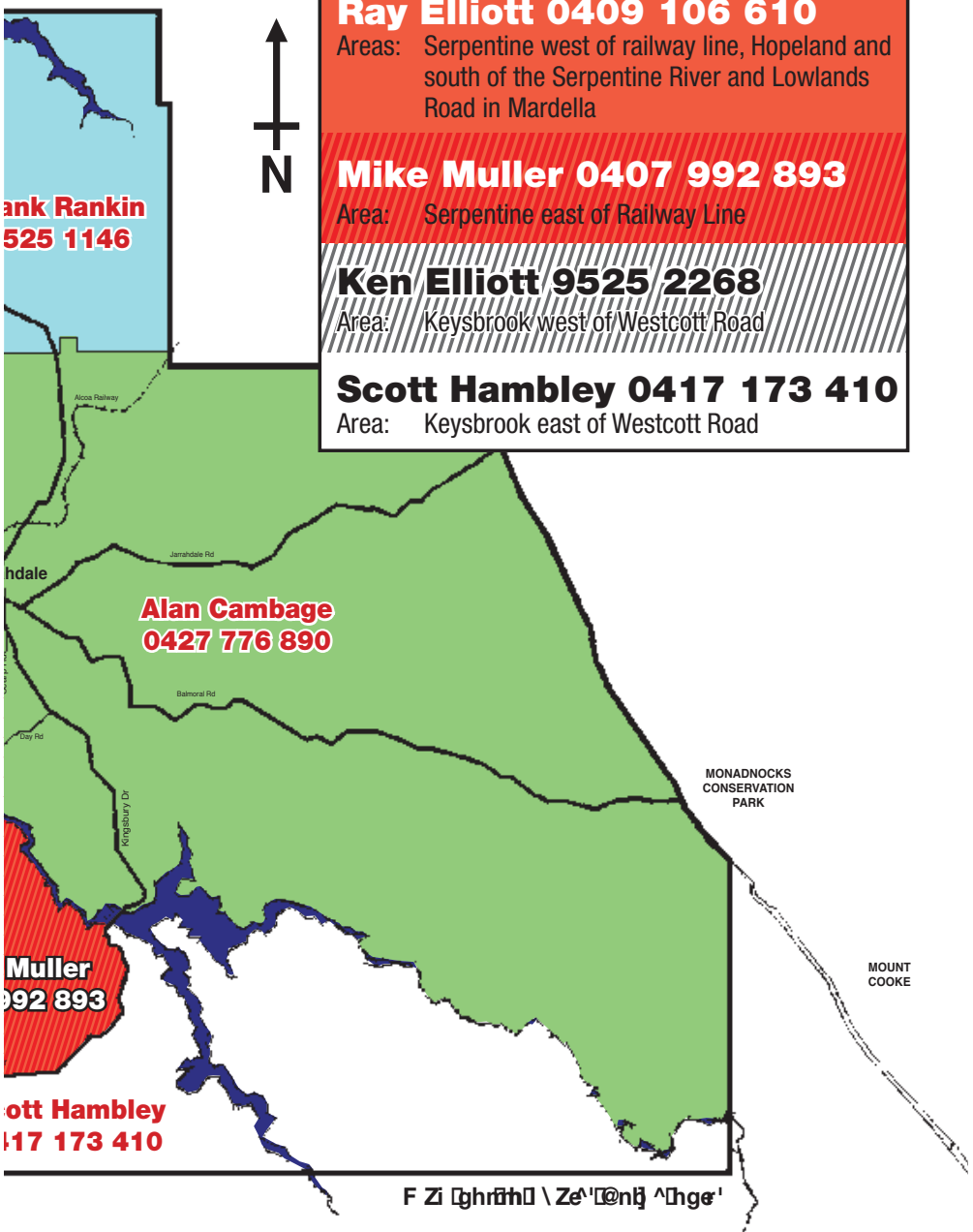
Alan Cambage 0427 776 890
Area: Jarrahdale

Ray Elliott 0409 106 610
Areas: Serpentine west of railway line, Hopeland and south of the Serpentine River and Lowlands Road in Mardella

Mike Muller 0407 992 893
Area: Serpentine east of Railway Line

Ken Elliott 9525 2268
Area: Keysbrook west of Westcott Road

Scott Hambley 0417 173 410
Area: Keysbrook east of Westcott Road



The following conditions apply to all burning and fires in the Shire during the restricted and prohibited burning periods:

- on any day where the Fire Danger Rating is 'very high', 'severe', 'extreme' or 'catastrophic', permits are automatically cancelled. In addition, any solid fuel fire for the purpose of camping or cooking and/or garden refuse burning (including, but not limited to: wood, solid fuel barbecues, pizza ovens, spit roasts, hangis, incinerators or Webers) are **NOT** permitted to be used under any circumstance.
- Where the conditions allow camping or cooking fires, bush and inflammable material must be cleared for three (3) metres around any cooking or camping fire prior to ignition.
- Due to unseasonable weather conditions the Restricted and/or Prohibited Burning Periods may be extended or shortened. Check with the Shire Office or your local Fire Control Officer to confirm the burning period.

The Fire Danger Rating can be found by calling the weather information line 1196. If in doubt or you cannot find out - call Council on 9526 1111 for further information, or do not burn.

What will I be fined if I don't comply?	
Failure to produce permit to burn	**$500**
Offences relating to lighting a fire in the open air	**$3,000**
Obstruction of an authorised officer	**$5,000**
Disposal of burning cigarettes etc.	**$5,000**
Failure of occupier to extinguish bush fire	**$10,000**
Setting fire to the bush during prohibited burning time	**$250,000 and 14 years imprisonment**

If Council's volunteer bush fire brigades attend a fire at any time of the year that is in the opinion of the attending officer deemed to be

- Illegal or;
- not under control or;
- not adequately controlled;

the owner or occupier of the property where that fire is burning may be liable to penalties imposed under Council's Annual Schedule of Fees and Charges up to $10,000, in addition to any infringements or penalties imposed under the Bush Fires Act 1954 (as amended).

Fire permit application

All persons wishing to set fire to the bush during the Restricted Burning Times must first obtain a written permit from a Bush Fire Control Officer for their relevant area.

"Bush" is defined as: any vegetation, trees, bushes, plants, stubble, scrub and undergrowth of all kinds whatsoever whether alive or dead and whether standing or not standing and also a part of a tree, plant or undergrowth and whether severed there from or not so severed.

Before you call a Fire Control Officer ensure you have the following information:

- Who will be the three able bodied persons in attendance at all times whilst the fire is alight including contact phone number?
- What is the address of the property for which the permit applies?
- What fire fighting equipment and resources will you have at the fire front and is it in good working order?
- What is the size of burn to take place?
- Are there firebreaks installed and can a fire unit get access to the area?
- Is the material you are burning vegetation that is dry enough to burn without creating a nuisance? Permits only apply to the burning of bush, so make sure any plastics, treated wood, tyres and other materials are removed from the burn area/pile. Burning these materials may be an offence under environmental legislation such as the *Environmental Protection Act.*

Validity of a permit

A permit is valid only for the day or days written on the permit. It is illegal for anyone who has been refused a permit or given a permit subject to special conditions to approach another Fire Control Officer for a permit concerning the same burn. Appeals can be lodged in writing to the Chief Bush Fire Control Officer of the Local Authority against the refusal of the permit or the conditions.

The Bush Fires Act and Regulations require that notification of the intention to set fire to the bush be given at least 4 days or not more than 28 days prior to burning to:

- The local bush fire control officer for the area.
- All neighbours.
- A Forest officer if the fire is to be lit within 3km of the State Forest.
- On the day of the burn, the Department of Fire and Emergency Services Communication Centre on 1800 198 140.

Notice can be verbal or written in such a way that the person to be notified is aware of the date and time that the burn will take place. In case where notice is given verbally, the period of notice may be determined by mutual agreement between all parties.

Please Note:

All hazard reduction burning over one acre in area which is being undertaken on behalf of a landowner for pecunary gain has the following conditions:

- Written permission and a valid "permit to set fire to the bush" must be obtained from the Shire of Serpentine Jarrahdale at least one week prior to the burn

- A copy of the prescription, including a site plan, traffic and smoke management plan, written permission from the landowner and details of the burn must be submitted as part of the written application

- The Shire and its authorised officer/s reserve the right to either approve, refuse, amend or request additional information in relation to any request to burn on a landowners behalf.

Note:

- At least three (3) able bodied persons and adequate fire suppression equipment or appliances must be in attendance at the fire until it is safe.
- The requirements for a fire to be "safe" is defined as all burning or smouldering debris to be completely extinguished for a distance of 30 metres within the perimeter of the burn area.
- The Fire Control Officer or Local Authority may endorse the permit to vary any conditions on the reverse of the permit.
- A fire may not be lit when the daily fire danger forecast for the area, issued by the Bureau of Meteorology, is very high, severe, extreme or catastrophic.
- The fire must be monitored to make sure smoke is not impacting on neighbours or causing a traffic hazard; if this is found to be the case, all fire must be extinguished as soon as possible.
- Local Government bans the lighting of fires on Sundays or Public Holidays except for brigades or Department of Parks and Wildlife.
- In all cases, the conditions written on the permit must be rigidly observed.
- If, in the opinion of a Fire Control Officer, the fire is considered to be not adequately controlled or is uncontrolled, you may be required to extinguish the fire or Council's Bush Fire Brigade(s) will extinguish the fire and fees may be charged in accordance with Council's Schedule of Fees and Charges.
- Failure to comply with the directions of a Fire Control Officer or obstructing a Fire Control Officer are offences under the *Bush Fires Act 1954* and carry penalties of $2,000 and $5,000 respectively.

Insurance before you burn

Please ensure you have appropriate insurance in place to cover you, your property and your public liability responsibilities before you begin to burn.

Environmental considerations

Does your property have specific environmental restrictions such as:

- threatened ecological communities
- environmentally sensitive areas
- noted as a bush forever site
- areas of native vegetation or specific areas of revegetation which may be prohibited from burning under legislation such as the *Environmental Protection Act 1986*
- previous development/subdivision approval conditions.

If the answer to any of these questions is yes, or you are not sure information is available by:

- accessing the Shire of Serpentine Jarrahdale's website
- contacting Councils office on 9526 1111

It is highly recommended that weed control be undertaken after burning, as weeds can actually increase the fuel loading after a burn. Contact SJ Landcare centre on 9526 0012 for further information.

Remember

It is the permit holder's responsibility to ensure that the fire remains under control. **In the event of any fire escaping beyond the boundaries of the area, the holder of the permit shall dial "000" immediately.** In accordance with Regulation 43 of the Bush Fires Regulations, notification must be made to the local government within seven (7) days reporting in full the circumstances causing the escape of the fire and any losses and equipment used to suppress the fire. Should a fire escape, the permit holder may be held responsible to damages caused to others.

Roadside (verge) burning: Please note it is an offence to set fire to Council road reserves/verges at any time of the year without an approved permit. Permits for this activity can only be obtained from the Council. Contact 9526 1111 to have the relevant paperwork sent to you for completion.

Penalties

The Bush Fires Act Regulations specifies penalties for breaches of these conditions. If a brigade has to attend your burn for suppression activities you could be liable for fines and/or costs.

Advice

Further information can be obtained from your local Fire Control Officer or from the Shire Office on 9526 1111.

Garden refuse

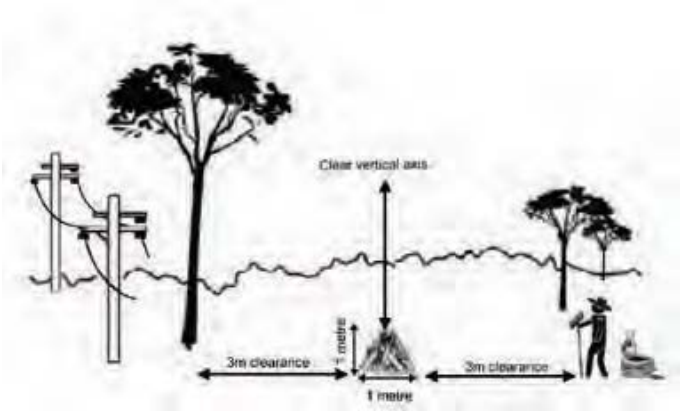
Burning of garden refuse is permitted during the restricted burning period as long as residents comply with this firebreak notice. If in doubt, check with your local Fire Control Officer or the Shire of Serpentine Jarrahdale.

Burning on any day with a fire danger of 'Very High', 'Severe', 'Extreme', or 'Catastrophic' is not permitted, and holds a penalty of $3,000.

As a courtesy, you must notify all residents who adjoin the site of the garden burn at least 72 hours prior to the burn. Where practicable, other residents who might be inconvenienced by the pile burn should also be notified. This allows residents with respiratory conditions to make alternative arrangements prior to the burning of garden refuse. The following requirements apply to all garden refuse burning:

- The pile must not exceed one cubic metre in size.
- Only dry garden refuse (vegetation) may be burnt. This means no household or building materials, plastics, pallets or cardboard may be burnt.
- Garden refuse being burnt must be from the property on which the burn is occurring. You may not burn garden refuse from other properties.
- At least one person must be in attendance during the entire duration of the burn.
- Three (3) metres must be cleared from the edge of the pile in all directions .
- Only one pile may be burnt at a time. If you wish to burn more than one pile at a time you will need a permit from a your local Fire Control Officer.
- All adjoining residents must be notified at least 72 hours prior to the burn. Notice can be either verbal or written.
- The fire cannot be lit before 6pm at night, additional vegetation may be added to a maximum of 1m in width and height until 11pm and the fire must be fully extinguished by midnight on the same night.
- **There is a maximum of two garden refuse burns per calendar month per property.**
- Accelerants must not be used in the pile.
- Penalties of up to $3,000 apply for burning garden refuse contrary to any of these conditions.

RIGHT ☑



Pile is the correct size and clearance. Burn pile clear of trees, fences, buildings and power lines

WRONG ⊗

More than one pile being burnt, piles are too big and are being burnt under trees.

YOU WOULD NOT WANT TO COME HOME TO THIS!

Imagine returning from work to find all your possessions gone, all the valuables, jewellery, treasured mementos from children and family, all your tools, machinery and vehicles burnt beyond recognition.

Could your family cope with being homeless? What about your pets and livestock? What if your family was injured or worse?

TAKE ACTION NOW

- **Know your neighbours, share information and practice your fire plan! (pages 34 and 35)**
- **Follow the Hazard Reduction Program (page 14-16)**
- **Have a bushfire action plan**
- **Have an evacuation plan, contingency plan and know where you will go in an emergency**

ARE YOU BUSHFIRE READY?

BUSHFIRE READY INFORMATION

There are a range of bushfire safety publications available from the following websites:

- www.dfes.wa.gov.au/safetyinformation
- www.areyouready.wa.gov.au
- www.redcross.org.au/prepare

These publications include:

- bushfire action plans and checklists
- information on preparing survival kits
- how to prepare pets and animals for emergencies
- understanding fire danger ratings and warnings

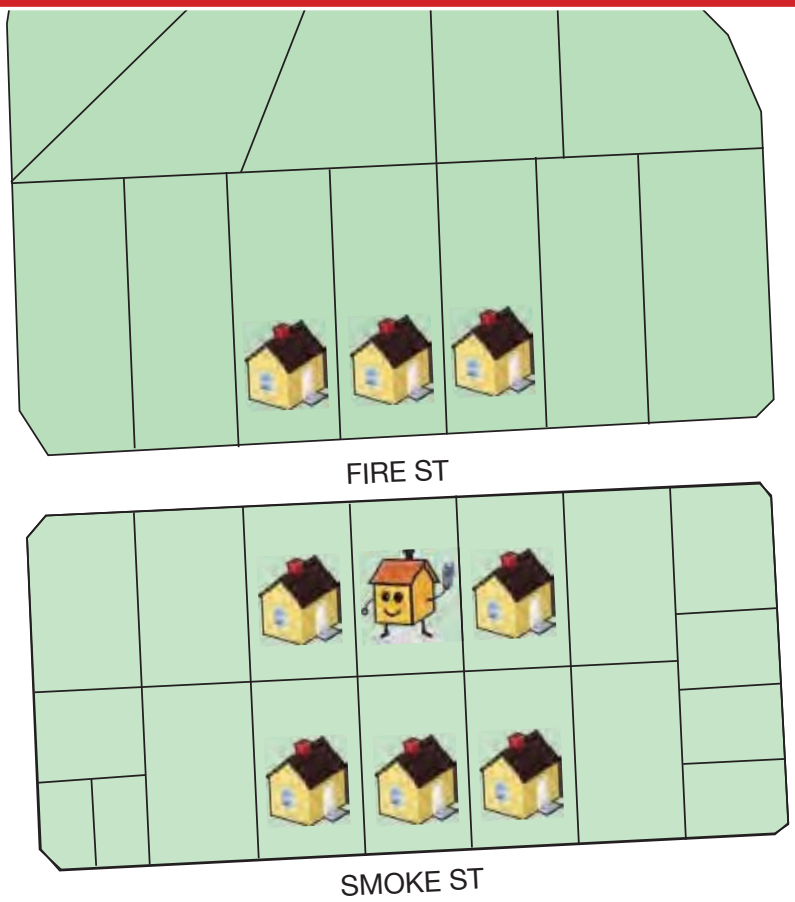
ALERTS AND WARNINGS

During a bushfire, alerts and warnings may be provided by the Department of Fire and Emergency Services or Parks and Wildlife through the following sources:

- www.dfes.wa.gov.au/alerts
- www.twitter.com/dfes_wa
- www.facebook.com/dfeswa
- 13 DFES (13 3337)
- www.dpaw.wa.gov.au/
- www.twitter.com/WAParksWildlife

Alerts, warnings and fire ban information is also broadcast on the local ABC radio station (720 AM).

"Be a mate to eight"



NEIGHBOUR CONTACT DETAILS

	Name	Address
1		
2		
3		
4		
5		
6		
7		
8		

IMPORTANT EMERGENCY CONTACTS

Name/Organisation	Contact Number
Fire / Police / Ambulance	000
State Emergency Service	132 500
DFES Public Information	13 33 37
Main Roads WA	138 138
Western Power	13 13 51
ATCO Gas	13 13 52
Water Corporation	13 13 75
Telstra	13 22 03
RSPCA WA	9209 9300
Wildcare Helpline	9474 9055
Local GP/Doctors	
Hospital	
Insurance Company	

Home Phone	Work Phone	Mobile Phone

Remember, report all fires to

000

**If firefighters can't get to you,
have you done enough to survive?**

Are you being a part of your community?
Join your local Volunteer Bushfire Brigade!
There are a lot of ways you can help, from
active and physical roles to brigade support roles.

Make a difference!
Call 9526 1111

Shire of
Serpentine
Jarrahdale

A 6 Paterson Street, Mundijong WA 6123
T (08) 9526 1111
F (08) 9525 5441
E info@sjshire.wa.gov.au

www.sjshire.wa.gov.au

RPS

APPENDIX 2

Total Fire Bans

Government of **Western Australia**
Department of **Fire & Emergency Services**

PREPARE. ACT. SURVIVE.

Total Fire Bans

Total Fire Bans affect everyone, whether you live near bush or in a built up area. They are a prevention measure to warn you of a day of predicted adverse fire weather. On these days you should be particularly careful not to cause a fire to start.

WHAT DOES A TOTAL FIRE BAN MEAN?

It means a person must not:

- light, maintain or use a fire in the open air
- carry out an activity in the open air that causes or is likely to cause a fire.

The ban includes:

- hot works (welding, grinding, soldering, gas cutting)
- all open solid fuel fires for the purpose of cooking or camping
- use of incinerators and other activities (as described in the 'What Can't I do on a Total Fire Ban day?' section).

WHEN WILL A TOTAL FIRE BAN BE DECLARED?

They are declared on days when fires will be difficult to control, are most likely to threaten lives and property, or when widespread fires are impacting the availability of resources.

The decision to put a ban in place is based on the weather forecast. DFES consults with the Bureau of Meteorology to determine when dangerous fire weather conditions are likely. DFES also consults with local govenments that will be affected.

The need for the ban to remain is assessed and may be revoked in the morning if weather conditions ease. The status of a ban should be checked after 6pm each day.

HOW LONG IS A TOTAL FIRE BAN IN PLACE FOR?

The ban will be in place from 12.01am to 11.59pm on the day declared.

HOW IS A TOTAL FIRE BAN DECLARED?

They are declared by the Minister for Emergency Services, or his authorised delegate, using the whole local government boundary.

HOW WILL I KNOW WHEN ONE HAS BEEN DECLARED?

You can check if your shire has a ban:

- on the DFES website at **www.dfes.wa.gov.au**
- by calling **1800 709 355**
- by listening to ABC local radio and other media outlets
- on roadside Fire Danger Rating signs
- subscribe to RSS or follow DFES on twitter **www.twitter.com/dfes_wa**

Total Fire Bans

WHAT ARE THE PENALTIES FOR IGNORING A TOTAL FIRE BAN?

You could be fined up to $25,000 and/or jailed for 12 months, if you ignore a ban.

CAN I GET AN EXEMPTION TO CARRY OUT WORK DURING A TOTAL FIRE BAN?

Some industries and activities may be given an exemption depending on the nature of their activity.

HOW CAN I GET AN EXEMPTION?

An exemption may be granted if you can show you are taking proper steps to prevent any fire spreading, and that you can control and put out any fire that may start.

Exemptions can cover specific times and locations, and can be changed or cancelled at any time.

You need to apply for an exemption in writing by completing an exemption application form, available at **www.dfes.wa.gov.au**

WHAT CAN'T I DO ON A TOTAL FIRE BAN DAY?

BBQs

Can I use my BBQ?

This depends on what type of BBQ or cooker you have, and where it is located. During a Total Fire Ban you cannot light or use a fire in the open air. Undercover areas such as patios, pergolas and huts that are open or partially open to the weather are deemed to be in the open air.

Solid fuel

No. You cannot use any BBQ or cooker that requires solid fuel such as wood or charcoal. This includes wood fired ovens or stoves, and Weber like BBQs.

Gas

Yes. You can use a gas BBQ for cooking if it has an enclosed flame and:

- All flammable material is cleared five metres away from around your BBQ.
- Your BBQ is never left unattended.
- BBQs with exposed flames cannot be used.

Electric

Yes. You can use an electric BBQ where there is no flame.

What happens if I don't have a five metre buffer zone for my BBQ?

In residential areas where there is not enough space to create your five metre buffer, due to a fence or building, you must:

- Ensure the area around your BBQ is free from flammable material.
- Ensure no burning or hot material escapes this area.
- Be in reach of a garden hose.
- Short green grass less than five centimetres in height, paving stones, bricks and reticulated gardens are not considered to be flammable.

Can I have a BBQ in my local park?

Yes. But only under strict conditions. If you are in a public space or park you must only cook in an area sign posted as a BBQ area. You can only use an electric or gas appliance that has an enclosed flame. All flammable material must be cleared five metres around the appliance. Short green grass less than five centimetres in height, paving stones, bricks and reticulated gardens are not considered to be flammable. You cannot use solid fuel such as wood or charcoal in the open air.

Can I use my wood fired pizza oven?

No. You cannot use solid fuel such as wood or charcoal in the open air this includes outdoor wood fired pizza ovens. Undercover areas such as patios, pergolas and huts that are open or partially open to the weather are deemed to be in the open air.

Tools and Equipment

Can I use a chainsaw, plant or grass trimmer, or lawn mower?

Yes. These activities can be undertaken in suburban or built up areas, but not in bush or other areas where their use is likely to cause a fire. If possible postpone this work as the risk of starting a fire is extremely high.

Can I use a generator?

Yes. This can be undertaken in suburban or built up areas, but not in bush or other areas where their use is likely to cause a fire. If possible postpone this work as the risk of starting a fire is extremely high.

PREPARE. ACT. SURVIVE.

Total Fire Bans

Can I use equipment and machinery (e.g. bobcats, excavators, bulldozers etc)?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government and not in the bush or other areas where their use is likely to cause a fire. If possible postpone this work as the risk of starting a fire is extremely high. Their use is permitted in suburban or built up areas where the area is sufficiently cleared of flammable material to prevent a fire escaping.

Can I do grinding, welding or other forms of 'hot works'?

These types of activities are not allowed in the open air at all unless you have an exemption.

Can I use an angle grinder, power tools or welder inside my shed?

This depends on the type of shed you are working from. You cannot use any of these if your shed has one or more open sides that are exposed to the weather. This is because of the risk of wind blowing through and causing sparks to land on flammable material starting a bushfire. You can use these tools inside your shed if it is fully enclosed on all sides, and has a door and roof to prevent sparks blowing outside. Please be aware of general safety risks when working inside enclosed spaces, including the risk of fumes.

Can I burn leaves, garden waste and grass cuttings, or use an incinerator?

No. During a Total Fire Ban it is illegal to:

- light, maintain or use a fire in the open air
- carry out any activity that causes or is likely to cause a fire in the open air

Camping and Recreation

Can I light a camp fire?

No. During a Total Fire Ban it is illegal to:

- light, maintain or use a fire in the open air
- carry out any activity that causes or is likely to cause a fire in the open air

Can I cook while camping outdoors?

No. You cannot:

- light a camp fire or maintain a fire in the open air
- use any solid fuel such as wood or charcoal for cooking
- carry out any activity that causes or is likely to cause a fire in the open air

If you are in a public space or park you must only cook in an area sign posted for the purpose. You can only use an electric or gas appliance that has an enclosed flame. All flammable material must be cleared five metres around the appliance.

Can I drive on to my bushland block and go camping?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government and the road, track and camping area used is sufficiently cleared of flammable material to prevent a fire escaping. You cannot light a camp fire see 'Can I cook while camping outdoors?' for details.

Can I ride my motorbike/motocross bike or quad bike in bush or on a paddock or track?

No. During a Total Fire Ban you cannot use a vehicle in bush or a paddock, unless it is for agricultural purposes. You can only use a vehicle on a road, track or in an area that has been sufficiently cleared of flammable material.

Can I use a dune buggy?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government and the road, track and camping area used is sufficiently cleared of flammable material to prevent a fire escaping.

Farming and Industry

Can I harvest my crop?

Yes. But only if a Harvest and Vehicle Movement Ban has not been implemented by your local government. Additionally, check with your local government regarding any fire suppression equipment that may be required to be onsite while harvesting.

PREPARE. ACT. SURVIVE.

Total Fire Bans

Can I feed or water my stock in a paddock?

Yes. But only if a Vehicle Movement Ban has not been implemented by your local government. If one has been implemented, the immediate welfare of animals, such as urgent watering and feeding of stock has an automatic exemption.

However:

- you must ensure your vehicle is mechanically sound and the exhaust system is in good condition, free of gas leaks and/or has a spark arrester that is well maintained
- you must ensure all reasonable precautions have been taken to prevent a bushfire starting.

Can I operate or move an aeroplane or helicopter in a paddock?

Yes. But only if a Vehicle Movement Ban has not been implemented by your local government. Note however that the following conditions need to be met:

- you must ensure your aeroplane or helicopter is mechanically sound
- you must take all reasonable precautions to prevent a bushfire starting

What if both a Total Fire Ban and a Harvest and Vehicle Movement Ban are in place?

If both bans are in place for your local Shire then you cannot work or use a vehicle, equipment or machinery powered by an internal combustion engine on land covered by bush, crop, pasture or stubble as there is a chance it will start a fire. However the immediate welfare of animals, such as urgent watering and feeding of stock has an automatic exemption.

Can I work on a professional construction site near bushland, crops or pastures during a Total Fire Ban?

No. You cannot use power tools, including grinders and welders, or carry out any activity that causes or is likely to cause a fire in the open air, unless you have applied for and received an exemption.

Other

Can I use fireworks?

No. Any activity that causes or is likely to cause a fire in the open air is banned. Licensed pyrotechnics should seek further advice from DFES or their local shire council.

Can I use a hot air balloon?

No. Any activity that causes or is likely to cause a fire in the open air is banned.

Can I use blasting equipment or explosives?

There are too many variations with regard to this activity. If it is necessary to carry out this activity you should contact your local Chief Bushfire Control Officer at your local shire council or nearest DFES office.

Does the ban apply to cigarettes, cigars, tobacco and matches?

Throwing a burning cigarette, cigar, tobacco or match away in a situation that causes or is likely to cause a fire, including from a vehicle, is banned

Our ref: EEL15055.004

APPENDIX F

STATE ADMINISTRATIVE TRIBUNAL

Jurisdiction:	*Planning and Development Act 2005*
Application:	Review of a decision under a local planning scheme or region planning scheme
Parties:	**Michelle McAllister and Craig McAllister 1st Applicant** **Shire of Serpentine Jarrahdale** (Respondent)
Matter Number:	DR 145/2017
Application Lodged:	1 May 2017
Date of Decision:	7 March 2018 (decision on documents)
Decision of:	Member Patric De Villiers
Outcome:	Application Granted Conditionally

1. The application for review is upheld with respect to conditions 2, 17 and 18 of the development approval granted by the respondent on 28 August 2017.

2. Condition 2 is deleted and the following condition substituted:

   "Subject to the following requirements, sand extraction is permitted within the stage 3 extraction area shown on the figure 2 staging plan:

   (a) There must be no sand extraction or other disturbance within that part of the stage 3 extraction area shown on the Ecological Retention Plan dated 5/2/2018, a copy of which is attached as Annexure A, as 'proposed retention' and 'proposed 20m buffer';

   (b) A batter must be constructed outside of the proposed 20m buffer to protect vegetation from extraction works; and

   (c) Prior to any sand extraction within the stage 3 extraction area, fencing must be installed around the proposed retention area within the proposed 20m buffer and thereafter maintained to the satisfaction of the Shire."

3. Condition 17 is deleted and the following condition substituted:

   "Prior to the commencement of sand extraction, the applicants shall pay an amount of $33,750 to the Shire as a contribution to works to be undertaken by the Shire to upgrade the intersection of Hopeland Road and Karnup Road."

4. Condition 18 is deleted and the following condition substituted:

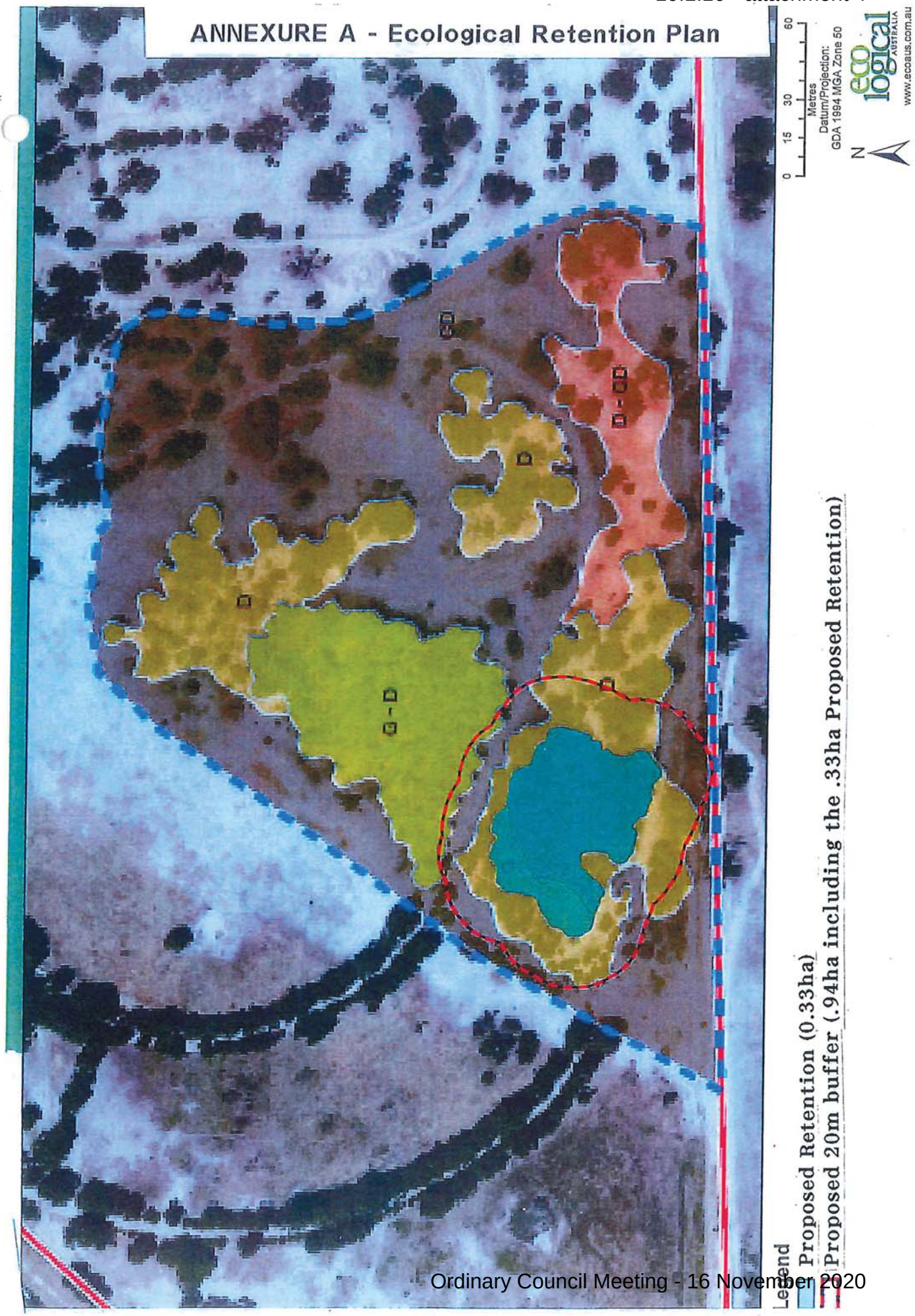
   "Prior to the commencement of works, the developer shall construct a 3 metre wide road with 500mm shoulder on both sides and one passing lane for semi-trailers within the un-made road

STATE ADMINISTRATIVE TRIBUNAL

reserve up to Hopeland Road with 2 coat seal from the existing gate to Hopeland Road (being approximately 20 metres from its intersection with Hopeland Road). The pavement shall be built to the specification shown in plan 17-4-42/100 (Rev. A) dated June 2017 and prepared by Porter Consulting Engineers, a copy of which is attached as Annexure B."

5. The hearing listed at 10 am on 8 March 2018 is vacated.

6. There is no order as to costs.


ANNEXURE A - Ecological Retention Plan
0
15
30
60
Metres
Datum/Projection:
GDA 1994 MGA Zone 50
N
ecological
AUSTRALIA
www.ecoaus.com.au
Legend
Proposed Retention (0.33ha)
Proposed 20m buffer (.94ha including the .33ha Proposed Retention)


ANNEXURE B - Plan 17-4-42/100 -
Hopeland Rd
Hopeland Rd
Hopeland Rd
Hopeland Rd
Punrak Rd
Punrak Rd
Punrak Rd
Punrak Rd
Punrak Rd
Jarrah Rd
NOTE:
PAVEMENT TO BE:
APPLY TWO COAT SEAL FROM THE EXISTING GATE TO HOPELAND ROAD.
200mm THICK COMPACTED CRUSHED GRANITE BASECOURSE ON THE EXISTING LIMESTONE/GRAVEL FORMATION, (ASSUMED EXISTING LIMESTONE/GRAVEL FORMATION TO BE GREATER THAN 150mm THICK)
OR
IF THE EXISTING LIMESTONE /GRAVEL FORMATION IS LESS THAN 150mm THICK, THEN 150mm "CRACKER DUST" IS TO BE INSTALLED.
FOR PASSING WIDENING, PAVEMENT TO BE 200mm THICK CRUSHED GRANITE BASE COURSE ON A COMPACTED SUBGRADE.
HANSON
LAYOUT PLAN
17-4-42/100
A A1
FOR CONSENT
LOT 137 PUNRAK ROAD
HOPELAND

Our ref: EEL15055.004

APPENDIX G

Rehabilitation Management Plan

Table 1 Staged Rehabilitation Management Plan Works

Application	Description	Responsibility and timing
Stage 1 to 4		
Water Management	• Maintain a final minimum unsaturated clearance of 1.28m, in accordance with Hopeland's Water Management Plan (RPS 2018).	Hanson, prior to rehabilitation works and across a period of up to 18 months of groundwater monitoring.
Earthworks	• Prepare final contours (one in three) to be visually comparable with the flatter parts of the site and similar to those in the local area. Contours to be acceptable for horse agistment or a similar rural land use. • Land surface graded to ensure final slopes will not exceed one in three vertical to horizontal in accordance with Shire of Serpentine-Jarrahdale Extractive Industries Local Law. • Excavation left in a safe manner in accordance with the *Mines Safety and Inspection Act 1994*.	Hanson; at most two years post extraction activity.
Revegetation	• Respread topsoil stockpiled (when determined necessary) as part of clearing works to a depth of 100 mm during the wetter months (April to October) to minimise dust generation. • Soil is ripped to a depth of 300 mm (or as determined necessary) to assist in the establishment of pasture species.	Hanson; respreading and ripping to be undertaken during wetter months (April to October).
	• Stabilise batter areas through revegetation with native plant or pasture species to minimise erosion risk. • Where required, seed for pasture species will be spared to maximise growth and ensure vegetation cover is achieved. • Pastural species composition should consist of a mix that will maximise on ground outcomes.	Hanson; seeding undertaken during winter (June to August).

Application	Description	Responsibility and timing
Maintenance and contingency measures	• Spread mulched vegetation, stockpiled during clearing works, on revegetation areas to prevent dust lift off prior to turf growth binding the soil. • To enhance the establishment of vegetation cover, no livestock will be kept in the rehabilitated areas for 6-months. • If turf growth is ineffective, fertiliser may be applied and pastural species may be reseeded. • Conduct regular monitoring of success of the contingency measures.	Hanson; post revegetation works. Maintenance and any contingency measures to be undertaken during the 6 months after rehabilitation works begin for each stage.
	• Implement weed control program, as required: • spraying herbicide/insecticide during the spring flowering season (non-toxic to livestock), using selective sprays to kill certain weeds • Maintain hygiene boundaries to prevent the spread of weeds within the project area.	Hanson; carry out ongoing monitoring. Spot spraying Arum Lily undertaken in June to October.
Fencing	• Maintain fencing installed prior to sand extraction in stages around the proposed retention area within the proposed 20 m buffer.	Hanson; post extraction activities, up to 6 months after rehabilitation works begin at each stage.

Figure 1 Staging Plan