

# Environmental Management Plan

## King Road Sand Quarry, Oldbury

Project No: EP20-161(01)

**Prepared for LWP King Road Syndicate Pty Ltd  
June 2021**

# Environmental Management Plan

King Road Sand Quarry, Oldbury



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# Environmental Management Plan

## King Road Sand Quarry, Oldbury



## Executive Summary

This *Environmental Management Plan* (EMP) has been prepared on behalf of LWP Group Pty Ltd (the proponent) to support the renewal of an existing Extractive Industry Licence (EIL) and Development Approval (DA) for the extraction of sand within Lots 200, 441, 713 and 1242 King Road, Oldbury (referred to as the 'site'). The site is 108.72 ha, located within the Swan Coastal Plain, approximately 33.4 km south-east of the Perth CBD, within the Shire of Serpentine Jarrahdale (Shire of SJ), as shown in **Figure 1**. The site is generally bound by broad acre rural landholdings zoned 'Rural' to the north, east and south with Anderson Road to the north and Coyle Road to south. Large areas of remnant vegetation are located to the west associated with the Banksia Nature Reserve zoned 'Parks and Recreation'.

The Shire of SJ has previously granted approval for the sand extraction quarry within the central portion of the site, extending over approximately 19.57 ha, (referred to as the 'Excavation Area'), as shown in **Figure 2**. Sand extracted from the quarry will be utilised as a source of high-grade fill for The Glades, Byford residential estate, located approximately 8 km to the north-east of the site. With the sand resource soon to be exhausted, the proponent is seeking the relevant approvals to extract the remaining material from the Excavation Area for an additional five years. A total 904,767 cubic meters (m<sup>3</sup>) of material has been excavated to date with 271,387 m<sup>3</sup> of material remaining in the excavation site.

This EMP is the key supporting environmental document for the DA and EIL applications, providing a consideration of relevant environmental issues associated with the continued sand excavation activities. Specifically, the EMP is intended to satisfy and address the conditional requirements under the planning (development) approval and EIL. The following condition was implemented on the previous DA (Shire of SJ Ref: OC11/6407), which states:

*'all operations are to be undertaken in accordance with the approved Works and Excavation Programme, Environmental Management Plan, and Rehabilitation and Decommissioning Programme.'*

The existing environmental assets and sensitive receptors within and adjacent to the site, that have the potential to be impacted by the quarry are summarised as follows:

- The majority of the site is classified as Class 2 – Moderate to low risk of ASS occurring within 3.0 m of the natural soil surface, with the north western corner classified as Class 1 – high to moderate risk of ASS occurring within 3.0 m of the natural soil surface (DWER 2021).
- There are no natural surface water features within the site. A Water Corporation drain runs along the northern boundary of the site, crossing under King Rd and connecting to the Berriga Main drain to the south east of the site. The site is elevated and is well drained with good potential for surface water management.
- Groundwater flows in a south easterly direction across the site ranging from 20 m Australian Height Datum (AHD) to 18 m AHD (DWER 2021). Excavation activities are required to maintain a minimum clearance of 2 m between the excavation floor and the highest known groundwater level.

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- The site is already subject to significant land degradation processes as a result of historical and existing land uses, and existing vegetation is highly disturbed from its natural state. All native vegetation within the application area has been assessed as being in a 'degraded' or 'completely degraded' condition and does not represent a high level of biological diversity.
- No threatened or priority flora species were recorded within the site, nor are any considered likely to occur. No threatened or priority ecological communities occur within the site.
- Fauna habitat values within the site are limited and do not provide significant habitat for native fauna.
- The site is identified as bushfire prone in the WA Map of Bush Fire Prone Areas (OBRM 2019).
- The majority of the site is mapped as multiple use wetlands, comprising UFI 14704 and 1408 extending over a total 91.60 ha (DBCA 2020). One MUW (UFI 14743) extends over 2.36 ha, a portion of which intersects with the Excavation Area. Two Conservation Category Wetlands (CCW)'s (UFI 6998, 6999) are mapped across the south-western portion of the site, approximately 70 m south of the Excavation Area.
- Several sensitive land uses including residential landholdings and scenic walking tracks are located within a 450 m radius of the sand quarry with potential to be affected by future noise, dust and visual amenity loss.
- No evidence of phytophthora dieback infestation is currently present within the site. The invasion of weeds and disease is a key threat to the surrounding vegetated areas within the site and the adjacent Banksia Reserve to the west.

This EMP outlines the management strategies to mitigate and manage the aforementioned risks to key environmental assets and sensitive receptors. The management actions to be implemented comprise eight categories with associated objectives as summarised below:

- **Groundwater:** Excavation activities are required to maintain a minimum clearance of 2 m between the excavation floor and the highest known groundwater level. Groundwater monitoring results indicate the excavation area is bound by the Average Annual Maximum Groundwater Level contour of 20.18m AHD. On this basis, the maximum depth that the sand can be excavated to is 22.18m AHD. Groundwater will be protected from hydrocarbons or other potential chemical pollutants spillage by appropriate spillway drains and clean up areas, where necessary. On-site testing and monitoring of groundwater levels and quality will be undertaken annually during winter to ensure a minimum clearance of 2 m between the excavation floor and groundwater is maintained
- **Stormwater soil and erosion:** Stormwater will be managed during the construction and operational phases of the sand quarry such that no uncontrolled discharge of water from the extraction area will result in erosion or sedimentation into the adjacent conservation category wetlands (CCW's UFI 6998, 6999). A 50 m wetland buffer has been identified around these two CCW's, located to the south of the excavation area. No machinery or support vehicles will enter the wetland buffer to ensure the environmental values of CCW's are maintained and ensure no disturbance activities will occur within this area during the excavation activities. Diversion banks and catch drains will ensure effective segregation of sediment-laden runoff and allow clean surface water to return to natural drainage lines.

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- **Native vegetation:** Native flora and vegetation will be managed so that biological diversity and ecological integrity are maintained within and adjacent to the site. The extent of the clearing area will be clearly defined before any clearing activities commence to ensure there will be no encroachment of disturbance activities into adjacent vegetation. Clearing of native vegetation will occur progressively associated with extraction stages and rehabilitated in accordance with the *Rehabilitation and Decommissioning Plan (Appendix D)*.
- **Weeds and *phytophthora* dieback:** Hygiene procedures will be adopted during excavation activities to prevent spread of weed species or *Phytophthora* dieback within the site.
- **Bushfire risks:** Certain activities will not occur on site including; construction of permanent or temporary habitable buildings on site, the storage of large quantities of fuel and the parking and servicing of trucks on site.
- **Dust:** Procedures to control dust will ensure dust levels meet statutory requirements and acceptable standards including; watering haul roads and stockpiles, use of dust technologies (crusher enclosures, wet drilling, automatic sprinklers) and speed restrictions.
- **Noise:** The results of the noise assessment (Coffey Environmental 2010) conducted to support previous planning approvals, indicate quarrying operations are predicted to comply with the *Environmental Protection (Noise) Regulations 1997*. The noise report indicates that the predicted noise levels will comply with the required standard, and as such, no specific noise reducing measures are required. It was noted vegetated buffers between the development and nearby rural residential areas will reduce the potential for the lateral propagation of operational noise. No further noise monitoring has been completed, however given the intermittent operations and the lack of complaints over the past 10 years, further noise monitoring is not considered necessary.
- **Visual amenity:** Perimeter screening along Anderson and King Roads was established in July 2010 and has matured to the extent that it now provides suitable screening for the sand quarry. In addition, the quarry is worked from behind the face of the ridge which provides further screening to King Road and adjoining users. As the sand resource is removed from the ridge, the land will be returned to an elevation matching the adjoining land to the north and south, therefore the end result will not be visually prominent in the landscape. Therefore, it is considered that with the screening in place the sand quarry does not present a major visual impact on the landscape of this area.

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### Appendix B

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### Appendix C

Works and Excavation Plan (Taylor Burrell Barnett 2021)

### Appendix D

Rehabilitation and Decommissioning Plan (Emerge Associates 2021)

### Appendix E

Vegetation Survey, Sand Resource Area (Landform Research, 2005)

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## King Road Sand Quarry, Oldbury



## 1 Introduction

### 1.1 Background

LWP King Road Syndicate Pty Ltd (the proponent) is seeking to renew an existing Development Approval which is due to expire on 1 July 2021, and separately an Extractive Industries Licence (EIL) for the extraction of sand within Lots 200, 441, 713 and 1242 King Road, Oldbury (referred to as the 'site'). The site is 108.72 ha, located approximately 33.4 km south-east of the Perth CBD within the Shire of Serpentine Jarrahdale (Shire of SJ) as shown in **Figure 1**. Sand is proposed to be extracted from the central ridgeline extending over approximately 19.57 ha of the site. The sand quarry activities will be confined to the extraction boundary, referred to as the 'Excavation Area', as shown in **Figure 2**.

The site is zoned 'Rural' under the Metropolitan Region Scheme (MRS) and the Shire of SJ Town Planning Scheme No.2 (TPS 2). The site generally is located in an area that has historically supported low-intensity agricultural activities and is bound by broad acre rural landholdings zoned 'Rural' to the north, east and south with Anderson Road to the north and Coyle Road to south. Large areas of remnant vegetation are located to the west associated with the Banksia Nature Reserve zoned 'Parks and Recreation' under the MRS.

With the sand reserve soon to be exhausted, the proponent is seeking the relevant approvals to extract the remaining material from the Excavation Area for an additional five years. Sand will be utilised as a source of high-grade fill for The Glades, Byford residential estate, located approximately 8 km to the north-east of the site. A total 904,767 cubic meters (m<sup>3</sup>) of material has been excavated to date with 271,387 m<sup>3</sup> of material remaining in the excavation area to service several future stages of the residential development. The proposed quarrying process and operations within the sand quarry will continue in accordance with existing operations. No on-site processing such as screening or washing of extracted materials is proposed. Sand is extracted using a loader and placed directly onto road trucks for transportation.

### 1.2 Purpose of report

Emerge Associates (Emerge) were engaged by the proponent to prepare an EMP to outline the environmental management procedures to be implemented as part of continued sand extraction activities. Specifically, this report:

- Identifies the existing environmental values and attributes of the site (**Section 3**).
- Discusses the proposed expansion and quarry operations (**Section 4**).
- Discusses how the proposed expanded quarry design responds to the existing environmental features and values and provides an implementation framework for environmental management procedures to comply with identified environmental objectives (**Section 5**).

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### 1.3 Scope of report

This EMP is the primary supporting environmental document for the DA and EIL applications, providing a consideration of relevant environmental issues associated with the extraction of sand within the site. The EMP also summarises and consolidates existing commitments from the previously approved extraction activities. The proponent has prepared or commissioned the following technical reports to support the DA and EIL applications for the site:

- *King Road Groundwater Mapping* (JDA 2009, 2020)
- *King Road Quarry Soil Mapping* (JDA 2010)
- *King Road Sand Quarry Environmental Management Plan* (Coffey Environments 2010)
- *Excavation and Rehabilitation Management Plan* (Landform Research 2005)
- *King Road Sand Quarry Application for Renewal of Development Approval and Extractive Industry Licence* (Taylor Burrell Barnett Town Planning 2010).

The outcomes of these site-specific investigations, as well as the comprehensive desktop review of available information on environmental conditions has provided context for the following within and adjacent to the site:

- Landforms, topography and soils
- Flora and vegetation
- Terrestrial fauna
- Surface and groundwater hydrology
- Aboriginal and non-indigenous heritage
- Historical and existing land uses within and surrounding the site
- Bushfire hazards.

### 1.4 Stakeholder consultation

As a component on the DA and EIL processes, stakeholders will have the opportunity to comment on the proposal and the proponent will provide a response to all submissions received. In addition, the proponent has held discussions with the Shire of SJ with regards to bushfire risk management.

It was confirmed with the Shire of SJ that a separate Bushfire Management Plan or Risk Management Plan will not be required for the sand quarry, however mitigation measures for the increased risk of bushfire ignition, such as fuel storage, would need to be addressed in the Environmental Management Plan to support the DA/EIL applications.

No complaints have been made to date regarding the onsite operations relating to the quarry. It is noted that an adjacent resident has previously raised concerns regarding the transport of material from the site regarding truck drivers not exercising a suitable amount of caution on public roads. These concerns have been addressed in consultation with the Shire of SJ and trucking contractor. A revised haulage route has also been determined in consultation with the Shire of SJ, as discussed further in **Section 4.7**.

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## 2 Statutory, Planning and Policy Context

### 2.1 Planning context

#### 2.1.1 State planning policy 2.4 – basic raw materials

*State Planning Policy 2.4 - Basic Raw Materials* (SPP 2.4) (WAPC 2000) was prepared to assist local governments in the determination of applications for extractive industry proposals. SPP 2.4 identifies two 'Sand Resource' areas to the east of the site along King Road and a further Sand Resource area to the west along Coyle Road. Whilst the site is not identified as an extraction area, it is located within an area with ongoing extractive industry land uses. This EMP has been prepared with regard to all the relevant considerations set out in SPP 2.4.

#### 2.1.2 Shire of SJ Local Planning Policy 4.16 – Landscape and Revegetation

The Shire of SJ's *Local Planning Policy 4.16– Landscape and Revegetation* (LPP 4.16) outlines the Shire's expectations for revegetation using native, local endemic flora for screening and landscape amenity in rural areas. The rehabilitation of the site during and upon completion of the proposed extractive operations is outlined the *Rehabilitation and Decommissioning Plan* (Emerge Associates 2021; **Appendix D**). The requirements of LPP 4.16 have been considered in the preparation of the proposed rehabilitation measures.

### 2.2 Existing Approvals

#### 2.2.1 Part V *Environmental Protection Act 1986 (WA)*

A Native Vegetation Clearing Permit pursuant to Part V of the EP Act was lodged on 9 November 2010 for the clearing of 14.8 ha native vegetation within the central portion of the site for the purposes of sand extraction. The Department of Environment and Conservation (DEC) granted approval of Clearing permit 4069/1 (Area Permit) in September 2011 subject to the following conditions:

- When undertaking any clearing or other activity authorised under the Permit, the Permit Holder must take the specified steps under the Permit to minimise the risk of the introduction and spread of weeds and dieback.
- Prior to undertaking any clearing authorised by the Permit, the area(s) have to be inspected by a fauna specialist to identify habitat trees suitable to be utilised by Carnaby's black cockatoo and inspect the habitat trees for the presence of the species.
- The permit holder shall retain the vegetative material and topsoil removed by clearing authorised under the Permit and stockpile the vegetative material and topsoil within an area already cleared.

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DWER regulates industrial emissions and discharges to the environment through a works approval, licensing and registration process, under Part V of the EP Act. Industrial premises with potential to cause emissions and discharges to air, land or water are known as 'prescribed premises' and trigger regulation pursuant to the EP Act. Prescribed premises categories are outlined in Schedule 1 of the *Environmental Protection Regulations 1987*.

The sand quarry operations do not fall under a prescribed premise as listed under Part V, Division 3 of the EP Act.

#### 2.2.2 Shire of Serpentine-Jarrahdale Planning Development Approval

Local and regional planning schemes provide guidance on what types of development and building activities require local government planning approval. Under the Shire of Serpentine-Jarrahdale TPS No. 2, activities involving the extraction of raw materials are to be addressed as part of a formal development application.

Development Approval for the initial construction and operation of the sand quarry was granted through Orders issued by the State Administrative Tribunal of Western Australia (SAT) on 1 July 2006. The Shire of SJ was required to file with the SAT a 'Schedule of Conditions as Amended by Orders of 28 June 2006' (SAT Orders). The Schedule of Conditions outline various management and monitoring requirements to be undertaken and completed in association with the land use. This approval expired five years from the date of the Orders, being 1 July 2011.

In August 2011, the proponent lodged a Development Application to continue sand excavation activities within the site, which was approved by the Shire of SJ, subject to multiple conditions expiring on 30 June 2021. A copy of the DA (Ref. OC11/6407) is attached as **Appendix A**.

#### 2.2.3 Shire of Serpentine-Jarrahdale Extractive Industries Local Law (1995)

The *Shire of SJ Extractive Industry Local Law* establishes the need for extractive industries to operate under a licence. In March 2019, the Shire of SJ issued an EIL for the sand quarry expiring in June 2021 and subject to specific conditions (incorporated in **Section 5** of this EMP). A copy of the EIL is attached as **Appendix B**.

The information provided in this EMP is intended to support the EIL application for the continuation of the sand excavation activities.

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## 3 Existing Environment

### 3.1 Climate

The climate of the site (which applies to the wider Perth region) is described as Mediterranean, with hot, dry summers and moderately wet, mild winters. An average of 816.0 millimetres (mm) of rainfall is recorded annually from the Jandakot weather station (Site Number: 009172). The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Jandakot weather station range from 19.1°C in July to 34.4°C in January and February, while mean minimum temperatures range from 16.5°C in July to 29.3°C in February (BoM 2021).

### 3.2 Geomorphology

#### 3.2.1 Topography

The topography of the site slopes in a westerly direction, with elevation ranging from 34 m AHD in the eastern portion falling to 21 m AHD within the western portion, as shown in **Figure 1**. The Excavation Area extends over a narrow ridge of sand transecting the central portion of the site.

#### 3.2.2 Landform, soils and geology

Examination of broad scale mapping places the site within the Bassendean System. This system comprises '*Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths*' (Churchward and McArthur 1980).

Finer scale mapping (DPIRD 2018) shows four soil landscape units as occurring within the site, as described in **Table 1** below and shown in **Figure 3**.

Table 1: Soil landscape mapping units within the site (DPIRD 2018)

Soil landscape unit	Location within site	Description
Bassendean B1 Phase	Transecting the central portion along a sand dune.	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
Bassendean B3 Phase	Extending over the north western portion of the site	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam
Bassendean B4 Phase	Extending over the south eastern corner,	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.
Bassendean B6 Phase	Small portions of the north eastern and south western corners	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

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Geotechnical surveys undertaken by JDA (2010) involved the drilling of 20 soil cores to investigate the soil characteristics across the site. The survey found the soil characteristics underlying the site are generally consistent with the regional mapping, being leached white sand grading to yellow sand at depth with a thin layer of grey sand containing organic matter at the surface.

#### 3.2.3 Acid sulfate soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, ASS are generally present in waterlogged and/or anoxic conditions and do not present any risk to the environment. ASS can pose issues when oxidised, producing sulphuric acid, which can present a range of risks for the surrounding environment, infrastructure and human health.

The Department of Water and Environment Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2021). A review of this mapping indicates that the majority of the site is classified as Class 2 – Moderate to low risk of ASS occurring within 3.0 m of the natural soil surface, with the north western corner classified as Class 1 – high to moderate risk of ASS occurring within 3.0 m of the natural soil surface, as shown in **Figure 4**.

The site is characterised by free-draining sandy soils as detailed in **Section 3.2.2**, which are consequently unlikely to experience waterlogged conditions prone to forming ASS. The excavation activities are restricted to a level no lower than two meters above the highest known water table and therefore will not intersect the groundwater table. In addition, no dewatering activities be required as part of the sand quarry excavation activities. As no dewatering will be conducted on the site and excavation activities will not intersect with groundwater, there is no requirement to undertake an ASS field investigation or develop an ASS Management Plan. No further consideration of ASS is required as part of the management considerations for the sand quarry operations.

### 3.3 Hydrology

#### 3.3.1 Surface water

There are no natural water surface water features within the site. A Water Corporation drain runs along the northern boundary of the site, crossing under King Rd and connecting to the Berriga Main drain to the south-east of the site, as shown in **Figure 5**.

The highly permeable properties of the sands of the Bassendean Dune systems result in very high infiltration rates and minimal to no surface runoff in these areas. Lower depressions between the dune system may exhibit some temporary pooling of surface water.

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### 3.3.2 Groundwater

#### 3.3.2.1 Groundwater levels

Information on the regional groundwater resources obtained from the DWER Water Register (DWER 2020c) indicates that the site is underlain by a multi-layered aquifer system comprised of the following resources:

- Perth - Superficial Swan
- Perth – Leederville
- Perth – Yarragadee North.

The *Perth Groundwater Map* (DWER 2020b) shows that groundwater flows in a south easterly direction across the site ranging from 20 m Australian Height Datum (AHD) to 18 m AHD.

Groundwater monitoring has been carried out across the site by JDA (2009, 2020) to estimate the Average Annual Maximum Groundwater Level (AAMGL) across the site. Two groundwater bores located downstream of the excavation area (labelled KR3 and KR8, shown in **Figure 6**) were sampled prior to the commencement of mining to establish a baseline, with subsequent biannual monitoring events every winter and spring.

Excavation activities are required to maintain a minimum clearance of 2 m between the excavation floor and the highest known groundwater. The groundwater monitoring results indicate the excavation area is bound by the AAMGL contour of 20.18m AHD. On this basis, the maximum depth that the sand dune can be excavated to is 22.18m AHD. Groundwater contours are shown in **Figure 6**. It has been noted, groundwater has not been encountered during any of the excavation activities previously undertaken within the site (JDA Hydrologists 2020).

#### 3.3.2.2 Groundwater quality

Groundwater quality monitoring has been carried out across the site by JDA (2009, 2020) prior to the commencement of mining to establish a baseline, with subsequent biannual monitoring events every winter and spring. The *South-western Australia – Wetland subset of the Australia and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Water Quality, Guidelines for Fresh and Marine Waters (ANNZECC, 2000)* have been used to develop the nutrient and metal trigger levels for the life of the quarry.

The samples from the groundwater bores were analysed for total recoverable hydrocarbons (TRH), heavy metals (arsenic, mercury, lead, nickel, copper, zinc and cadmium), nutrients (NO<sub>x</sub>; ammonia (NH<sub>4</sub>); total nitrogen (TN); filterable reactive phosphorus (FRP); and total phosphorus (TP)), chloride, sulphate and pH. The analysis for TRH was used to identify if any contamination from vehicle operations occurred onsite, and the chloride:sulphate ratio was calculated to indicate any change from the baseline levels that may suggest that there has been sulphate released due to the oxidation of ASS material.

The results of the groundwater quality monitoring indicate there have been no exceedances against the Australian Drinking Water Guidelines (NHMRC and NRMCC, 2004) to date (JDA 2009, 2020).

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### 3.3.3 Wetlands

Wetlands are areas which are permanently, seasonally or intermittently waterlogged or inundated with water. Naturally occurring wetland features are common across the Swan Coastal Plain and can contain fresh or salty water, which may be flowing or still. Wetlands can be further categorised based on their hydrological characteristics and physical structure.

The Department of Biodiversity Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2020) database, which categorises geomorphic wetland features into specific management categories based on their attributes and management objectives. The management categories of wetlands are conservation, resource enhancement and multiple use, and are detailed in **Table 2** below.

Table 2: *Geomorphic Wetlands of the Swan Coastal Plain management categories (Hill et al. 1996)*

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state-owned land. Protection provided under environmental protection policies.
Resource Enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

A review of the Geomorphic Wetlands on the Swan Coastal Plain dataset (DBCA 2020) indicates that the majority of the site is mapped as multiple use wetlands, comprising UFI 14704 and 1408 extending over a total 91.60 ha. One MUW (UFI 14743) extends over 2.36 ha, a portion of which intersects with the Excavation Area. Two Conservation Category Wetlands (CCW)'s (UFI 6998, 6999) are mapped across the south-western portion of the site, approximately 70 m south of the approved Excavation Area. The locations of the geomorphic wetlands in the vicinity of site are shown in **Figure 5**.

MUWs are described as wetlands that retain few ecological attributes but may still provide hydrological functions (EPA 2008), which is consistent with the observed characteristics of the portions of the three MUWs intersecting the site. The mapped MUWs extending into the site have been previously cleared for agricultural purposes and contain pasture species with scattered paddock trees. As a result, the MUWs have experienced a high level of disturbance that has reduced the ecological values of the wetlands, which now support vegetation in 'Completely Degraded' condition.

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CCWs are the highest priority wetlands, described as wetlands supporting a high level of values, attributes and functions (DBCA 2021). The EPA generally recommend a buffer of 50 metres (m), consistent with the WAPC's draft *Guideline for the Determination of Wetland Buffer Requirements* (2005) and the EPA's *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (2008).

The two CCWs (UFI 6998, 6999) within the site support significantly reduced diversity of native flora species due to human induced disturbances, to the extent that the wetlands no longer support natural attributes and functions. The two CCWs have been provided with a 50 m buffer from the boundary of the Excavation Area. No machinery or support vehicles will enter the buffer area shown in Figure 9. This will ensure the environmental values of local conservation are maintained and ensure no disturbance activities will occur within this area during the excavation activities, as discussed further in **Section 5.3**.

### 3.4 Flora and vegetation

#### 3.4.1 Regional context

The site is contained within the 'JF1' or northern jarrah forest subregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Environment Australia 2000). The subregion is characterised as *Eucalyptus marginata* (jarrah) – *Corymbia calophylla* (marri) forest on laterite gravels with *Eucalyptus wandoo* – marri woodlands in the eastern part (Beard 1990).

Regional vegetation complex mapping extending over the Darling Scarp undertaken by (Hedde et al. 1980) delineates the various vegetation complex types which would have occurred across the region prior to European settlement in Western Australia. Based on this mapping, the site falls within the Bassendean Complex – Central and South, described as 'Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - Banksia species to low woodland of Melaleuca species, and sedgeland on the moister sites.'

The Bassendean Complex – Central and South has approximately 26.87% of its pre-European extent remaining (Government of Western Australia 2018), of which 1.86% is under formal protection. The national objectives and targets for biodiversity conservation established an objective of retaining 30% of the original extent of each vegetation complex (Environment Australia 2001). The Bassendean Complex – Central and South complex falls below the 30% minimum threshold for unconstrained areas of the Perth and Peel regions.

Native vegetation in 'Good' or better condition is considered representative of the Bassendean Complex – Central and South complex. However, as discussed in **Section 3.4.3**, all vegetation within the site was determined to be in 'degraded' or 'completely degraded' condition due to the intensive historical and ongoing disturbance from agricultural land uses, and as such is not considered to represent the mapped native vegetation complex.

#### 3.4.2 Plant communities

A 'level 1' flora and vegetation survey was undertaken by Landform Research (2005). The majority of the site was cleared prior to 1953 for agricultural land uses including livestock grazing, with the

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exception of scattered paddock trees along property boundaries. Based on the results of the survey, the site has been subject to long-term disturbance and modification, and as such is dominated by non-native vegetation. Where native vegetation does occur, it is primarily in isolated patches with low species diversity.

A total of 18 plant taxa were recorded within the site during the survey. It was determined the site supports a low species richness, with an average 1.1 species/100 m<sup>2</sup>. Overall, the flora species diversity within the site is much lower than what would be expected if the land had not been subject to the high levels of disturbance and modification observed. The predominant native species identified included *Kunzea ericifolia*, *Scholtzia involucrate*, *Jacksonia furcellata* and *Acacia heugelii* in addition to non-native grasses and scattered *Allocasuarina fraseriana* (sheoak) trees.

The vegetation identified was not determined to be representative of a threatened or priority ecological community. No threatened or priority flora species were recorded in the site during the flora and vegetation survey (Landform Research, 2005).

#### 3.4.3 Vegetation condition

All vegetation within the site was determined to be in 'degraded' or 'completely degraded' condition, due to the intensive historical and ongoing disturbance from agricultural land uses. The majority of the site (87.3%, 11 ha) comprises vegetation in 'Completely degraded' condition with a small portion (12.7%, 1.6 ha) in 'Degraded' condition attributed to areas south of the sand with regrowth vegetation.

#### 3.4.4 Bush Forever

There are no Bush Forever sites (or conservation reserves) within the site, although Banksia Nature Reserve, reserved as 'Parks and Recreation Regional', is located to the west of the site, as shown in **Figure 7**.

#### 3.4.5 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding values such as significant wetlands, threatened flora, threatened communities and *Bush Forever* sites. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. However, exemptions under Schedule 6 of the EP Act still apply, which includes any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the EP Act).

One ESA occurs within the southern portion of the site external to the Excavation Area, following the general alignment of the two CCW's (UFI 6998, 6999), see **Figure 7**. As discussed in **Section 3.3.3**, this portion of the site supports a significantly reduced diversity of native flora species due to human induced disturbances and historical clearing, to the extent that the wetlands no longer support natural attributes and functions. Notwithstanding, the entire extent of the CCW's encompassing the ESA have been provided with a 50 m buffer from the excavation footprint, as discussed further in **Section 5.3**.

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#### 3.4.6 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998). The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

There are no mapped ecological linkages within the site. One regional ecological linkage occurs to the east of the site, connecting remnant vegetation within rural-residential lots. The location is shown in **Figure 7**.

#### 3.5 Terrestrial fauna

While no specific fauna survey has been undertaken, the fauna habitat values within the site are generally limited, the majority of the site habitat values are compromised by the removal of most of the native vegetation and impacts of historical degradation (Landform Research, 2005). As a result, the site primarily provides habitat that is suitable for common and widespread native species with non-specific habitat requirements.

Extensive areas of higher quantity fauna habitat occur in surrounding areas, such as within the Banksia Nature Reserve to the east of the site.

#### 3.6 Heritage

##### 3.6.1 Indigenous heritage

The Aboriginal Heritage Inquiry System (AHIS) is maintained pursuant to Section 38 of the Aboriginal Heritage Act 1972 by the Department of Planning, Lands and Heritage. It contains information on Registered Aboriginal Heritages Sites and Other Heritage Places throughout Western Australia.

In accordance with the Aboriginal Heritage Due Diligence Guidelines (DAA 2013), a search of the AHIS online database (DPLH 2020) was undertaken. No Registered Aboriginal Heritage Sites or Other Heritage Places have been identified within the site.

##### 3.6.2 Non-indigenous heritage

Based on a review of available information at a federal, state and local government level, there are no recorded non-indigenous heritage sites found within the site.

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### 3.7 Bushfire hazards

The Map of Bush Fire Prone Areas published by the Office of Bushfire Risk Management (OBRM, 2019) identifies the site and surrounding area as a 'bushfire prone area.' Development within an area identified as bushfire prone is subject to consideration under the *Planning and Development Act 2005*, and in turn *State Planning Policy 3.7 – Planning in Bushfire Prone Areas (SPP 3.7)* and its Guidelines.

Three structures comprising a site office, shed and residential dwelling are located within the northern portion of the site. As part of the proposed excavation activities, these structures will be removed and the requirements for a site office will be reassessed. There is no other permanent infrastructure on site associated with the quarry other than fencing, gates, loop road and a hardstand refuelling area. The proposed activities will not necessitate the construction of habitable dwellings within the site which are required to demonstrate compliance with SPP 3.7. As such, a bushfire management plan is not required.

Notwithstanding, an increased level of activity at the site may lead to an increased risk of fire if quarrying activities are not adequately managed. The potential for fire to start from faulty vehicle exhaust systems, malfunctions within plant causing friction and potential electrical shorts, will be addressed from the outset of installation and ongoing quarrying operations. Firebreaks in accordance with the Shire of SJ requirements have been established. Additional fire management measures to be implemented onsite are detailed in **Section 5.5**.

If it is determined that a site office will be required for the final stages of extraction, then a separate development application will be made to the Shire of SJ for the installation of a temporary facility, likely to be located within the north-eastern area of the site outside of the excavation boundary, and the need for a bushfire management plan reconsidered.

### 3.8 Other land use considerations

#### 3.8.1 Historic and existing land uses

A review of historical aerial imagery from 1953 onwards indicates the majority of the site was cleared for agricultural land uses including livestock grazing, with the exception of scattered paddock trees along fence lines (Landgate 2021). The central portion of the site supported relatively undisturbed native vegetation until 1977, after which the eastern portion was cleared for the construction of residential dwellings and a shed. There is evidence of vegetation regrowth along the central sand ridge between 2006 to 2015. In 2015, the regrowth vegetation in this area was cleared for the expansion of the sand quarry, as shown in **Plate 1** below.

The site occurs within a highly cleared and modified local area, which supports rural and agricultural land uses, with extensive areas of cleared land used for pasture. As a result of historical and existing land uses, the site is already subject to significant land degradation processes and existing vegetation is highly disturbed from its natural state.

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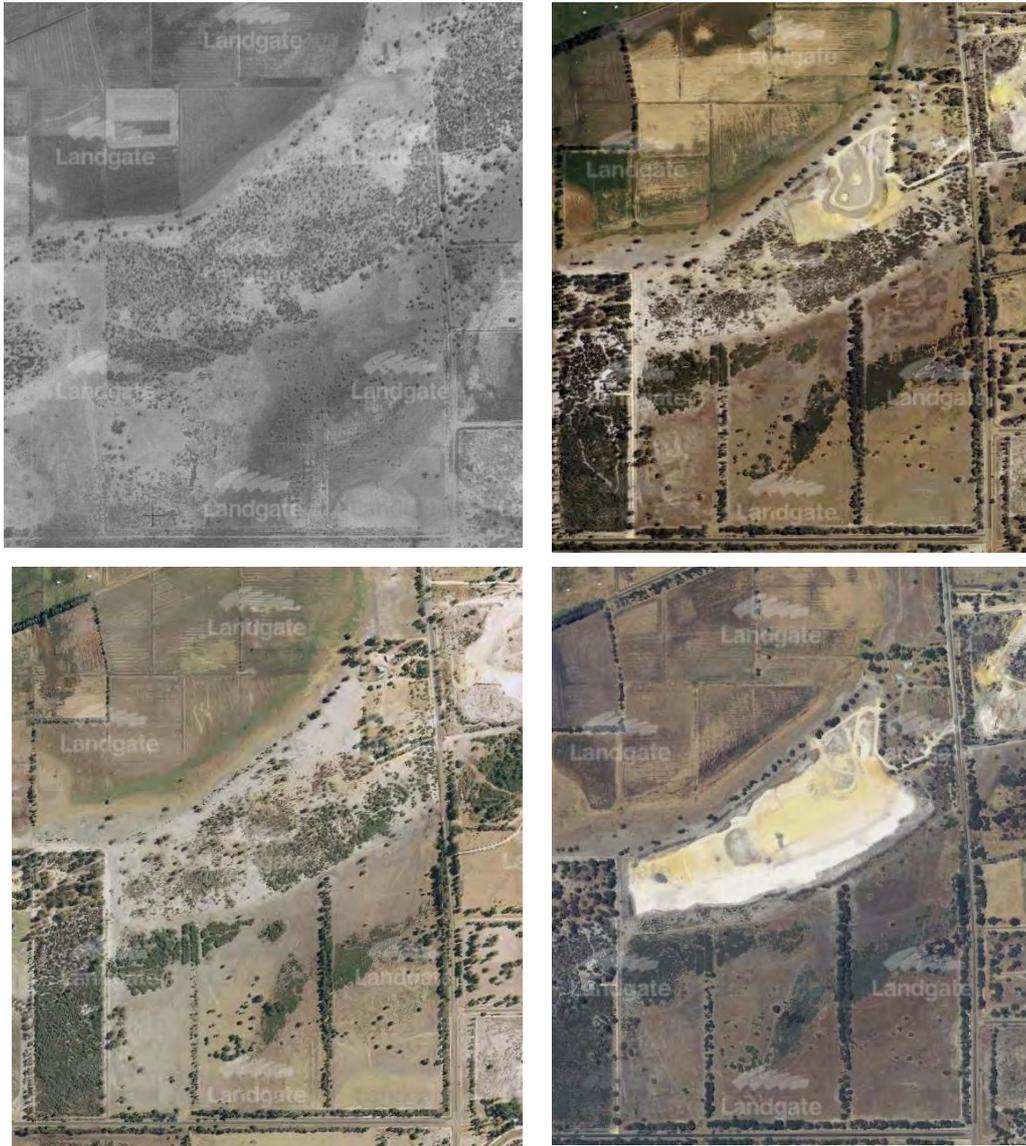


Plate 1: Historical aerial imagery (Landgate 2021) showing top left 1977, top right, 2006, bottom left 2010, bottom right 2015.

### 3.8.2 Potential site contamination

A review of the Department of Environment Regulation Contaminated Sites Database (DWER 2021b) indicates that the site is not registered as a contaminated site pursuant to the *Contaminated Sites Act 2003*, nor are other registered sites located nearby.

Given the historic agricultural and cattle grazing land uses, the site is unlikely to pose significant contamination risks. Additionally, given there will be no intended change in land use (and particularly the sensitivity of the land use), contamination is unlikely to be an issue which would require any specific consideration.

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#### 3.8.3 Surrounding land uses

The site generally is located in an area that has historically supported low-intensity agricultural activities such as cropping. The site is generally bound by broad acre rural landholdings zoned 'Rural' to the north, east and south with Anderson Road to the north and Coyle Road to south. Large areas of remnant vegetation are located to the west associated with the Banksia Nature Reserve zoned 'Parks and Recreation'.

A number of residential dwellings are located within a 1.5 km radius from the Excavation Area, with the closest residence located 250 m to the east which is considered as a sensitive land-use, as shown in **Figure 8**. EPA Guidance Statement no. 3 *Separation Distances Between Industrial and Sensitive Land Uses* specifically addresses generic separation distances between industrial and sensitive land uses to avoid conflicts between these land uses.

The generic separation distances are based on the consideration of typical emissions that may affect the amenity of nearby sensitive land uses. Under EPA Guidance Statement no. 3, the recommended buffer distance for 'Extractive Industries - sand' ranges from 300 m to 500 km.

#### 3.9 Visual amenity

The Visual Landscape Planning in Western Australia Manual provides information regarding visual landscape evaluation and impact assessment to be considered in the planning process in the absence of a formal state planning policy position. The manual also incorporates guidelines to assist planners and decision makers to assess proposals put forward for consideration and approval.

Part 3 of the manual outlines the components of mining and quarrying land uses that may have direct visual impacts and consequently need to be considered. These include the size of footprint, depth, configuration of outer boundary, angle of faces, length of time faces are exposed before being re-contoured and re-vegetated, time sequence for planting exposed surfaces, planting programs (including screen planting), location of powerlines and other services, changes to the original landscape (especially landform and vegetation) and lighting.

Several residential landholdings are located within a 1.5 km radius of the sand quarry, as shown in **Figure 8**. The sand ridge is visible from the north of the site along King Road which is at a higher elevation than the quarry. Due to private rural landholdings surrounding the quarry visual amenity impacts on adjacent land uses needs to be considered. Within the vicinity of the site, views are largely dominated by cleared agricultural land, plantation, orchards and blocks of remnant native vegetation.

Perimeter screening along Anderson and King Roads was established in July 2010 and has matured to the extent that it now provides suitable screening of the sand quarry. In addition, the quarry is worked from behind the face of the ridge which provides further screening to King Road and adjoining users. As the sand resource is removed from the ridge, the land will be returned to an elevation matching the adjoining land to the north and south, therefore the final landform will not be visually prominent in the landscape.

Visual impact mitigation strategies have been considered and are addressed within **Section 5.8** of this EMP.

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#### 3.10 Noise impacts

Several residential landholdings are located within a 1.5 km radius of the quarry, as shown in **Figure 8**. The closest noise sensitive premise is a single residential dwelling located approximately 250m from the site, separated from the site by remnant vegetation. The next closest residence is 500m to the north of the site.

A Noise Assessment (Coffey Environmental 2010) was conducted comparing the predicted noise levels from the quarry against the 'assigned' noise level in the *Environmental Protection (Noise) Regulations 1997*. Day-to-day noise produced by quarrying equipment will be limited to the loader and cartage trucks. Noise monitoring was conducted at one location along the northern boundary of the site over a four-day period in May 2010 prior to quarrying commencement. Subsequent monitoring was conducted at three locations on 10 June, the first day of full-scale quarrying.

The results of the survey indicate mining operations will comply with the *Environmental Protection (Noise) Regulations 1997*. To ensure that the regulations are complied with, suitable vegetated buffers are proposed between the development and nearby rural residential areas. The location of the quarry within the nominated buffers will reduce the potential for the lateral propagation of operational noise.

No further noise monitoring has been completed, however given the intermittent operations and the lack of complaints over the past 10 years, further noise monitoring is not considered necessary. Notwithstanding, noise management actions for the site are detailed in **Section 5.7**.

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### 3.11 Dust impacts

Dust is a generic term used to describe 'solid airborne particles generated and dispersed into the air by processes such as handling, crushing and grinding of organic or inorganic materials such as rock, ore, metal, wood or grain and stockpiling of materials and wind-blown dust' (DEC 2011).

There are several activities within the proposed extraction area that have potential to generate dust, including:

- Removal of topsoil and stockpiling on site (lifting onto vehicles, movement of vehicles and placement of topsoil in stockpiles)
- Extraction of sand resource
- Transfer/relocation of stockpiled topsoil
- Vehicular movement within the site on unsealed roads, as well as entering and exiting the site. It is noted that access to the site is via a sealed driveway that traverses over a right-of-carriageway extending from King Road, thereby reducing dust associated with its operations.

Dust level monitoring was conducted continuously over the period 3 May 2010 to 14 June 2010 using two DustTrack monitors at fixed locations on the eastern and western boundaries of the site, prior to the renewed 2011 approval (Coffey Environmental 2010). Measurements were compared to initial baseline levels established prior to the commencement of extractive operations. This monitoring found:

- Dust levels were generally well below the threshold of 50 micrograms/m<sup>3</sup> (as per Condition 42 of the SAT orders)
- Any exceedances recorded prior to and during the operations were as a result of prescribed burning by the former Department of Environment and Conservation (DEC) now Department of Biodiversity, Conservation and Attractions (DBCA).
- Dust levels generated as a result of quarrying were generally below the threshold (with average daily levels at or less than 50% the threshold level).

No further dust monitoring has been completed, however given the intermittent operations and the lack of complaints over the past 10 years, further dust monitoring is not considered necessary. Notwithstanding, dust management actions for the site are detailed in **Section 5.6**.

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## 4 The Proposal

### 4.1 Overview

With the sand resource within the open portions of the site soon to be exhausted, the proponent is seeking approval to expand the sand extraction area as shown in **Figure 2**. Specifically, sand will be excavated from the eastern and northern-most extents of the proposed Extraction Area for an additional five years. A total 904,767 m<sup>3</sup> resource has been removed to date, with approximately 271,387 m<sup>3</sup> of material remaining and proposed to be excavated over a period of five years.

The proposed quarrying process and operations within the sand quarry will continue in accordance with existing operations. The following section is structured to specifically respond to the operational descriptions required by the *Shire of Serpentine Jarrahdale Extractive Industries Local Law 1999*. Descriptions of environmental considerations and corresponding management are covered within **Sections 3 and 5** of this EMP.

This EMP will be implemented by the proponent prior to and throughout the life of the project. In addition, the proposed quarrying process and operations are to be undertaken in accordance with the following:

- Works and Excavation Plan (**Appendix C**)
- Rehabilitation and Decommissioning Plan (**Appendix D**)

### 4.2 Nature and duration of proposed excavation

The proposed extraction methods are not dissimilar to those employed in other extraction sites within the Perth metropolitan area and immediate locality. Hours of operation for the sand quarry will remain the same, occurring between 6am to 7pm Monday to Saturday, in accordance with Condition 2 of the SAT orders. This will include the movement of all vehicles involved in the extractive industry. The quarry will not operate on Sundays or Public Holidays.

No on-site processing such as screening or washing of extracted materials is proposed. Sand is extracted using a loader and placed directly onto road trucks for transportation.

### 4.3 Excavation stages and timing

The final stage of excavation is located within the eastern portion of the sand ridge, as shown in **Figure 2**. Sand will be extracted from the eastern most-extent of this stage until the minimum extraction level (above AHD/water table) is reached. Extractive operations will then proceed in a westerly direction towards the central portion of the excavation area. This general staging sequence will serve to facilitate the passive screening of the extractive operations from King Road by using the existing topography as a visual buffer. Rehabilitation will be undertaken in the autumn immediately following the completion of extraction of the sand resource. A general outline of the intended staging of extraction on the site is provided in **Appendix C**.

### 4.4 Depth and extent of the existing and proposed excavation

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The ultimate depth of excavation will be to a maximum of 2 m above the groundwater level with a finished floor level of 22.18 m. Batters during quarrying operations will be no less than 1 in 2 and final batters will be no less than 1 in 4 to prevent erosion from surface water. The water table is at 20.18 mAHD according to the groundwater monitoring, refer to **Section 3.3.2.1**.

#### 4.5 Depth and description of topsoil to be removed

The topsoil and overburden will be removed prior to sand excavation activities and stockpiled for future rehabilitation. Topsoil will consist of the top 50 mm of soil across the extraction expansion area.

#### 4.6 Removal of vegetation, topsoil and overburden

Vegetation, overburden and topsoil will be removed in sections and stockpiled as detailed in the Rehabilitation and Decommissioning Plan (**Appendix D**)

#### 4.7 Site access

Site access for vehicles (i.e. 6 x 4 trucks and semi-trucks) entering and exiting the site will continue to occur via an existing crossover and loop road, specifically constructed for extraction purposes. The location and design of the existing crossover has been approved by the Shire in accordance with conditions 9, 10, 11 and 14 of the SAT Orders. The crossover is located at the crest of King Road to ensure that maximum sightline distances are achieved for haulage vehicles accessing the site to ensure the safety of passing public traffic.

A loop road, as required by Conditions 12 and 13 of the SAT orders, has been constructed linking the crossover with the existing excavation areas. The location of this road will vary subject to location of the excavation face at any given point in time. A maximum speed limit of 25 km per hour will be applied to all internal roads, driveways and vehicle access ways and signs in this regard displayed at the entrances to the site.

Truck movements will vary according to extraction requirements. Based on operations undertaken within the previous year, the daily export target was 6,000 tonnes, equating to approximately 240 semi-tipper dump truck movements per day by approximately 18-22 trucks. Two front end loaders were mobilised to service this export rate.

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#### 4.8 Extraction methods and on-site processing works

Extraction is to be undertaken on the following basis:

- Topsoil will be removed (approximately 50 mm thick) and stockpiled in windrows (low mounds of approximately 1 m in height).
- Sand will be excavated from the pit floor to a finished depth of 22.18m AHD by a loader. No over-excavation is to be undertaken below pit finished floor levels.
- The sand material will be loaded onto road transport trailers. Trucks will enter and cart material from the pit throughout the extraction period.
- In areas where the face heights exceed 5-6 metres, the site will be benched to allow safe operation. The material from the top bench will be pushed over the lower bench. The stockpiles will be located adjacent to a road-base haul road which will be established to allow road vehicles to access the site for pickup of product. This road will be progressively extended through the quarry area as required.
- Excavation operations will progress from east to west, moving away from King Road. This will ensure that the visual impact from King Road is limited to truck access/egress only until the final stages of excavation.
- Upon completion of extraction, the pit floor will be ripped prior to topsoil replacement. Rehabilitation will be undertaken in the autumn immediately following the completion of extraction of the sand resource, after the application of any weed control measures in accordance with the Rehabilitation and Decommissioning Plan, provided in **Appendix D**.

#### 4.9 Restoration and reinstatement of excavation site

In areas where excavation is completed, and prior to the ultimate re-forming of the area for subsequent revegetation, slopes around the perimeter of the excavation area will be re-contoured to achieve stable gradients (less than 1:4 vertical to horizontal).

The final landform is anticipated to be a gently sloping surface created by the sand extraction 'scalping' the existing topography. The floor of the excavated areas will be deep ripped parallel to contours to minimise or eliminate erosion and seed loss and provide a base for pasture revegetation, as discussed below. The restoration and reinstatement of the excavation site will be undertaken progressively upon the completion of each extraction stage.

#### 4.10 Rehabilitation and Decommissioning Program

A Rehabilitation and Decommissioning Plan (Emerge Associates 2021) has been prepared in accordance with the requirements of the *City of Armadale Extractive Industries Local Law (CoA 2000)* to support this EMP, see **Appendix D**.

The rehabilitation program proposed for the sand quarry also considers previous rehabilitation commitments associated with historically approved stages of the existing quarry.

Where possible the revegetation of the site will be from the existing seed bank, however due to the degraded nature of the site and the lack of diversity it is expected that tubestock of native trees and

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shrubs and seeds of pasture species will be required. Species to be used are outlined in the Rehabilitation and Decommissioning Plan (Emerge Associates 2021).

Revegetation of portions of the site with pasture and native species has begun. Weed control and rehabilitation commenced for the southern screening vegetation with seedlings planted in July 2010. Weed control was undertaken by boomspray and no symptoms of dieback were noted during the weed control activities. Future rehabilitation will be undertaken in the autumn immediately following the completion of extraction of the sand resource, after the application of any weed control measures required.

Compliance reporting and adaptive management measures are specified in the Rehabilitation and Decommissioning Plan to ensure the intended outcomes are achieved. Maintenance and monitoring will be conducted until completion criteria and objectives for previously disturbed portions of the site are met.

#### 4.11 Proposed structures

A site office, shed and dwelling were established within the eastern portion of the site in May 2010. As the excavation moves into the eastern portion of the Excavation Area, the structures will be demolished and removed prior to excavation. There is no other permanent infrastructure on site other than fencing, gates, and the access track, and no further structures are proposed.

#### 4.12 Drainage conditions

Surface water protection is an important part of the management of quarries. Detailed management measures for stormwater, soil and erosion control are provided in **Section 5.2**. It is anticipated that any stormwater not diverted away from the extraction area will be easily contained within the confines of the quarry excavation area and will infiltrate through the soil profile. The groundwater will be protected from diesel spillage by appropriate spillway drains and clean up areas, where necessary. There will be no fuel storage on site.

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#### 4.13 Specific exclusions

Given some of the issues raised during previous applications, it is important to note that the following activities will not be occurring on site:

- Fuel storage on the site. All refuelling activities will be undertaken by mobile refuelling. This will take place on a hardstand area designated for refuelling on the site, which will be bunded and drained to a pollutant receptor.
- Screening or washing of sand material will not be undertaken on the site.
- Storage of dangerous goods or hazardous substances on site.
- The servicing of vehicles at the site. Only minor greasing of vehicles will occur occasionally onsite. All other vehicle maintenance and servicing will occur elsewhere.
- The undertaking of extraction activities on Sunday and Public Holidays. Operation hours have been stated above, and the operators will strictly adhere to these.
- Dewatering or blasting. No dewatering or blasting activities are proposed within the site nor are currently undertaken as part of the existing quarry operations.

##### 4.13.1 Clearing and disturbance exclusion areas

A 50 m wetland 'avoidance area' has been identified around the two CCW's (UFI 6998, 6999) to the south of the Excavation Area as shown in **Figure 9**. No disturbance activities will occur within this area during the excavation activities in order to protect the natural flow of the wetland, to prevent the trampling of riparian vegetation and minimise weed and pest encroachment.

In addition, all native vegetation external to the Excavation Area will be retained and protected within the broader site. The extent of the clearing area will be clearly defined before any clearing activities commence to ensure there will be no encroachment of disturbance activities into adjacent vegetation.

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## 5 Environmental Management

The following section details the potential environmental issues that may be encountered during the operation of the quarry and the management strategies to minimise and impacts to these issues.

### 5.1 Groundwater

#### 5.1.1 Objective

To protect the integrity, quality and quantity of the groundwater beneath the site. All quarrying operations will be conducted and implemented in a way to maintain the quality and quantity of the underlying groundwater so that existing and potential environmental values are protected.

#### 5.1.2 Target

Maintain 2 m of undisturbed profile between the maximum water table level and the finished pit floor level. No release of hydrocarbons or other potential chemical pollutants to the natural environment.

#### 5.1.3 Management actions

Table 3: Management actions for groundwater

Parameter	No.	Action	Timing
Groundwater levels	G1	On-site testing and monitoring of groundwater levels will be undertaken biannually during winter and spring of each year to ensure the depth to the water table is no less than 2m	Every winter and spring from commencement to completion.
	G2	Complete feature survey report in completed stages	Complete feature survey report at the end of each financial year for the duration of the quarry activities.
	G3	No dewatering will be undertaken as part of sand extraction activities	N/A
Groundwater quality	G4	Undertake an annual groundwater quality monitoring event (TRH, heavy metals, nutrients, chloride sulphate and pH) to identify if any contamination from the sand excavation operations has occurred onsite. The annual monitoring event will coincide with the time of seasonal groundwater high.	Annual at the time of seasonal groundwater high (winter-early spring) from commencement to completion.
	G5	No potential chemical pollutants hazardous substances will be stored on site, apart from vehicle lubricants and fuel for minor machinery servicing.	N/A
	G6	Groundwater will be protected from diesel spillage by appropriate spillway drains and clean up areas, where necessary.	N/A

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Parameter	No.	Action	Timing
	G7	Any exceedances 10% over the groundwater quality trigger levels as outlined in <b>Section 3.3.2.2</b> will be investigated and the source of any contamination will be isolated and rectified if shown to be the result of the operation of the extractive industry.	N/A
	G8	Any exceedance of the baseline level of more than 10% of the chloride sulphate ratio will result in an investigation in accordance with the <i>Acid Sulphate Soils Guideline Series: Identification and Investigation of Acid Sulphate Soils and Acidic Landscapes and Draft Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes</i> .	N/A

## 5.2 Stormwater and erosion control

### 5.2.1 Objective

To control the severity and extent of soil erosion and pollutant transport during the construction and operational phases of the sand quarry. To maintain the quantity of surface water so that adjacent environmental values, including the wetlands to the south of the excavation area are protected.

Surface water protection is an important part of the management of quarry. There two CCW's (UFI 6998, 6999) located approximately 70 m to the south of the existing operations.

The extraction of sand is a clean operation as no chemicals are used apart from machinery lubricants. The site is elevated and is well drained with good potential for surface water management. On this basis, erosion and sedimentation is not expected to be a significant issue for the site.

### 5.2.2 Target

No uncontrolled discharge of water from the extraction area that results in erosion or sedimentation into natural surface water features or retained vegetation within the site. Areas where hardstanding material is brought onsite to form roads and other operational infrastructure will be managed through onsite swale/culvert infiltration drainage systems with ongoing maintenance.

### 5.2.3 Management actions

Table 4: Management actions for stormwater, soil and erosion control

Parameter	No.	Action	Timing
Stormwater	S1	Construct appropriate spillway drains to prevent diesel spillage as appropriate.	Prior to clearing
	S2	Construct catch drains to capture runoff from disturbed areas and direct into the pit area to enable infiltration.	Prior to clearing
	S3	A 50 m wetland buffer has been identified around two CCWs (UFI 6998, 6999) to the south of the excavation area, as shown in <b>Figure 9</b> . No machinery or support vehicles will enter the wetland buffer to ensure the environmental values of CCWs are maintained and ensure no disturbance activities will occur within this area during the excavation activities.	At all times
	S4	Drains should discharge clean stormwater into vegetated natural drainage lines.	N/A
	S5	Keep natural drainage lines open wherever possible.	N/A

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Parameter	No.	Action	Timing
Erosion control	S6	Cleared areas will be stabilised (hydro-mulch or similar) as soon as possible to minimise erosion.	Upon quarry closure
	S7	Level or gently sloping areas will be selected as stockpile sites to minimise erosion and potential soil loss where possible.	To be reviewed immediately post topsoil removal
	S8	Appropriate sediment controls will be installed upslope of stockpiles to divert water around and downslope of the stockpiles to prevent soil loss	To be reviewed immediately post topsoil removal
	S9	Access routes will follow existing cleared access routes where possible	N/A
	S10	Construct batters during mining no less than 1 in 2 and final contours no less than 1 in 4 to prevent erosion from surface water.	During excavation activities

### 5.3 Native vegetation

#### 5.3.1 Objective

To protect native flora and vegetation as far as practicable so that biological diversity and ecological integrity are maintained within and adjacent to the site.

The project will involve the removal of vegetation over the Excavation Area excluding areas previously quarried and undergoing rehabilitation in accordance with the with the Rehabilitation and Decommissioning Plan (see **Appendix D**)

#### 5.3.2 Target

Clearing of native vegetation within the site is limited to the Excavation Area as shown in **Figure 1**.

#### 5.3.3 Management actions

Table 5: Management actions for native vegetation management

Parameter	No.	Action	Timing
Native vegetation	V1	No clearing or disturbance is to take place within the 50 m buffer to the two CCWs (UFI 6998, 6999), as shown in <b>Figure 9</b> . No machinery or support vehicles to enter the protected buffer area.	N/A
	V2	The extent of the clearing area will be clearly defined on the ground before any clearing activities commence to ensure there will be no inadvertent encroachment of disturbance into areas of retained vegetation.	To review prior to clearing activities
	V3	Progressive rehabilitation will be undertaken in completed stages in accordance with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> )	Upon quarry closure
	V4	Monitor success of rehabilitation against the completion criteria outlined within the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> )	Annually in summer for three years after completion of each stage or until the completion criteria and objectives are met. If rehabilitation

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Parameter	No.	Action	Timing
			objectives and completion criteria are met earlier than the three year period, this condition can be re-looked at before this time.

#### 5.4 Weeds and *Phytophthora* dieback

##### 5.4.1 Objective

To prevent spread of weed species or *Phytophthora* dieback within the site.

##### 5.4.2 Target

Controlled management of weeds and *Phytophthora* dieback within the site and enhanced outcomes of the proposed rehabilitation works.

##### 5.4.3 Management actions

Prior to revegetation activities, the most appropriate method to control weeds will be decided after the site has been inspected (so that the methods should be fit for purpose). Weed control may include manual (hand weeding) and chemical (herbicide) based approaches. Hand weeding can be successful for certain species and when weed abundance is relatively low. When weed cover is relatively high a broad spectrum herbicide formulation may be applied as a spot spray that targets specific weeds. Alternatively, if grass weeds are prevalent, a grass selective formulation may be applied to more efficiently suppress weed growth, without risking off target impact to native plants. Herbicides will be applied by a licenced pesticide management technician and in accordance with manufacturers' instructions as provided on product label.

The success of the weed control will be monitored on an annual basis every summer. This will include a visual assessment of the weed control measures in comparison to the completion criteria outlined in the Rehabilitation and Decommissioning Plan (**Appendix D**).

While no evidence of *phytophthora* dieback infestation is currently present within the site, hygiene procedures will be adopted during excavation within the Excavation Area to ensure that any incidence of dieback is not increased.

Specific management actions for weed and dieback control are provided in **Table 6**.

Table 6: Management actions for weed and dieback control

Parameter	No.	Action	Timing
Surface Material	W1	Assess weed and dieback potential within topsoil material prior to removal and separate topsoil for treatment or disposal if required.	Prior to and during topsoil removal

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Parameter	No.	Action	Timing
	W2	Store significantly weedy surface material separately to clean surface material.	Surface material removal
	W3	Stockpile all surface materials in the general vicinity of its origin.	Surface material removal
Hygiene Measures	W5	As far as reasonable and practicable all vehicles and machinery will be cleaned of plant material, mud and soil prior to entry and exit of the site.	N/A
	W6	No soil and vegetation should be brought to the site apart from that to be used in rehabilitation and plants used in rehabilitation should be free of weeds.	N/A
	W7	A visual assessment for symptoms of dieback will be undertaken during the assessment of the rehabilitation	During rehabilitation activities
Access	W8	Control access within the quarry area to reduce the spread of weeds, especially off-road vehicle access, to prevent disturbance to vegetation and weed invasion.	N/A
	W9	Restrict access to areas outside the quarry operations to reduce the spread of weeds into or out of the site.	N/A
Weed Control	W10	Chemical spraying is to be undertaken in accordance with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	N/A
	W11	Undertake visual assessment of the weed control measures to measure success against completion criteria outlined in the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Annually in summer for each area rehabilitated to three years after completion of each stage

## 5.5 Bushfire

As outlined in **Section 3.7**, the proposed quarry expansion does not require the preparation of a bushfire management plan.

To manage the risk of ignition, the following activities will not occur on site:

- Construction of permanent or temporary habitable buildings on site.
- Mass storing of fuel
- Parking of trucks at the site
- Servicing of vehicles at the site

Further consideration of bushfire will be required if any future building construction is proposed within the 'bushfire prone areas' (within the Map of Bush Fire Prone Areas, as published) at the time of Development Approval.

The Shire of SJ releases a Firebreak Notice on an annual basis to provide a framework for bushfire management within the municipality. The Shire of Serpentine Jarrahdale is able to enforce this notice in accordance with Section 33 of the *Bush Fires Act 1954*. In addition, Section 33 1(b) also provides the Shire with additional power to direct landowners to undertake works to remedy conditions conducive to the outbreak or spread of bushfire.

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The proponent will be required to comply with the Firebreak Notice, including the maintenance of minimum 3 m-wide perimeter firebreaks to accommodate for the width of emergency vehicles and have a minimum height clearance of 4 m to allow for the height of emergency vehicles.

#### 5.6 Dust

##### 5.6.1 Objective

To control the severity and extent of dust impacts offsite during the construction and operational phases of the sand quarry.

##### 5.6.2 Target

No complaints received from the community, neighbours, other stakeholders or regulatory authorities in relation to offsite dust impacts from the extractive operations.

##### 5.6.3 Management actions

Table 7: Management actions for dust control

Parameter	No.	Action	Timing
Dust control	D1	Monitor weather forecasts to determine ground moisture level, wind strength (especially prevailing winds) or direction or other seasonal conditions applicable to the extractive operations.	At all times
	D2	In the event that weather conditions are unfavourable, especially in the case of adverse ground moisture level or wind strength or direction, operations will be rescheduled or ceased to minimise excessive dust emissions associated with its operations on neighbouring land uses.	When required by unfavourable weather conditions
	D3	A water truck (6 x 4 in size) with hydraulic water pumps is to be used to wet the access/driveways and stockpiles when hot, dry and windy conditions are anticipated to occur during operations.	When required by unfavourable weather conditions
	D4	A 25 km/hr speed limit will be applied to all internal roads, driveways and vehicle access ways, supported by appropriate signage.	At all times

#### 5.7 Noise

##### 5.7.1 Objective

To control the severity and extent of noise impacts offsite during the construction and operational phases of the gravel quarry.

##### 5.7.2 Target

No complaints received from the community, neighbours, other stakeholders or regulatory authorities in relation to offsite noise impacts from the extractive operations.

##### 5.7.3 Management actions

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As discussed in **Section 3.10**, monitoring has already been undertaken which included the assessment of noise impacts before and after the commencement of extractive operations. The results of the noise assessment indicate that quarrying operations will comply with the *Environmental Protection (Noise) Regulations 1997*, as such, no specific noise reducing measures are required.

No further noise monitoring has been completed, however given the intermittent operations and the lack of complaints over the past 10 years, further noise monitoring is not considered necessary. Notwithstanding, noise management actions for the site are detailed in **Table 8**.

Table 8: Management actions for noise

Parameter	No.	Action	Timing
Noise control	N1	Works generating excessive noise will not occur outside the hours of 7am to 7pm or on a Sunday or Public Holiday.	Between 7am to 7pm or on a Sunday or Public Holiday.
	N2	Undertake regular maintenance of plant and ensuring acoustic enclosures or covers fitted to plant are used at all times.	N/A

## 5.8 Visual amenity

### 5.8.1 Objective

To reduce adverse visual impacts on the surrounding environment to as low as reasonably practicable.

### 5.8.2 Target

Works in visually prominent places are minimised and disturbed natural areas rehabilitated to maintain the existing landscape character.

### 5.8.3 Management actions

The site includes a large sand ridge that will be removed as part of quarrying operations. The sand ridge is visible from the north of the site along King Road which is at a higher elevation than the quarry.

A number of measures have already been undertaken to ensure that the extractive operations are appropriately screened from the surrounding areas as described in **Section 3.9**. As the sand resource is removed from the ridge, the land will be returned to an elevation matching the adjoining land to the north and south. To minimise the potential visual impact of the ongoing operations on the surrounding landscape, the mitigation measures outlined in **Table 9** will be implemented.

Table 9: Management actions for visual amenity

Parameter	No.	Action	Timing
Visual	V1	Respread topsoil and progressively rehabilitate post-quarried areas in accordance with the Rehabilitation and Decommissioning Plan, so the exposed quarry faces are less visually prominent.	Ongoing.

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Parameter	No.	Action	Timing
	V2	Storage for the mobile equipment on site after hours will be on the quarry floor to reduce the visual impact of the sand mine.	At all times.

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## 6 Rehabilitation and Decommissioning Plan

A Rehabilitation and Decommissioning Plan in accordance with the requirements of the *City of Armadale Extractive Industries Local Law (CoA 2000)* has been prepared to support this EMP, see **Appendix D**. A summary of the management actions has been provided in **Table 10** below.

### 6.1 Management actions

Table 10: Management actions for revegetation

Parameter	No.	Action	Timing
Landform	R1	All slopes will be contoured to achieve a maximum slope of 1:3 vertical to horizontal.	Prior to revegetation
	R2	Deep rip (0.5 m minimum) on contours to reduce erosion, reduce flow velocities, promote water capture/infiltration, and promote soil binding. Carry out shallow ripping as required.	Prior to revegetation
	R3	Stockpiled topsoil will be re-spread to create a land surface that is safe and stable.	Prior to revegetation
Revegetation	R4	Undertake revegetation in accordance with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Prior to revegetation
Maintenance	R5	Undertake maintenance measures as per Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Maintenance is proposed to occur for a duration of three years, or until the completion criteria and objectives are met. This condition can be re-looked at if the completion criteria are met before this time.
Monitoring	R6	Monitoring and reporting work are required to ensure that the revegetation objectives are achieved. Undertake monitoring as per Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Annually in summer for three years after completion of each stage or until the completion criteria and objectives are met. If rehabilitation objectives and completion criteria are met earlier than the three year period, this condition can be re-looked at before this time.

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## 7 Implementation

### 7.1 Roles and responsibilities

Key roles and responsibilities for the implementation of this EMP are presented in **Table 11**. These will be clearly communicated to personnel via site induction. It is essential that all personnel associated with the project comply with the requirements of applicable environmental legislation, regulations and standards.

*Table 11 Roles and responsibilities for EMP implementation*

Roles	Responsibilities
Site Manager	<ul style="list-style-type: none"> <li>• Ensure that all personnel are inducted in the requirements of this EMP and the system used for reporting of environmental incidents.</li> <li>• In the event of a non-compliance, take corrective action to prevent repeat offences.</li> <li>• Ensure that the site remains tidy and safe for personnel.</li> </ul>
All personnel (including subcontractors)	<ul style="list-style-type: none"> <li>• Attend environmental induction or any other training as required.</li> <li>• Report all environmental non-compliances or risks as they occur to the Site Manager.</li> </ul>

### 7.2 Inspections and reporting

#### 7.2.1 Induction records

All personnel will be provided with a site induction covering the requirements of this EMP prior to commencing work on the site. Records of site induction training attendance will be kept on-site.

#### 7.2.2 Inspections

The Site Manager will undertake regular inspections to ensure management measures contained in this EMP are being followed. All non-compliances during inspections will be documented and details provided to the Shire of SJ regarding how these were handled.

#### 7.2.3 Compliants register and consultation

The Site Manager is responsible for dealing with any complaints received by the community, neighbours, other stakeholders or regulatory authorities in relation to the extractive operations. The Site Manager will also be responsible for informing neighbours or other relevant parties of clearing, and overburden removal as planned to minimise any complaints which are specifically related to dust emissions.

A compliants register should be established and appropriate consultation should be undertaken with the relevant parties immediately to address their concerns in relation to reducing dust or noise emissions associated with the operations.

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### 7.3 Summary of actions

**Table 12** below provides a summary of the actions to be implemented by LWP King Road Syndicate Pty Ltd in order to avoid, minimise and manage any impacts from the quarrying activities on the environment.

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Table 12: Summary of Management Action

Parameter	No.	Action	Timing
<b>Groundwater</b>			
Groundwater levels	G1	On-site testing and monitoring of groundwater levels will be undertaken biannually during winter and spring of each year within the Excavation Area. Measure Standing Water Level (SWL) in groundwater bores and compare the surveyed levels upon completion of each stage of the mining activity to ensure the depth to the water table is no less than 2m	Every winter and spring from commencement to three years after completion of extraction.
	G2	Complete feature survey report in completed stages	At the completion of extraction from each stage.
	G3	No dewatering will be undertaken as part of sand extraction activities	N/A
Groundwater quality	G4	Undertake an annual groundwater quality monitoring event (TRH, heavy metals, nutrients, chloride sulphate and pH) to identify if any contamination from the sand excavation operations has occurred onsite. The annual monitoring event will coincide with the time of seasonal groundwater high.	Annual at the time of seasonal groundwater high (winter-early spring) from commencement to completion.
	G5	No potential chemical pollutants hazardous substances will be stored on site, apart from vehicle lubricants and fuel for minor machinery servicing.	N/A
	G6	Major servicing of large machinery will be undertaken offsite.	N/A
	G7	Any exceedances 10% over the groundwater quality trigger levels as outlined in <b>Section 3.3.2.2</b> will be investigated and the source of any contamination will be isolated and rectified if shown to be the result of the operation of the extractive industry.	N/A
	G8	Any exceedance of the baseline level of more than 10% of the chloride sulphate ratio will result in an investigation in accordance with the <i>Acid Sulphate Soils Guideline Series: Identification and Investigation of Acid Sulphate Soils and Acidic Landscapes and Draft Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes</i> .	N/A

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Parameter	No.	Action	Timing
<b>Stormwater and erosion</b>			
Stormwater	S1	Construct appropriate spillway drains to prevent diesel spillage as appropriate.	Prior to clearing
	S2	Construct catch drains to capture runoff from disturbed areas and direct into the pit area to enable infiltration.	Prior to clearing
	S3	No clearing or disturbance is to take place within the 50 m buffer to the two CCWs (UFI 6998, 6999), as shown in <b>Figure 9</b> .	N/A
	S4	Drains should discharge clean stormwater into vegetated natural drainage lines.	N/A
Erosion control	S5	Keep natural drainage lines open wherever possible.	N/A
	S6	Cleared areas will be stabilised (hydro-mulch or similar) as soon as possible to minimise erosion.	Upon quarry closure
	S7	Level or gently sloping areas will be selected as stockpile sites to minimise erosion and potential soil loss where possible.	To be reviewed immediately post topsoil removal
	S8	Appropriate sediment controls will be installed upslope of stockpiles to divert water around and downslope of the stockpiles to prevent soil loss	To be reviewed immediately post topsoil removal
	S9	Access routes will follow existing cleared access routes where possible	N/A
	S10	Construct batters during mining no less than 1 in 2 and final contours no less than 1 in 4 to prevent erosion from surface water.	During excavation activities
<b>Native vegetation</b>			
Native vegetation	V1	No clearing or disturbance is to take place within the 50 m buffer to the two CCWs (UFI 6998, 6999), as shown in <b>Figure 9</b> . No machinery or support vehicles to enter any of the conservation or protected buffer areas.	N/A
	V2	Vegetation will be cleared incrementally and only as required by mining operations.	During excavation activities
	V3	Progressive rehabilitation will be undertaken in completed stages in accordance with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Upon quarry closure
	V4	Monitor success of rehabilitation against the completion criteria outline within the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Annually in summer for three years after completion of each stage, or until completion criteria and objectives are met.

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Parameter	No.	Action	Timing
<b>Weed and dieback</b>			
Surface material	W1	Assess weed and dieback potential within topsoil material prior to removal and separate topsoil for treatment or disposal if required.	Prior to and during topsoil removal
	W2	Store significantly weedy surface material separately to clean surface material.	Surface material removal
	W3	Stockpile all surface materials in the general vicinity of its origin.	Surface material removal
Hygiene measures	W4	As far as reasonable and practicable all vehicles and machinery will be cleaned of plant material, mud and soil prior to entry and exit of the site.	N/A
	W5	No soil and vegetation should be brought to the site apart from that to be used in rehabilitation and plants used in rehabilitation should be free of weeds.	N/A
Access	W6	Control access within the quarry area to reduce the spread of weeds, especially off-road vehicle access, to prevent disturbance to vegetation and weed invasion.	N/A
	W7	Restrict access to areas outside the quarry operations to reduce the spread of weeds into or out of the site.	N/A
Weed control	W8	Chemical spraying is to be undertaken in accordance with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	As required
	W9	Undertake visual assessment of the weed control measures to measure success against completion criteria outlined in the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Annually in summer for each area rehabilitated to three years after completion of each stage or until completion criteria and objectives are met
<b>Dust</b>			
Dust control	D1	Monitor weather forecasts to determine ground moisture level, wind strength (especially prevailing winds) or direction or other seasonal conditions applicable to the extractive operations.	At all times
	D2	In the event that weather conditions are unfavourable, especially in the case of adverse ground moisture level or wind strength or direction, operations will be rescheduled or ceased to minimise excessive dust emissions associated with its operations on neighbouring land uses.	When required by unfavourable weather conditions
	D3	A water truck (6 x 4 in size) with hydraulic water pumps is to be used to wet the access/driveways and stockpiles when hot, dry and windy conditions are anticipated to occur during operations.	When required by unfavourable weather conditions

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Parameter	No.	Action	Timing
	D4	A 25 km/hr speed limit will be applied to all internal roads, driveways and vehicle access ways, supported by appropriate signage.	At all times
<b>Noise</b>			
Noise Control	N1	Works generating excessive noise will not occur outside the hours of 7am to 7pm or on a Sunday or Public Holiday.	Between 7am to 7pm or on a Sunday or Public Holiday.
	N2	Undertake regular maintenance of plant and ensuring acoustic enclosures or covers fitted to plant are used at all times.	N/A
<b>Visual amenity</b>			
Visual impacts	V1	Respread topsoil and progressively rehabilitate post-quarried areas in accordance with the Rehabilitation and Decommissioning Plan, so the exposed quarry faces are less visually prominent.	Ongoing.
	V2	Storage for the mobile equipment on site after hours will be on the quarry floor to reduce the visual impact of the sand mine.	At all times.
<b>Revegetation</b>			
Landform	R1	All slopes will be contoured to achieve a maximum slope of 1:4 vertical to horizontal.	Prior to revegetation
	R2	Deep rip (approximately 0.5 m) on contours to reduce erosion, reduce flow velocities, promote water capture/infiltration, and promote soil binding. Carry out shallow ripping as required.	Prior to revegetation
	R3	Stockpiled topsoil will be re-spread to create a land surface that is safe and stable.	Prior to revegetation
Revegetation	R4	Undertake revegetation in accordance with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> )	Refer to <b>Appendix D</b> .
Maintenance	R5	Undertake maintenance measures with the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> )	Refer to <b>Appendix D</b> .
Monitoring	R6	Monitoring and reporting work are required to ensure that the revegetation objectives are achieved. Undertake monitoring as per the Rehabilitation and Decommissioning Plan ( <b>Appendix D</b> ).	Refer to <b>Appendix D</b> .

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## 8 Monitoring

A program of monitoring of the revegetation works is required to ensure that the objectives are achieved. The proponent will be responsible for the implementation of this EMP. The recommended evaluation criteria for management objectives are presented in **Table 13**.

Table 13: Objectives, success criteria and evaluation timeframes.

Objective	Success Criteria	Timeframe
1. Avoid uncontrolled discharge of water from the site that results in erosion or sedimentation and offsite dust impacts from the construction activities	<ul style="list-style-type: none"> <li>• Post development environmental flows and/or hydrological cycles are maintained relative to predevelopment conditions, and that water quality is maintained and/or improved with the aim of maintaining and restoring ecological systems.</li> <li>• No complaints received from the community, neighbours, other stakeholders or regulatory authorities in relation to offsite dust impacts</li> </ul>	Prior to and during construction.
2. Avoid disturbance to native vegetation within and adjacent to the site.	<ul style="list-style-type: none"> <li>• No clearing or disturbance occurs outside of clearing area.</li> </ul>	At all times.
3. Avoid and minimise introduction and/or spread of weeds into areas of retained native vegetation within and adjacent to the site.	<ul style="list-style-type: none"> <li>• No weeds introduced as direct result of construction activities.</li> </ul>	During construction.
4. Undertake effective hygiene measures to ensure <i>Phytophthora cinnamomi</i> (dieback) and other soil pathogens are not introduced to the site or adjacent native vegetation as a result of construction activities.	<ul style="list-style-type: none"> <li>• No dieback or other pathogen introduced as direct result of construction activities.</li> </ul>	During construction.
6. Avoid disturbance the two CCWs (UFI 6998, 6999).	<ul style="list-style-type: none"> <li>• No clearing or disturbance occurs outside of the Excavation Area</li> </ul>	At all times.
7. Minimise bushfire risk as part of the construction activities	<ul style="list-style-type: none"> <li>• No storage of large quantities of fuel storage on site</li> <li>• No construction of permanent habitable structures</li> <li>• No servicing of vehicles at the site</li> </ul>	During construction.

### 8.1 Incidents

If criteria are not met due to unforeseen factors, or over small areas due to issues with implementation, the relevant tasks may be repeated. Contingency actions will only be required should success criteria be determined not to have been met.

Where it is demonstrated that the prescribed methods have been ineffective, alternative methods may be sought and adopted to better achieve the desired outcomes. In the event that this is required, further liaison with the Shire of SJ will be undertaken to confirm the acceptability of any modification to proposed methodology.

# Environmental Management Plan

## King Road Sand Quarry, Oldbury



## 9 References

### 9.1 General references

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### 9.2 Online references

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- Department of Water and Environmental Regulation (DWER) 2018b, *Perth Groundwater Map*, viewed November 2018, <<https://maps.water.wa.gov.au/#/webmap/gwm>>.
- Office of Bushfire Risk management (OBRM) 2019, *Map of Bush Fire Prone Areas*, viewed October 2020, <<https://maps.slip.wa.gov.au/landgate/bushfireprone/>>

# Environmental Management Plan

King Road Sand Quarry, Oldbury



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*Figure 2: Excavation Staging*

*Figure 3: Landforms and Soils*

*Figure 4: Acid Sulfate Soils*

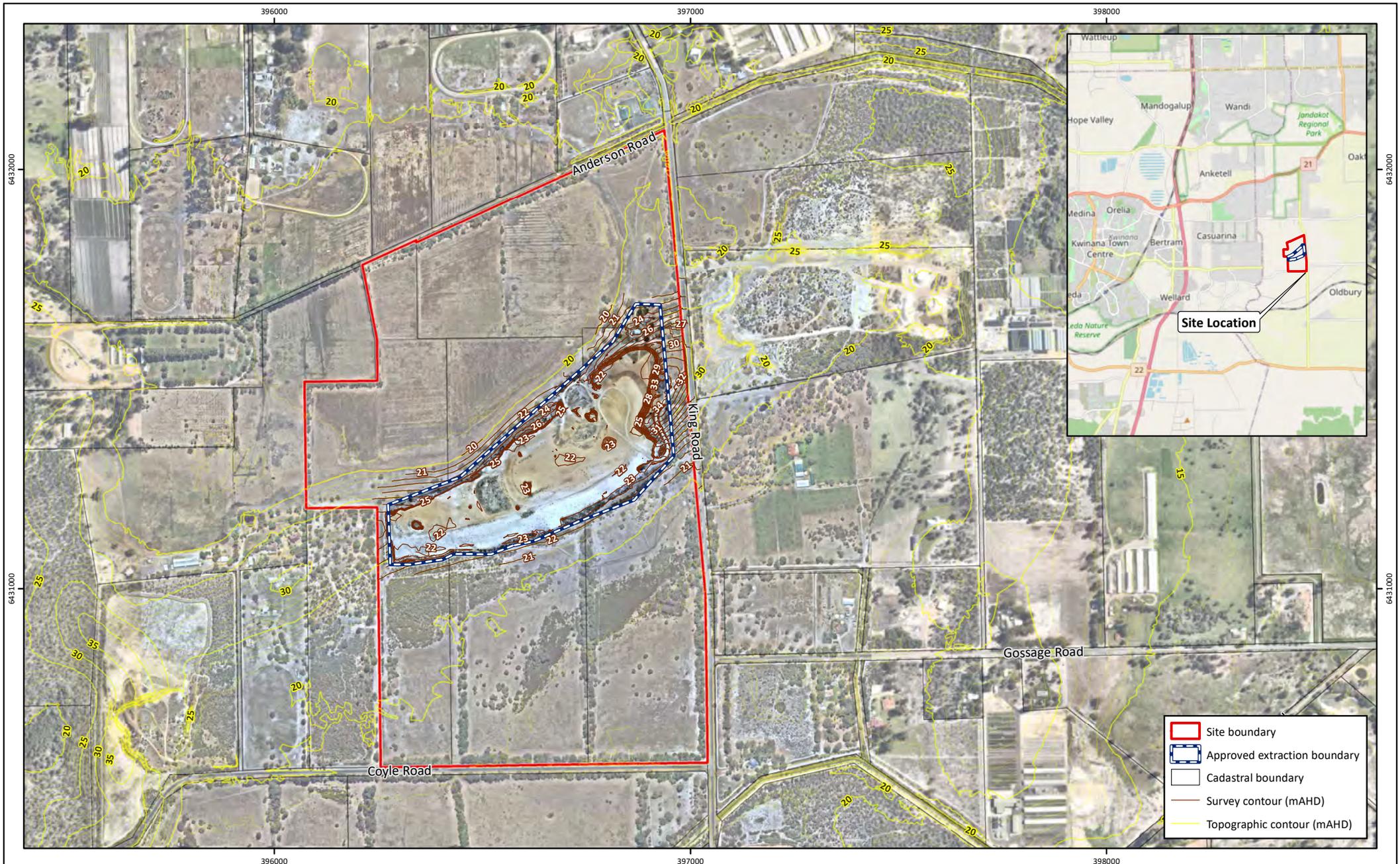
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**Figure 1: Site Location and Topographic Contours**

**Project:** Environmental Management Plan  
King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

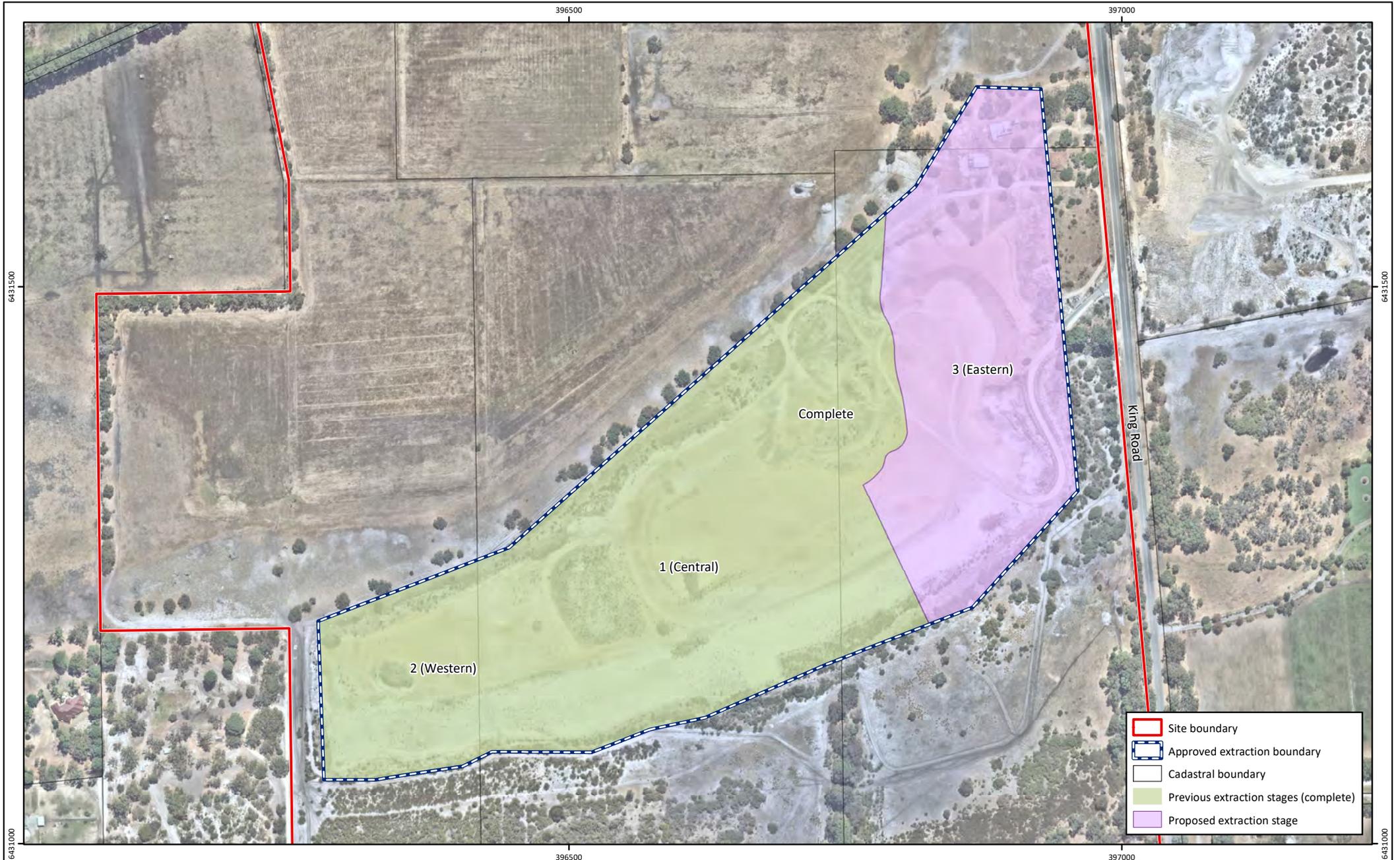
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**Date:** 18/06/2021



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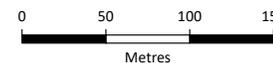
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**Figure 2: Excavation Staging**

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King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

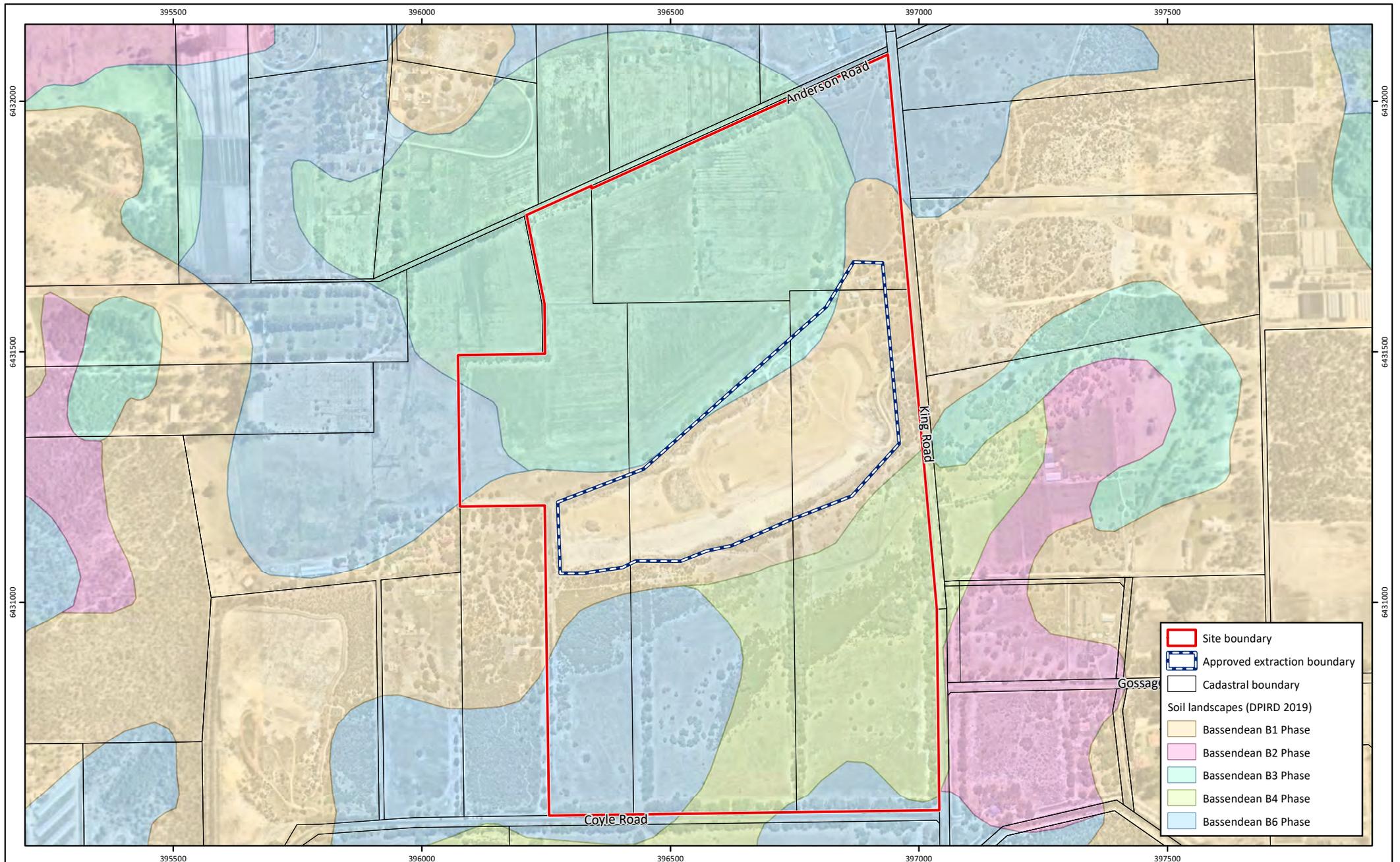
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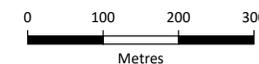


	Site boundary
	Approved extraction boundary
	Cadastral boundary
Soil landscapes (DPIRD 2019)	
	Bassendean B1 Phase
	Bassendean B2 Phase
	Bassendean B3 Phase
	Bassendean B4 Phase
	Bassendean B6 Phase

**Figure 3: Landforms and Soils**

**Project:** Environmental Management Plan  
King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

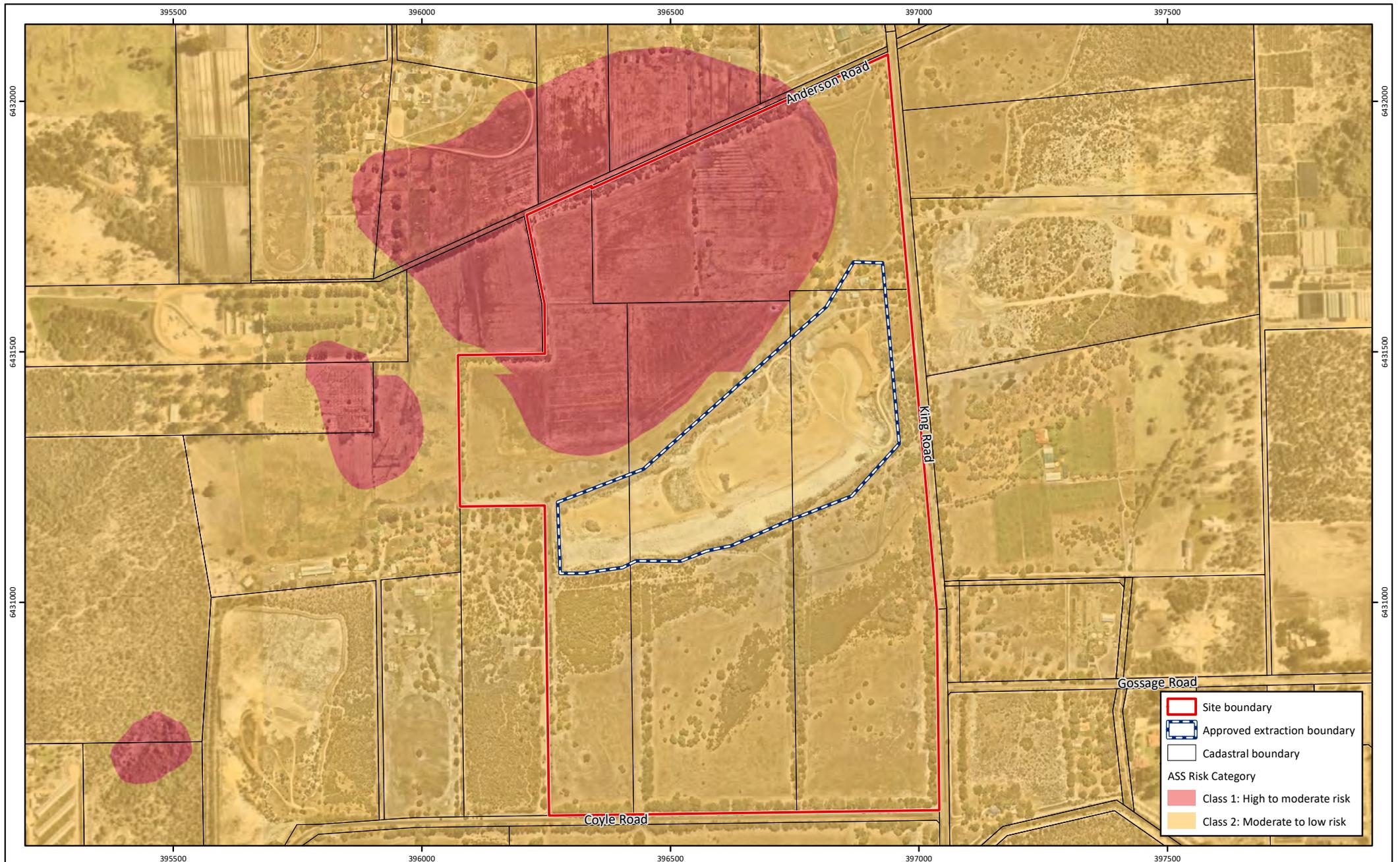
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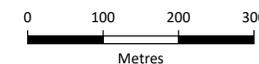
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**Figure 4: Acid Sulfate Soils**

**Project:** Environmental Management Plan  
King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

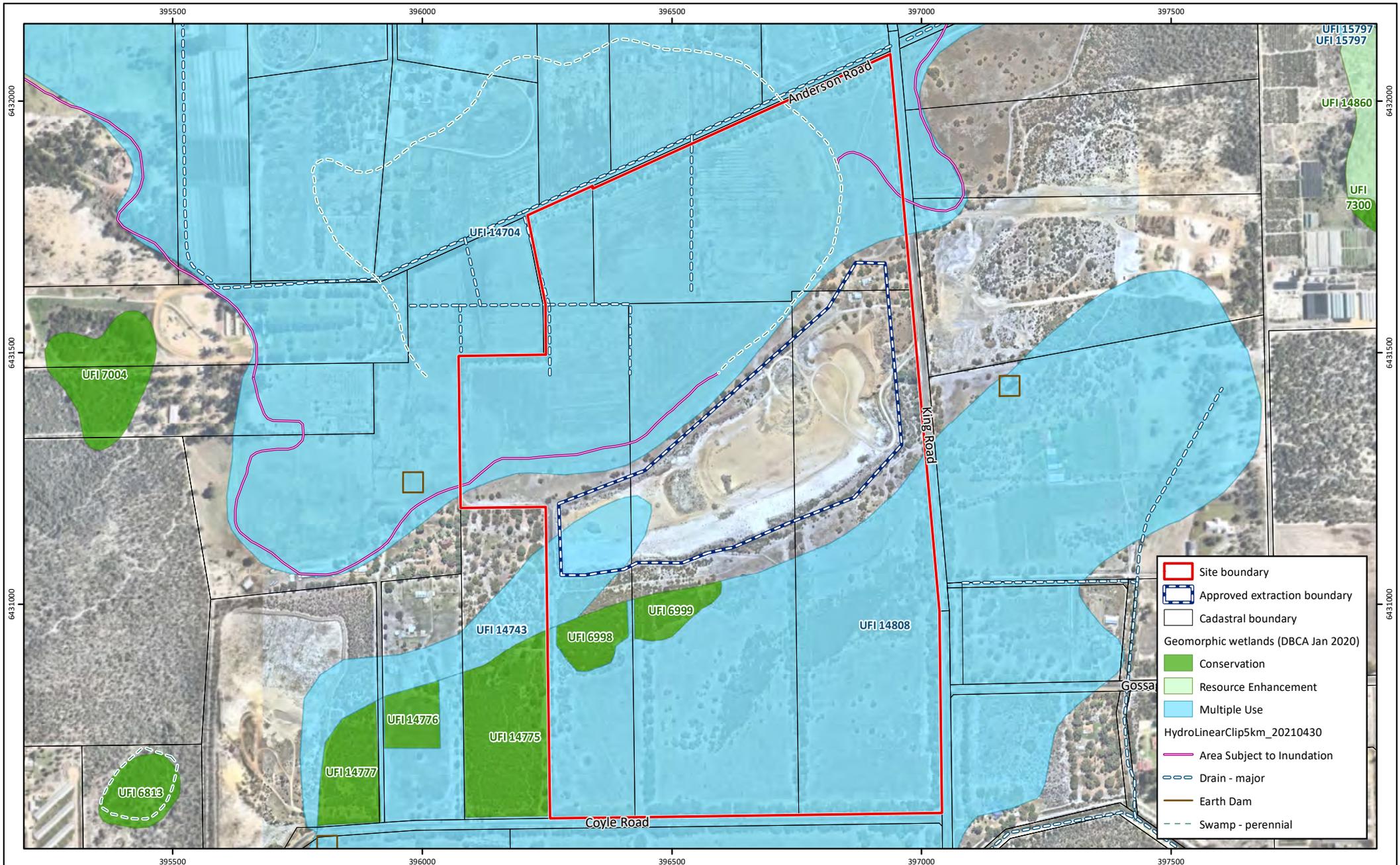
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**Figure 5: Hydrological Features**

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King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

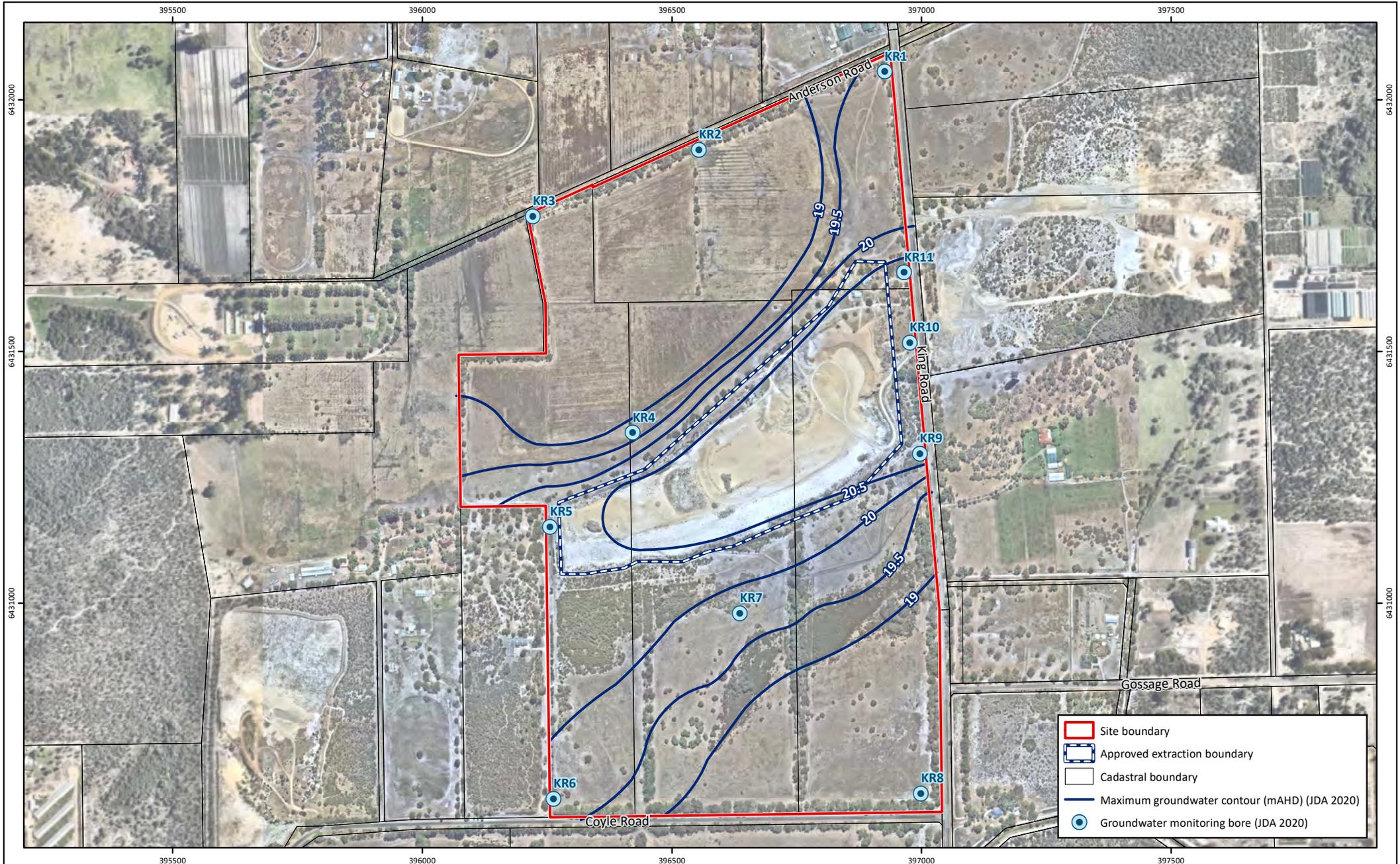
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**Figure 6: Groundwater Features**

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King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

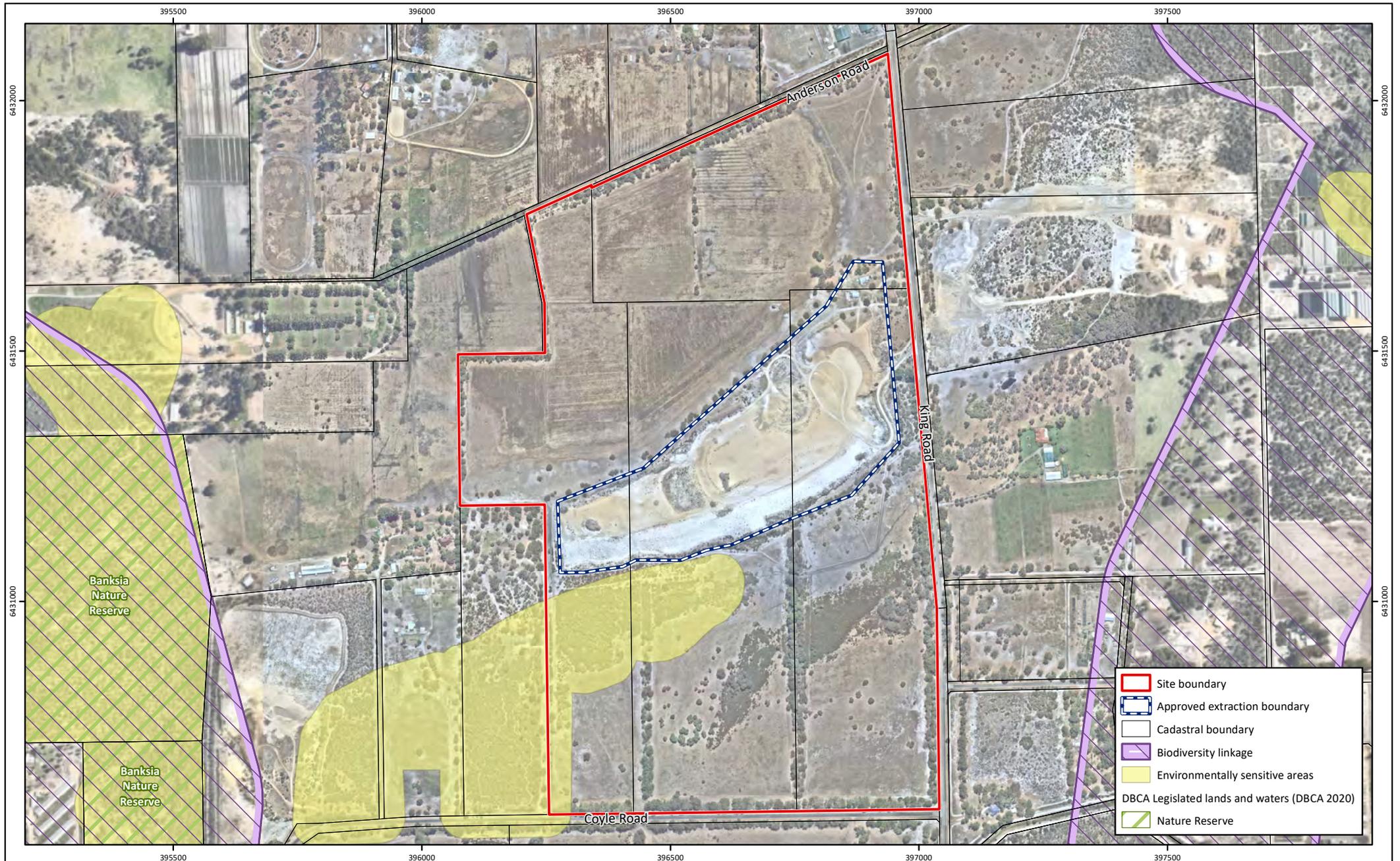
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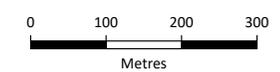
	Site boundary
	Approved extraction boundary
	Cadastral boundary
	Biodiversity linkage
	Environmentally sensitive areas
	Nature Reserve

DBCA Legislated lands and waters (DBCA 2020)

**Figure 7: Conservation Reserves**

**Project:** Environmental Management Plan  
King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

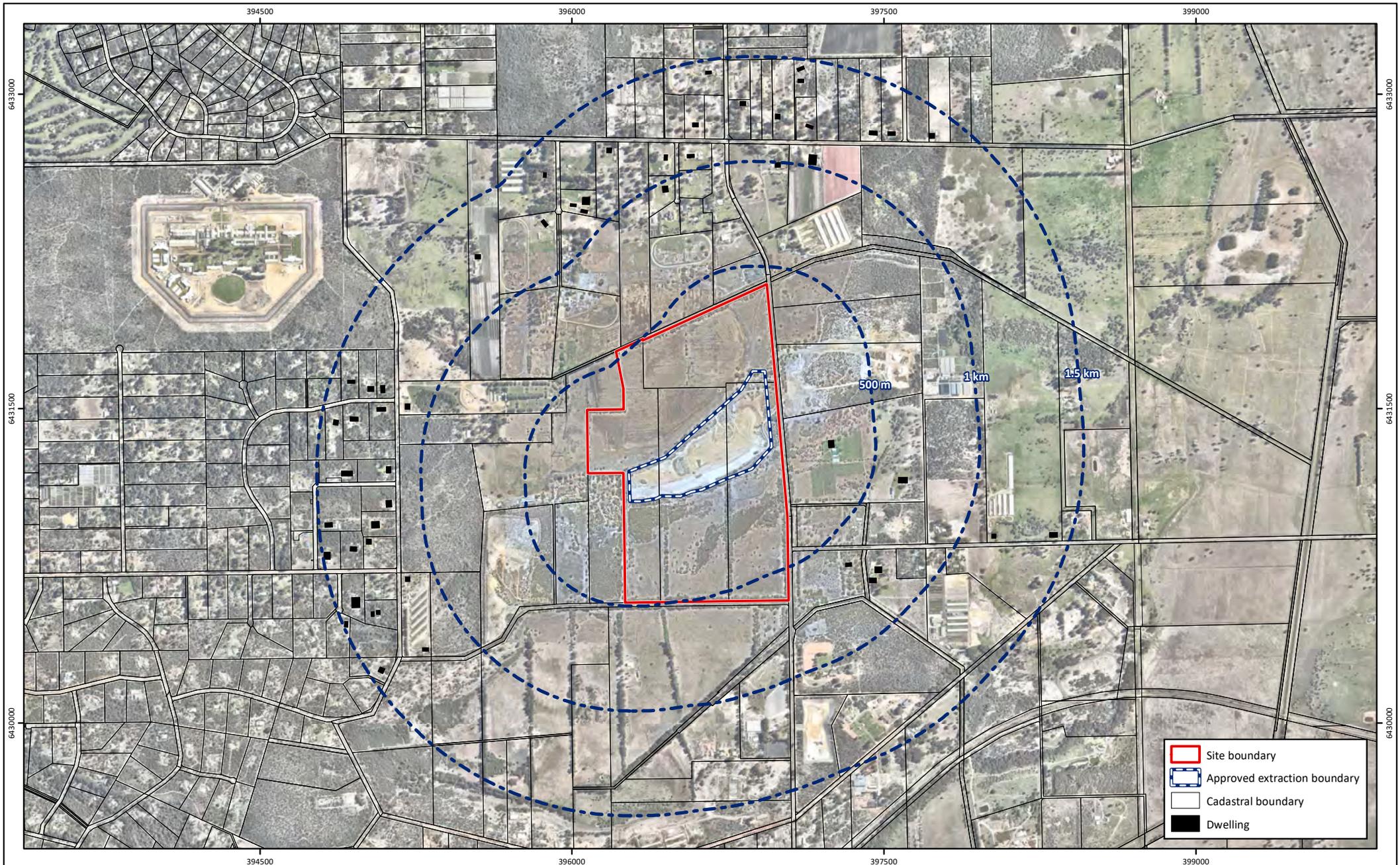
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**Date:** 30/04/2021  
**Checked:** PPS  
**Approved:** BRB  
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**Figure 8: Proximity of Sensitive Land Uses**

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King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

**Plan Number:**  
EP20-161(01)--F07  
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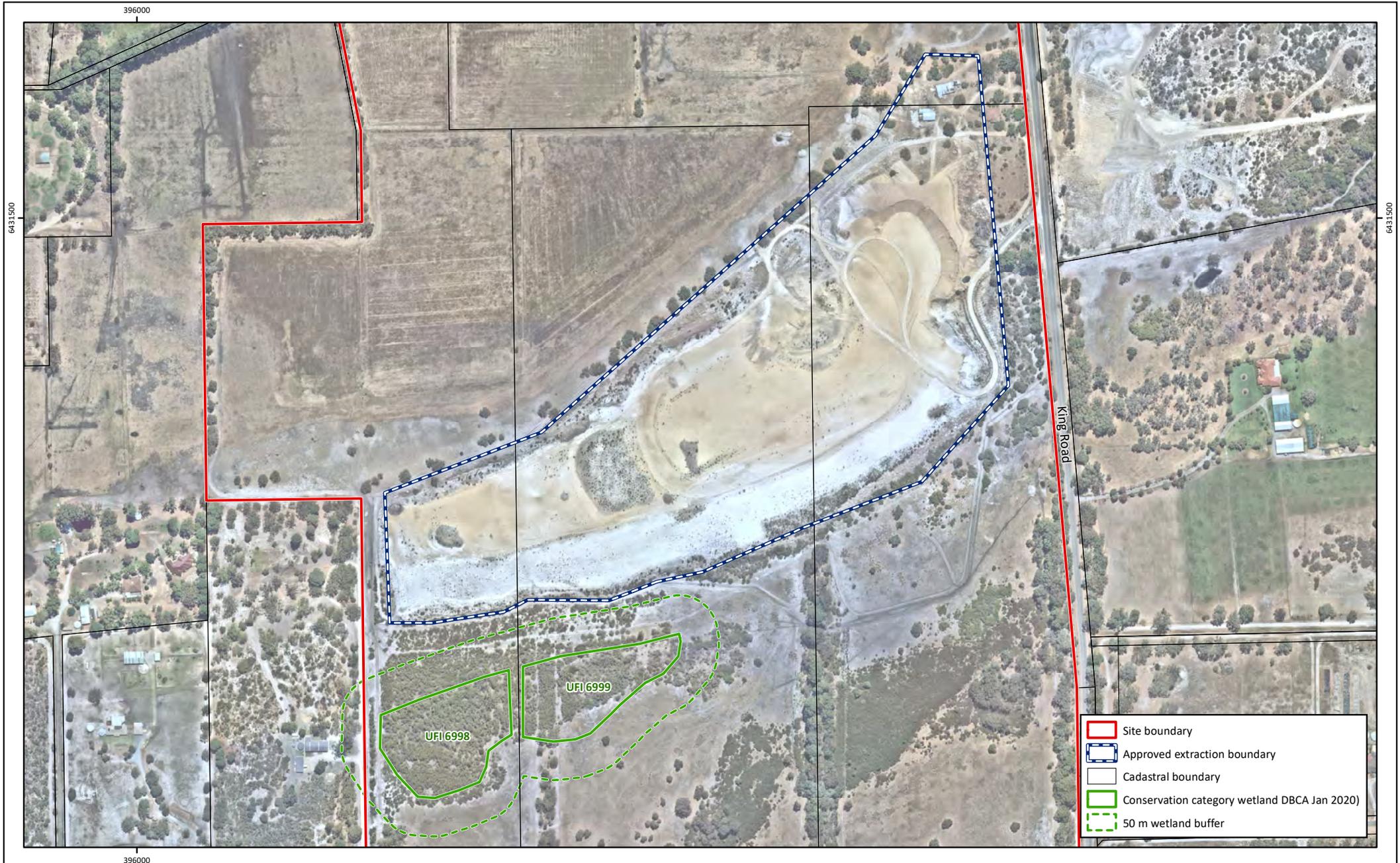


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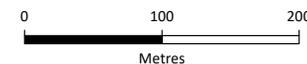
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**Figure 9: Clearing Avoidance Area**

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King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

**Plan Number:**  
EP20-161(01)--F09  
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# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle  
Road and 713 and 1242, King Road, Oldbury)

Project No: EP20-161(02)

**Prepared for LWP King Road Syndicate Pty Ltd  
June 2021**

# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



## Document Control

<b>Doc name:</b> Rehabilitation and Decommissioning Plan King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)					
<b>Doc no.:</b> EP20-161(02)--002					
Version	Date	Author		Reviewer	
1	June 2021	Pascal Scholz	PPS	Ashley Bird	ALB
	Submitted for approval.				
A	June 2021	Pascal Scholz	PPS	Ashley Bird	ALB
	Updated in response to client comments.				
B	July 2021	Pascal Scholz	PPS	Ashley Bird	ALB
	Updated in response to client comments.				

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## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



### Executive Summary

The renewal of an existing Development Approval and an Extractive Industries Licence is proposed by LWP King Road Syndicate Pty Ltd (the proponent) for the extraction of sand within Lots 200, 441, 713 and 1242 King Road, Oldbury within the Shire of Serpentine-Jarrahdale (referred to as 'the site').

This Rehabilitation and Decommissioning Plan (RDP) supports the application for renewal and forms part of the Environmental Management Plan for the King Road sand quarry.

The RDP describes the existing environment within the site and outlines the Rehabilitation objectives, processes, and subsequent quarry decommission. Furthermore, this RDP focusses on the rehabilitation and decommissioning processes within the site's approved extraction boundary in accordance with the requirements of the Shire of Serpentine-Jarrahdale *Extractive Industries Local Law 1999*.

# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



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# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



## List of Abbreviations

*Table A1: Abbreviations - General Terms*

General Terms	
ASS	Acid sulfate soils
AHD	Australian height datum
ha	Hectares
km	Kilometres
RDP	Rehabilitation and Decommissioning Plan
SoSJ	Shire of Serpentine-Jarrahdale

# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



## 1 Introduction

### 1.1 Background

LWP King Road Syndicate Pty Ltd (the proponent) is seeking to renew an existing Development Approval which is due to expire on 1 July 2021, and separately an Extractive Industries Licence for the extraction of sand within Lots 200, 441 713 and 1242 King Road, Oldbury (herein referred to as 'the site'). The site is 108.72 hectares (ha) in size and located approximately 33.4 kilometres (km) south-east of the Perth Central Business District within the Shire of Serpentine-Jarrahdale (SoSJ), the site is shown in **Figure 1**.

The proposal is to extract sand from the site's central ridgeline, which extends over approximately 19.57 ha within the confined extraction boundary (herein referred to as the 'excavation area'). The extraction area is shown in **Figure 1**.

The proponent is seeking the relevant approvals to extract the remaining material (approximately 271,387 m<sup>3</sup>) from the excavation area for an additional five years to service several future stages of residential development of the Glades, Byford residential estate, located approximately 8 km to the north-east of the site.

### 1.2 Purpose and objectives of report

This Rehabilitation and Decommissioning Plan (RDP) has been prepared to accompany the application for the renewal of an existing Development Approval and separately and Extractive Industries License for the extraction of sand within multiple lots on King Road, Oldbury. This RDP forms part of the King Road Sand Quarry Environmental Management Plan. However, the RDP acts as a standalone document to enable better synergies across the two documents and a centralised reporting framework for all environmental management, rehabilitation and decommissioning related activities within the site.

Furthermore, the purpose of this RDP is to address the key aspects of the King Quarry closure and rehabilitation so that they meet the government, community and company expectations. More specifically the RDP has been prepared in accordance with the following objectives:

- Achievement of acceptable post disturbance land use suitability: Rehabilitation will aim to create a stable landform with land capability such as for agricultural suitability similar to that prior to disturbance and having regard to the nature of the surrounding landscape.
- Creation of stable post-disturbance landform: Disturbed land will be rehabilitated to a condition that provides self-sustaining cover of parkland pasture on the cleared areas within the site.
- Achievement of acceptable quarry decommissioning: Quarry closure will provide for the removal of buildings, plant, waste and final site clean-up in accordance with the local guidelines.

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



### 1.3 Scope of report

This RDP has been prepared by Emerge Associates in accordance with the requirements of the Shire of Serpentine-Jarrahdale *Extractive Industries Local Law 1999* (SoSJ 1999). Part 2 section 2.3c of the local law provides for the 'Licensing Requirements for an Extractive Industry' 'Application for License' and outlines the rehabilitation and decommissioning objectives. Additionally, the rehabilitation program is guided by the SoSJ's expectations for revegetation outlined in the SoSJ *Local Planning Policy 4.16-Landscape and Revegetation* (Shire of Serpentine Jarrahdale 2018).

This RDP outlines the following information in accordance with the SoSJ local law:

- i. The objectives of the plan, having due regard to the nature of the surrounding area and the proposed end-use of the excavation site (**section 3.1**);
- ii. Whether restoration and reinstatement of the excavation site is to be undertaken progressively or upon completion of excavation operations (**section 3.2**);
- iii. How each face is made to be safe and batters sloped;
- iv. The method by which topsoil is to be replaced and revegetated (**section 3.3**);
- v. The numbers and types of trees and shrubs to be planted and other landscaping features to be developed (**section 3.4**);
- vi. How rehabilitated areas are to be maintained (**section 3.6**); and
- vii. The plan for the removal of buildings, plant, waste and final site clean-up (**section 4**).

# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



## 2 Existing Environment

### 2.1 Climate

The climate of the site is described as Mediterranean, with hot, dry summers and moderately wet, mild winters. An average of 816.0 millimetres of rainfall is recorded annually from the Jandakot weather station (Site Number: 009172). The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Jandakot weather station range from 19.1°C in July to 34.4°C in January and February, while mean minimum temperatures range from 16.5°C in July to 29.3°C in February (BoM 2021).

### 2.2 Geomorphology

#### 2.2.1 Topography

The topography of the site slopes in a westerly direction, with elevation ranging from approximately 34 metres Australian height datum (AHD) in the eastern portion falling to 21 m AHD within the western portion.

#### 2.2.2 Landform, soils and geology

Examination of broad scale mapping places the site within the Bassendean System. This system comprises '*Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths*' (Churchward and McArthur 1980).

Finer scale mapping (DPIRD 2018) shows four soil landscape units as occurring within the site, as described in **Table 2** below.

Table 2: Soil landscape mapping units within the site (DPIRD 2018)

Soil Landscape unit	Location within site	Description
Bassendean B1 Phase	Transecting the central portion along a sand dune.	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
Bassendean B3 Phase	Extending over the north western portion of the site	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam
Bassendean B4 Phase	Extending over the south eastern corner,	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



Soil Landscape unit	Location within site	Description
Bassendean B6 Phase	Small portions of the north eastern and south western corners	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

There are no unique landforms or geological features within the site.

### 2.2.3 Acid sulfate soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, ASS are generally present in waterlogged and/or anoxic conditions and do not present any risk to the environment. ASS can pose issues when oxidised, producing sulphuric acid, which can present a range of risks for the surrounding environment, infrastructure and human health.

The Department of Water and Environment Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2021). A review of this mapping indicates that the majority of the site is classified as Class 2 – ‘moderate to low risk’ of ASS occurring within 3.0 m of the natural soil surface, with the north western corner classified as Class 1 – ‘high to moderate risk’ of ASS occurring within 3.0 m of the natural soil surface.

## 2.3 Hydrology

### 2.3.1 Surface water

There are no natural water surface features within the site. A Water Corporation drain runs along the northern boundary of the site, crossing under King Road and connecting to the Berriga Main drain to the south-east of the site.

The highly permeable properties of the sands of the Bassendean Dune systems result in very high infiltration rates and minimal to no surface runoff in these areas. Notwithstanding this, lower depressions between the dune systems may exhibit some temporary pooling of surface water.

### 2.3.2 Groundwater

The groundwater flows in a south easterly direction across the site ranging from 20 m Australian Height Datum (AHD) to 18 m AHD.

### 2.3.3 Wetlands

Wetlands are areas which are permanently, seasonally or intermittently waterlogged or inundated with water. Naturally occurring wetland features are common across the Swan Coastal Plain and can contain fresh or salty water, which may be flowing or still.

The Department of Biodiversity Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2020) database, which categorises geomorphic wetland features into specific management categories based on their attributes and management objectives.

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



A review of the Geomorphic Wetlands on the Swan Coastal Plain dataset (DBCA 2020) indicates that the majority of the site is mapped as multiple use wetlands, comprising UFI 14704 and 1408 extending over a total 91.60 ha. One MUW (UFI 14743) extends over 2.36 ha, a portion of which intersects with the excavation Area. Two Conservation Category Wetlands (CCW)'s (UFI 6998, 6999) are mapped across the south western portion of the site, approximately 70 m south of the approved excavation area.

### 2.4 Flora and vegetation

The majority of the site was cleared prior to 1953 for agricultural land uses including livestock grazing with the exception of scattered paddock trees along the site's boundary. As a result the site is dominated by non-native vegetation, with some native vegetation occurring as primarily isolated patches holding low species diversity.

A total of 18 plant taxa were identified during site-specific surveys with an average of 1.1 species per 100 m<sup>2</sup>. The predominant native species identified included *Kunzea ericifolia*, *Scholtzia involucrate*, *Jacksonia furcellata* and *Acacia heugelii* in addition to non-native grasses and scattered *Allocasuarina fraseriana* (sheoak) trees. All vegetation within the site was determined to be in 'degraded' (12.7%, 1.6ha) or 'completely degraded' (87.3%, 11ha) condition due to the historical and ongoing disturbance from agricultural land uses.

No threatened or priority ecological communities were identified during site-specific surveys.

### 2.5 Terrestrial fauna

The majority of the site's habitat values are compromised by the removal of most of the native vegetation and impacts of historical degradation. As a result, it was determined that the site primarily provides habitat that may be suitable for common and widespread native species with non-specific habitat requirements.

### 2.6 Bushfire hazards

The Map of Bush Fire Prone Areas published by the Office of Bushfire Risk Management (OBRM, 2019) identifies the site and surrounding areas as 'bushfire prone areas'. There is no permanent infrastructure on the site associated with the quarry other than fencing, gates, loop road and a hardstand refuelling area.

### 2.7 Other land use considerations

#### 2.7.1 Visual amenity

Several residential landholdings are located within a 1.5 km radius of the site. The sand ridge is visible from the north of the site along King Road which is at a higher elevation than the quarry. Within the vicinity of the site, views are largely dominated by cleared agricultural land, plantations, orchards and blocks of remnant native vegetation. Perimeter screening along Anderson and King Road was established in 2010 and has since matured to the extent that it provides suitable screening

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



of the sand quarry. Additionally, the quarry is worked from behind the ridge providing further screening. Ultimately as the sand resource is removed from the ridge, the land will be returned to an elevation matching the adjoining land to the north and south.

### 2.7.2 Surrounding land uses

The site is situated within a highly cleared and modified local area, which supports rural and agricultural land uses with extensive cleared land used for pasture. A number of residential dwellings are located within a 1.5 km radius from the excavation area.

### 2.8 Noise impacts

As mentioned in **section 2.7.2**, a number of residential dwellings are located within a 1.5 km radius from the excavation area. The closest noise sensitive premise is a single residential dwelling located approximately 250 m from the site, separated by remnant vegetation. A noise assessment was conducted in 2010 and it was determined that mining operations will comply with the *Environmental Protection (Noise) Regulations 1997*.

### 2.9 Dust impacts

Dust level monitoring was conducted over a period in 2010 prior to the renewed 2011 approval and determined that dust levels generated as a result of quarrying were generally below the accepted threshold (average daily levels at or less than 50% of the threshold level).

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



### 3 Rehabilitation and Decommissioning Plan

The following section is structured to provide a rehabilitation and decommissioning plan in accordance with the requirements of the Shire of Serpentine-Jarrahdale *Extractive Industries Local Law 1999*. The rehabilitation plan also takes into account previous rehabilitation commitments associated with historically approved stages of the existing quarry such as rehabilitation and perimeter screen planting works commenced in July 2010, details shown in **Figure 1**.

Sections of the quarry will be rehabilitated progressively as they become available. This may reduce the long-term closure liability and is expected to be cost effective, as any earthworks can be completed while necessary equipment is on site. Other benefits of this process include the reduction in the overall un-rehabilitated footprint of the quarry, opportunities to trial various rehabilitation treatments and demonstrating that the proponent is committed to undertake the rehabilitation and closure of the quarry.

#### 3.1 Rehabilitation objectives

The objective is to return the land within the excavation area to a condition capable of supporting agricultural activities in accordance with the historical and post-mining land use of the site, with pasture production rates equivalent to or better than pre-quarrying production rates.

Rehabilitation will be directed towards revegetation to post-quarrying pasture land use and local native species for the excavation area. The topography will be returned to a form that matches the surrounding elevation to eliminate any potential visual amenity impacts, prior to the ultimate-reforming of the area for subsequent revegetation. Revegetation will be undertaken in the autumn immediately following the completion of extraction of the sand resource.

#### 3.2 Restoration and reinstatement of the excavation area

The final landform within the excavation area is anticipated to be a gently sloping surface created by the gravel sand extraction 'scalping' the existing upland topography. In areas where excavation is completed, and prior to the re-forming of the area for subsequent revegetation, slopes around the perimeter of the excavation area will be re-contoured to achieve stable gradients (less than 1:4 vertical to horizontal, a flatter slope than the maximum allowable of 1:3 as stated by the SoSJ local law). Additionally, at the end of the excavation, the floor of the excavated areas will be deep ripped parallel to contours, covered by a layer of overburden and top soil and rehabilitated with pasture with local native tree species to minimise or eliminate erosion and seed loss. Carrying out shallow ripping (0.5 m minimum) prior to revegetation will furthermore reduce water flow velocities, promote water capture and infiltration, and promote soil binding.

It is noted that the restoration and reinstatement of the excavation area will be undertaken progressively upon the completion of each extraction stage.

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



### 3.3 Topsoil replacement and revegetation

The topsoil and overburden will be removed prior to sand excavation activities and stockpiled for future rehabilitation. Where possible topsoil clearing will be undertaken in wetter months and directly transferred from an area being cleared or historically cleared to an area to be rehabilitated. This will retain the organic carbon fraction, improving soil properties such as resistance to water and wind erosion and moisture retention. Where this is not possible, the topsoil and overburden will be stored in windrows (low mounds of approximately 1 m in height) for subsequent quarry closure rehabilitation. Upon completion of extraction the pit floor will be ripped prior to topsoil replacements. The topsoil will consist of the top 50 mm of soil removed from the extraction area.

Revegetation will be undertaken in the autumn immediately following the completion of sand extraction within the excavation area.

### 3.4 Revegetation details

Revegetation of the excavated areas will be to parkland pasture with clumps of trees and shrubs. For pasture revegetation it is essential that the species are matched to the soil types and rainfall. Revegetation within previously excavated and completed areas has already commenced, with future revegetation to occur following the closure of future stages. The revegetation areas are shown in **Figure 1**.

Where possible the rehabilitation of the excavation area will be from the existing seed bank, however this may be deficient in native shrubs and trees and weed affected. Additionally, the degraded nature of the site and the lack of diversity are likely factors resulting in the requirement of tubestock of native trees, shrubs and seeds of pasture species. Species to be used in the rehabilitation process are outlined in **Table 3** below.

The revegetation will be undertaken at a density of 10 stems/ha for tree overstorey, a minimum of 10 stems/ha of shrub layer (*Acacia* is short lived, it is recommended to plant more avoiding potential loss during the first year of revegetation), with the remaining area to be covered by pasture ground cover species. Furthermore, revegetation will be undertaken in the autumn following the completion of sand extraction and after the application of any weed control measures if required.

As previously stated revegetation of portions of the excavation area with pasture and native species has begun in July 2010. Weed control and rehabilitation has been commenced for the southern screening vegetation with seedlings planted in winter 2010, shown in **Figure 1**. Weed control was undertaken by boomspray using Glyphosate, Gesatop and Msf and no symptoms of dieback were noted during the weed control activities.

Compliance reporting and management measures to ensure the intended outcomes are achieved are specified in **section 3.7** and **section 3.8**.

# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



Table 3: Selected species list for rehabilitation

Vegetation Structure	Species	Common Name
Tree Overstorey	<i>Corymbia calophylla</i>	Marri
Shrub Layer	<i>Acacia saligna</i>	Coojong, Golden wreath wattle, Orange wattle, Blue-leafed wattle, Western Australian golden wattle
Understorey	Perennial pasture mix*	To be determined*

The actual species used will be determined by the individual season and the nature of the rainfall in the preceding months of planting\*.

### 3.4.1 Completion criteria

To achieve the objectives of this RDP and ensure that future management is minimised, the completion criteria are as follows:

- Rehabilitation of the excavated area will be to parkland pasture and clumps of native trees and shrubs;
- Weed species are not significantly prevalent on rehabilitation areas;
- Native seed/tube stock is used in rehabilitation matching the site's surroundings according to local guidelines;
- The native vegetation and pasture is self-sustaining;
- An adequate density (as described in **section 3.4**), species richness and cover (less than 5% bare ground) has developed and a reduction of weed cover to less than 10% (pasture is not considered a weed in this RDP) is achieved.

### 3.5 Weed and dieback management

The effective control of weed species and phytophthora dieback within the excavation area of the site is a critical component of the site's rehabilitation and decommission. To achieve the objectives and completion criteria, good weed and dieback management practices are to be implemented throughout the ongoing quarry operations and rehabilitation process.

#### 3.5.1 Weed management

The primary objective of weed control is to prevent weed species competing with native plants and pasture for light, nutrients and moisture. Pre-planting and post-planting weed control is a crucial component of this RDP. Rehabilitation of the excavation area using topsoil and the existing seed bank poses a risk of significant weed infestation as weeds are commonly naturally occurring in topsoils.

Weeds are most likely to impact on disturbed areas such as overburden dumps, topsoil stockpiles and edges of access tracks.

The following weed control measures will be implemented within the excavation area:

- Conduct inspections and monitor the presence of weeds on an annual (in autumn, prior to winter rains) or more frequent basis, as required;

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



- Undertake removal and spraying of weeds (autumn and spring) using a qualified contractor;
- Weed control is to be conducted prior to revegetation including an assessment of topsoil material for weeds and if required separate weed affected topsoil for treatment or disposal;
- All vehicles and equipment brought into the site during quarry operations are to be clean and free from soil or plant material when arriving at site;
- No soil or vegetation will be brought to the site apart from that to be used in the rehabilitation process;
- Weeds are to be sprayed with broad spectrum spray prior to planting or seeding in weed affected soils;
- Weed management will start with the least affected areas and continue with the most affected areas;

### 3.5.2 Dieback management

In many ways the management of Phytophthora dieback in the excavation area is similar to that for the management of weeds. No evidence of dieback is currently present within the site, likely because of the level of disturbance.

The aim of dieback management during ongoing quarry operations and rehabilitation processes is to minimize the risk of entry of any potential pathogens to the site. It is deemed very low risk of the ongoing quarry operations to spread dieback onto vegetation on adjoining properties. The following management actions will be implemented to prevent dieback from impacting the rehabilitation areas:

- Vehicles are restricted from entering vegetation ahead of excavation, apart from traveling along firebreaks and roads;
- All vehicles entering the site will be clean and not carry any soil or vegetation material;
- When removing topsoil, vehicle will run around the perimeter and then push inwards where possible;
- Plants to be used for revegetation will be certified as from dieback free sources;
- Unwanted access to vegetated areas is restricted through reduced tracks, signage, site marking and fencing as appropriate;
- Rehabilitated surfaces will be free draining and not contain wet or waterlogged conditions;
- Roads are to be maintained as free draining and hard surfaced.

### 3.6 Maintenance of rehabilitation areas

Maintenance will be undertaken following seeding and/or planting with all activities to be conducted in response to maintenance inspections and monitoring discussed in **section 3.7** below.

Planted seedlings (tubestock) may require extensive watering if conditions are dry, hence increasing the success rate of rehabilitation in wetter months such as in autumn. Some maintenance fertilizer may be required in areas planted with small trees.

The key element involved with maintenance work will include the management of weeds and infill planting with the requirement of management of each determined following each monitoring event.

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



The effective control of weed species within the excavation area is a critical and essential component of this RDP. Weed control will be undertaken in accordance with the methods outlined in **section 3.5.1**. A licensed contractor will be utilised to spray weeds if required during times of first autumn rainfall when weeds are most likely to germinate.

Maintenance will continue to be undertaken as required until the completion criteria outlined in **section 3.4.1** has been achieved.

### 3.7 Monitoring and reporting

Monitoring and reporting is an essential part of the revegetation works as it ensures that the objectives are achieved to the best possible outcome.

An assessment of the success of the rehabilitation will be undertaken during late summer which determines the rehabilitation requirements for the following winter. To demonstrate compliance with the completion criteria (outlined in **section 3.4.1**), monitoring of randomly selected quadrats within completed cells will be undertaken, including photo monitoring points at each quadrat. Monitoring of the rehabilitation area will include visual assessments and where necessary reporting of counts to determine the success of the rehabilitation and restoration. Where appropriate, visual assessment criteria may include the following:

- Plant density;
- Plant growth;
- Plant deaths;
- Regeneration and;
- Weed infestation.

A report will be prepared on the results from each formal monitoring event, addressing the criteria provided above.

Where deficiencies in the vegetation require additional materials for planting in the following winter (i.e. for weed management, infill planting or pest control), all necessary steps will be taken prior to any correction.

Rehabilitation of each stage will be monitored for a period of three years or until the completion criteria (**section 3.4.1**) and objectives (**section 3.1**) of this RDP are met and the site is self-sustaining. Furthermore, monitoring of potential influence of rabbits will be undertaken on annual basis and if required suitably managed.

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



### 3.8 Management actions

Table 4: Management actions for rehabilitation

Parameter	No.	Action	Timing
Landform	1	All slopes will be contoured to achieve a maximum slope of 1:3 vertical to horizontal.	Prior to revegetation and in areas where excavation is completed
	2	Deep rip (0.5 m minimum) on contours to reduce erosion, reduce flow velocities, promote water capture/infiltration, and promote soil binding. Carry out shallow ripping as required.	Prior to revegetation
	3	Stockpiled topsoil will be re-spread to create a land surface that is safe and stable.	Prior to revegetation
Revegetation	4	Undertake revegetation as per <b>section 3.4</b>	During revegetation
Weed and Dieback	5	Undertake management actions for weed and dieback as per <b>section 3.5</b>	Prior to and during rehabilitation and ongoing quarry operations
Maintenance	6	Undertake maintenance measures as per <b>section 3.6</b>	During revegetation
Monitoring	7	Monitoring and reporting work are required to ensure that the revegetation objectives are achieved. Undertake monitoring as per <b>section 3.7</b>	During revegetation

## Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



### 4 Quarry closure

Part 7 section 7.4 of the Shire of Serpentine-Jarrahdale *Extractive Industries Local Law 1999* outlines the works to be carried out on cessation of extractive operations. Decommissioning objectives for the site, described in the local laws, include ‘the removal from the site of all buildings, plant and equipment erected, installed or used for or in relation to the carrying on of an extractive industry on the site’.

Decommissioning is anticipated to commence at the cessation of quarrying activities, as most areas of the quarry, including equipment will be fully utilised until the end of the quarry life. However, as with rehabilitation, opportunities to decommission areas prior to complete quarry closure will be reviewed through the planning process.

The key supporting infrastructure developed and installed within the site as a component of the application will include:

- Access tracks;
- Fencing;
- Gates.

No other permanent infrastructure are proposed and the site office, shed and dwelling constructed within the eastern portion of the site in May 2010 will be demolished and removed prior to excavation.

All supporting infrastructure constructed and installed by the proponent will be removed by the end of the quarrying operations and all wastes will be removed from the site. Furthermore, closure will involve the re-contouring of the final landforms as described in **section 3.2** followed by all areas within the excavation boundary topsoiled, revegetate via seed where possible and tubestock as outlined in **sections 3.3** and **3.4**. Additionally, maintenance and monitoring will be conducted until completion criteria are met, refer to **section 3.4.1**. In case of unexpected or early quarry closure, decommission will be completed in the same way as permanent closure.

# Rehabilitation and Decommissioning Plan

King Road Sand Quarry (Part Lots 200 and 441 Coyle Road and 713 and 1242, King Road, Oldbury)



## 5 References

### 5.1 General references

Churchward, H. M. and McArthur, W. M. 1980, '*Landforms and Soils of the Darling System, Western Australia*', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Department of Biodiversity, Conservation and Attractions (DBCA) 2020, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Primary Industries and Regional Development (DPIRD) 2018, *Soil Landscape Mapping - Systems (DPIRD-027)*.

Shire of Serpentine Jarrahdale 2018, *Local Planning Policy 4.16: Landscape and Vegetation Policy*.

SHIRE OF SERPENTINE-JARRAHDAL (SoSJ) 1999, *Local Government Act 1995 SHIRE OF SERPENTINE-JARRAHDAL Extractive Industries Local Law*.

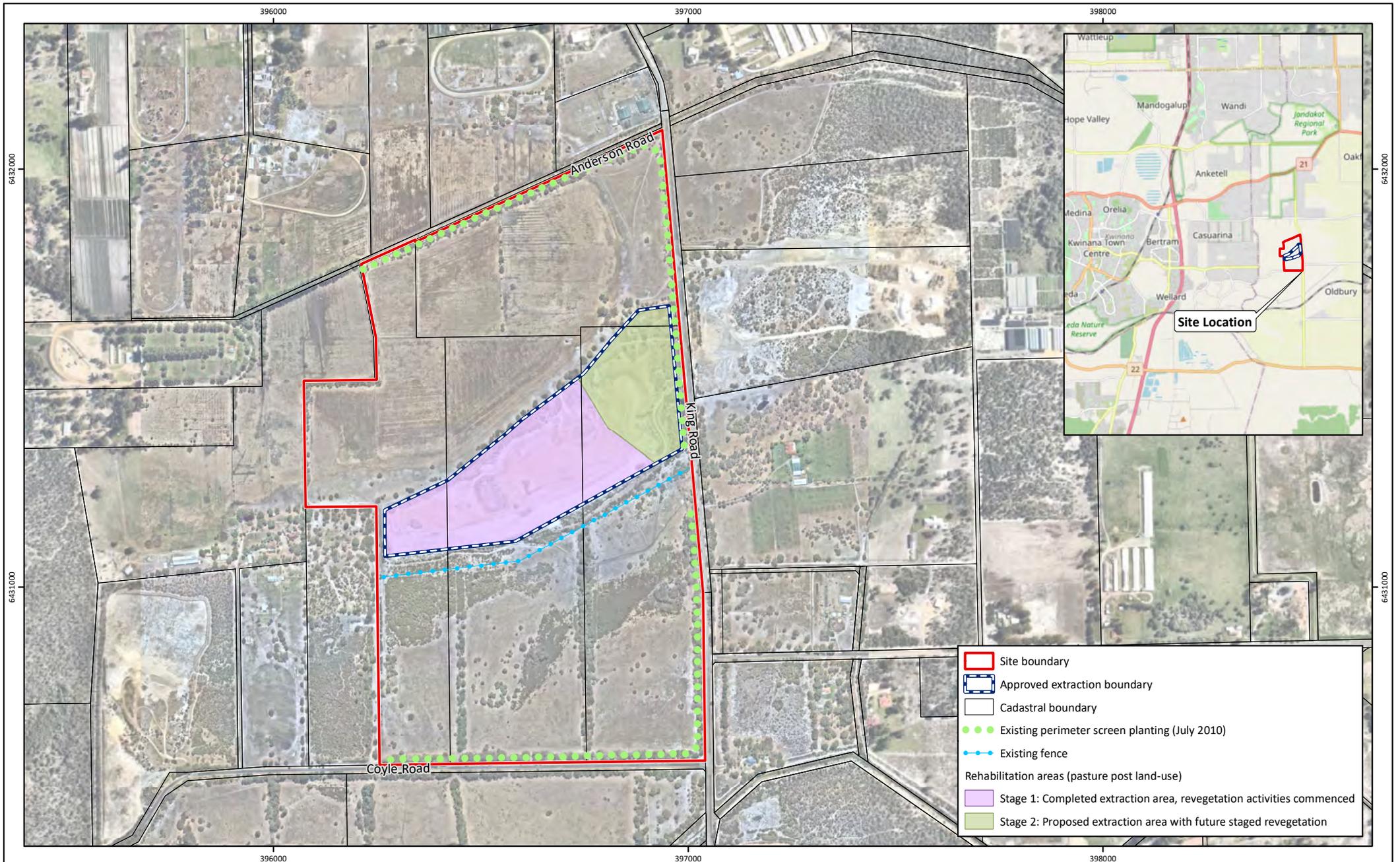
### 5.2 Online references

Office of Bushfire Risk management (OBRM) 2019, *Map of Bush Fire Prone Areas*, viewed October 2020, <https://maps.slip.wa.gov.au/landgate/bushfireprone/>

# Figures



*Figure 1: Site Location and Rehabilitation Area*



- Site boundary
- Approved extraction boundary
- Cadastral boundary
- Existing perimeter screen planting (July 2010)
- Existing fence

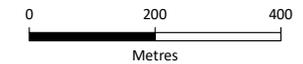
Rehabilitation areas (pasture post land-use)

- Stage 1: Completed extraction area, revegetation activities commenced
- Stage 2: Proposed extraction area with future staged revegetation

**Figure 1: Site Location and Rehabilitation Area**

**Project:** Rehabilitation and Decommissioning Plan  
 King Road Sand Quarry, Oldbury  
**Client:** LWP King Road Syndicate Pty Ltd

**Plan Number:**  
 EP20-161(02)--F10  
 Drawn: GAR  
 Date: 09/06/2021  
 Checked: PPS  
 Approved: ALB  
 Date: 11/06/2021



Scale: 1:12,000@A4  
 GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
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) VEGETATION SURVEY,  
SAND RESOURCE AREA

Portion of Lots 200, 441, 713 and 1242,  
King Road, Oldbury

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**Tables**

Data from Sample Plots	Attached
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**Figures**

Figure 1	Vegetation	Attached
Figure 2	Site Photographs	Attached

VEGETATION SURVEY,  
SAND RESOURCE AREA  
Portion of Lots 200, 441, 713 and 1242,  
King Road, Oldbury

21 NOVEMBER 2005

## 1.0 INTRODUCTION

This vegetation study was conducted as part of an assessment for sand excavation on portion of Lots 200, 441, 713 and 1242, King Road, Oldbury.

The resource, which is required for fill sand for developments in the Byford area has a cover of pasture and remnant vegetation regrowth

The site is generally covered by a mixture of pasture, areas of parkland pasture and disturbed remnant vegetation.

The proposed quarry will provide a strategic resource of sand in the southern Perth Metropolitan and Darling Scarp areas, in line with Government Planning Policies, including SPP 2.4, which requires the protection and staged use of Basic Raw Materials.

This report is attached as an Appendix to the Excavation and Environmental Management Plan, for a modification to the existing Planning Approval, to the Shire of Serpentine - Jarrahdale.

## 2.0 METHODOLOGY

### Aims of the Surveys

Landform Research was asked to assess the vegetation in terms of its plant communities, vegetation condition, plant species, the potential for Rare and Priority Species to be present and the clearing principles in Schedule 5 of the Environmental Protection Act, 1986, as part of the application for modification of the existing approval.

A site inspection was made by Lindsay Stephens on 16 November 2005. During the site inspection the whole resource area was traversed along the ridge. All native species noted during the traverses were recorded.

In addition, to gain a fair impression of the quality of the vegetation, the northern and southern sides of the ridge were walked in a straight line with a 100 m<sup>2</sup> sample plot being located every 50 paces. All native species within each plot were recorded. The locations of the traverses were chosen to cut the better vegetation, so the results will be skewed towards a better result. For example areas of bare sand were not traversed.

The 10m x 10m plots were measured using a hand tape. The location of each plot was recorded on the attached aerial photograph. Figure 1.

Presence and absence data was provided for each plot. See Table 2.

Exotic species other than pasture species were not recorded because of constraints on the survey and the fact that these species did not contribute to the aims. Pasture species were not recorded.

The main reference works for plant identification were knowledge of the assessor, published texts and Florabase. All species recorded were common species.

Following identification of the species, a comparison was made to the Declared Rare and Priority Flora List (CALM 22 February 2005) to determine if any Rare or Priority species had been identified.

Moreover, the species observed are all common local species. No species that might be similar to Rare or Priority species were noted during the site investigation.

### 3.0 PHYSICAL ENVIRONMENT

#### 3.1 Site Description

The site lies on a ridge of Bassendean Sand that consists of leached white sand over deep yellow sand rising to between 28 and 34 metres AHD from the surrounding land at about 22 metres AHD.

The typical profile of the sand is a shallow grey sand topsoil over leached white silica sand of variable depth grading to yellow sand.

Cattle have grazed the site for many years and continue to do so as an active rural property.

There is no evidence of surface salinity.

The elevation of the highest known water table is 19 metres, from DOE Perth Groundwater Atlas 2004.

### 4.0 VEGETATION

#### 4.1 Community Types

The vegetation of the resource area is dominated by *Kunzea ericifolia* and tall *Scholtzia involucreta* of 1 – 2 metres high (*Scholtzia involucreta*) and 2 –3 metres high (*Kunzea ericifolia*) with only scattered or isolated other species of the original vegetation.

The original vegetation community of the ridge is difficult to determine because there are so few species and almost no understorey species.

The original vegetation has been classified as originally Bassendean Complex, Central and South, by Heddle et al, 1980, *Vegetation Complexes of the Darling System, Western Australia in Atlas of Natural Resources, Darling System, Western Australia*, Department of Conservation and Environment.

Community Types were isolated by Gibson et al, 1994, *A Floristic Survey of the Southern Swan Coastal Plain*, Unpublished Report for the Australian Heritage Commission, prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia. These were based on understorey species and, with the paucity of these, the original Community Type cannot be readily identified, although on geomorphology and the species present probably was best correlated to Community Type 23, *Banksia attenuata* – *B. menziesii* woodlands.

Community Type 23, *Banksia attenuata* – *B. menziesii* woodlands, has a very high mean species richness of natural communities as 62.8 species per 100 m<sup>2</sup> plot.

EPA Guidance for the Assessment of Environmental Factors, Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of System 1 region, 2003, lists Bassendean Complex, Central and South as having 27% remaining with only 0.7% in secure reserves. The percentage in secure reserves is now likely to be greater with provision within Bush Forever Sites, the Jandakot Botanical Park and other conservation reservations.

#### 4.2 Species List – Plant Density

The species recorded during the site investigation are listed in the attached table. A total of only 18 taxa were observed in the site investigations. Of the 22 sample plots located in lines through the best vegetation, only one recorded 3 species, with five plots having 2 species, 12 plots containing 1 species and four plots containing no native species.

From the 22 sample plots it can be seen that the majority of the vegetation is a mono-species with an average of 1.1 species per 100 m<sup>2</sup>. The sample plots were placed in the better vegetation and provide data biased to the higher level of vegetation. Of the sample plots the level of species representation is 1.8% of the original species.

It should be reinforced that the best vegetation was selected for the assessment. Compare the location of the sample plots to the remaining vegetation on the attached aerial photograph. The sample plots represent a bias towards better vegetation rather than an average for the site.

The plant density was not counted, but in the better areas of vegetation there were a few stems of particular species even though only one species may be present. The majority of vegetation on site are *Kunzea ericifolia* and tall *Scholtzia involucreta* shrubs of 1 to 3 metres high. These shrubs can be seen on the aerial photograph, and within the 100 m<sup>2</sup> plots there could be between 1 and 4 plants in the better vegetated areas.

The vegetation is not thick enough to be termed a significant Thicket as occurs in areas of lower elevation such as to the south of the ridge.

### 4.3 Rare and Priority Flora

A comparison was made to the Declared Rare and Priority Flora List (CALM 22 February 2005) to determine if any Rare or Priority species had been identified.

None of the species identified are listed as declared Rare or Priority Species. They are all common species.

### 4.4 Vegetation Condition

The counts of the species within each plot provide an indication of the degree of disturbance.

The species richness of the better vegetation that was assessed averaged 1.1 species /100 m<sup>2</sup> which represents 1.8% of the species in the original community. See Figure 1.

In mapping in other areas of the State by Landform Research, vegetation of 4 - 8 species per 100 m<sup>2</sup> correlated with "Degraded" condition and less than 4 species per 100 m<sup>2</sup> correlated with "Completely Degraded" vegetation. The vegetation is really restricted to two common species *Kunzea ericifolia* and tall *Scholtzia involucreta* with *Kunzea ericifolia* being the most common.

Kaesehagen, 1995, Bushland Condition Mapping, IN *Invasive Weeds and Regenerating Ecosystems in Western Australia, Proceedings of Conference held at Murdoch University, July 1994*, Institute for Science and Technology Policy, Murdoch University, 1995, as discussed in Attachment 2, combined species abundance in vegetation condition score analysis. In the system suggested by Kaesehagen, 1995, 20 - 50% of species remaining represents "Poor" vegetation and 0 - 20% the lowest level or "Very Poor". With an average of only 1.8% of the original species present for the sample plots, biased to the better vegetation, this is at the lowest end of Kaesehagen, 1995, table of "Very Poor" vegetation condition.

The vegetation condition mapping used by the Department of Environment is taken from Bush Forever 2000 and uses a condition scale that distorts the perception of middle vegetation condition because the condition above "Degraded" is "Good" in that scale. In previous studies the word "Good" would have been a lower classification such as "Poor" as shown in Bush Forever 2000, page 48. The scale Good also does not seem to match the vegetation description provided on page 48.

In the case of the excavation area though, the terms Degraded and Completely Degraded are appropriate and are used. These have the same meaning as Bush Forever 2000 which is also used by the Department of Environment.

The proposed area of excavation consists of 12.6 hectares. Of the 12.6 hectares 1.6 hectares is classified as Degraded, with the remaining 11.0 hectares being classified as Completely Degraded or cleared.

## 5.0 SIGNIFICANCE OF THE FLORA

EPA Position Statement No 2, December 2000, *Environmental Protection of Native Vegetation in Western Australia*, specifically targets the retention of native vegetation in the Agricultural Areas in 4.1, *Clearing in the agricultural area for agricultural purposes*. In 4.3, *Clearing in other areas of Western Australia*, it is unclear what "other areas" refer to, but may refer to retention of a 30% threshold in non agricultural areas.

Section 4.3 *Clearing in other areas of Western Australia*, (EPA Position Statement No 2, December 2000) expects that clearing will not take vegetation types below the 30% of the pre-clearing vegetation as recommended by ANZECC, 1999, *National Framework for the Management and Monitoring of Australia's Native Vegetation*. The National Objectives and Targets for Biodiversity Conservation 2001 - 2005 (Commonwealth of Australia 2001) also recognise 30% as the trigger value.

Plant communities with < 10% remaining are classified as Endangered.

EPA Guidance for the Assessment of Environmental Factors, Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of System 1 region, 2003, lists Bassendean Complex, Central and South as having 27% remaining.

With only 1.8% of the original species remaining, based on sampling biased to towards the better vegetation, the vegetation on site is generally mono-species.

As such low species richness currently exists there is an opportunity to rehabilitate part of the excavated surface to higher levels of species richness through the use of direct seeding and tree planting. This can effectively replace a proportion of the vegetation which is lost through excavation, by rehabilitated vegetation in better species richness and plant density.

As only 1.6 hectares of the existing vegetation in Degraded condition is to be cleared it makes more sense to use the rehabilitation to native species as an offset to provide linkages between the existing vegetation to the south. This can provide a linkage between the wetland area in the adjoining Lot 439 to the west through remnant vegetation south of the sand ridge to remnant vegetation in the conservation category wetland east of King Road. This would involve 2.4 hectares which is greater than the area of Degraded vegetation that is proposed to be cleared. See Excavation – Rehabilitation Management Plan Figure 5 (main report).

Providing a linkage can provide environmental offsets as recommended in EPA Position Statement 9, *Environmental Offsets*, (preliminary version - June 2005)

At some stage the rehabilitated linkage could be fenced leaving fenced laneways to permit the movement of stock, vehicles and act as fire breaks.

This would be in addition to the rehabilitation of the sand ridge to clumps of native trees and shrubs at the rate of 200 per hectare.

## 6.0 CLEARING PRINCIPLES

If the proposed revegetation and restoration of the linkages are completed as proposed then the proposal would be assessed under the clearing principles as outlined below.

	<b>CLEARING PRINCIPLE</b> (Schedule 5 Environmental Protection Amendment Act, 1986)	<b>COMMENT</b>
1a	High Level of diversity	<ul style="list-style-type: none"> <li>The site has been assessed in the flora survey. It has previously been cleared, disturbed and grazed and has a very low level of species diversity.</li> <li>The vegetation on site consists of 11 hectares of Completely Degraded vegetation and Cleared land with 1.6 hectares of Degraded vegetation, using Bush Forever, 2000 classification. Kaesehagen, 1995, would classify the remnants of vegetation on the resource area as "Very Poor".</li> </ul>
1b	Significant fauna habitat	<ul style="list-style-type: none"> <li>Being disturbed, of very low species richness and subject to grazing as part of a rural property the vegetation will possibly have less fauna habitat than undisturbed vegetation.</li> <li>The better vegetation south of the sand ridge would be expected to provide higher levels of habitat.</li> <li>There is an opportunity to enhance and protect the fauna habitats and linkages through this proposal, in line with EPA Position Statement No 9 (preliminary).</li> </ul>
1c	Necessary to existence of Rare flora	<ul style="list-style-type: none"> <li>No Declared Rare or Priority flora have been found.</li> </ul>
1d	Threatened Ecological Community	<ul style="list-style-type: none"> <li>The vegetation on site is not listed as Threatened Ecological Community.</li> </ul>
1e	Significant area of vegetation in an area that has been extensively cleared	<ul style="list-style-type: none"> <li>The existing vegetation has very low species richness.</li> <li>There is an opportunity to provide rehabilitation with higher species richness than currently occurs, and therefore enhance and protect the fauna habitats and linkages.</li> </ul>
1f	Wetland or watercourse	<ul style="list-style-type: none"> <li>No wetlands or watercourses are proposed to be disturbed by the clearing. In fact the wetlands to the east and west can be enhanced by providing the vegetation linkages.</li> </ul>
1g	Land degradation	<ul style="list-style-type: none"> <li>An Excavation and Environmental Management Plan has been prepared for the site. Excavation can be managed in manner that will not lead to land degradation. The land is currently at higher risk of wind erosion because it is higher in the landscape and has very low capability to grow pasture.</li> </ul>
1h	Impact on adjacent or nearby conservation areas	<ul style="list-style-type: none"> <li>There are is an opportunity to provide linkages to adjoining wetland conservation areas.</li> </ul>

Excavation – Rehabilitation Management Plan,  
Sand Excavation, Portion of Lots 200, 441, 713 and 1242, King Road, Oldbury

1i	Deterioration of underground water	<ul style="list-style-type: none"> <li>• Quarrying is one of the few industries that are permitted in areas where groundwater is close to the surface. The proposed final land surface complies with the Department of Environment guidelines for separations to the ground water. No significant alteration to surface water and no alteration to groundwater is proposed. None has been recorded in past excavation. (See main report 5.5 Water Quality).</li> <li>• Groundwater may increase slightly, though a small additional recharge by the planting of clumps of trees as parkland pasture will help minimise this effect.</li> </ul>
1j	Increase flooding	<ul style="list-style-type: none"> <li>• There is no potential for flooding on site because the resource lies on a low ridge.</li> </ul>

## 7.0 CONCLUSIONS

The proposed excavation will involve the clearing of 1.6 hectares of Degraded vegetation in addition to 11 hectares of cleared land and Completely Degraded vegetation.

The current species richness is very low due to past clearing an ongoing period of grazing by cattle.

Rehabilitation is recommended to be to parkland pasture on the excavated area with clumps of trees and shrubs of local species at the rate of 200 per hectare. In addition it is recommended to rehabilitate 2.4 hectares of vegetation linkage between existing remnant vegetation to the south of the excavate area.

As such there is potential to provide a better environmental outcome for the site. This outcome can provide the following benefits;

1. Excavation of a sand resource much needed by the community.
2. Lowering of the sand ridge to form more productive pasture better suited to agriculture.
3. Rehabilitation of the excavated area to clumps of native vegetation.
4. Linkage of the remnant vegetation on Lot 439 to the west through remnant vegetation to the conservation category wetland east of King Road.
5. Potential for a greater area of better quality vegetation than currently exists.
6. Potential to fence the linkage and provide protection to the existing vegetation, that currently does not exist.
7. Potential to enhance the biodiversity value of two wetland areas of conservation status that adjoin the property through establishing a vegetation linkage.

The taking of the resource complies with "The National Objectives and Targets for Biodiversity Conservation 2001 - 2005 (Commonwealth of Australia 2001)".

It complies with EPA Position Statement No 2, December 2000, *Environmental Protection of Native Vegetation in Western Australia* and can meet the CLEARING PRINCIPLES outlined in Clearing Provisions of Schedule 5 Environmental Protection Amendment Act, 1986.

It allows for Environmental offsets in line with EPA Position Statement No 9 (preliminary).

Lindsay Stephens

## References

Commonwealth of Australia, 2001, *National Framework for the Management and Monitoring of Australia's Native Vegetation*, The National Objectives and Targets for Biodiversity Conservation 2001 – 2005.

EPA Position Statement No 2, December 2000, *Environmental Protection of Native Vegetation in Western Australia*.

EPA Position Statement 9, 2005, *Environmental Offsets*, (preliminary version - June 2005)

Government of Western Australia, 2000, *Bush Forever*.

Kaesehagen, 1995, Bushland Condition Mapping, IN *Invasive Weeds and Regenerating Ecosystems in Western Australia, Proceedings of Conference held at Murdoch University, July 1994*, Institute for Science and Technology Policy, Murdoch University.

Gibson et al, 1994, *A Floristic Survey of the southern Swan Coastal Plain*, A report to the Australian Heritage Commission, prepared by Department of Conservation and Land Management, the Australian Conservation Council of Western Australia Inc.

Mattiske E M and J J Havel, 1998, *Regional Forest Agreement, Vegetation Complexes*, Perth, Western Australia.

Western Australian Planning Commission, *Statement of Planning Policy 2.4, Basic Raw Materials*.

Excavation – Rehabilitation Management Plan,  
Sand Excavation Portion of Lots 200, 441, 713 and 1242, King Road, Oldbury

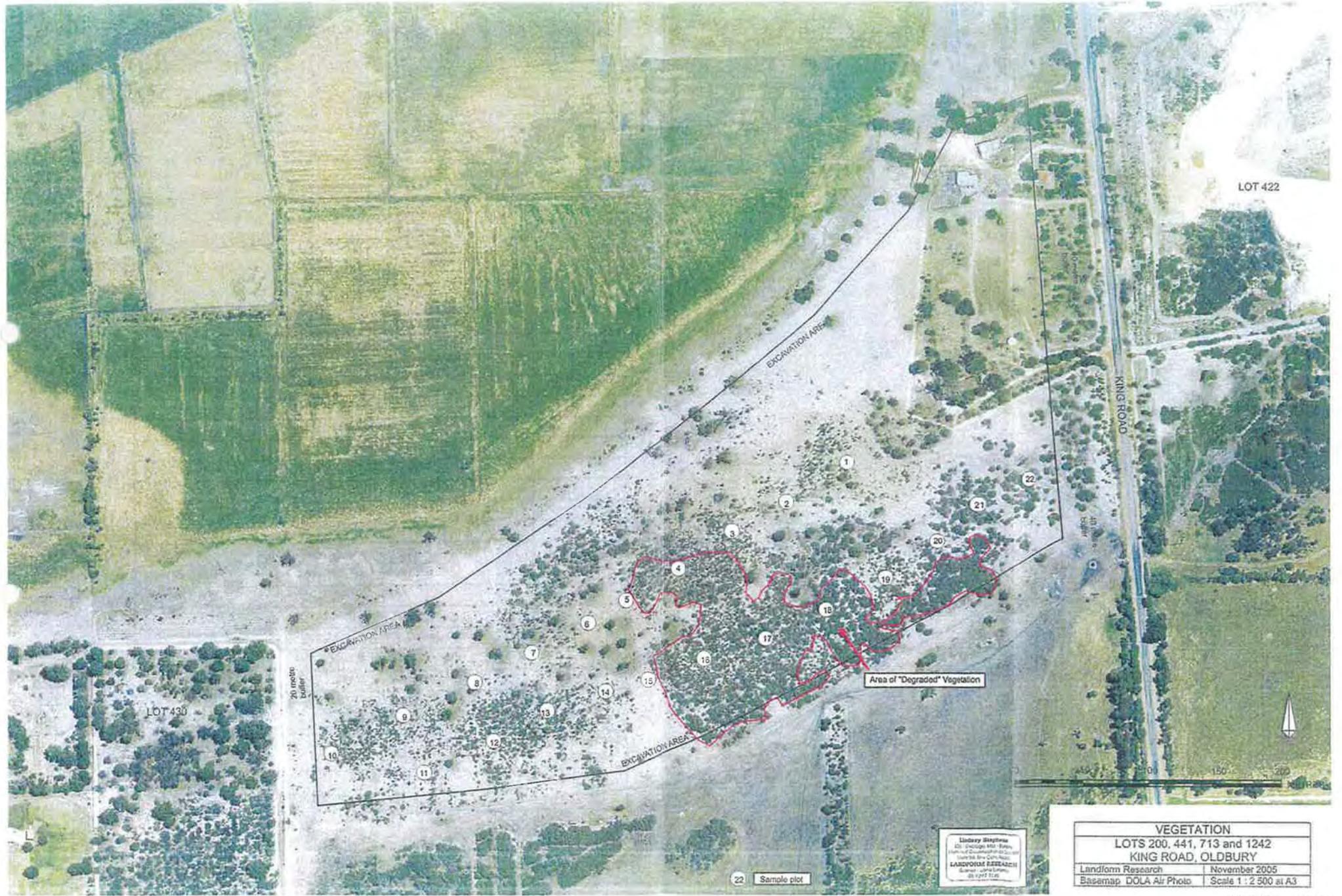
Family	Species	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7
		396648E 6431201N	396603E 6431166N	396574E 6431135N			396426E 6431066N	39373E 6431041N
Asteraceae	<i>Podotheca chrysantha</i>							
Casuarinaceae	<i>Allocasuarina humilis</i>							
	<i>Allocasuarina fraseriana</i>							
Dilleniaceae	<i>Hibbertia hypericoides</i>							
Epacridaceae	<i>Conostephium pendulum</i>							
Hæmodoraceae	<i>Conostylis aculeata</i>							
Mimoseae	<i>Acacia heugelii</i>							
Myrtaceae	<i>Eremaea pauciflora</i>							
	<i>Kunzea ericifolia</i>	X	X		X			
	<i>Scholtzia involucrata</i>				X			
Papilionaceae	<i>Gompholobium tomentosum</i>					X		
	<i>Jacksonia furcellata</i>	X		X				
Proteaceae	<i>Banksia attenuata</i>							
	<i>Banksia ilicifolia</i>							
	<i>Banksia menziesii</i>							
	<i>Petrophile linearis</i>							
Restionaceae	<i>Alexgeorgea nitens</i>							
	<i>Desmocladus faciculatus</i>							
TOTAL	Total species per 100 m <sup>2</sup> plot	2	1	1	2	1	0	0

Excavation – Rehabilitation Management Plan,  
Sand Excavation Portion of Lots 200, 441, 713 and 1242, King Road, Oldbury

Family	Species	PLOT 8	PLOT 9	PLOT 10	PLOT 11	PLOT 12	PLOT 13	PLOT 14
		396319E 6431029N	396273E 6431013N	396224E 6431004N	396245E 6430935N	396288E 6430951N	396316E 6430970N	39353E 6430984N
Asteraceae	<i>Podotheca chrysantha</i>							
Casuarinaceae	<i>Allocasuarina humilis</i>							
	<i>Allocasuarina fraseriana</i>			X				
Dilleniaceae	<i>Hibbertia hypericoides</i>							
Epacridaceae	<i>Conostephium pendulum</i>							
Haemodoraceae	<i>Conostylis aculeata</i>						X	X
Mimoseae	<i>Acacia heugelii</i>						X	
Myrtaceae	<i>Eremaea pauciflora</i>						X	
	<i>Kunzea ericifolia</i>							
	<i>Scholtzia involucrata</i>				X	X		X
Papilionaceae	<i>Gompholobium tomentosum</i>							
	<i>Jacksonia furcellata</i>		X					
Proteaceae	<i>Banksia attenuata</i>							
	<i>Banksia ilicifolia</i>							
	<i>Banksia menziesii</i>							
	<i>Petrophile linearis</i>							
Restionaceae	<i>Alexgeorgea nitens</i>							
	<i>Desmocladius fasciculatus</i>							
TOTAL	Total species per 100 m <sup>2</sup> plot	0	1	1	1	1	3	2

Family	Species	PLOT 15	PLOT 16	PLOT 17	PLOT 18	PLOT 19	PLOT 20	PLOT 21
		396416E 6431006N	396456E 6431019N	396516E 6431046N	396536E 6431048N	396575E 6431079N	396616E 6431105N	396667E 6431128N
Asteraceae	<i>Podotheca chrysantha</i>							
Casuarinaceae	<i>Allocasuarina humilis</i>							
	<i>Allocasuarina fraseriana</i>							
Dilleniaceae	<i>Hibbertia hypericoides</i>							
Epacridaceae	<i>Conostephium pendulum</i>							
Haemodoraceae	<i>Conostylis aculeata</i>							
Mimoseae	<i>Acacia heugelii</i>							
Myrtaceae	<i>Eremaea pauciflora</i>							
	<i>Kunzea ericifolia</i>			X		X		X
	<i>Scholtzia involucreta</i>		X	X	X		X	
Papilionaceae	<i>Gompholobium tomentosum</i>							
	<i>Jacksonia furcellata</i>							
Proteaceae	<i>Banksia attenuata</i>							
	<i>Banksia ilicifolia</i>							
	<i>Banksia menziesii</i>							
	<i>Petrophile linearis</i>							X
Restionaceae	<i>Alexgeorgea nitens</i>							
	<i>Desmocladius faciculatus</i>							
TOTAL	Total species per 100 m <sup>2</sup> plot	0	1	2	1	1	1	2

Family	Species	PLOT 22
		396723E 6431166N
Asteraceae	<i>Podotheca chrysantha</i>	
Casuarinaceae	<i>Allocasuarina humilis</i>	
	<i>Allocasuarina fraseriana</i>	
Dilleniaceae	<i>Hibbertia hypericoides</i>	
Epacridaceae	<i>Conostephium pendulum</i>	
Haemodoraceae	<i>Conostylis aculeata</i>	
Mimoseae	<i>Acacia heugelii</i>	
Myrtaceae	<i>Eremaea pauciflora</i>	
	<i>Kunzea ericifolia</i>	X
	<i>Scholtzia involucreta</i>	
Papilionaceae	<i>Gompholobium tomentosum</i>	
	<i>Jacksonia furcellata</i>	
Proteaceae	<i>Banksia attenuata</i>	
	<i>Banksia ilicifolia</i>	
	<i>Banksia menziesii</i>	
	<i>Petrophile linearis</i>	
Restionaceae	<i>Alexgeorgea nitens</i>	
	<i>Desmocladius faciculatus</i>	
TOTAL	Total species per 100 m <sup>2</sup> plot	1



Vegetation Figure 1



View east of then northern edge of the resource showing the better pasture at lower elevation on the left and poor quality pasture on the sand ridge



Typical sand ridge vegetation



Sandridge vegetation in better condition (Degraded)



Sandridge vegetation in better condition (Degraded)



*Kunzea ericifolia* Thicket in "Degraded" vegetation



*Kunzea ericifolia* Thicket in "Degraded" vegetation

SITE PHOTOGRAPHS	
LOTS 200, 441, 713 and 1242	
KING ROAD, OLDBURY	
Landform Research	November 2005

Vegetation Figure 2

ORIGINAL - NOT TO BE REMOVED FROM OFFICE OF T

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Application G539426

WESTERN



AUSTRALIA

Volume 1186 Folio 482

1642 760

# CERTIFICATE OF TITLE

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

I certify that the person described in the First Schedule hereto is the registered proprietor of the undermentioned estate in the undermentioned land subject to the easements and encumbrances shown in the Second Schedule hereto.

Dated 28th April, 1983

REGISTRAR OF TITLES



### ESTATE AND LAND REFERRED TO

Estate in fee simple in Peel Estate Lot 1242, delineated and coloured green on the map in the Third Schedule hereto, limited however to the natural surface and therefrom to a depth of 60.96 metres.

### FIRST SCHEDULE (continued overleaf)

Norma Kate Cumming of King Road, Byford, Married Woman and the said Norma Kate Cumming, as Executrix of the Will of James Michael Wade, deceased, as tenants in common in equal shares.

### SECOND SCHEDULE (continued overleaf)

NIL

REGISTRAR OF TITLES

### THIRD SCHEDULE



SCALE 1:10000  
INDEX PLAN PEEL 5000 0213  
JH

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

NOTE: RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES THAT AN ENTRY NO LONGER HAS EFFECT. ENTRIES NOT RULED THROUGH MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

72009/12/77-48M-8/2860

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Superseded - Copy for Sketch Only

760 FOLIO  
1642 VOL



**ORIGINAL: Not to be removed from the Department of Land Administration**

APPLICATION H571808

VOLUME 1055 FOLIO 466

WESTERN



AUSTRALIA

VOLUME FOLIO  
2203 722  
IN THE REGISTER



# CERTIFICATE OF TITLE

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

The person described in the First Schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the Second Schedule.

DATED 11<sup>TH</sup> OCTOBER, 2000

**CANCELLED**

*J. H. H. H.*  
REGISTRAR OF TITLES



### LAND DESCRIPTION:

PEEL ESTATE LOTS 423, 441 AND 713 ON CROWN PLAN 2731, DELINEATED ON THE MAP IN THE THIRD SCHEDULE HERETO.

REGISTERED PROPRIETOR:  
FIRST SCHEDULE (continued overleaf)

NORMA KATE CUMMINGS OF ONE UNDIVIDED HALF SHARE OF 344 KING ROAD, OLDBURY AND THE SAID NORMA KATE CUMMINGS AS EXECUTOR OF THE WILL OF JAMES MICHAEL WADE DECEASED OF ONE UNDIVIDED HALF SHARE AS TENANTS IN COMMON.

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

NIL

THIRD SCHEDULE

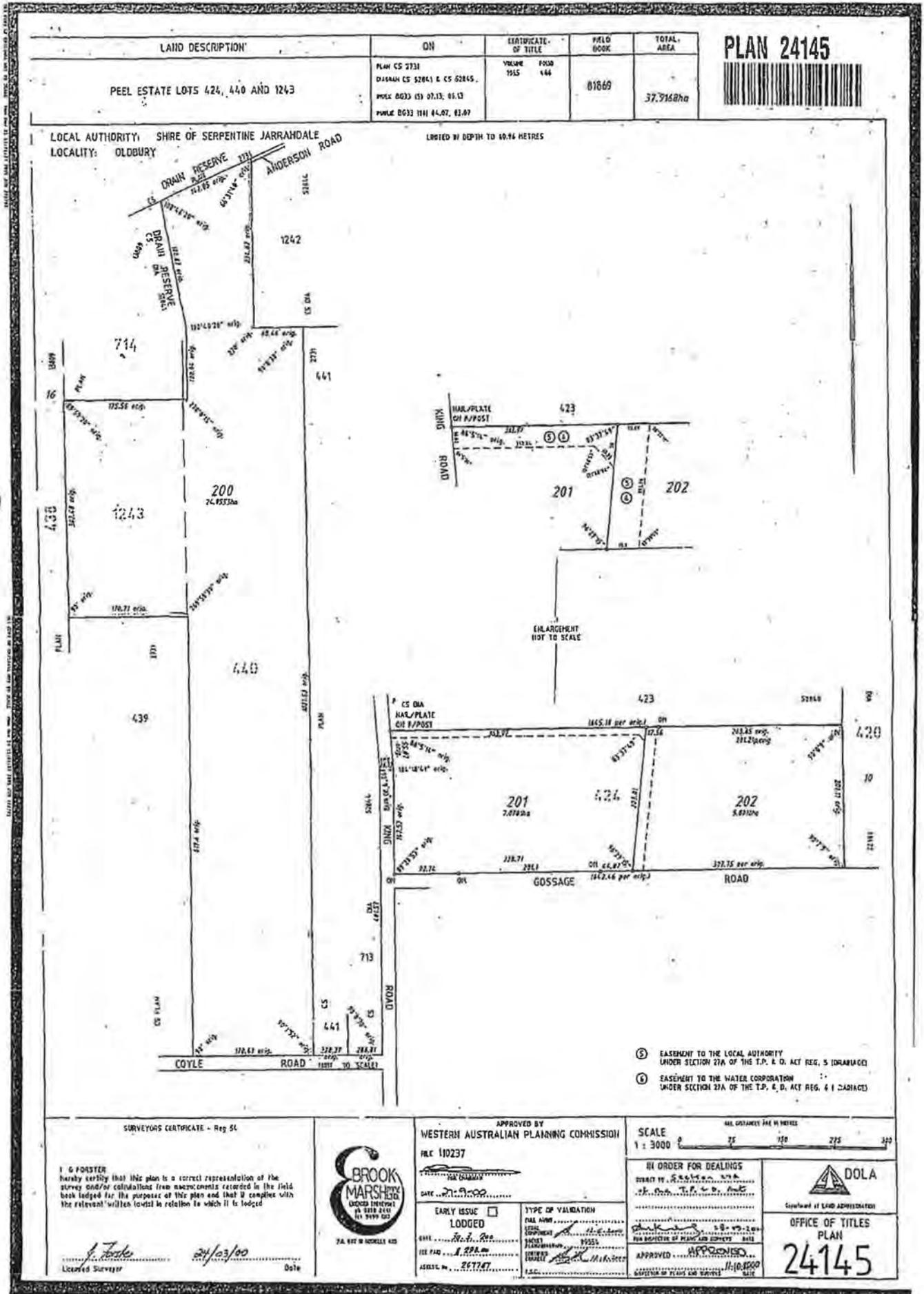
**CANCELLED**



**Superseded - Copy for Sketch Only**

**CANCELLED**

**NOTE: Entries may be affected by subsequent endorsements.**



SURVEYORS CERTIFICATE - Reg 54

I, G. FOSTER, hereby certify that this plan is a correct representation of the survey and/or calculations from measurements recorded in the field book lodged for the purpose of this plan and that it complies with the relevant written law in relation to which it is lodged.

G. Foster  
Licensed Surveyor

24/03/00  
Date

2A, 807 W. HICKSLEY AVE

APPROVED BY  
WESTERN AUSTRALIAN PLANNING COMMISSION

FILE 110237

DATE 27/9/00

EARLY ISSUE <input type="checkbox"/> LODGED <input checked="" type="checkbox"/>	TYPE OF VALIDATION FULL AMV <input type="checkbox"/> LOCAL GOVERNMENT <input checked="" type="checkbox"/> SOCIETY <input type="checkbox"/> FIDUCIARY <input type="checkbox"/> INTEREST <input type="checkbox"/> FORCE <input type="checkbox"/> I.C.C. <input type="checkbox"/>
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OFFICE OF TITLES  
PLAN  
**24145**

SCALE  
1 : 3000

ALL DISTANCES ARE IN METRES

IN ORDER FOR DEALINGS  
SUBJECT TO REGULATION 47A  
OF THE REGULATIONS MADE UNDER THE  
ACT OF 1980 AS AMENDED  
BY THE MINISTER OF PUBLIC WORKS  
AND ADMINISTRATION

APPROVED  APPROVED   
SUPERVISOR OF PLANS AND SURVEYS