EXCAVATION and REHABILITATION MANAGEMENT PLAN

Extension of Sand Extraction Lot 1, Corio Road, Ravenswood

Shire of Murray

16 December 2024

Bronzewing Investments Pty Ltd

Summary

Lot 1 is located in an area that need for fill sand for the developing Peel Region, much of which is low lying and needs to be filled to support the development of dwellings and construction of houses.

There is a small ridge of sand that can be skimmed off Lot 1 adjacent to Corio Road to leave the land surface at a slightly lower elevation that provides better pasture retention through summer and better agricultural land capability.

Need for the Sand

Lot 1 contains a small local sand resource in the Pinjarra - Peel Region.

The extraction of sand complies with State Planning Policy No 2.4 Basic Raw Materials which requires that identified sand resources are utilised prior to sterilisation, in line with State Planning Policy No 2.5, Agricultural and Rural Land Use Planning.

The resource is listed as an Extraction Area in State Planning Policy 2.4.

Being so close to the development areas of the Peel Region, there will be considerable savings in transport distances, road impacts and greenhouse emissions by supplying sand from as close as possible to the use locations.

Proposed Site Operations

Sand Excavations are proposed for 10 hectares over an area of approximately 12.5 hectares, for a period of ten years.

Excavation will be completed by a loader loading directly to road trucks.

Access will be directly to Corio Road. The access road and crossover at the existing gate will be upgraded to enable excavation.

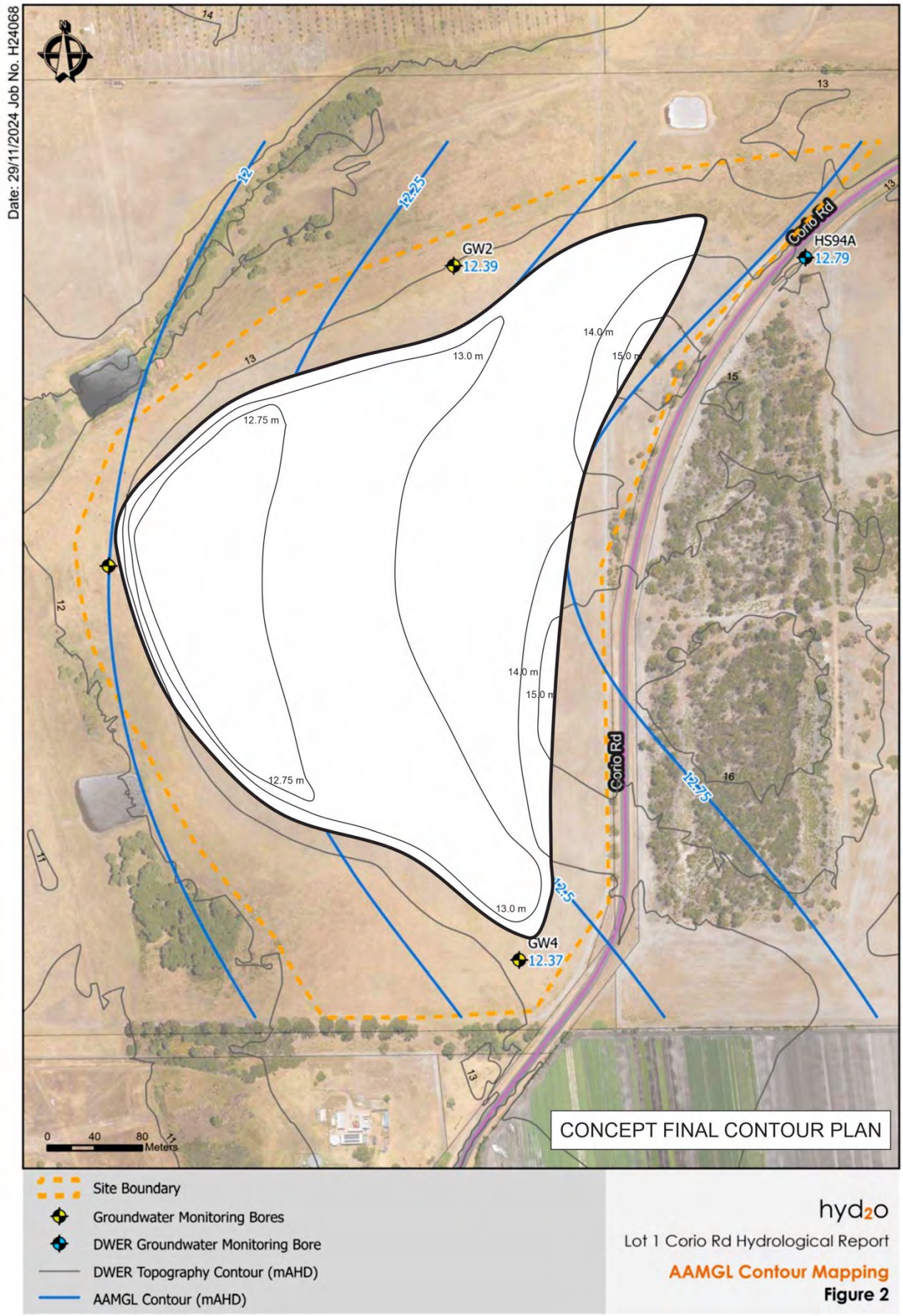
There will be no increase in the scale of the operations, tonnages, hours of operation or transport movements. The bitumen access road and cross over will remain unchanged.

The floor of the pit provides for a 0.5 metre separation to the water table in compliance with DWER Water Quality Protection Note 15.

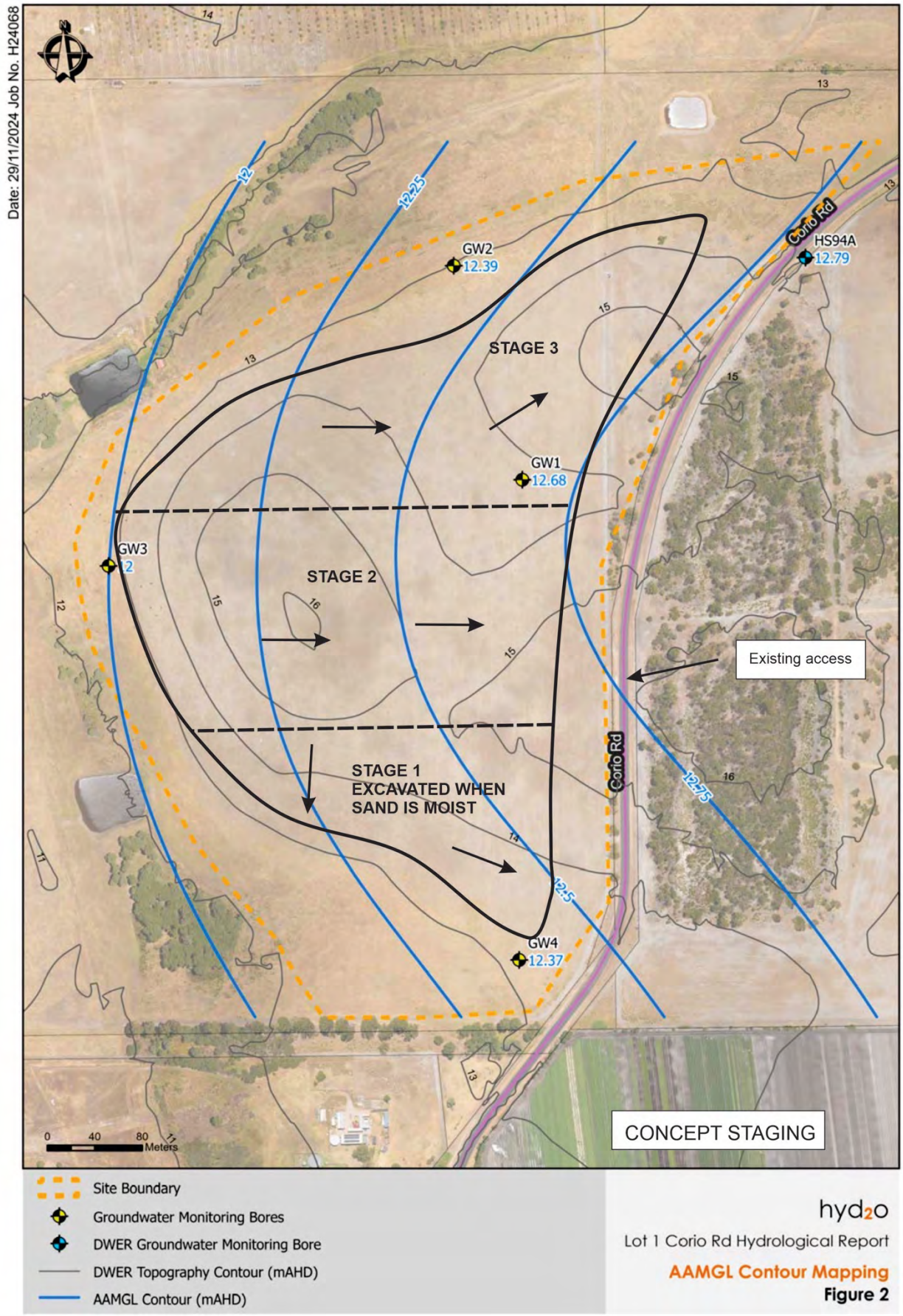
Sand extraction has been designed to comply with all Government policies and requirements.

This document provides the supporting information for the Application for Planning Consent and an Extractive Industries Licence.

S1: Existing Contour Plan



S2: Concept Final Contour Plan



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1.0 INTRODUCTION

1.1 Background

Lot 1 is located in an area that needs fill sand for the developing Peel Region, much of which is low lying and needs to be filled to support the development of dwellings and construction of houses.

There is a small ridge of sand that can be skimmed off Lot 1 adjacent to Corio Road to leave the land surface at a slightly lower elevation which provides better pasture retention through summer and better agricultural land capability.

1.2 History of the Project Approvals

Sand excavation has been undertaken on some adjoining and nearby lots for many years from small pits which have been returned to productive pasture.

There are currently no approvals for Lot 1.

1.3 Proposal

Bronzewing Investments Holdings Pty Ltd are applying for a Planning Consent and Extractive Industries Licence for Portion of Lot 1 Corio Road Ravenswood.

The aims of the Proposal are to:

- Provide a supply of white and yellow silica fill sand.
- Provide an additional area of extractable sand resource within the Peel Region.
- Maximise the use of basic raw materials in the local area, to enable greenhouse gases, transport, and other environmental issues associated with alternative resources, to be minimised.
- Help to keep the prices of local basic raw materials at the lowest possible levels, by maintaining small transport distances.
- Comply with State Planning Policy No 2.5, Agricultural and Rural Land Use Planning 2016, which states that basic raw materials should be taken prior to sterilisation of the area by development.
- Comply with the Peel Region Scheme, Basic Raw Materials Policy 2021.
- Increase the carrying capacity and land capability of the soils by lowering the land surface to enable the soils to hold additional soil moisture through summer.

1.4 End Use

Rehabilitation of the proposed excavated area will be a return to agricultural land with an increased stock carrying capability

1.5 Proponent

Bronzewing Investments Pty Ltd as Trustee for the P & F Gangemi Family Trust.

1.6 Location and Ownership

Lot 1 lies to the west of Corio Road, Ravenswood. Just north from Pinjarra townsite.

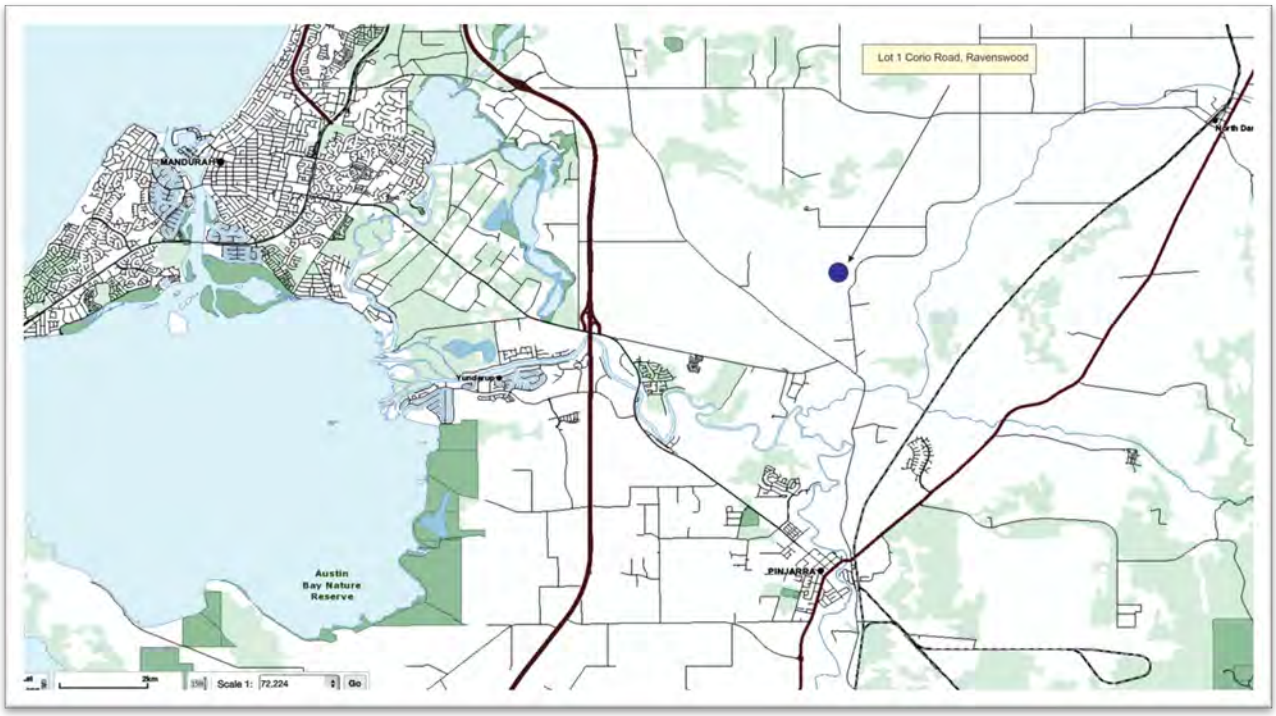

Figure 1: Location of proposed sand pit

2.0 PLANNING REVIEW

2.1 Importance and Rationale of Sand Resources

Lot 1 represents a small but locally significant sand resource within the Murray Shire and the Peel Region.

The reality is that the sand is only extracted for the community. If the community did not need the sand, for sand pads, concrete products and construction materials, there would be no extraction. The Peel Region has extensive areas of low lying ground that must be raised by sand fill to enable development and servicing.

Unfortunately the sand resources south of the Swan River and within the Peel Region are currently severely limited because of the spread of urbanisation and conservation listings. Sand is very cost impacted by transport distances and greenhouse gas emissions so the extraction of sand from as close as possible to the site requiring the sand makes economic and environmental sense.

Not all sand has the same characteristics and the best deposits are valuable community assets. The sand on site is a particularly valuable community resource because it lies in an area where extraction can occur with minimal impact on the community, and therefore has very high community value as the Perth Metropolitan area spreads south.

The characteristics of the sand are well known with the grainsizes useful for both fill and potentially concrete sand. The sand is geologically similar to sand extracted from nearby sand pits and the existing Bronzewing Investments pit on the nearby Lot 242

Additional information can be found in;

- Western Australian Planning Commission, State Planning Policy 2.4, Planning for Basic Raw Materials, 2021.
- Western Australian Planning Commission, State Planning Policy No 2.5, Agricultural and Rural Land Use Planning 2016.
- Department of Planning 2016, Basic Raw Materials Fact Sheet.
- Abeysinghe P B, 2003, Silica Sand Resources of Western Australia, Geological Survey of Western Australia, Mineral Resources Bulletin 21.
- Department of Planning 2009, Basic Raw Materials – Applicants Manual.
- Geoview (Geological Survey of Western Australia, Regionally Significant Basic Raw Materials (Sand).
- EPA, 2008, Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System – Phosphorus Management.

2.2 Current Land use

Lot 1 is used for pasture and will be returned to pasture.

2.3 Land Zonings and Policies

2.3.1 State Government Policies and Planning Schemes

The State Planning Policy Framework provides for the implementation of a planning framework through the recognition and implementation of Regional Planning Policies above Local Planning Schemes and Policies.

Within each layer of planning, there are a number of key policies and strategies to provide guidance to planning and development to enable sustainable communities to develop, expand and prosper without compromising the environment and future generations.

Planning is governed under the *Planning and Development Act 2005*. This Act enables Government to introduce State and Regional Planning Schemes, Policies and Strategies to provide direction for future planning. The State and Regional Schemes sit above Town Planning Schemes and Strategies introduced by Local Government.

Strategies and Policies provide guidance on how planning is to be undertaken and how proposed developments are to be considered. These Strategies and Policies are at the State, Regional and Local levels.

Schemes are gazetted documents that provide for consideration and approval of proposed developments. These are normally at the Regional and Local Level.

In addition to the documents produced under the *Planning and Development Act 2005*, the *Local Government Act 1995* provides Local Governments with a mechanism to prepare Local Laws to manage issues of local significance.

As noted above the policies have little relevance over mining tenements on Crown Land in State Forest, but they do have relevance to the local roads, and the recognition of the need for materials for dwellings, roads and construction.

With respect to the supply of sand to the community, the overarching document is the;

State Planning Policy 1.0 State Planning Framework.

The State Planning Policy Framework provides for the implementation of a planning framework through the recognition and implementation of Regional Planning Policies above Local Planning Schemes and Policies.

A number of State Policies have been released under the State Planning Framework Policy.

State Planning Policy 2.0, Environment and Natural Resources Policy
State Planning Policy 2.4, Basic Raw Materials
State Planning Policy No 2.5, Agricultural and Rural Land Use Planning
State Planning Policy No 4.1, State Industrial Buffer Policy

State Planning Policy 2.0, Environment and Natural Resources Policy

This policy provides for the protection of all natural resources under a number of sections;

5.1 General Measures
5.2 Water Quality including stormwater and wetlands
5.3 Air Quality
5.4 Soil and Land Quality
5.5 Biodiversity
5.6 Agricultural Land and Rangelands
5.7 Minerals Petroleum and Basic Raw Materials
5.8 Marine Resources and Aquaculture
5.9 Landscape
5.10 Greenhouse Gas Emissions and Energy Efficiency.

In addition to recognising the importance of protecting air quality, soil and land quality, water and wetlands and landscapes, the importance of Basic Raw Materials to the community is identified with reference to *SPP 2.4 Basic Raw Materials 2021, State Gravel Strategy 1998* and *State Lime Strategy 2001*.

Section 5.7 of SPP 2.0, deals with Minerals, Petroleum and Basic Raw Materials.

Part of Section 5.7 states;

Basic raw materials include sand, clay, hard rock, limestone and gravel together with other construction and road building requirements. A ready supply of basic raw materials close to development areas is required in order to keep down the cost of land development and the price of housing.

Planning strategies, schemes and decision making should:

ii. Identify and protect important basic raw materials and provide for their extraction and use in accordance with State Planning Policy No 10 (2.4); Basic Raw Materials.

iii. Support sequencing of uses where appropriate to maximise options and resultant benefits to community and the environment.

The other factors of the natural environment are provided with the best protection possible, by this management plan, by selection of the site, operational staging and footprint and rehabilitation, bearing in mind the constraints of excavating and processing the resource.

The proposed sand extraction complies with this policy.

State Planning Strategy, 2050 (2014)

The Western Australian Planning Commission (WAPC) released the *State Planning Strategy 2050.* It comprises a range of strategies, actions, policies and plans to guide the planning and development of regional and local areas in Western Australia and assists in achieving a coordinated response to the planning challenges and issues of the future by State and Local Governments.

The State Planning Strategy contains key principles. These are:

- Economic Development
- Physical Infrastructure
- Social Infrastructure
- Environment
- Security

The extraction of resources are essential for economic development, for the construction of facilities, for the Social Infrastructure of dwellings and communities, and the Physical Infrastructure such as roads and transport corridors.

The extraction of the resources is to be undertaken in an environmentally acceptable manner, which in this location means reduced haulage routes for the sand to the growing Peel Region, minimising transport and greenhouse gas impacts.

The approach in the strategy considers Basic Raw Materials as listed below.

ELEMENT	2050 OUTCOMES	MEASUREMENT	ASPIRATIONS
Basic raw material (BRM) supply	Accessible and affordable supplies of BRM are available close to dem	The cost of supplying basic raw materials to the building and construction industry	Appropriate polices are in place to manage existing and future BRM supplies over the long term. BRM are optimally used for their highest purpose. The securing of BRM sites is managed through robust strategic sequential land use planning and development control prior to final land use Demand for BRM is partly managed through compact settlement structures that contain high-density built form.

The proposed extension of sand extraction complies with State Planning Strategy 2050.

The environmental management of the quarry has been developed to minimise short and long term impacts on the local community and environment.

The operations have been designed to continue to provide good environmental management that minimises environmental change and enables continued rural land uses.

Regionally Significant basic raw materials are identified by the Geological Survey of Western Australia in Geoview. These are large resources of sand.

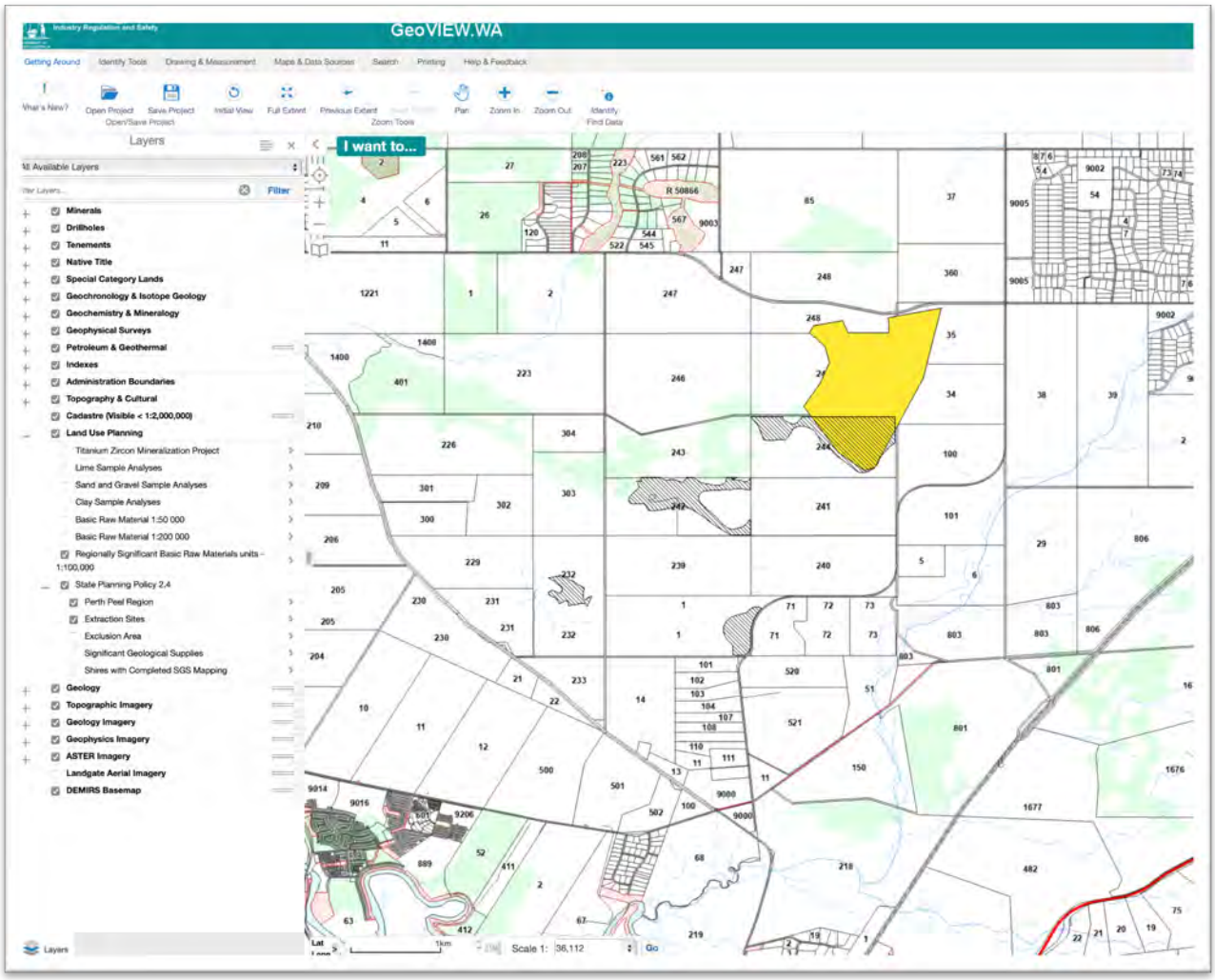

Figure 2: SPP 2.4. Regionally significant resources (yellow) Extraction Sites (hatched black) - Geoview

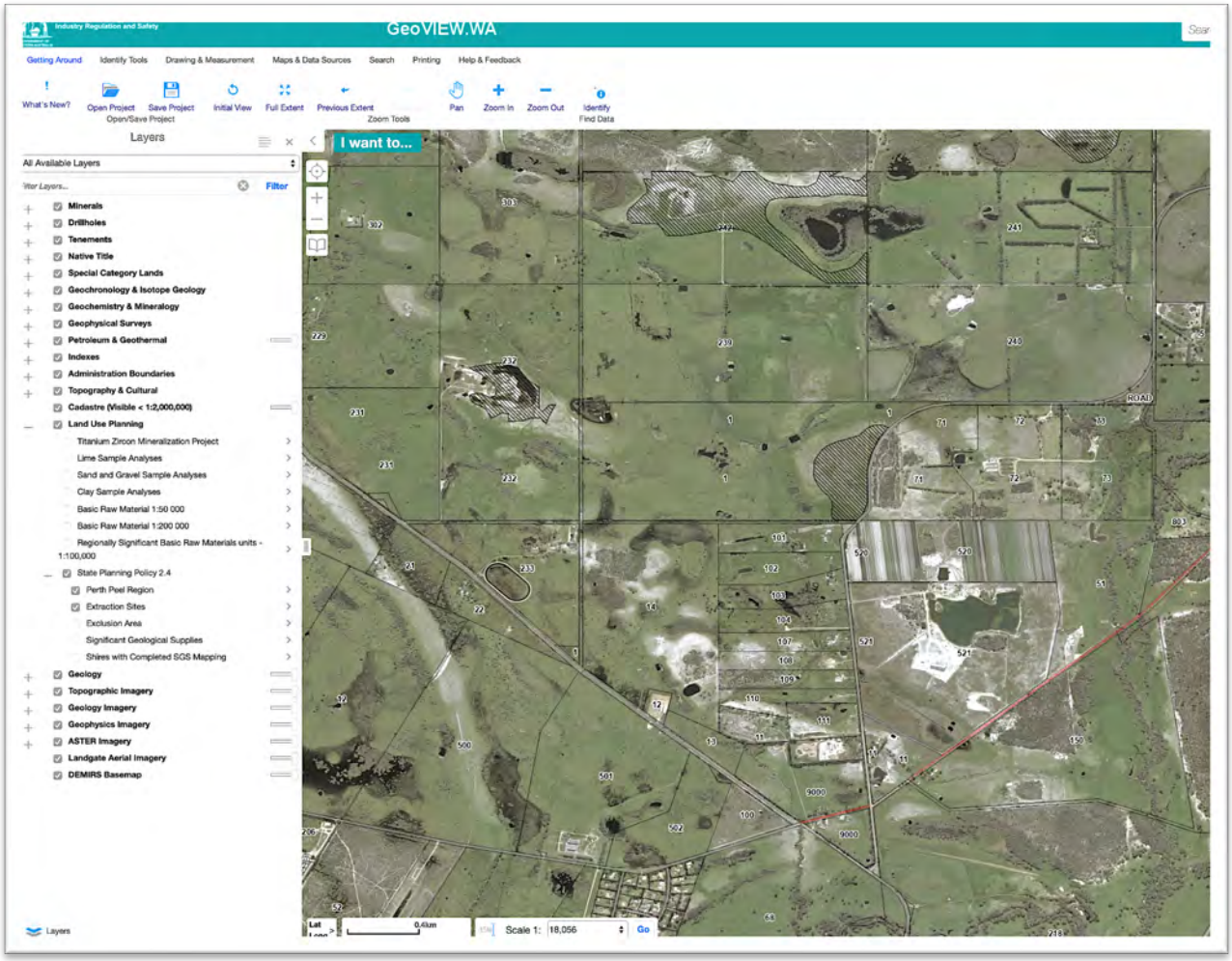

Figure 3: Local aerial photograph

State Planning Policy 2.4, Basic Raw Materials, 2021

SPP 2.4 requires that resources be staged and taken prior to sterilisation by other land uses.

The need for sand is also recognised by the Chamber of Commerce and Industry in their comprehensive summary of Basic Raw Materials, (*Managing the Basic Raw materials of the Perth and Outer Metropolitan Region, April 1996*) and in SPP 2.4 and all planning policies.

On the other hand sand is in very short supply within the Peel Region and any sand that can be extracted is a significant community asset, particularly one that has phosphate retention characteristics.

The site is a valuable community asset, as sand can continue to be extracted with minimal community inconvenience in the local region.

SPP 2.4 supports the principle that basic raw materials should be taken before they become sterilised by development. It provides guidelines to local government to recognise the importance of not permitting conflicting land uses to impinge on the operation and enable the resource to be taken in a staged manner.

This policy makes many statements on the intent and actions which local authorities should use to protect and manage basic raw materials.

SPP 2.4 (2021) has the following policy objectives;

5 POLICY OBJECTIVES

The objectives of this policy are to:

(a) ensure BRM and its regional importance is considered at the earliest stages of the planning process;

(b) protect BRM in SGS areas and ES by avoiding encroachment from incompatible land uses;

(c) ensure BRM resources are used efficiently in land use planning and development;

(d) identify BRM extraction opportunities through sequential land use without compromising the final intended land use; and

(e) ensure the extraction of BRM avoids, minimises or mitigates any adverse impacts on the community, water resources and biodiversity values.

The Western Australian Geological Survey has produced new mapping identifying Strategically Significant Basic Raw Materials across private land and State Forest, but that mapping used cut offs that excluded this site as being too small. Figure 2.

The GWSA does not list the site as a Regionally Significant Resource as it is too small, but the site is recognised as an "Extraction Site" and is "shaded" in Figure 2.

- *The proposed sand extraction complies with SPP 2.4 and the assessments by the Geological Survey of Western Australia (GSWA).*
- *The proposed site is identified as an Extraction Area by Geological Survey of Western Australia.*
- *The sand excavation has been designed to fit with the GSWA assessments of basic raw materials for this location and has been modified to maximise the potential resource and minimise the potential environmental impacts and enhance local conservation.*

SPP 2.5 – Agricultural and Rural Land Use Planning (2016)

SPP 2.5 Rural Planning predominantly deals with the continued rural use of suitable land and its protection for the future. The policy was updated in December 2016 and provides strong measures to identify, protect and use basic raw materials. SPP 2.5 does not cover this area but provides an indication of the factors considered in basic raw material extraction.

SPP 2.5 reiterates the need to protect and use basic raw materials.

Basic Raw Materials are included in the definitions as;

> *Sand (including silica sand), clay, hard rock, limestone (including metalurgical limestone), agricultural lime, gravel, gypsum, and other construction materials. The materials may be of State, regional or local significance depending on the resource location, size, relative scarcity, value and demand for the product.*

Amongst seeking to protect agricultural values, Policy Objective 4 (c) states

> *Outside the Perth and Peel Planning regions, secure significant basic raw material resources and provide for their extraction.*

The Policy Objectives provide for the prevention of land and environmental degradation during the extraction of basic raw materials (Section 4(4)(d). The policy position is clearly put in Section 5.4.3 Mineral and Basic Raw Material Resource Areas.

i. Town Planning schemes should make provisions for the protection of basic raw materials, mineral and energy resources identified in the local planning strategy.

ii. Town planning schemes should include provisions for the extraction of basic raw materials, mineral and energy resources. These provisions should include the development of appropriate local policies and requirements, particularly buffer requirements, that the extraction industries will be subject to: sequential land use proposals; and environmental management activities.

iii. These activities should be regarded as generally acceptable, subject to assessment on their individual merits in rural areas.

Section 5.9 deals with Basic Raw Materials and seeks to achieve the following in an environmentally acceptable manner;

Protect the resources until the resource is extracted (5.9.a)

Identify significant basic raw materials on sub-regional and local planning strategies, region and local planning schemes (5.9.b, 5.9.c, 5.9.d)

The extraction of basic raw materials should not be generally prohibited (5.9.e)

Provide for sequential land use (5.9.f)

Limit sensitive land uses to locations demonstrated to not limit existing or potential extraction of basic raw materials (5.9.g)

Provide for the consideration of native vegetation or significant biodiversity values and may require retention and protection of vegetation and environmental assets (5.9.h)

Have regard for the potential impacts of fragmentation and connectivity of native vegetation (5.9.i)

Maintain adequate buffers to protect water quality in public drinking water source areas (5.9j).

SPP 2.5 also supports preventing conflicting land uses (5.12.1), supports the generic buffers recommended by other Government documents such as the EPA Guidelines for separation distances (5.12.3), and seeks to restrict subdivision from impinging on basic raw material resources.

The Policy is also supported by Guidelines that seek to protect the Landscape and secure Transport Routes.

- *The proposed extension of sand extraction has been designed to comply with the provisions of SPP 2.5.*

Now that the revised SPP 2.4 (WAPC, 2021a) has been released, all BRM provisions detailed in SPP2.5 (WAPC, 2016) are now superseded.

State Planning Policy No 4.1, State Industrial Buffer Policy

SPP 4.1 discusses the need to consider adjoining land uses when locating buffers but does not prescribe set buffers for operations such as this. The development and processing of the resource has been designed to maintain maximum buffer distances. In situations where the buffers are less, actions such as the provision of perimeter bunding to provide visual and noise management, tree planting and operational procedures, are used to mitigate and reduce impacts.

This is discussed further in Section 5.1 Surrounding Landuses Buffers of this document. The proposed sand pit

complies with the buffer policy.

Directions 2031 and Beyond (WAPC 2010)

Directions 2031 and Beyond provides data on the land uses and growth of the Perth Metropolitan and Peel areas over the 20 years to 2031.

- *The proposed extension of sand extraction has the potential to supply a small amount of sand to enable construction of subdivisions and dwellings in the growing Peel Region.*

Perth and Peel @ 3.5 million

Perth and Peel @ 3.5million, developed by the Western Australian Planning Commission has determined that the Metropolitan Area will grow significantly between 2012 and 2050 by around 600,000 dwellings (Updated October 2015).

If each housing lot has an area of only 350 m^2 and with an average depth of 1 metre then around 500 tonnes of fill sand are required per dwelling or over 100 million tonnes of fill sand per dwelling for South Metropolitan and Peel.

North West Corridor	114 923
Central	215 000
North East Corridor	76 547
South and Peel	205 493

The construction of dwellings needs sand for developments, for preparing the individual lots, in addition to concrete and other products that include some sand.

- *The proposed extension of sand extraction has the potential to supply a significant portion of the required sand highlighted to be required until 2050 including high phosphorus retaining sand to minimise nutrient impacts on the Peel Harvey Estuary.*

Peel Region Scheme 2005

The Shire of Murray is covered by the Peel Region Scheme.

Lot 1 falls under the *Peel Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy dated October 2002.* Section 5.0 of that Policy requires the town planning schemes to be consistent with the Peel Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy where it is listed as a sand pit.

The Peel Region Scheme overrides the *Town Planning Scheme (Planning and Development Act 2005 Part 9 123 (1 – 3).* The Town Planning Scheme must be made consistent with the *Peel Region Scheme (Planning and Development Act 2005 Part 9 123 (1 – 3).*

Lot 1 is listed as Rural Land in the Peel Region Scheme. It is shown as lying between nominated sand resources within the Peel Region Scheme Basic Raw Materials mapping.

Section 4.0 Objectives of the Peel Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy;

to identify land within the Peel Region that contains basic raw materials of State or Regional Significance and to prevent them from being sterilised by incompatible development and land uses.

- *The proposed extension of sand extraction complies with the Peel Region Scheme.*

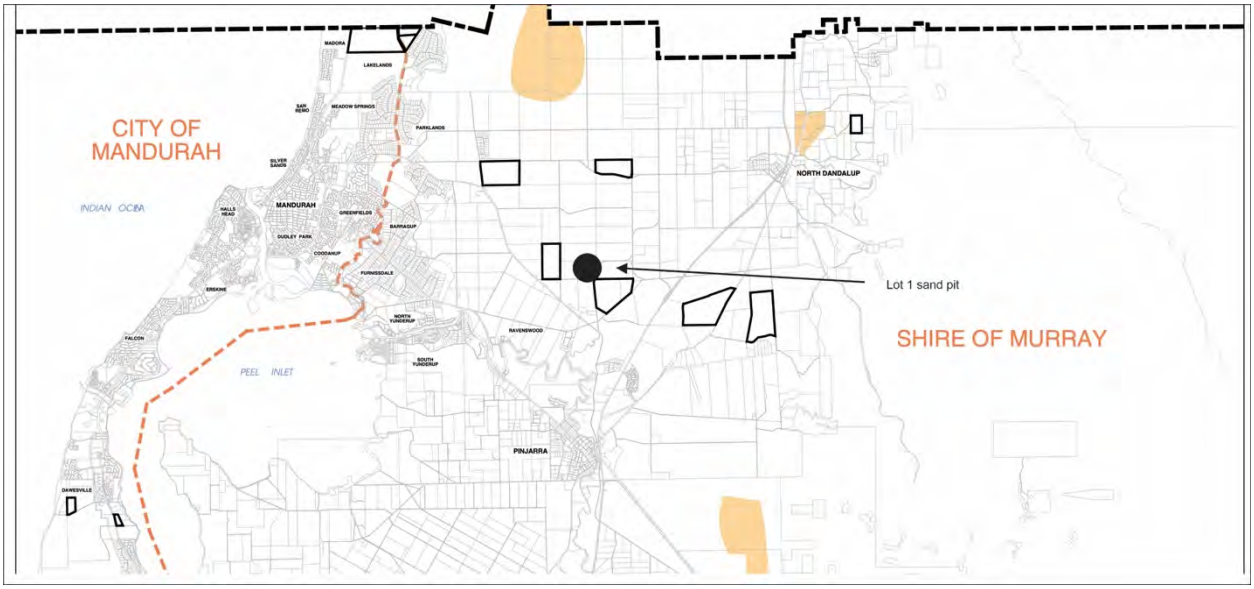

Figure 4: Peel Region Scheme sand extraction areas

2.3.2 Local Government Policies and Planning Schemes

Shire of Murray Town Planning Scheme No 4 (1989)

Lot 1 is zoned Rural in the Shire of Murray Town Planning Scheme No 4.

Extractive Industries are an SA use in the Zone, which means that Council, using its discretion, may approve an Extractive Industry.

The Zone objectives are printed on a separate document. The objectives for the Rural Zone are to provide for and protect intensive and extensive agricultural pursuits. The Objectives are silent on basic raw materials.

The end use of the excavated area is compatible with the Zone Objectives.

Shire of Murray Local Planning Strategy 1994 - 1997

The Shire Murray Local Rural Strategy recognises the importance of basic raw materials in Section 2.4 Mineral, Resources and Extractive Material.

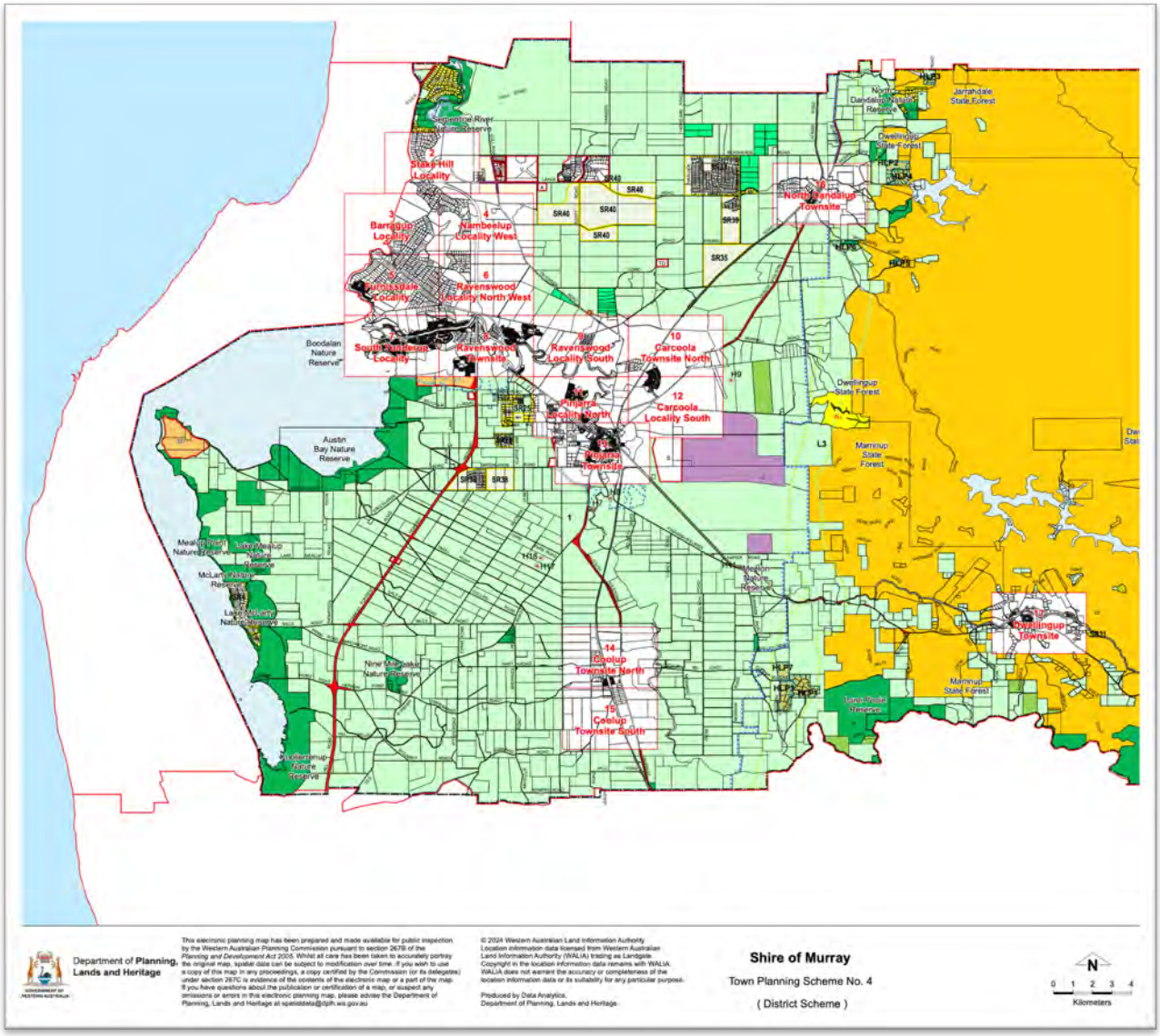

Figure 5: Shire of Murray Town Planning Scheme 4.

Shire of Murray Extractive Industries Local Law 2021

The proposed excavation has been designed to comply with the Local Law.

Shire of Murray Biodiversity Protection Local Planning Policy 2018

This policy seeks to identify and preserve significant trees and vegetation, mainly relating to subdivisions and other similar developments.

The proposed excavation retains the remnant vegetation and provides for the planting of additional local native vegetation.

This policy outlines the methods of planting and establishing trees, but relates to smaller rural living lots and landscape protection areas.

2.3.3 End Use – Sequential Planning

The planned end use of the site is to restore a natural soil and return the excavated area to improved productive

pasture with native vegetation tree belts.

The sand resource and natural soils are leached white sand over partial yellow sand across most of the excavation footprint. With the removal of the leached upper layers of sand the remaining sand will have much higher phosphate retention which will assist with future rural land uses.

In addition, by lowering the pasture land surface, capillary action will occur and the pasture will be able to gain soil moisture into summer. Capillary action allows for rises of soil moisture by 300 – 500 mm and, with root depth considered, land formed 0.5 - 1.0 metres above the groundwater enables pasture to grow through summer, therefore providing significantly improved agricultural values.

The end use of the land is unlikely to be urban or rural living in the foreseeable future, but is anticipated to remain rural because of potential land use conflicts.

The floor of the pit will be lowered to 0.5 metres above the highest known water table to enable better soil moisture in summer and better pasture growth for continued agricultural production. Whilst Lot 1 is located in the Peel Region the Department of Water South West Region Guideline for Extractive Industries and DWER Water Quality Protection Note 15 are more applicable as the end use will be to agricultural activities and pasture and allow 0.5 m separation to the water table.

2.4 Legislative Framework - Stakeholders

Table 1: Legislative Controls

Relevant Legislation	Environmental Factor Regulated/Affected	Discussion	Action - Management
Aboriginal Heritage Act 1972	A search of the Aboriginal Heritage Sites Register at the Department of Aboriginal Affairs was made and revealed no affected sites.	The DPLH sites register was searched and no sites were found to be listed.	None required.
Planning And Development Act 2005	Development approvals for on site constructions and any ensuing environmental impacts.	Planning Consent is required from the Shire of Murray and the WAPC.	A concurrent application for development approval is lodged with the Shire of Murray for both Development Approval and an Extractive Industry Licence.
Local Government Act	The operations of the quarry are regulated by both the Planning Approval and Extractive Industries Licence	An Extractive Industries Licence is required.	A concurrent application for development approval is lodged with the Shire of Murray for both Development Approval and an Extractive Industry Licence.
Health Act 1911	Environmental and health impacts from waste water treatment and community health.	An approved septic system is in place on site.	No matters of significance that would trigger this legislation have been identified. The proposal complies with the Health Department Guideline for Dust separation.
Department of Planning, Land and	Transport along	New developments may need to consider transport	The crossover and access will be upgraded to provide a sealed surface and locked gates as

Relevant Legislation	Environmental Factor Regulated/Affected	Discussion	Action - Management
Heritage Transport Impact Guidelines 2016	local roads	options.	the access will change from normal farm access to a sand pit access. There is an existing operation to a Bronzewing sand pit just north along Corio Road. An agreement will be reached with the Shire of Murray in respect to transport along Corio Road.
Western Australian Planning Commission Planning Bulletin 111/2016	New developments may need to consider fire risk and mitigation such as a bushfire policy and BAL attack document.	This is an existing operation with no changes to the access and scale of activities or transport or fire risk.	When not manned, there are locked gates in place at the entrance from Corio Road. The bare sand within the quarry will form fire breaks and reduce the fire risk rather than increasing the risk.
Environmental Protection Act 1986 *Part IV* - Assessment	Referred to the EPA if the project is or may constitute a significant environmental impact.	The proposal is small and not of a scale that would normally require review by the EPA.	
Environmental Protection Act 1986 *Part V* – DWER Licence	Environmental factors that may be significantly impacted related to Prescribed Premises. Processing and Screening.	A Licence or Registration will be required under Environmental Protection Act 1986 Part (V) if a screening plant processing more than 5,000 tonnes per year is used.	A DWER Part (V) Licence will be lodged as required.
Environmental Protection (Noise) Regulations 1997	Noise impacts.	The closest point of the excavation lies 260 metres to the closest dwelling. Excavation will be completed by a loader behind the operating face which has a similar noise impact to a farm tractor and will only need to excavate in that area for a very short time to extract the sand at a distance of < 300 metres. At that distance excavation in sand quarries readily complies with the Noise Regulations. The EPA generic buffer guidelines suggest that 300 metres can be used for sand and limestone quarries. Limestone quarries have a higher level of impact as the resource is harder.	The operations will comply with the *Environmental Protection (Noise) Regulations 1997* and comply with the EPA Generic Buffer Guidelines for all but a small area which can be completed during wetter months.
Environment Protection and	Matters listed on	No maters listed by the Commonwealth are present	Noted

Relevant Legislation	Environmental Factor Regulated/Affected	Discussion	Action - Management
Biodiversity Conservation Act 1999 (Commonwealth)	the EPBC database.	on site.	
Biodiversity Conservation Act 2016	The legislation seeks to protect and manage biodiversity in all its forms through regulation, conservation and restoration.	The site is cleared pasture.	Noted
Conservation and Land Management Act 1984	Parks and Reserves and issues relating to flora and fauna.	There are no nearby reserve lands.	Noted.
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	*Environmental Protection (Clearing of Native Vegetation) Regulations 2004*	The site is cleared pasture. A Clearing Permit will not be required.	Noted
Rights in Water and Irrigation Act 1914	Water quality and management of water from bores.		Water quality and management of surface water. There are no watercourses on site. The wet area to the north west and west is excluded. A Water Management Plan has been prepared and is included. No materials are present or to be used which would trigger this legislation apart from normal fuel and maintenance.
Waterways Conservation Act 1976	Water quality and management of surface water	There are no watercourses on site.	Water quality and management of surface water. There are no watercourses on the excavation site. The wet areas to the north west and west are excluded.
Dangerous Goods Safety Act 2004	Potential for dangerous goods to impact on the environment.	Refers to fuel, which is required and blasting under the *Dangerous Goods Safety (Explosives) Regulations 2007.*	The Water Management Plan addresses the use of fuel on site.
Work, Health and Safety Act 2020 and Work Health and safety (Mines) Regulations 2022	Safety and management of mining operations which in turn may impact on the environment.		The site will be registered under the SRS with DEMIRS and will have in place a Safety Management System.

2.5 Community Consultation

The proposed excavation program and quarry will be circulated to Government Departments and Authorities by the

Shire of Murray.

Complaints Procedures

A complaints register is proposed.

- The contact details are to be displayed at the entrance to the operations.

Any complaints will be recorded, investigated and, if substantiated, action will be taken as required. The details of all complaints will be contained in a record keeping facility at Bronzewing Investments Pty Ltd office.

A complaints book that lists the items below will be used. The book will be available to officers of the Shire of Murray.

- A complaints book is provided and maintained for all pits.
- Upon receipt of a complaint, the complaint will be investigated and action taken if the complaint is determined to be legitimate.
- When a complaint is found to be legitimate, any reasonable actions to mitigate the cause of the complaint will be taken, to prevent a recurrence of the situation in the future.
- Details of any complaints, the date and time, means by which the complaint was made, the nature of the complaint, the complainant, investigations and any resulting actions and the reasons, will be recorded in the Complaints Book.
- The Shire of Murray will be informed of any complaint or any other report provided to a Government Department within 3 working days.
- The complaints book will be made available for viewing or requested details made available to the Shire or any other official upon request.

2.6 Heritage

The database of the Sites Department of the DPLH has no record of any aboriginal sites on the subject land.

The site has been grazed, and partially farmed and used for sand extraction. Therefore disturbance of the soils has been a regular occurrence over much of the land.

Should any evidence of early aboriginal occupation be uncovered, development will be stopped pending an assessment by a recognised consultant.

If the site is confirmed as a site under the provisions of *Section 15 of the Aboriginal Heritage Act 1972-1980* and Amendments operations will cease pending relevant negotiations.

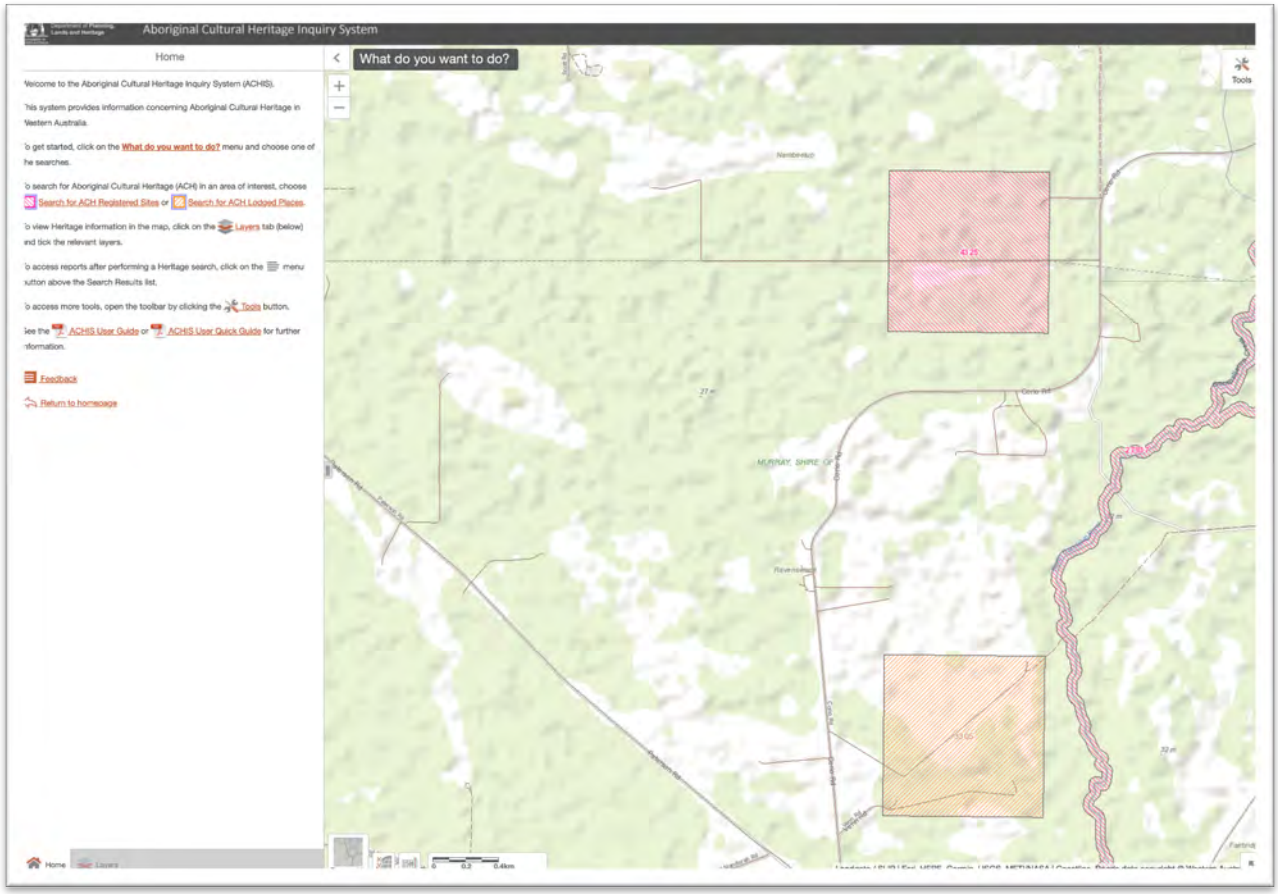

Figure 6: DPLH heritage search, December 2024

Figure 7: Surrounding land uses. Distance to closest house is 260 metres

2.7 Buffers and Setbacks

Setbacks of 40 metres to Corio Road are provided in line with normal extractive industry bylaws.

2.7.1 Consideration of nearby sensitive premises

The quarry is designed to maximise the setbacks to the closest sensitive premises. Figure 7.

As part of the development of the management plans for the proposed quarry extensive analysis of the local landform, land uses and location of sensitive premises were made by Landform Research from the available sources of published information, aerial photography, historical aerial photography, site mapping, review of the nearby and surrounding land uses, local and regional planning and local and wider environmental attributes.

The main environmental issues identified in relation to buffers and setbacks to sensitive premises, in addition to those generally recognised by the various Government and Published guidance's are;

- Visual amenity
- Dust management
- Noise management
- Blasting
- Local amenity
- Cumulative impacts of quarries

Separation to Dwellings

State Planning Policy No 2.5, Agricultural and Rural Land Use Planning, makes provision for the extraction of basic raw materials as does State Planning Policy 2.4 Basic Raw Materials.

Both policies have similar aims. SPP 2.5 in Point 9 states that "*The location of rural residential and rural small holdings should avoid unacceptable impacts on, or sterilisation of natural primary resources including prospective areas for mineralisation and basic raw materials .....".*

The Site is listed as an "Extraction Area" in State Planning Policy Mapping (Geoview.) Figure 2.

The issue of appropriate buffers is a matter of the distance and protection measures to prevent impact on adjoining land users. This applies mainly to noise, dust and visual impact, all of which are treated separately.

State Planning Policy No 4.1, State Industrial Buffer Policy, (draft July 2004) discusses the need to consider adjoining land uses when locating buffers but does not prescribe set buffers for operations such as this.

Generic buffer requirements were developed by the Victorian Government and used by the Environmental Protection Authority as the basis for a Draft guideline on recommended buffer distances. These formed the basis of EPA Guidance Statement Number 3, Separation Distance between Industrial and Sensitive Land Uses, June 2005.

EPA guidance "*Separation Distances between Industrial and Sensitive Land Uses", June 2005* lists the generic buffers for sand and limestone pits as 300 - 500 metres depending on the extent of processing. A generic buffer relates to the distance at which there are unlikely to be any problems without some further investigations and does not mean that smaller buffers are not acceptable. EPA Guidance for the Assessment of Environmental Factors No 3 June 2005 provides for a case by case separation, based on the potential impacts.

This sand pit will have the lowest potential impact as the resource is so small.

A 40 metre road buffer to Corio Road is provided in line with the Shire of Murray Extractive Industry Bylaws.

Figure 8: View towards the closest dwelling, located behind existing trees

The closest point of the excavation lies 260 metres to the closest dwelling. Excavation will be completed by a loader behind the operating face which has a similar noise impact to a farm tractor and will only need to excavate in that area for a very short time to extract the sand at a distance of < 300 metres.

If a screening plant is required, it will be located at least 300 metres from the closest dwelling, on the floor of the pit.

The EPA generic buffer guidelines suggest that 300 metres can be used for sand and limestone quarries. Limestone quarries have a higher level of impact as the resource is harder.

The issue of appropriate buffers is a matter of the distance and protection measures to prevent impact on adjoining land users. This applies mainly to noise, dust and visual impact, all of which are treated separately.

Sand excavation, which does not include screening or processing, would be at the lower end of the generic buffer.

In sand excavation the only mobile plant is a loader and road trucks. The examples provided below show that the distances between the active pit and a dwelling on the proposed operation are consistent with operations in other locations.

Operator	Location	Resource and buffer
WA Limestone	Wattleup Road Hope Valley	Limestone and sand
Italia Stone Group	Wattleup, Hope Valley	Limestone
NLG Sand Supplies	Jandakot Road Jandakot	Sand 40 – 80 metres

NLG Sand Supplies	Coyle Road Oldbury	75 metres
Boral Bricks	Wandena Road, Muchea	Clay 250 metres
NLG Sand Supplies	Coyle Road Oakford	40 metres
Cockburn Cement	Fancote Road, Munster	Sand and Limestone 70 metres
WA Limestone	Kerosene Lane, Medina	Limestone, 150 metres

Excavation will be worked from inside out on the floor of the pit working below natural ground level, working to the east and south so that the face of the pit provides solid screening to better manage dust and noise risk.

- *The proposed and pit extension complies with the EPA Generic Buffer Guidelines for almost all of its proposed area.*

3.0 PHYSICAL ENVIRONMENT

3.1 Geology and Geomorphology

Lot 1 is located within the Perth Basin, 8 km west from the Darling Scarp which forms the eastern edge of the Plain.

The Geological Survey of WA's Environmental Geology Map (Pinjarra) describes the site as Qpa/Qpb (Thin veneer of Bassendean sand over Guildford formation clay) to the south west and Qpb (Bassendean sand) in the central part.

The Guildford Formation forms an undulating surface which is cut into by the current channel of the North Dardanup River.

Superimposed on the Guildford Formation is the Bassendean Sand, which forms a relatively shallow sand ridge on the east of Lot 1, dropping away and pinching out on the edges to the north and west.

The soils are Bassendean Sand overlying the Guildford Formation.

On this site the geology is relatively simple; the Guildford Formation has low vertical permeability and acts as a partial aquitard. On the other hand the Bassendean Formation is an aquifer that sits on the surface and allows lateral movement of superficial groundwater to flow through it.

3.2 Regolith and Soils

Wells M R, 1989, Land Capability Study of the Shires of Mandurah and Murray, Department of Agriculture WA Land Resources Series 2 shows the sand ridge on Lot 1 as B2, *"Sand plain of deep well drained bleached grey sand with an iron-organic hardpan or less commonly a pale yellow B horizon, generally at 1 – 2 m depth"* which is a good summary of the soils.

The resource of Bassendean Sand is pale grey to white, and occasionally brown, moderately-sorted, fine to medium-grained quartz sand with traces of heavy minerals. A layer of friable, mostly weakly goethite cemented sand known as 'coffee rock' is commonly present at or just above the water table or historic water table. It commonly occurs on top of the sand clay interface.

The yellow colour of the lower soils is due to a coating of goethite on the sand grains. The goethite has been found to originate from the weathering of iron based heavy minerals. There can also be minor amounts of clay originating from the weathering of small amounts of feldspar that occurred in the original sediment. Bastian 1996.

Over time and under the influence of organic acids the iron oxides (Goethite) are dissolved from the sand grains and deposited at the wet – dry seasonal interfaces related to the thickness of the sand, depth of groundwater and depth to clay.

The typical iron indurated material on site does not contain organic material and is better called a ferricreted bed or iron hard pan rather than attaching the word organic.

The origin of the iron induration layer results from the goethite coating of the naturally yellow sand being dissolved under the influence of organic soil acids. The mobile iron then precipitates at the wetting- drying front at the groundwater interface. The current coffee rock may represent past or recent water tables and it is not uncommon to have several layers of iron induration.

With the removal of the iron oxide coating the sand grains turn their natural white colour, hence the white near surface soils, explaining why yellow sand on exposure to the atmosphere for some years is gradually "bleached" white.

The yellow subsoils and iron enriched materials have high phosphate retention. Testing conducted by Strategen found those materials to have Phosphate Retention Indices of 5 – over 100.

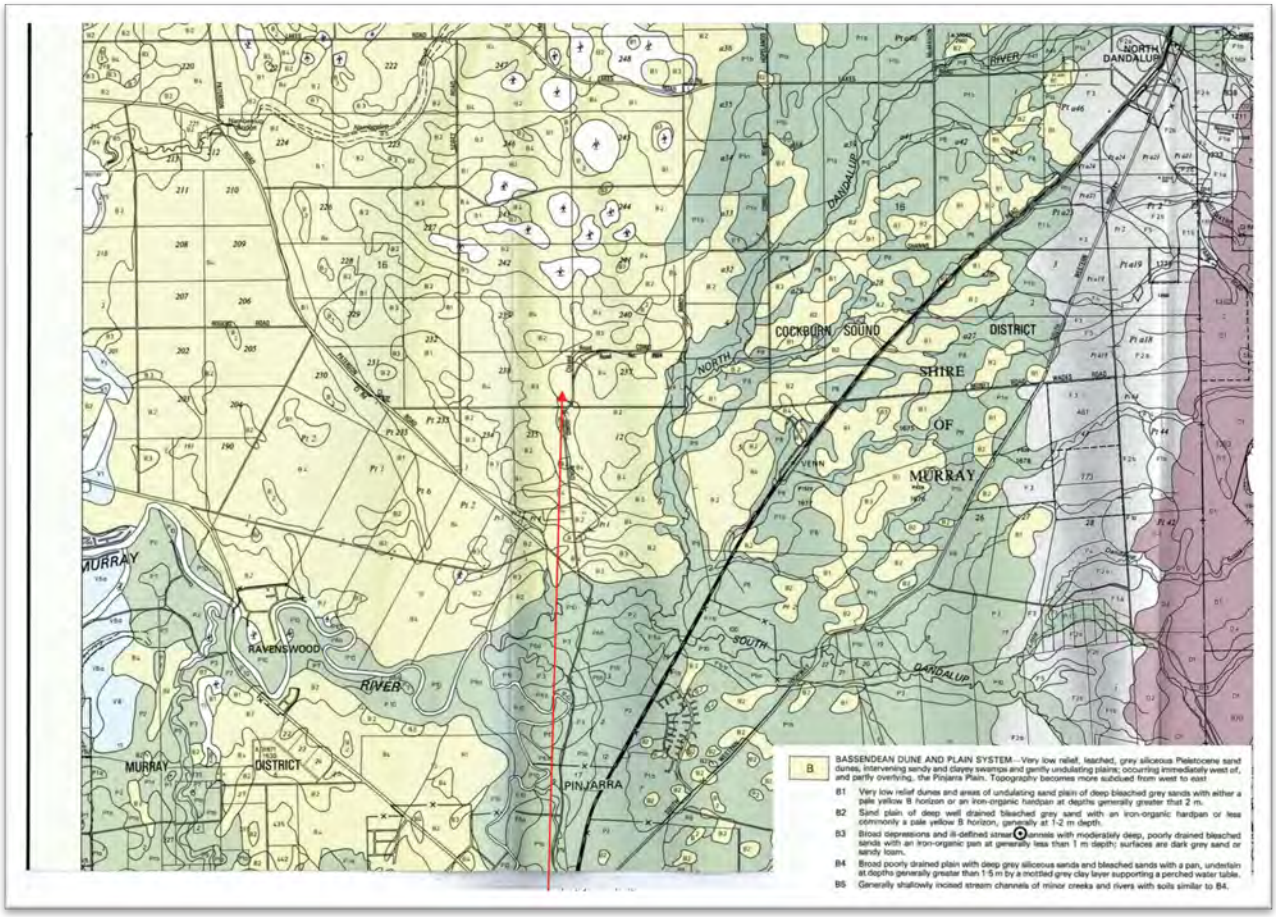

Figure 9: Soil Units (Wells 1989)

This is consistent with Lantzke N, 1997, *Phosphorus and nitrate loss from horticulture on the Swan Coastal Plain,* Department Primary Industries and Regional Development, Miscellaneous Publication 16/97.

The yellow sand and iron indurated sand has potential for use in amending or sheeting soils to reduce phosphate export when used for developments in the Peel Harvey Estuary.

Investigations and rehabilitation conducted by Lindsay Stephens of Landform Research show that such soils provide good mediums for plant growth that significantly exceed the soil capabilities of the more leached surface soil horizons of the Bassendean land systems. Local pasture revegetation has been shown on similar local sand pits to grow well on reconstructed soils on the Spearwood Land System in the trial revegetation and site rehabilitation that is outlined.

Acid Sulfate Risk

Lot 1 lies outside the High risk areas based on DWER databases for Acid Sulfate Risk. See Figure 9.

There has been an increased interest in acid sulfate soils since the release of WAPC Planning Bulletin 64.

However the interest has been over-reactive, with assessments sought and risk applied in many situations where there is no geological risk or evidence of acid sulfate potential or actual conditions. Even if acid sulfate conditions occur they are normally treated simply dosing with limesand or limestone.

Acid Sulfate Soils can potentially form under reducing conditions when there is a source of carbon and a source of sulfur (normally from sea or saline water). Micro-organisms are thought to play an important role in reducing the sulfates within the sediments to form the iron sulfide. It is a natural phenomena, that can be exacerbated by

disturbance.

With a separation to the water table of 2 metres there is no risk of disturbing acid sulfate conditions which must be under reducing and anoxic conditions prior to exposure to the atmosphere.

The most definitive survey procedure was produced by the Acid Sulfate Soil Management Advisory Committee NSW, 1998, in their *Acid Sulfate Manual.* That Manual formed the basis for much of the assessment procedures in Australia, including those adopted by the Western Australian Planning Commission and the Department of Water Environmental Regulation (DWER) in their documented assessment procedures.

DWER 2015 released two documents, *Identification and investigation of acid sulphate soils and acidic landscapes* and *Treatment and management of soil and water in acid sulphate soil landscapes.* These two documents provide the Acid Sulfate guidelines for Western Australia.

National Guidelines for Acid Sulfate identification and management were developed in 2018. The Queensland Government updated their Acid Sulfate Guidelines in 2023.

The National Guidelines and all other assessments rely on an assessment completed by a competent person. That person will assess the risk based on a staged approach, which was used in the field reviews and the geotechnical assessments for the site as part of the compilation of the management Plan for the proposed extraction.

WAPC Planning Bulletin Number 64, identifies the whole area as yellow, Moderate to Low risk (yellow) of acid sulfate conditions (AASS and PASS) occurring below 3 metres depth. This is the same as all the existing surrounding land and indicates a generic listing of the risk rather than an individual site investigation.

The site has been visited by Lindsay Stephens of Landform Research in 2024.

Materials at risk under reducing conditions are normally grey in colour or have been grey with no brown or red brown iron oxides. Where exposed to the atmosphere there is a change to brown iron oxides, with yellow jarosite and other alteration minerals that are distinctive.

Hyd2o completed holes to the water table to form monitoring bores. The logs of those holes are provided in the attached Hyd20 report and show no evidence of acid sulfate conditions.

The sand in the pit and eexcavation is highly oxidised, hence the presence of the goethite coatings. The sampling and drilling of monitoring bores by Hyd2o did not intersect any peat or substances of potential acid sulfate conditions.

No peat or organic matter has been intersected in the pit, is present in the faces or floor, and none is likely considering the existing excavation at 12.5 metres in the west to 13.25 metres in the east. See attached Hydrogeological report.

This concurs with *Nattaporn-Prakongkep, R J Gilkes, B Singh and S Wong, 2011, Mineralogy and chemistry of sandy soils in the Perth metropolitan area of the Swan Coastal Plain*, Department of Environment and Conservation who concluded that there is no risk of acid sulfate soils in sands unless there is peat or organoferricrete present and excavation proceeds below the at risk conditions.

- *There are no acid sulfate conditions on site as the resources lie well above the water table and do not contain reducing conditions or potentially sulfide rich zones*

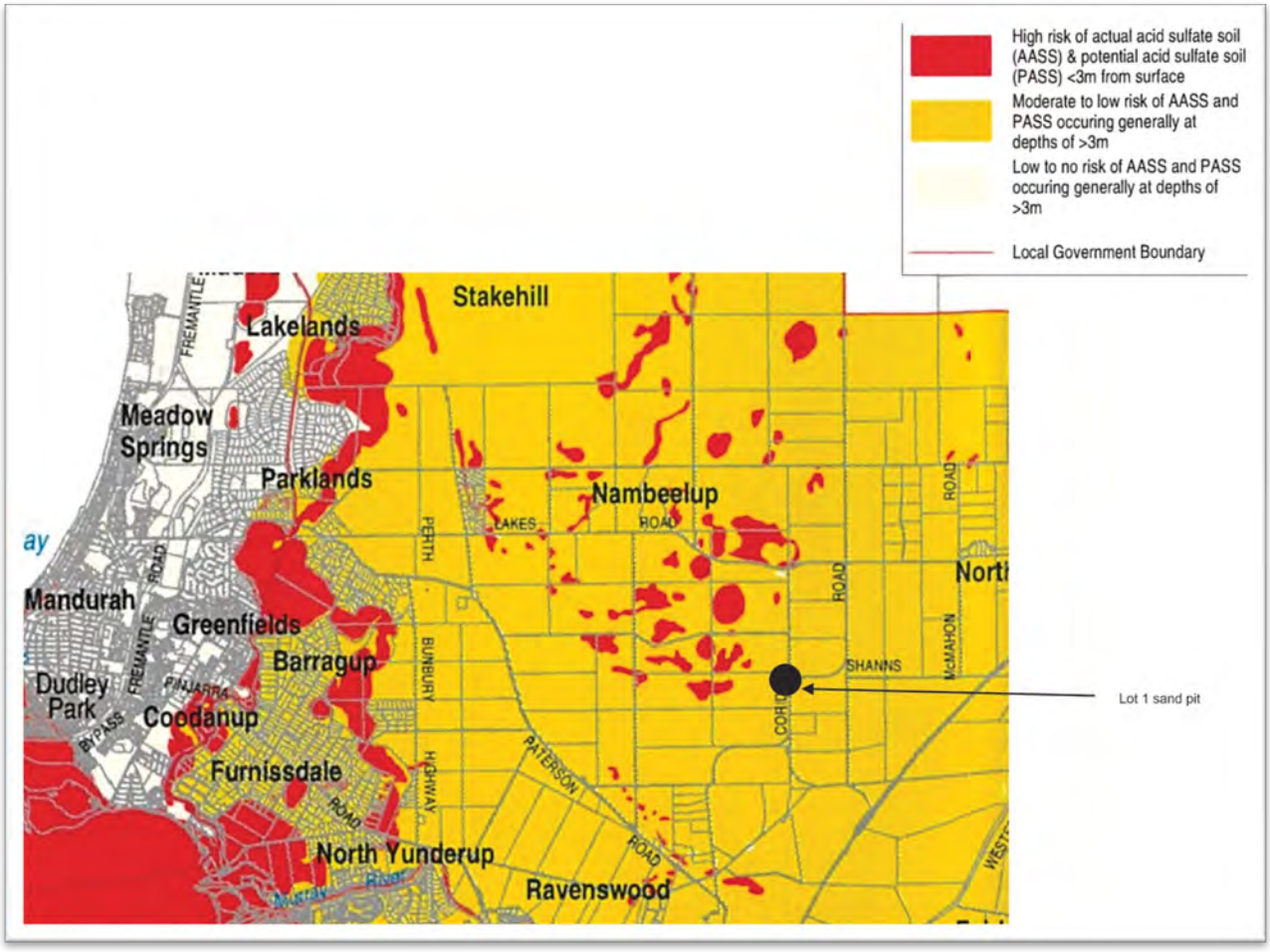

Figure 10: DPLH acid sulfate risk mapping

3.2 Climate

The nearest Bureau of Meteorology stations with long term data are Mandurah and Pinjarra. The site, being some 3 km further from the Darling Scarp than Pinjarra, and 10 km further from the coast than Mandurah, is expected to have slightly lower rainfall and slightly higher temperatures.

The Murray study area has a Mediterranean climate with hot dry summers and cool wet winters, typical of the south-west region of Western Australia. Rainfall analysis at two long term stations in the study area was undertaken; the Pinjarra rainfall site (9596) and the Mandurah rainfall site which is a collation of data from station 9572 (1893 – 2001) and the currently operating station 9977 (2001– 2008). (DOW 2010)

Maximum and minimum daily temperatures are 23.3°C and 13.4 °C respectively. The highest temperatures are in January and February with highest maxima of 43 °C and the lowest minimum being in August at 0.6 °C.

An average of 86% of the rain falls within the May – October period, and the average monthly distribution of rainfall is similar at both the Mandurah and Pinjarra sites.

However, individual rainfall events are often localised on the Swan Coastal Plain, and the spatial heterogeneity of the rainfall is important to capture in a distributed numerical model.

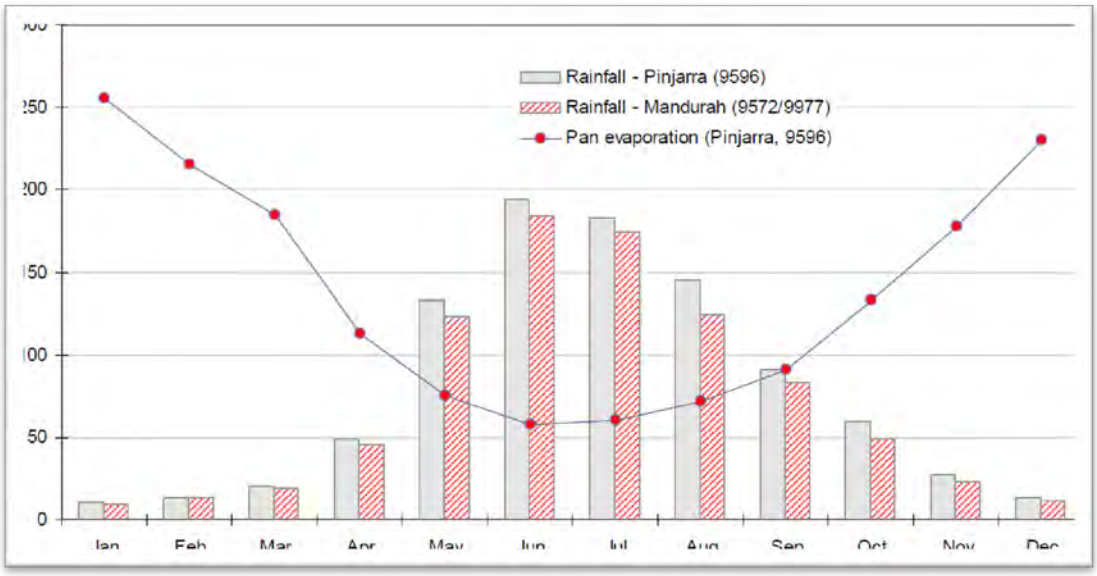

Figure 11: Climate data Pinjarra

The average annual rainfall for Pinjarra is 939 mm, with a maximum rainfall of 1493 mm recorded in 1955; and a minimum rainfall of 531 mm recorded in 1941. The average annual rainfall from 1877 to 1975 was 970 mm, which is 14% greater than the average rainfall between 1975 and 2008, indicating that the commonly referred to 'step-down' in rainfall over the past 30 years is present in the study area.

Average rainfall in Pinjarra is higher than Mandurah, and generally the rainfall isohyets follow an east–west gradient.

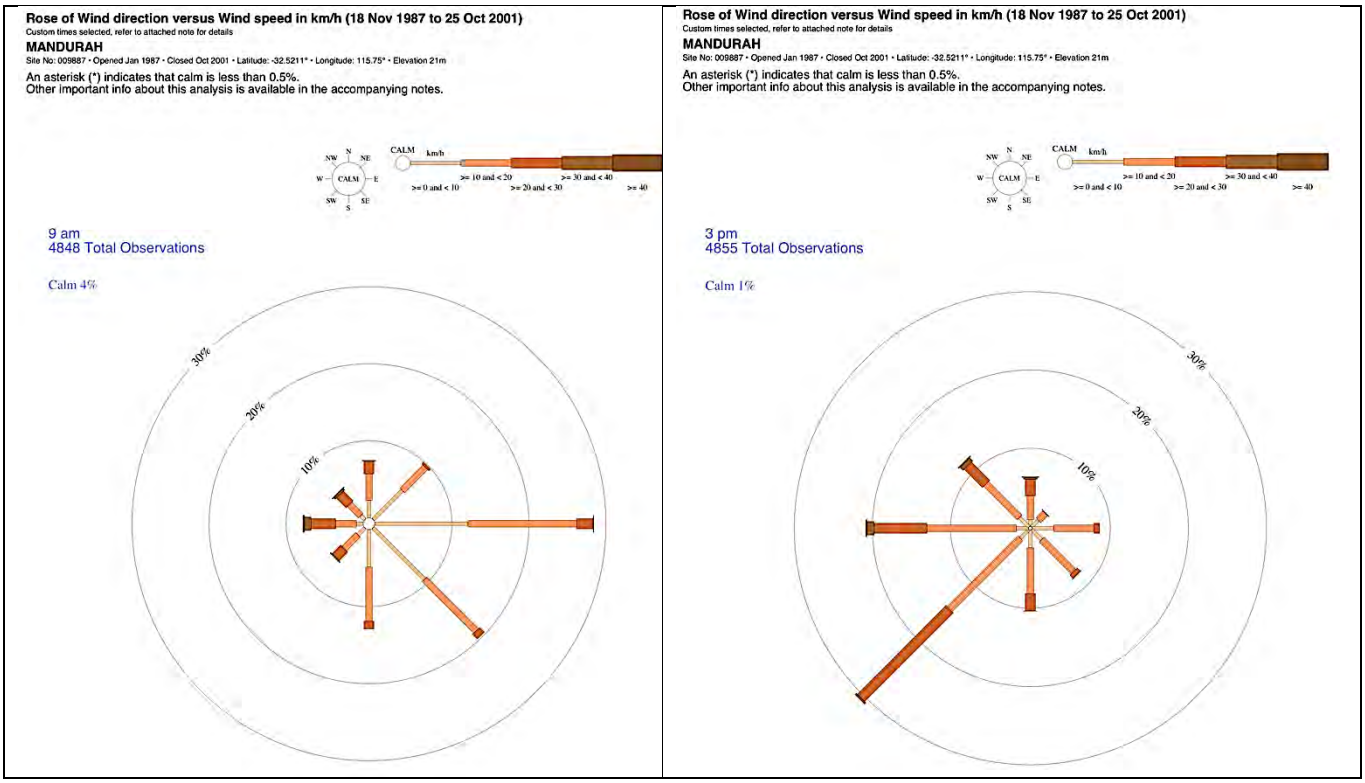

Figure 12: Wind data Mandurah

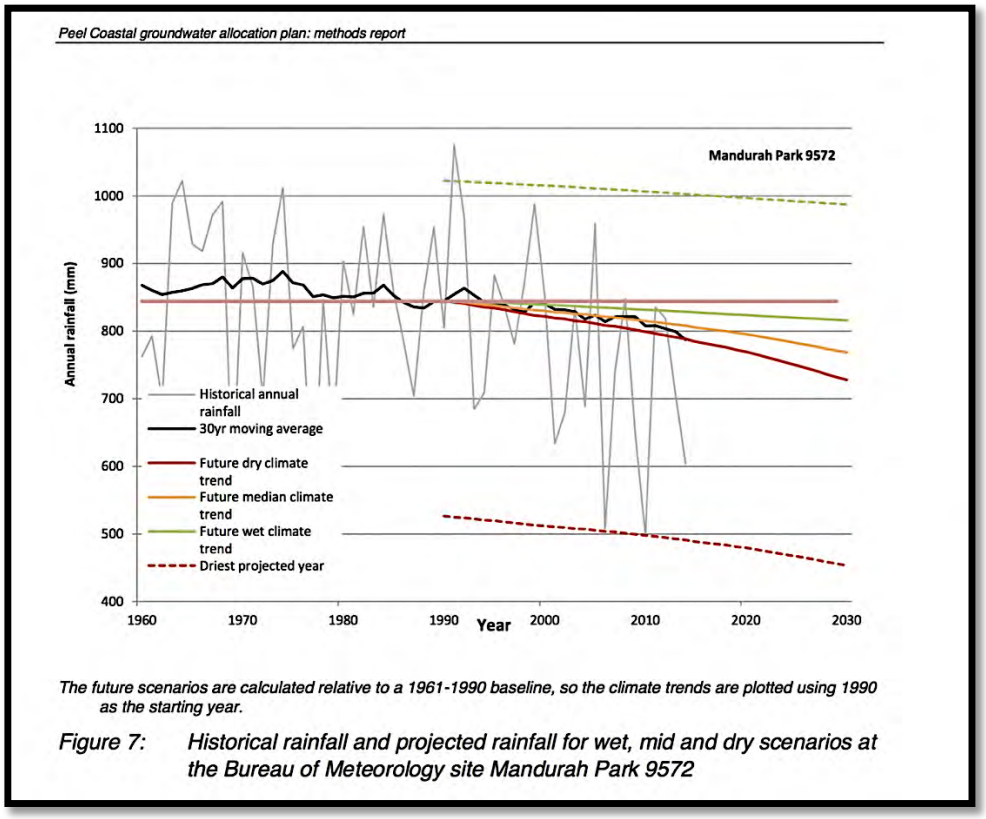

Figure 13: Historic rainfall data at Mandurah Park

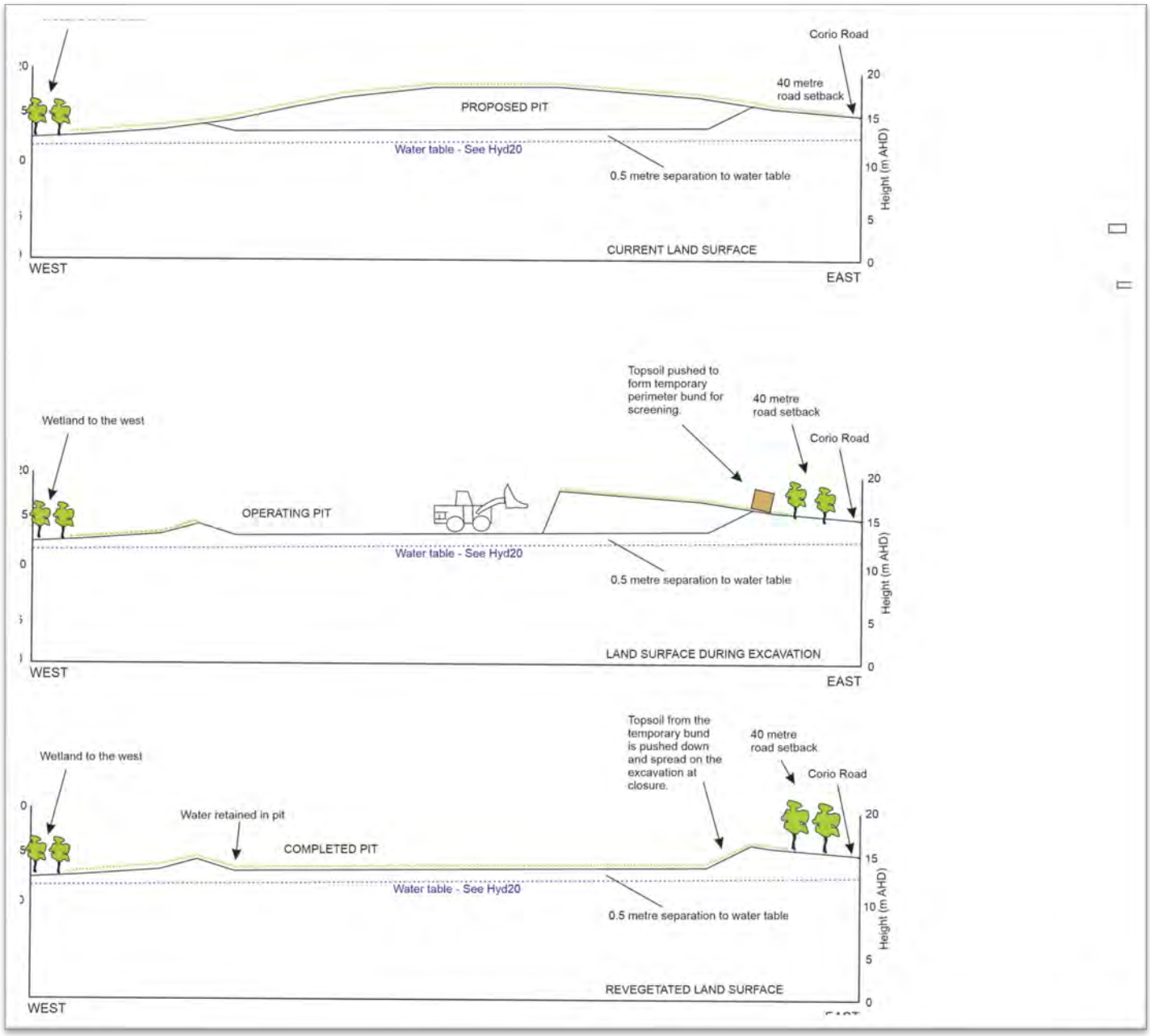

Figure 14: Sketch section of the proposed excavation

4.0 PROJECT DESCRIPTION

4.1 Construction

Environmental issues including dust, noise and traffic can be managed in such a way to minimise or eliminate any potential impact on the local community. Dust and noise can be contained by the methods of extraction to be used and the control measures which will be put into place.

The staging and direction of excavation is from the west and to the south to minimise impacts on the close dwellings.

This is an extension of existing operations, with no proposed changes to the methods of excavation. Bronzewing Investments Holdings is experienced in this type of quarrying having operated at least two other sand pits within the local area.

Figure 15: View south east across the sand resource

Construction Time

The construction time will be taken up with the construction of the cross over to Corio Road and the access road.

4.2 Excavation

4.2.1 Sand Extraction

The sand will be excavated in stages, moving from the existing operations, working west and north. As the sand is

excavated the soils will be reformed.

The amount of sand required by the community and contracts won will determine the rate of extraction, which is not anticipated to change.

The steps in the excavation plan are listed below.

Survey

- The disturbance footprint will be surveyed and pegged prior to land clearing and excavation.

Clearing and Preparation of each Stage

- Clearing will be completed progressively on each resource stage. There is no native vegetation on the resource site; just pasture.
- The land will be cleared of pasture with the topsoil.
- Topsoil will be remove to a depth of 100 mm and pushed to the perimeter or transferred directly to an area being rehabilitated. This reduces stockpiles and maintains the viability of the micro-organisms and seed stored in the soil, and assists the rehabilitation program.
- Where top soil cannot be spread directly, small stockpiles of topsoil and vegetation fragments, to heights of 1000 mm, will be created to store the materials for later use.
- Overburden, where present, as sand with vegetation fragments will be removed by pushing to the perimeter of the pit footprint to form perimeter safety bunding to the pit.

Excavation

Excavation will be carried out as a sequence. Figure 5 shows typical plant to be used.

1. The excavation is similar to past excavation on the adjoining lot to the west and all other quarries in the area.
2. A loader will be used to remove any pasture and topsoil cover by pushing it into windrows, for use on the batters to minimise soil erosion and spreading on the final land surface as part of the final rehabilitation.
3. Overburden – interburden, or subgrade sand will be removed by pushing to the perimeter of the pit to form perimeter bunding to the pit.
4. Yellow sand that has higher phosphate retention will be excavated and sold separately to provide a source of material for use on subdivisions in the Peel Harvey Estuary Catchment.
5. Bunding will be pushed to the perimeter of the footprint along the western edge to assist with visual protection. See Figure 14.
6. Sand will be excavated to 0.5 metres above the highest known water table as measured in water monitoring bores and piezometres during excavation. See Hyd2o Hydrological Report (attached).
7. The sand is highly porous and surface water will not develop on the pit floor. Any surface water generated during rainfall events will be retained within the pit.
8. The depth of excavation will be 1 to 3 metres AHD. The floor will be flat to gently sloping at 1 : 5 to 1 : 10 vertical to horizontal to enable a productive agricultural end land use.
9. Water is unlikely to be used for dust suppression apart from the watering of internal access roads to enable

road trucks to access the resource to be loaded. See the attached Dust Risks Management Plan for dust management.

Details of the Rehabilitation are listed under 9.0 Mine Closure.

Closure

- A Concept Final Contours plan is provided in the Summary at the front of the document.
- At the completion of excavation, the final soil slope on the floor of the excavation will be flat and slightly undulating. The floor will rise from 12.5 in the west to 13.25 in the east.
- The batters will be graded to ensure the final slopes form an interim stable land surface in compliance with the Work Health and Safety (Mines) Regulations 2022 at 1 : 3 vertical to horizontal because the final land surface will be returned to local native vegetation.
- Rehabilitation will progressively follow mining, wherever possible with completed areas of the excavation being revegetated as soon as practicable.

4.3 Processing

No processing is anticipated although the use of a small mobile screening plant to remove roots and organic matter remains a contingency. If used for screening the sand no additional types of mobile plant will be required on site.

No screening will be undertaken unless an *Environmental Protection Act 1986 Part V* Licence or Works Approval is in place. If the amount of screened sand is > 5,000 tonnes per year an *Environmental Protection Act 1986 Part (V)* Licence will be required, which will be applied for.

4.4 Pit Design and Staging

The volume and rate of excavation is, of course, determined by the sales orders for the various contracts.

It is expected that excavation will take up to 10 years to be completed. There is approximately 175,000 bench m3 of sand available for extraction or approximately 330,000 tonnes.

Staging is shown on Figure 16.

Excavation will progress from west to east, south and north. Note that Stage 1 will only be excavated when soils are moist to reduce potential dust risk.

The southern portion will be excavated when sand is moist to minimise dust impacts on the closest dwellings.

In total the disturbance is 12.5 hectares. 2 – 4 hectares is anticipated to be open at any one time.

This area is required to provide sufficient floor area for excavation, plant and truck turning facilities. The batter slopes will be additional to that to ensure their stability.

During the life of the excavation it is anticipated that progressive rehabilitation will be used, reducing the amount of ground open at any one time.

4.5 Stockpiles

Stockpiles of products will be retained on the floor of the pit to reduce visual impact.

If sand is to be screened relatively small stockpiles of 10 –2000 tonnes are proposed.

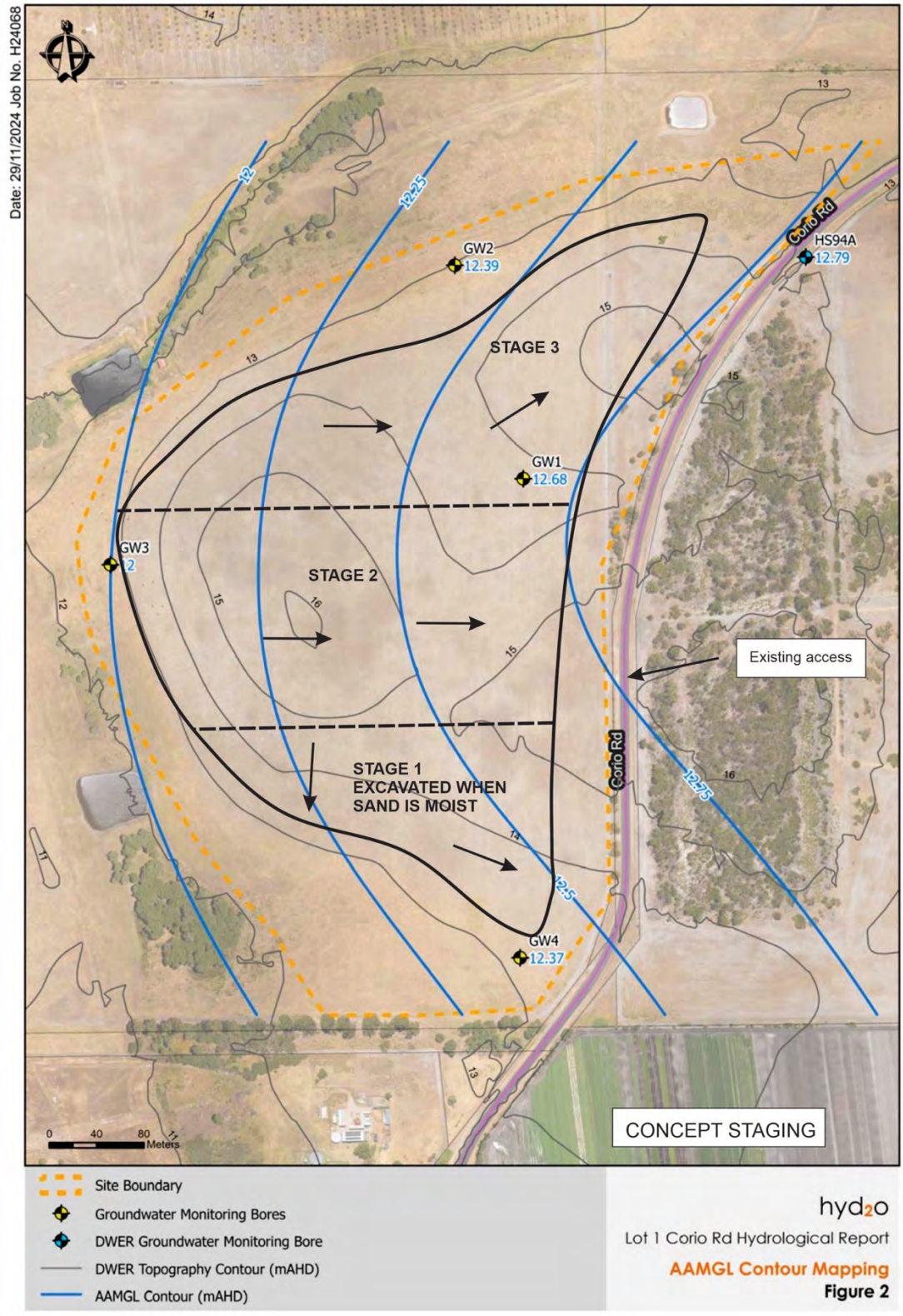

Figure 16: Concept Staging

4.6 Equipment

EQUIPMENT	• DESCRIPTION
Site office/lunchroom	• A portable site office/lunchroom may be maintained on site for the management and security of small items. • This facility will be located near the access road. • Generally the site will be serviced from the Local facilities on Lot 241 to the north, which also services the sand pit on Lot 242 Corio Road.
Toilet system	• An approved septic toilet system or serviced portable toilet system will be provided, located to the north on Lot 241.
Storage sheds	• At this stage a storage shed is not proposed.
Fenced compound	• A fenced security compound may be combined with the proposed site office.
Bulldozer	• Not required for sand excavation but may be required to complete earthworks.
Water tanker	• A 10,000 L water truck or similar may be required for dust suppression on the access road and working floors as required. The access road will be constructed of limestone or similar hardstand and will be removed at the end of excavation unless required for future farm access.
Loader	• A loader (Cat 980 or similar) is to be used for the movement and excavation of sand, loading road trucks and (if required) feeding a screening plant.
Excavator	• Not normally required but may be used for specialty work such as specific excavation of drains, trenches or other locations that are difficult to access.
Weighbridge	• A weighbridge is not proposed.
Mobile screening plant	• Mobile screening plant may be used for screening sand, (licensed by DER Category 70 for 5 000 – 50 000 tonnes per year. • A screening plant will be self powered and located on the floor of the pit at least 300 metres from dwellings.
Fuel Storage	• Vehicles will be refuelled from mobile tankers and not stored on site.

4.7 Hours of Operation

Hours of operation are unchanged and will be 7.00 am to 5.00 pm Monday to Saturday inclusive, excluding public holidays, for processing and excavation.

Loading and transport from site may commence at 6.00 am Monday to Saturday inclusive, excluding public holidays.

Transporting material on Saturday should not present a problem because of the high traffic volumes using local roads and low numbers of dwellings.

4.8 Access and Security

The access road from Corio Road will be at a constructed crossover to be installed with locked gates.

The site is secured by locked gates when it is not being actively worked. The boundary fencing is maintained to prevent inadvertent and unauthorised entry. See Figure 16.

Warning signs for trucks will be used to alert road users to the entrance onto Corio Road.

Maintenance of signage will be undertaken in consultation with the Shire of Murray.

Figure 17: Sightline south from the existing entrance

Figure 18: Sightline north from the existing entrance

4.9 Transport

Truck access will be north and south along Corio Road. Figures 16, 17 and 18.

The number of truck movements will vary throughout the year depending on the size of contracts. To transport the required amount of sand a certain number of trucks must be used.

Road transport will continue to use a variety of vehicles such as rigid trucks, semi-trailers or rigid (8) wheeler trucks to a 5 axle dog trailer.

As there is around 330,000 tonnes of sand on site, and with the increased need for sand locally for housing it is anticipated that the rate of extraction will be around 75,000 tonnes per year without large contracts.

However if a large contract is won all the sand could be extracted over a period of 1 -2 years.

If for example 100,000 tonnes was transported out in one year, at an average truck load of 30 tonnes on 250 days, there would be 13.3 laden trucks leaving site per day.

However an average is unlikely because as noted above, on some days there may be 20 or more laden trucks leaving the site per day, but on many other days there will be no transport.

The pit will be staged to enable sequencing of clearing topsoil followed by overburden and then the restoration of the land surface.

As the sand is anticipated to be removed in one or several contracts a five year approval is all that is required and proposed.

Similarly it is not known in what time frame any sand delivered under contract will be required, and therefore an estimate on daily truck numbers is difficult to predict at this stage.

It must be remembered that there is a finite and limited amount of sand. How the sand is taken will determine the transport impacts.

If the sand is taken within a 12 or 24 month period, then this amounts to a larger number of trucks per day, but for a short time frame.

Excavating at a slower rate will increase the number of days worked, but the number of trucks per day will be substantially less. At other times there will be no activity on site. As the number and type of contracts are unknown at this time a defined number of truck cannot be provided.

The access and loading of each truck will normally take 5 – 10 minutes.

Therefore even on busy days the level of activity is anticipated to be low with only one loader and an average of one truck on site at any one time. To excavate at a faster rate, two loaders will be required and there will be times when two trucks will be on site with a truck perhaps parked, waiting on site.

A road maintenance agreement is in place with the Shire of Murray and will be re-negotiated as part of the assessment for this application.

4.10 Water Use

Water will be required for dust suppression on the access road during summer conditions or the access road will be treated as required with dust sealant, a cellulose based product to mininise the need for wetting the road.

A rounded figure of 500 litres or 0.5 kL water use per day is anticipated based on past experience for dust

suppression for access roads for the sand extraction.

For say 100 days of full water requirements in a year, considering the low extraction volumes, winter and other wet days, the water requirements are anticipated to be 150 kL of water for dust suppression annually. A Dwelling normally uses around 300 kL per year as a comparison.

4.11 Workforce

The workforce will vary, depending on the level of operation and market demands, but usually 2 – 3 persons will work on site plus truck drivers as they access the operations.

4.12 Safety

Safety Management System

- All quarries operate under the provisions of the *Work, Health and Safety Act 2020 and Regulations 2022* regulated through the DEMIRS Safety Regulations and Reporting Systems (SRS) Risk Assessments and Management Plans and Operational Procedures.
- Bronzewing is already registered and has the site operational procedures, site induction and training procedures in place for their existing pit. These induction procedures include environmental factors such as the management of water, dust noise, dieback and the protection of vegetation.
- Officers from the Safety Division of the DEMIRS will regularly inspect the operations in relation to health and safety. This site will be under the supervision of the Collie Branch of the DEMIRS.
- Bronzewing Sands and their contractors are committed to maintaining a safe working environment that considers the mitigation and minimisation of environmental impacts.
- Portion of the site will be fenced with farm style fencing combined with a locked gates and signage for security purposes.
- Warning signs are installed to the DEMIRS specification, as approved by the district inspectors.
- Completed faces will be left in a safe manner to the requirements of DEMIRS for the abandonment of small sand quarries.
- The site is within mobile phone range.
- Bronzewing has procedures in place to manage safety, health, environmental impact, site completion and rehabilitation at their existing operations. This pit will use similar procedures.
- All vehicles have two way radio capability. No light vehicles are permitted on site without registering with mobile plant on site. Full personal protection is required for all persons on site at all times.
- Personal protection is worn by all persons on site, with a minimum of hi – viz, safety boots, long clothing, hearing and eye protection and helmets when near the face or operating machinery.
- Road trucks are separated from the operating loader. Site warning signs and directions will be installed as required to maintain safety.
- The operator contacts will be displayed at the entrance from Corio Road.
- Safety bunds or temporary fences will be used above any active vertical faces.

- Warning signs are to be maintained as required.
- Emergency preparedness plans will be developed and implemented.
- Staff and contractors are inducted and trained as necessary and have the relevant qualifications to fulfill the tasks they are assigned to.
- Every morning prior to start there is a daily briefing or consideration of the potential hazards, any incidents such near misses, health and safety and any other relevant issues.
- Where applicable Safe Operating Procedure Sheets are made available for hazards. Workers and staff on all sites are trained in the use of the procedures and all employees provided with site induction and training as necessary prior to commencing work on the site.

Geotechnical Safety

The working procedures comply with normal operational procedures for small Open Pit Mines as required and described by the *Department of Energy Mines and Petroleum Guidelines, Mines Safety and Inspection Act 1994 and Regulations 1995* and Read and Stacey 2009.

The sand will be excavated as one face where it flows freely down the face at the angle of repose in compliance with DEMIRS Guidelines.

The maximum sand face will be three metres which is lower than the reach of the loader bucket and complies with all excavation guidelines.

The loader will only approach the face in a perpendicular manner and not park at the face. Where the sand does not run freely at the angle of repose the height of the face will be limited by the reach of the loader bucket through the use of benching or pushing down of the sand by a dozer. Figure 14.

The batter slopes are retained in a stable form to comply with the Work Health and Safety (Mines) Regulations 2022 with slopes battered to or 1 : 3 vertical to horizontal.

Final Surface

The final surface is determined by the elevation of the water table as determined by Hyd2o. The final surface is set at 0.5 metres above the highest known water table, even though DWER Water Quality Protection Note (WQPN) 15, is a minimum of 0.3 metres.

That means that the floor will rise from 12.5 metres in the west to 13.25 metres in the east near Corio Road.

Fire Management

Fire can cause impacts on the surrounding vegetation in addition to a safety risk.

Fire management is considered under the Safety Management System within the SRS system of the DEMIRS through the Safety Division and will include emergency procedures for fire, evacuation and other fire risk.

The excavation area will continue to form a natural firebreak; the access road will also assist. Water available on site can be used for fire fighting.

Western Australian Planning Commission Planning Bulletin 111/2016 provides for an exemption of a bushfire plan requirement because there will be no structures that will burn and the open ground will form a fire break. It also provides for an exemption where the proposed activity is a continuation of existing activities. This applies to this continuation of sand extraction.

The Department of Energy Mines Industry Regulation and Safety, SRS and PMP systems, with the registration of all quarries, requires bushfire planning to be covered under that system.

The management actions that are used to minimise fire risk are summarised below.

- Vehicles will be restricted to operational area, particularly on high fire risk days.
- Diesel rather than petrol powered vehicles are used.
- Perimeter fire breaks will be maintained for Lot 1 by the landowner.
- All vehicles, mobile and fixed plant will be installed with fire extinguishers,
- The mobile plant on site will be available to assist with emergency fire management when safe to do so.
- The site is secured from unauthorised access by maintaining the existing fencing and locked gates.
- Public access will not be permitted.
- An emergency muster area is to be provided.
- On site communications and worker induction and training will be provided.
- The site is within mobile phone range, the surrounding area is relatively flat and any bushfire smoke will readily be noticed.
- Excavation equipment will be available for the construction of fire breaks and emergencies.
- During summer contact with DFES and the Shire of Murray will be maintained to ensure that any potential fire is known and precautions taken with evacuation or other appropriate action.
- The site will stop work and prevent the movement of vehicles on days deemed to be high – extreme fire risk days, in line with normal farm practise.

Flood

The site is located on partially elevated highly porous sand with no watercourses. There is no potential for flood risk.

Storm

Like other sites there is potential for storm events to impact on operations.

The weather conditions will be assessed and if a severe storm warning or thunderstorms is forecast the risk will be assessed based on the operations at that time and the plant being used to determine whether operations should be temporarily shut down and the plant temporarily removed from site.

Storm risk and management procedures have been approved under the DEMIRS, SRS system.

5.0 ENVIRONMENTAL FACTORS POTENTIALLY IMPACTED

5.1 Visual Management

5.1.1 Baseline Data

- *The proposed pit extension is designed to minimise visual impacts Corio Road and close dwellings.*

5.1.2 Environmental Assessment - Visual Management

	Aesthetics and Visual Management	**Reference**
EPA Objective	*To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.*	
Statutory Requirements and Guidelines	*WAPC 2007, Visual Landscape Planning in Western Australia* provides an assessment methodology for the visual impacts from roads, developed and recreational areas and sensitive premises. The policy has been viewed and the project considered against that document. The relevant section is Part Three, pages 144 to 152 of the Guideline and the site has been assessed against the Guideline.	
Potential Impacts	Visual Impact can occur in a number of circumstances, by the operation set high in the landscape, by being too close to neighbours and by insufficient visual protection. The proposed sand pit extension is located on a low ridge adjacent to Corio Road with management though the staging and direction of excavation.	
Assessment of Impacts	The pit footprint has been selected to minimise the visual impact and to enable excavation from behind the low ridge.	
Mitigation	***Avoid*** The area of sand extraction has been selected west from Corio Road to reduce visual impact from the road network. The setback matches the setbacks and excavation matches State Planning Policy 2.4 for Lot 1. The area selected is located within the nominated *"Extraction Area"* State Planning Policy 2. ***Minimise*** The pit is located behind the highest part of the ridge. The pit is set back 40 metres from Corio Road. Excavation is selected to cut to the east and south to provide visual protection. A buffer of tree planning is proposed along Corio Road. The crossover from Corio Road and the access road are sealed. ***Rehabilitate*** The pit will be returned to productive pasture. The tree belt will be retained after excavation is completed.	Figures 14 and 16.
Outcomes	The proposed sand extraction will have reduced visibility from Corio Road and local dwellings.	
Residual Impact	Glimpses of the working face may be visible from some directions.	

Offsets	No offsets required for visual management.	

5.2 Hydrology

5.2.1 Baseline Data

Surface Water

There is no surface runoff of water due to the porosity and permeability of the sand, with precipitation draining to the water table.

Groundwater

Hyd20 completed a hydrological study of the site to determine the maximum winter water tables. See the attached report and Figures in the summary S1, S2 and S3.

The final surface is determined by the elevation of the water table as determined by Hyd2o. The final surface is set at 0.5 metres above the highest known water table, even though DWER Water Quality Protection Note (WQPN) 15, is a minimum of 0.3 metres.

That means that the floor will rise from 12.5 metres in the west to 13.25 metres in the east near Corio Road.

5.2.2 Environmental Assessment – Hydrogeology, Water Quality

	Hydrology and Water Management	
EPA Objective	*To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.*	
Statutory Requirements and Guidelines	*Waterways Conservation Act 1976* *Rights in Water and Irrigation Act 1914* *Contaminated Sites Act 2003* *DWER Water Quality Protection Note 15 – Basic Raw Materials Extraction* 2019.	
Potential Impacts	Sand excavation is a very clean industry using a loader, loading directly to road trucks. Sand excavation is one of the few land uses permitted by the *Department of Environment and Conservation in Priority 1 Public Drinking Water Source Areas.* If the pit is not managed effectively there is potential for the water table to be intersected. There is potential for water quality to be impacted by fuel and hydrocarbon spills.	Figure 14, and contour plans
Assessment of Impacts	Only sand excavation will be permitted in the proposed sand extraction area with no fuel storage or other activities.	
Mitigation	***Avoid*** The separation to the water table is proposed to be 0.5 metres, 0.2 m higher than DWER policies (WQPN 15) for sand excavation in environmentally sensitive areas and groundwater protection areas. No fuel will be stored within the proposed pit footprint. Fuel will be brought to site as required . ***Minimise*** A Water Management Plan is provided. (See below).	Water Management.

	Hyd20 have installed piezometers which can be used for water monitoring. ***Rehabilitate*** The completed floor of the pit and the faces/batter slopes of the 12.5 hectares will be revegetated with pasture within 12 months of excavation being completed within each stage	
Outcomes	The floor of the pit will be formed at a minimum elevation of 0.5 metres above the *highest known water table.* The Water Management Plan (below) will provide protection for the water table and groundwater.	Figure 14.
Residual Impact	There are not anticipated to be any residual impacts on the water table in terms of water quality, ground water elevations or flows.	
Offsets	No offsets will be required for water management.	

Water Quality Management

Table 2: Water Quality Management

ACTIVITY	POSSIBLE RISK SEVERITY and FREQUENCY	OPERATIONAL PROCEDURES AND COMMITMENTS	RISK AFTER MANAGEMENT
WATER			
Surface Water	Low - Occasionally during heavy storm events	Surface water runoff will only occur under extreme events and for short distances before the water soaks into the sand. The pit will be designed to retain any surface water that might occur during heavy rain. (Figure 14) At the end of excavation the land surface will be reformed to be similar to that existing prior to excavation with similar soils. That is, in storm events some minor surface flows might occur in heavy storms before soaking into the ground. (Figure 14) As the site lies within the Peel - Harvey Catchment, the management of hydrocarbons will mitigate any flow to the Peel Harvey watercourses. With such porous soils, defined detention basins and sumps and dams will not be required.	Low
Ground Water	Low - During operations	The final surface is determined by the elevation of the water table as assessed by Hyd2o. The final surface is set at 0.5 metres above the highest known water table, in compliance with DWER Water Quality Protection Note (WQPN) 15, Surface water is clean and will soak into the sandy soils. All water will be retained in the pit for infiltration. Dewatering will not be necessary and is not proposed. Hydrocarbons and waste will be managed to mitigate impacts on the soils and water.	Low
Recharge	Low	As the land is currently pasture and will be returned to pasture there will be no change to recharge to groundwater.	Low
HYDROCARBONS			

ACTIVITY	POSSIBLE RISK SEVERITY and FREQUENCY	OPERATIONAL PROCEDURES AND COMMITMENTS	RISK AFTER MANAGEMENT
Refuelling	Low - Frequent during operations	*The operations are designed to comply with WQPN 15 Basic Raw Materials Extraction*. Mobile tankers will be used, which are approved double skinned facilities. There will be no onsite fuel storage. The operators of the mobile refuelling facilities (SWP) are trained in refuelling duties including the management of any spills. The mobile facilities are equipped with adsorbent mats and products (eg attapulgite) to be used in the event of spills. Minor spills and drips will be quickly degraded by soil microbial matter. Drips or minor fluid spills will be scooped up with the sand and sent offsite for on the ground bacterial remediation; the most commonly used method of dealing with small spills. Refuelling and lubricating activities are to occur in the base of the pit, and equipment for the containment and cleanup of spills is to be provided. Spillage will be contained in plant and working areas by shutting down plant or equipment if the plant or equipment is the source of the spill (provided it is safe to do so). Any spills will be contained by the excavation. Soil and resource will quickly be placed around the spill to contain it in as small an area as possible. When contained, the contaminated sand will be scooped up and removed to an approved landfill or other approved site. All significant adverse incidents (such as a fuel spill of >5 litres) in one dump, are to be recorded, investigated and remediated. A record is to be kept of incidents, and DWER and Shire of Murray notified within 24 hours of an incident. In the event of a spill or adverse incident, activities will be stopped in that area until the incident is resolved.	Low

ACTIVITY	POSSIBLE RISK SEVERITY and FREQUENCY	OPERATIONAL PROCEDURES AND COMMITMENTS	RISK AFTER MANAGEMENT
Servicing	Low - Occasional during operations	All major servicing of vehicles will be conducted off site, and maintenance using dedicated trucks with oil and waste recovery systems will be used. Waste oil and other fluids derived from the routine maintenance of mobile machinery, will be transported off site and disposed of at an approved landfill site. Grease canisters, fuel filters, oil filters and top-up oils will be stored in appropriate containers in a shed or brought to the site as required. Vehicle washdown is not proposed. Regular inspections and maintenance of fuel, oil and hydraulic fluids in storages and lines will be carried out for wear or faults. Servicing plant and equipment will be in accordance with a maintenance schedule. Accidental spill containment and cleanup protocol will be implemented as necessary. Rubbish generated is to be recycled wherever possible and periodically disposed of at an approved landfill site. The site will be maintained in a tidy manner by removing all rubbish regularly offsite.	Low
WASTES			
Resource Wastes	Low - During operations	There is and will be no washing of products. There will be no waste rock or tailings.	Low
Illegal Dumping	Moderate - At any time	Access is to be restricted by current farm fencing and locked gates. Fences will be maintained. Any illegally dumped materials are to be removed promptly to an approved landfill or other suitable site, depending on the nature of the material.	Low
Ablutions	Low - During operations	An approved septic waste water and toilet facility is provided at the farm on Lot 241 to the north.	Low
MONITORING			
Monitoring	NA	Monitoring will concentrate in three areas; • Supervision and management of the operations. • Monitoring of soils for spills and leakages. • Water quality monitoring of the Inert Landfill site. Soils found to be contaminated will be dealt with as outlined above. Being such a small short term operation, that complies with WQPN15 Guidelines. Water monitoring bores are provided to measure groundwater elevations. At this time no water quality monitoring is proposed, but will be implemented if there is a significant spill of hydrocarbons or other materials.	NA

5.3 Flora and Vegetation

5.3.1 Baseline Data

The site is pasture with no native vegetation. The wet areas to the north west are delineated by the presence of *Melaleuca preissiana*.

The vegetation is pasture. No native vegetation exists of the proposed excavation area.

Figure 19: View across the sand resource

Figure 20: The wetland of *Melaleuca preissiana* which is excluded from excavation and installed with a setback of around 80 metres

5.3.2 Environmental Assessment – Flora and Vegetation

	Flora and Vegetation Management	
EPA Objective	*To protect flora and vegetation so that biological diversity and ecological integrity are maintained*	
Statutory Requirements and Guidelines	*Environmental Protection Act 1986 Part IV assessment. (State)* *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.* *Biodiversity Conservation Act 2016.* *Environment Protection and Biodiversity Conservation Act 1999. (Commonwealth).*	
Potential Impacts	No clearing approvals are required because the site is pasture.	
Assessment of Impacts	The only impact will be temporary loss of pasture. Revegetation to pasture will follow excavation.	
Mitigation	***Avoid*** The size of the proposed pit has been restricted to the sand ridge. The Melaleuca preissiana to the north will be provided with an 80 metre buffer. There will be a temporary loss of pasture which will be returned, but to an improved condition because the reconstructed soil will be closer to the water table and will hold pasture longer through summer and provide better grazing. Staging will minimise the amount of ground open at any one time. The open ground is anticipated to be 2 – 4 hectares allowing for the access road and safe working areas for truck movements. ***Minimise*** In total the disturbance is 12.5. hectares. 2 – 4 hectares is anticipated to be open at any one time. This will minimise the potential impacts on vegetation in the longer term. Weed management procedures will be practised. Excavation will occur on the floor of the pit below the adjoining pasture and therefore with less potential for impacts from weeds, apart from land clearing and reinstatement operations. ***Rehabilitate*** The completed floor of the pit and the faces/batter slopes will be revegetated within 12 months of excavation being completed within each stage	
Outcomes	There will be a temporary loss of pasture during the life of the pit, but this will be offset by the progressive revegetation to improved pasture.	
Residual Impact	As there will be a net gain to the overall quality of pasture at the end of excavation there are not anticipated to be any long term residual impacts.	
offsets	No offsets to clearing pasture are required.	

5.4 Fauna

5.4.1 Baseline Data

The site is covered by pasture and unlikely to significantly impact native faun as the resource area is pasture.

The only noted fauna were occasional roosting of Straw Necked Ibis in some of the *Melaleuca preissiana* associated with the wet areas to the north west. The edge of the quarry is approximately 100 metres from those plants. Figure 20.

In other nearby areas Straw Necked Ibis roost and nest adjacent to pasture and near other activities and will be unlikely to be affect by sand excavation.

5.4.2 Environmental Assessment - Fauna

	Fauna Assessment and Management	
EPA Objective	*To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*	
Statutory Requirements and Guidelines	*Environmental Protection Act 1986 Part IV assessment. (State)* *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.* *Biodiversity Conservation Act 2016.* *Environment Protection and Biodiversity Conservation Act 1999. (Commonwealth).* Clearing approvals will be required from both the State and Commonwealth.	
Potential Impacts	The site is pasture and will be returned to improved pasture. ***Direct Impacts*** There would not appear to be any direct impact on native fauna. ***Indirect Impacts*** Local Straw Necked Ibis do not appear to be impacted by excavation or farm activities for the colonies that occur in the Murray Region, such as the sand excavations on Lot 242 by Bronzewing, nearby roost places on local farms. There is not proposed to be any direct impact or likely indirect impact on any Ibis activity. Local Straw Necked Ibis do not appear to be impacted by excavation or farm activities for the colonies that occur in the Murray Region, such as the sand excavations on Lot 242 by Bronzewing, nearby roost places on local farms. The amount of pasture habitat removed from the Ibis is 2 – 4 hectares and will be compensated by a return to more productive pasture. **Risks to Fauna** Nil	
Assessment of Impacts	No impacts on native fauna are anticipated.	
Mitigation	***Avoid*** The *Melaleuca preissiana* to the north west that are used by the Ibis are excluded and provided with an approximate 80 metre setback. ***Minimise*** Not required. ***Rehabilitate*** The site will be returned to pasture. Ibis utilise pasture for their food source.	
Outcomes	There are not anticipated to be any impacts on local fauna.	
Residual Impact	None are anticipated.	
offsets	None are required.	

5.5 Wetlands

5.5.1 Baseline Data

Hyd2o makes the following comments about wetlands;

> *"The site is covered partially by multiple use wetlands on its north, west and south boundaries. Conservation category wetlands are located adjacent to the site boundaries at northwest, southwest and northeast.*
>
> *The mining area will be separated from the conservation category wetlands by the required buffers, with no buffer requirements for the multiple use wetlands.*
>
> *Given the sandy profile of the site it is likely that water is infiltrated at source and there is little surface runoff contribution currently directed to the wetlands. This, along with mapped groundwater levels, would indicate that the mapped wetlands are primarily expressions of groundwater, and as such the post mining topographic levels of the development area will not have any adverse effect on the hydrology of the* surrounding wetlands."

The *Melaleuca pressiana* to the north west and south west are listed as a conservation category wetland. These will be protected. The 80 metre setback/buffer is shown on Figure 20 and shows that excavation will not impact the wetlands. Figures 21 and Figure 16.

5.5.2 Environmental Assessment - Wetlands

	Wetlands and Water Management	
EPA Objective	*To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.* *To protect flora and vegetation so that biological diversity and ecological integrity are maintained*	
Statutory Requirements and Guidelines	*Environmental Protection Act 1986 Part IV assessment. (State)* *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.* *Biodiversity Conservation Act 2016. (State).* *Environment Protection and Biodiversity Conservation Act 1999. (Commonwealth).*	
Potential Impacts	Conservation Category wetlands occur to the north west and south west of the sand extraction area. They will not be impacted. See Hyd2o and Figure 16.	
Assessment of Impacts	The distances to wetlands, the groundwater flow directions and potential impacts as considered by Hyd2o The pit will be setback 80 metres from the wetland.	
Mitigation	***Avoid*** The Conservation Category wetlands are excluded from excavation impacts. An 80 metre buffer is provided. ***Minimise*** No excavation activity near the wetland	
Outcomes	Groundwater elevations and flows will not chnage	
Residual Impact	Nil	
offsets	No offsets are required.	

Figure 21: Location of wetlands (Hyd2o)

5.6 Dust

5.6.1 Baseline Data

Environmental Dust

Excessive dust has the potential to impact on both the workers and the adjoining land, and its potential for generation must be taken in context.

There are a number of key aspects to dust impacts;

- What is the source of particles?
- What is the potential for the particles to be disturbed?
- What is the nature of the particles and how are they likely to behave?
- What types of impacts are the particles likely to have if they move?
- What management actions can be used to mitigate or reduce dust impacts?

Commonly called "dust," scientists and regulators refer to the term particulate matter (or PM) to describe the range of particles that exists in the air breathed in.

Particulate matter exists naturally in the atmosphere, eg sea-salt spray and pollens. PM can be increased due to human activities such as vehicle exhaust, industrial processes, power stations, mining, farming and wood heaters, or smoke from bushfires.

Exposure to PM can be associated with health and amenity impacts if the exposure is excessive.

5.6.2 Nature of Dust from Sand

The greatest proportion of dust in any quarry is visible dust. Dust during quarrying operations is only a problem when there is inadequate management of dust lift off. Most management consists of wetting down the products and keeping them moist, with other management being the use of screens and curtains on processing plant.

Sand excavations develop little or no dust during normal excavation as shown by the lack of dust in the existing operations over the years, such as on Lot 242 in the nearby Bronzewing sand pit.

Particulate matter needs to be suspended in the air to carry any distance, and will only carry short distances if the grains are too large to move. Sand grains are too large to become suspended. The particles that are able to be suspended are called Suspended Particulate Matter and the total amount of that is referred to as TSP.

Sand grains are too large to be blown and only move by saltation saltation (bouncing) and are trapped by vegetation. It is only fine organic particles within the topsoil that are likely to generate dust.

Most dust on a sand site is generated;

- during vehicle movements on hard surface such as roads when the road is dry. This is not related to the sand but rather the gravel of the road and is the same as any rural gravel or limestone road.

- when soil are dry, during land clearing and the movement of topsoil by excavation or respreading. The only materials released are the fine organic grey particles in the topsoil and only when the topsoil is completely dry. The sand grains are too large to blow or create dust.

A summary of the sources and proportions of dust can be found in; *NSW EPA and NSW Ministry of Health Environmental Health Branch 2015, Review of the health impacts of emission sources, types and levels of particulate matter air pollution in the ambient air in NSW.*

Even if the sand was screened at some point in the future, little dust is generated and can be readily treated. For such screening activity a DWER Works Approval and Licence will be required to process in excess of 5,000 tonnes per year under *the Environmental Protection Act 1986 Part (V*). Dust will be considered by the DWER at that time if screening was to be used and some form of dust management is normally conditioned on any approval.

The likely risk of these impacts depends on a range of factors including the size, structure and composition of the PM. The various dust particle size is also explained in *DEC (DWER) 2011 Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities. This Guideline supersedes the 1996 Guideline.*

5.6.3 Dust Composition

The normal dust compositions for quarries do not apply to sand excavation because of the large sand grain size and lack of crushing or grinding. As such thee is no risk of ingesting silica or gaining silica in the lungs.

There is data specifically from mining, (predominantly coal) from New South Wales (NSW Health) where particulate levels have been measured to be;

PM <2.5 microns as 2 – 5% of emissions (One micron is 1 / 1000 of 1 mm).

PM< 2.5 are invisible and called "fine particles". They are the main health issue and are caused by vehicle emissions whether they are along roads or on private land. Vehicle emissions will not occur at night or at other times when the site is not active. ***This type of dust risk for the sand excavation is very low and similar to normal farm activities.***

PM 2.5 – PM10 microns as 15 – 45%

PM 10 (particles between 2.5 and 10 microns) are invisible and called "coarse particles". They can be breathed in, but are removed by alveoli and mucous. (NSW Health). This dust may be generated when land is cleared and topsoil disturbed or the site is subject to traffic in summer. On this site the particles will be organic and are unlikely to be generated as the soils stay moist all year round with the rainfall through all months of the year and capillary action through the soils. ***This type of dust risk for the sand excavation is very low.***

PM>10 microns as 50 – 70%

PM>10 is visible dust and, based on the resource which is sand, will not apply as the particles are too large. ***This type of dust risk for the sand excavation is very low.***

Normally all sizes of dust are generated together, and there will be visible dust being generated when invisible dust is being formed. Therefore any ***visible dust present is a good sign and an early indicator of a dust risk.***

5.6.4 Dust Standards - Monitoring

NEPM

To provide for air quality in populated areas an Australian Standard was established.

The Ambient Air Quality NEPM as an instrument was established in 1998 under the *National Environment Protection Act 1994* (NEPC Act) to provide a nationally consistent framework for monitoring and reporting on six common ambient air pollutants – carbon monoxide, lead, nitrogen dioxide, photochemical oxidants (ozone), sulfur dioxide and particulate matter (PM) as the larger size fraction of PM10. It was varied in 2003 to include smaller sized particles, PM2.5.

In 2011 the DWER released Dust Management Guidelines that acknowledged the NEPM standards but rely on visual dust management. Visual dust management is the norm for quarries in Western Australia and in DWER Licences because it has been found to be the most effective and instantaneous as the dust can be seen on generation. Mechanical monitoring has been found not to offer any advantage and quarries and normally have significant time delays in obtaining the data, with the delays usually negating the ability to actually see the source of dust.

Following much review and consultation, the Air NEPM was amended on 4 February 2016 to upgrade the PM2.5 and to add *1-year average PM10 of 25 µg/*m^3 to complement the 24-hour average PM10 of 50 µg/m^3.

An exceedance of 1-day average standards in excess of normal historical fluctuations and background levels, was also added and is directly related to bushfire, jurisdiction-authorised hazard reduction burning or continental-scale windblown dust.

Western Australia has a goal of achieving the National Environment Protection Standard for PM10 in ambient air, in

line with the National Environment Protection (Ambient Air Quality) Measure (NEPM), based on the PM10 for a daily PM10 (visible dust) level that did not exceed 50 µg/m3, with an allowance only for exceedances for 'exceptional' events, such as bushfires.

The NEPM standards listed in DWER Draft Dust Guideline 2021 are shown below but on this site mainly relate to occupational dust, even though the standard relates to general environmental dust. Occupational Dust is managed under the *Work Health and Safety Act 2020 and (Mines) Regulations 2022*. If occupational dust is managed on site then it follows that environmental dust will also be managed. Occupational dust is overseen by the Department of Energy Mines Industry Regulation and Safety.

Table 1: Criteria for dust and associated contaminants

Pollutant	Criteria	Source	Impact
PM_{10}	50 µg/m^3 (24 hour average)	NEPC 2016	Health
	25 µg/m^3 (1 year average)		
$PM_{2.5}$	25 µg/m^3 (24 hour average)		
	8 µg/m^3 (1 year average)		
Lead (Pb)	0.5 µg/m^3 (1 year average)		
Asbestos	0.01 fibres/ml	NOHSC:3003 (2005)	Health
Metals and metalloids	Refer to *Draft Guideline: Air emissions*.		Health

The NEPM is applicable has been found to be readily able to be complied with, even at operating quarries, including hard rock quarries where blasting, crushing and screening are used management. To achieve compliance with the NEPM standards, normal dust management that involves the identification and treatment of visible dust as a very effective means of managing dust has been found to be the most effective.

Sand excavation is at the lowest risk from dust, producing very little dust material. The sand particles are comparatively large and only move in stronger winds by bouncing, when dry and are readily stopped by any vegetation, even pasture.

The NEPM standards are not applicable to this type of sand excavation because the sand is too large to form dust and the amount of impact of potential dust particles is so low.

Machine monitoring for the NEPM does not distinguish between organic and inorganic particles and it has been found in quarries that smoke from bushfires is the leading cause of NEPM exceedances at quarries and does not provide any data on the actual dust generated from the operations.

Depositional Dust

In EPA WA 2020 *Environmental Factor Guideline - Air Quality* the variable methods are used for dust monitoring with NEPM and depositional dust being available.

Depositional rates of dust measurement have been less widely used in Western Australia, but have been used when cheap, widespread and effective measurements are required around large projects. On the other depositional monitoring of dust is widely used in New South Wales including for mine dust.

Depositional types of dust measurement are widely used in New South Wales. For example the City of Newcastle has a dust monitoring program with a large network of depositional dust gauges across the city, the Rozelle Interchange, Lower Hunter Dust Study (EPA NSW, 2016 Lower Hunter Dust Study, prepared by AECOM Australia Pty Ltd), NSW EPA, Environmental Protection Licence 394 Ulan Coal Mines Limited Mudgee NSW. Sydney Recycling Park (Consulting Earth Scientists, 2020), Concrush Recycling Facility Teralba (RCA Australia, 2021).

The NSW EPA provides for a maximum of 4 g/m^2 per m^2 / 30 days and that no more than 2 g/m^2 dust should be added to the environment as a result of site activities. (EDO NSW, 2016 Technical Fact Sheet: Air Quality Dust

Monitoring and NSW Health 2017, Factsheet Mine Dust and you).

The EPA NSW provides for dust deposition criteria of 4g/m2/month as detailed in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2016). Table 3. This uses AS/NZ 3580:1, Methods of sampling and analysis of ambient air.

The NSW EPA depositional monitoring provides for a maximum deposition of 4 g/m^2 per m^2 / 30 days and that no more than 2 g/m^2 dust should be added to the environment as a result of site activities. (EDO NSW, 2016 Technical Fact Sheet: Air Quality Dust Monitoring).

The NSW EPA accepts data from networks of AS/NZ 3580:1 depositional monitors. Neither high volume samplers nor continuous particle monitors are appropriate for monitoring the current dust levels at site, because they do not separate out the organic matter from the inorganic matter or dust or the source.

Static monitors collect the dust which can be analysed and organic dust separated from mineral quarry dust and therefore depositional monitoring is more applicable to quarries where dust is to be quantified. That can provide data on the total dust and if directional collectors are used directional data will also be available.

Visual Dust Monitoring

As outlined below in the comments on the available monitoring types, the NEPM is not the best day to day management for monitoring quarry dust. The techniques used to obtain NEPM data are normally time delayed and only relate to a small part of the operation. There are simpler and better methods using AS/NZ 3580:1 depositional monitors and statistic directional monitors which provide long term data from around the site.

That is the on site observational assessments of dust and depositional measurements of dust and comparisons to known sites have proved to be the most effective method of dust monitoring. That combined with historic records and observations such as Bronzewing Investments experiences with sand extraction on Lot 242 demonstrate that visual dust monitoring is the most effective for smaller low risk quarries and is the only method used in most quarries.

All quarries in Western Australia use visual dust monitoring because it is the easiest and most reliable and most effective, form of monitoring leading to dust management. Other methods such as depositional dust and or NEPM

Dust as generated is visible, the source and cause is obvious, and there are no time delays, it has been found to be highly representative of general dust including invisible dust.

It has been found in quarries that if visible dust is controlled any invisible fractions of dust are also controlled

5.6.5 Tree Belt - Buffers

Dust particles are readily stopped by tree belts and distance, with which the site complies. Tree belts slow the wind and allow the dust to settle. See *Planning Guidelines Separating Agricultural and Residential Land Uses, Department of Natural Resources Queensland 1997 (Pages 65 – 111) and Department of Health WA, 2012, Guidelines for Separation of Agricultural and Residential Land Uses which uses the same criteria (Pages 112 – 118).*

The Queensland Guidelines predominantly relate to agricultural spray drift, but based on particle size also relate to dust.

The Guidelines provide for a buffer of 300 metres for open agricultural land, dropping down to 40 metres where an effective tree belt is in place. The Western Australian Department of Health also uses the same guidelines.

The Guidelines are based on field studies and demonstrate the effectiveness of tree belts and distance in providing screening against particulate travel.

The closest dwelling is set at a minimum distance of 260 metres from the closest edge of the proposed pit. Sand does generate dust, but rather it is the access roads and clearing land in summer. The southern part of the pit will be excavated when the soils are moist to minimise dust risk to the dwellings. Figures 8 and 16.

5.6.6 Assessment of Dust Risk – DWER 2011

Dust Guidelines

Dust management is an integral part of the extraction and processing of any basic raw material.

The most common form of disturbance is by mobile plant and vehicle impacts. In this local area dusty roads have the most potential to produce dust, such as the access road which is no different to any other local unsealed road.

The potential for dust emissions falls under the *Guidance for the Assessment of Environmental Factors, EPA, March 2000.* Assessments of the potential dust risk are normally made using the Land development sites and impacts on air quality, *Department of Environmental Protection and Conservation Guidelines, November 1996.*

These guidelines are still in place but are incorporated into the *DEC (DWER) 2011 Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities.*

The DEC (DWER) in 2008 released a draft Guideline for the Development and Implementation of a *Dust Management Plan. DWER Draft Dust Guideline 2021* but the generic risk is still determined by the 2011 Guideline.

The nearby Lot 242 sand pit has operated site over 10 years. Effective dust management is in place at that pit and has proven to be effective.

Even so a dust risk assessment has been completed using the DEC (DWER) 2011 Guideline for the proposed pit on Lot 1.

Table 3: Dust Risk Assessment to DWER 2011

PART A Number	**Item**	
		Score
1	Nuisance potential of the material	Low for excavated material and with dust control in place - 2
2	Topography and vegetation screening	Screened and sheltered - 1
3	Area of site activities	Active trafficked areas at any one time are 1 - 5 hectares in area - 3
4	Type of work being undertaken	The small scale of excavation is equivalent to partial earthworks - 6
	Summer total without dust measures	Maximum = 12

PART B Number	**Item**	
		Score
1	Distance to premises	Premises to the south - 6
2	Effect of prevailing wind	Isolated premises affected by one wind direction The premises is not really affected, not in the path of prevailing winds which are easterly and south westerly - 1
	Total Part B	Maximum = 7

Activity	Calculated Score Part A x Part B	Allocated Risk of Dust
Excavation **with or without** dust suppression.	**Maximum** **Premises = 12 x 8 = 84**	**Classification 1** **Negligible Risk,** The actions and contingencies proposed are consistent with the DWER Policy Dust management will be required for pit best practice and worker environment.

5.6.7 Buffers

Apart from one small area in the southern part of the resource, the proposed sand operations comply with the EPA Generic Buffers for sand excavation. That section of land will be excavated when the soils and resource is moist.

5.6.8 Occupational Dust

There is very low risk from occupational dust to workers on site, and if dust levels on site are low they are also low offsite.

5.6.9 Environmental Assessment - Dust Impacts

	Dust Assessment and Management	
EPA Objective	*To maintain air quality and minimise emissions so that environmental values are protected.* *To maintain the quality of land and soils so that environmental values are protected.*	
Statutory Requirements and Guidelines	*DEC (DWER) 2011 Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities.* *Department of Natural Resources Queensland (1997) Planning Guidelines: separating agricultural and residential land uses. Department of Health WA, 2012, Guidelines for Separation of Agricultural and Residential Land Uses.* *EPA (WA) Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses (Guidance Statement No. 3) (2005)* *EPA (WA) Environmental Factor Guideline – Air Quality (2016)* The *Ambient Air Quality NEPM* as an instrument was established in 1998 under the *National Environment Protection Act 1994 (NEPC Act).* *DWER (Draft) 2021 Guideline Dust Emissions.* Occupational dust associated with the quarrying processes falls under the *Work Health and Safety Act 2020 and (Mines) Regulations 2022.*	
Potential Impacts	The only potential impacts are the generation of dust from land clearing, site activities and vehicle movements. The most significant dust risk is from vehicle movements on access and haul roads.	
Assessment of Impacts	Bronzewing Investments have operated a sand pit for over ten years on Lot 242 and have found the dust risk minimal and mainly related to traffic on unsealed roads. Apart from the extreme southern portion of the pit the setbacks comply with EPA Generic Guidelines. Excavation in that small area will be completed when the soils are moist. Figure 16.	Figure 16
Mitigation	***Avoid*** The pit has been chosen to provide buffer distances in excess of DWER, EPA and Department of Health Guidelines for almost all of the quarry apart from the southern	Figure 14

	40 metre strip. ***Minimise*** The scale and intensity of the operations are similar to the existing pit on Lot 242. As far as is known there have been no noise complaints relating to current or past excavation activities. The methods of excavation and staging have been selected to operate from the floor of the pit and minimise dust risk generation. Land clearing and re-instatement will be conducted when the soils are moist. Excavation in the small southern area will be completed when the soils are moist. Any screening plant will be located at a distance of greater than 300 metres from the dwelling to the south and on the floor of the excavated pit. Areas of disturbance that are no longer required are closed and revegetated as soon as possible. The vegetated pasture buffers to the closest dwellings are to be maintained. A rehabilitation plan is provided at Section 6. ***Monitoring*** When dust visual trigger conditions are detected and/or alerted, relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc. Human monitoring can detect potential dust risks prior to, and take action prior to, significant dust being generated. The auditable condition is visible dust crossing the boundary of the premises; the lot boundary. This is the condition used on Department of Water Environmental Regulation Licences and all other quarries such as sand, limestone, gravel and hard rock quarries in Western Australia and has worked well in the past. Visual dust observations are also the method used by the DEMIRS and DWER to rapidly assess occupational dust on site. The quarry manager and leading hand are ultimately responsible for site supervision of dust. They will travel around the operations and pit frequently and are in two way radio contact with all mobile plant. This method has operated successfully during the past 20 years. All operators on site are to be instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues. Visual monitoring is even more effective when complemented by an extensive reporting and complaints process and this will be used. A complaints system is in place to record and manage dust complaints. As far as is known there have been no complaints relating to dust impacts on the pit nearby Lot 242 operated by Bronzewing during the past 10 years.	
Outcomes	Dust has been effectively managed at other Bronzewing Investments Quarries and will be able to be managed at this location.	
Residual Impact	There are not anticipated to be any residual impacts.	
offsets	There are not anticipated to be any residual impacts from dust that need to be offset.	

5.7 Noise

5.7.1 Baseline Data - Noise

Noise can originate from a number of operations and may impact on onsite workers, or travel offsite and impact on external sensitive premises. Both potential noise impacts are addressed by reducing the noise generated from the quarrying and processing operations.

Noise Regulation

Offsite noise is governed by the *Environmental Protection (Noise) Regulations 1997*.

The Environmental Protection (Noise) Regulations 1997, require that sensitive premises including dwellings in non industrial and rural areas, are not subjected to general noise levels (excluding blasting), during the hours 7.00 am to 7.00 pm Monday to Saturday that exceed 45 dBA. Allowable noise to 55 dBA is permitted for up to 10% of the time and to 65 dBA for 1% of the time. Noise levels are not to exceed 65 dBA during normal working hours.

Between 9.00 am and 7.00 pm on Sundays and Public Holidays, and between 7.00 pm and 10.00 pm on all days, the base level is 40 dBA.

At night, between 10.00 pm and 7.00 am Mondays to Saturday, and before 9.00 am on Sundays and Public Holidays the permitted level drops to 35 dBA.

The 10% and 1% "time above" allowances apply at night and on Sundays and Public Holidays as well.

There are penalties for tonality of 5 dB, modulation 5 dB and 10 dB for impulsiveness, that are added to the permitted levels. That is, if the noise is tonal or modulated the permitted levels drop by 5 dB. Impulsiveness is not likely to be relevant for the quarry under normal circumstances.

The Noise Regulations provide for Construction Noise exemptions to enable construction of the site such as the building of the screening bund and opening the pits.

Influencing factors that raise the allowable noise levels are activities such as external industrial noise, some nearby land uses and busy roads. These are not relevant to this site.

Under Schedule 1 of the Noise Regulations the premises on which the extraction of basic raw materials are extracted, is classified as Industrial Land for the purposes of calculating influencing factors. This was defined as the whole cadastral boundaries in *State Administrative Tribunal decision {2013} WASAT 139, Bushbeach v City of Mandurah*. In this case the premises is quite small and approximates the area of disturbance and will have little impact on the influencing factors.

At a distance greater than 15 metres from the sensitive premises (eg dwelling), and commercial premises, a base level of 60 dBA applies at all times, with the 10% time permitted to be up to 75 dBA and the 1% permitted to be up to 80 dBA. For industrial premises the base level is 65 dBA at all times with the 10% time permitted to be up to 80 dBA and the 1% permitted to be up to 90 dBA.

Excavation will be worked from inside out on the floor of the pit working below natural ground level with a perimeter low bund of topsoil stored to be respread at closure.

Based on the nature of the sand, equipment used and excavation methods, the extraction of sand has the lowest impact and even the generic buffer of 300 metres is too large for noise mitigation based on the proximity of dwellings to sand pits in the Perth and Peel Regions and in other parts of the State.

If required a DWER Works Approval and Licence under *Part V of the Environmental Protection Act 1986* will be applied for in relation to the screening of sand in excess of 5,000 tonnes per year. At this time screening of the sand is not anticipated.

5.7.2. Occupational Noise

The management of occupational noise is normally handled by providing all necessary hearing protection, as well as conducting worker inductions and educational programs for all staff, and hearing tests which are required. Regular site audits of quarry and mining operations are normally conducted by the Department of Energy Mines Industry Regulation and Safety.

All staff will be regularly checked for hearing under the *Work Health and Safety (Mines) Regulations*, 2022 the SRS

and Project Management System that are required under DEMIRS safety regulation.

5.7.3 Environmental Assessment – Noise Impacts

	Noise Assessment and Management	
EPA Objective		
Statutory Requirements and Guidelines	Offsite noise is governed by the *Environmental Protection (Noise) Regulations 1997*. *DWER (Draft) 2021, Guideline- Assessment of Environmental Noise Emissions*. Occupational noise associated with the quarrying processes falls under the *Work Health and Safety Act 2020 and (Mines) Regulations 2022.*	
Potential Impacts	Noise might impact the nearby residences.	
Assessment of Impacts	Bronzewing has operated a sand quarry on Lot 242 for over 10 years without any excessive noise impacts. The scale and intensity of the operations are similar to the existing pit on Lot 242. As far as is known there have been no noise complaints relating to current or past excavation activities.	
Mitigation	***Avoid*** The site and design of the pit has been selected based on the resource location, and the excavations designed to maximise the setbacks and minimise noise impacts to the closest sensitive premises. Apart from one small southern area the setbacks are in excess of Department of Health, EPA and DWER Guidelines for noise and much greater than many operating sand and limestone pits all of which are compliant. ***Minimise*** The crossover is to be sealed bitumen to minimise transport noise. All mobile plant will be maintained in good condition with efficient mufflers and noise shielding. The staging and direction of excavation is behind the pit face to use landform to minimise noise carry. Only one loader is proposed and is similar in noise impact to a farm tractor. Lights or low frequency frog beepers are to be used rather than high pitched beepers to restrict noise intrusion. A complaints recording and investigation procedure is implemented and maintained. All complaints will be recorded, investigated and if substantiated action taken to correct the issue raised.	Figures 14 and 16
Outcomes	Noise has been effectively managed for the past 10 years on Lot 242. As the sand excavation will progress from the approved pit to the proposed pit and there are not proposed to be any increases in the scale and intensity of sand excavation noise management will be able to be effectively managed.	
Residual Impact	There are not anticipated to be any residual impacts.	
offsets	There are not anticipated to be any residual impactsfrom noise that need to be offset.	

5.8 Weed Management

Weed management is to be used to minimise impact on site remnant vegetation and on adjoining properties. Good management practices are to be used as part of the ongoing normal quarry operations.

Weed management is conducted as part of normal farm management and for the excavation will be incorporated into that system.

The management of weeds is essentially similar to that for plant diseases. The impact of weeds is really the impact within the local area and the more they are controlled the better. It is desirable that the site does not become a haven for environmental weeds and therefore a management and control program is warranted at all sites.

Weeds can be declared under the *Agriculture and Related Resources Protection Act 1976* which requires that Declared Weeds are eradicated. Other weeds are not Declared but may be classified as Environmental Weeds because they are well known for impacting on vegetation.

Generally if the actions taken for Dieback are applied they will also control weeds. Not all potential impacts will apply to this quarry and the main impacts affecting this site are also listed, although on this site with no native vegetation impacted or to be returned dieback management will not be required.

Weed management will be used to minimise impact on site and on adjoining properties. Good management practices will be used as part of the ongoing normal quarry operations.

This plan utilises the most appropriate on ground measures to minimise the risk of spread of Declared and Environmental weeds. The information provided here summarises the key points of the on ground management.

Weeds are most likely to impact on;

- Disturbed areas such as overburden dumps, topsoil stockpiles.
- Edges of access roads.
- Edges of firebreaks adjacent to surrounding vegetation.
- Locations accessible to the public on which rubbish is dumped.

The main sources of weeds are;

- Naturally occurring in topsoil.
- Weeds from edge effects from access and local roads.
- Gradual creep of weeds along access roads.
- Rubbish dumped by the public.
- Materials or waste brought to site by employees.
- Soil and seeds from vehicles arriving at site. This often applies to trucks that have carried something else such as grain, or vehicles to be used in earthworks.
- Wind blown seed from surrounding land.
- Birds and other vectors. This is more common than is often given credit for. eg Solanum species.

Weed Management will consist of, but not be limited to, the following actions.

- Inspections are to be conducted to monitor the presence and introduction of Environmental and Declared Weeds on an annual or more frequent basis. On identification, Declared and significant environmental weeds will either be removed, buried, or sprayed with a herbicide.
- Large plants such as Castor Oil plants and Declared Weeds are to be periodically grubbed out or spot sprayed with a herbicide.

- Rehabilitation of the final land surface will be to interim revegetation for soil stabilisation. This will not involve the elimination of exotic species, but rather provide an interim cover that stabilises the soil. Weeds that impact on that interim cover will be treated.

- All vehicles and equipment to be used during land clearing or land reinstatement, are to be clean and free from soil or plant material when arriving at site.

- No soil and vegetation will be brought to the site apart from that to be used in rehabilitation.

- Vegetated areas ahead of excavation will be quarantined to excavation vehicles until required.

- Illegally dumped rubbish is the major source of weeds and will be removed promptly.

- Weeds are to be sprayed with broad spectrum spray prior to planting or seeding in weed affected soils as required.

- Weed management will work from the least affected areas to most affected.

- Ongoing monitoring of weeds should be undertaken at least annually in autumn, prior to winter rains as part of the normal farm management.

6.0 CLOSURE AND REHABILITATION

6.1 End Use

The proposed pit will be returned to improved pasture. The floor will be 0.5 metres above the highest water table (See Hyd2o) and rise gently from 12.5 m AHD in the west to 13.25 m in the east.

6.2 Rehabilitation Trials

The existing pit on the nearby Lot 242 operated by Bronzewing Investments has demonstrated that pasture can readily be returned on sand excavations.

6.3 Permanent Closure

The Closure Implementation describes the methods of permanent closure, progressive closure of each stage of the operation and at the end of excavation

Maintenance and monitoring will be conducted until completion criteria is met.

Land restoration and rehabilitation of any completed stages or areas will be conducted prior to the ground being vacated at the end of each campaign.

Unexpected or early closure will be completed in the same way as permanent closure below but the full rehabilitation will be completed as one operation.

The key issues are to;

- Make the site safe,
- After excavation ensure the impact on the environment and amenity is restored over time as the revegetation grows to maturity.

6.4 Rehabilitation Outcomes

Based on the identified environmental impacts the following Environmental Outcomes are proposed. These will form the basis for closure planning and the outcomes against which the success of the site closure and revegetation is measured.

Where the Rehabilitation Outcomes are not met additional work will be undertaken to bring the closed land into compliance with the outcomes.

Rehabilitation Outcomes

- Compliance with Conditions of Approval and commitments made.
- Stakeholder requirements are incorporated into the operations and closure.
- The closed landform has a form that is similar to adjoining agricultural land.
- The end landform is safe and minimises erosion.
- The reconstructed soils are capable of supporting appropriate pasture.

- No additional weed load as a result of mining activities that will adversely impact on the environmental values of the local area.
- No introduction of dieback disease.
- No unapproved contaminated materials as a result of excavations.
- Cover of pasture suitable for grazing..

6.5 Materials Characterisation for Closure and Rehabilitation

Table 4: Materials Characterisation for closure

Material Type	Comment	Treatment
Soil	Topsoil is natural leached quartz sand.	No specific action required. Topsoil will be recovered during land clearing, for use in revegetation. The amount of topsoil to be recovered is generally around 500 m^3 per hectare. This will be stored in temporary perimeter bunding if it cannot be directly spread. The material is natural and contains no detrimental materials to revegetation.
Subsoils	Subsoil of leached white and yellow sand.	The lower elevation yellow sand is slightly earthy and has better water and nutrient holding capacity than the leached white surface sand and will provide a better substrate for planting of the revegetation. Further lowering the surface will enable better summer soil moisture to retain grass longer through summer.
Waste sand, rock and non surface material	There will be no waste materials.	There are no known waste materials currently on site.
Groundwater	The water quality is fresh.	There is no surface water. Rainfall on site percolates vertically down to the water table. A separation of 0.5 metres is proposed. Water monitoring bores are in place. (See Hyd2o report; attached)
Limestone road and hardstand	These are used to form roads during mining.	The roads are constructed from inert materials which will be picked up on closure unless retained for future land use access.
Contaminated Goods and Hazardous Materials.	**FUEL** The various plant will be refuelled from mobile tanker.	Any soil or other materials with drips and spills will be removed offsite to an approved waste site or location. None will remain as they are scooped up when noticed
	SERVICE MATERIALS	Any wastes will be collected and removed from site promptly to an approved recycling or waste disposal area. Only minor servicing will be conducted on site. All major servicing will be conducted offsite.
	GENERAL WASTE	Regularly removed from site to an approved disposal area.

6.6 Closure and Revegetation

Table 5: Closure and Rehabilitation

Step	Closure and Revegetation Actions	When	By Whom
Seed Collection – Tube Plant Growth – Seed Bank	➢ All topsoils and pasture will be retained at land clearing and respread on closure of each section as the main seed source. ➢ Commercial seed will be applied as necessary.	Annually at suitable time of the year	Operator
Land Clearing	➢ Pasture and topsoil clearing will be progressive and minimised to that required for each stage of excavation by pushing it into windrows at the perimeter of the excavation.	During clearing	Operator
Topsoil Recovery	➢ The vegetation within the proposed pit is weed free. ➢ The topsoil cover of 50 – 100 mm will be pushed to the edge of the current excavation in separate windrows where available. ➢ If direct transfer is not possible the vegetation will be stored in low dumps to 1 metre high or swapped with a nearby operator to try and ensure that the material is not wasted. ➢ Studies have shown that topsoil stripping and placement is best undertaken in summer for maximum germination and this will be done, but this raises the potential for additional dust generation from the fine humus particles.	During pit reparation	Operator
Overburden	➢ No overburden is available for treatment.		
Excavation	➢ Progressive excavation will occur. As new ground is opened completed ground will be closed and rehabilitated.	Within 6 - 12 months	Operator
Stakeholder Consultation	➢ Review of all conditions of approval. ➢ Consult with the Shire of Murray, as necessary. ➢ Comply with legal requirements and commitments.	Prior to completion of each stage.	Operator
Landform Restoration	**Site Safety** ➢ The site is to be cleaned and all structures and constructions are to be removed. ➢ Mobile plant and other equipment not required will be removed from site. ➢ The completed land will be made safe and in compliance with the Work Health and Safety (*Mines) Regulations 2022* and DEMIRS *Mine Closure Guidelines*. ➢ The reformed land surface will be porous and resistant to water erosion. ➢ Holes, sumps drains, ditches and the like will be filled, fenced, signed, marked or removed if they present a short term safety hazard. ➢ Roadbase, hardstand and any other inert materials left over from the site operations will be scraped and picked up and will be removed from site unless required for future farm access. **Potential Contamination** ➢ All hydrocarbons and other fluids will be removed.	Progressive closure and landform reconstructi on will take place as soon as possible following mining. Within 6 months	Operator

Step	Closure and Revegetation Actions	When	By Whom
	➢ All waste products will be removed, ➢ All contaminated limestone and sand, and other materials will be removed. **Landform Reconstruction** ➢ Land restoration is to occur as soon as possible following the end of excavation on each stage of pit floor and batter slope. This is to be completed progressively by the normal mobile plant that operates on site during campaigns. A loader will be able to undertake this. ➢ The floor will be formed to be internally draining, and will permit precipitation to soak into the soils in the same manner as the natural local swales. ➢ The final land surface will be formed at a separation of at least 0.5 metres of sand to the highest known groundwater groundwater determined by ongoing monitoring. (See Hyd2o report; attached). ➢ 12.5 m AHD in the west to 13.25 m AHD in the east. **Pit faces – Geotechnical** ➢ The maximnum face elevation will be 3 metres with most in the range 1 – 2 metres. ➢ The pit will be prepared by pushing down, reducing and backfilling the active face with a loader. ➢ The batter slopes and pit faces will be left at a minimum of 1 : 3 vertical to horizontal.		
Hard Surface Removal	**Hardstand** ➢ Roadbase, hardstand and any other inert materials left over from the site operations will be scraped and picked up and will be removed from site unless required for future farm access.	Within 6 months	Operator
Erosion control	**Water Erosion** ➢ Soil erosion occurs when soil is exposed and disturbed by wind or water erosion. ➢ As the sand is porous there will be no need for upslope contour or diversion banks to prevent water entering the void. Similarly there will be no need for drainage works on the floor of the void. The floor will be formed to drain to low points to manage storm events. ➢ Water erosion on the batter slopes will be avoided by the permeability of the materials and by leaving the surface soft, and the maximum 1 : 3 vertical to horizontal slope. **Wind Erosion** ➢ If wind erosion and soil stability become an issue, measures will be taken to stabilise the soils. These could include but not be limited to fence wind breaks, spray mulching, interim native vegetation, spreading mulch and vegetation or spray stabilisation. ➢ For rehabilitation areas, interim revegetation will take place as soon as possible following landform and soil reconstruction. ➢ Control of wind erosion potential will be assisted by spreading brush and vegetation across the topsoil on the batter slopes and reconstructed soils where local native vegetation is to be established.	As required and within 1 month of erosion occurring	Operator
Revegetation	➢ Rehabilitation will take place during the first 6 months following closure. Leaving the completed earth works for one season will reduce the success of rehabilitation by at least 50%, due to	First months following the	Operator and Bronzewing

Step	Closure and Revegetation Actions	When	By Whom
	compaction effects. **Sources of Seed** ➢ Cleared topsoil and pasture with commercial top up if required. **Establishment of pasture** ➢ Topsoil provides the best source of seed for pasture establisment when the correct handling of the topsoil is used, stripped and replaced dry (autumn direct return). ➢ However if sufficient seed is not available or does not germinate then additional seed will be added. The establishment of pasture, including the selection of the pasture species is appended to this Management Plan. The documentation is produced by the Department of Agriculture and Food. ➢ For pasture land in this situation it is essential that the species are matched to the soil types and rainfall. The location falls into the "High Rainfall Coastal" planting regime with sandy to loamy gravel soils. Suitable perennial legumes include Birdsfoot trefoil, Lucerne, Strawberry Clover, and Sulla. Perennial pasture includes Perennial Ryegrass, Phalaris, Cocksfoot, and Summer Active Tall Fescue, Kikuyu and Rhodes Grass. Annual pasture species include Italian Ryegrass, Serradella, subterranean clover. ➢ The actual species used will be determined by the individual season, nature of the rainfall in the preceding months and stocking/hay production proposed by the landholder which may change from time to time. ➢ Seeding rates are 2 – 5 kg/ha depending on the species used; for example Ryegrass is seeded at 3 kg/ha whereas Rhodes Grass is seeded at 4 kg/ha. ➢ Studies have shown that topsoil stripping and placement is best undertaken in summer for maximum germination, but this raises the potential for additional dust generation from the fine humus particles. ➢ Fertiliser is not always required and will add nutrients to the ground water. If used a fertiliser containing low nitrogen, low phosphorous and potassium, and trace elements, is recommended to be spread at rates of up to 100 kg/hectare, applied to rehabilitation areas in the year of planting. ➢ Further investigation will be needed to determine suitable rates and the timing of fertiliser application. It may be possible to integrate seed dispersal and fertilisation into a single pass. The fertiliser will need to supply macro-nutrients, phosphorus, nitrogen and potassium, and other micro-nutrients. **Tree Belt along Corio Road**	restoration earth works of each particular section of quarry. Within 6 – 12 months.	

Step	Closure and Revegetation Actions	When	By Whom
	The trees will be established at two rows 3 metres apart between the rows and 3 metres between the trees, planted alternately. Planting will be in ripped lines with the pasture killed to remove competition. The species used will be fast growing local native species such as; *Agonis flexuosa* *Casuarina obesa* *Corymbia (Eucalyptus) calophylla* *Eucalyptus laeliae* *Eucalyptus lane-poolei* *Eucalyptus marginata (sandplain)* *Eucalyptus megacarpa* *Eucalyptus patens* *Eucalyptus rudis* *Melaleuca preissiana* The species will be tube planted. **Weed Control** ➢ Any weeds likely to significantly impact on the rehabilitation will be sprayed with Roundup or similar herbicide or grubbed out, depending on the species involved. Weed affected topsoil and overburden will be buried. The Weed Management Plan will form the basis of weed treatment. Depending on the nature of the planting substrate, a broad spectrum spraying program may be used. In areas where grass only is a potential problem, grass specific sprays will be used. In some areas where topsoil from cleared native vegetation is available no spraying may be required. **Dieback Management** ➢ As there is no native vegetation and pasture is to be returned, treatment for potential dieback is not required.		

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Western Australian Planning Commission, State Planning Policy No 4.1, State Industrial Buffer Policy.

3 December 2024

Your Ref:
Our Ref: H24068Av1

G & G Corp
1/219 Midland Rd
Hazelmere WA 6055
ATTENTION: David Woo

Dear David,

RE: LOT 1 CORIO RD RAVENSWOOD HYDROLOGICAL REPORT

Hyd2o was commissioned by G&G Corp in October 2024 to prepare a hydrological report for Lot 1 Corio Road Ravenswood (the site) to estimate site groundwater levels in support of the establishment of an extractive industries design level for the property.

This report outlines the installation of groundwater bores at the site and provides average annual maximum groundwater level and maximum groundwater levels (AAMGL and MGL) calculations and contour mapping based on winter 2024 groundwater levels.

The report also discusses the local hydrology and wetlands in the site vicinity and proposes a sand extraction design level based on hydrological findings.

1. MONITORING PROGRAMME

Four groundwater monitoring bores were installed via auger by Hyd2o in the superficial aquifer at the site on 10 October 2024, with bores located strategically to provide coverage of the site.

Bores were constructed suitable for water level monitoring and were surveyed to Australian Height Datum by MNG. Soil profile logs for each bore were completed by Hyd2o and are contained in Appendix A. The bore profiles were generally dark grey to grey, fine to coarse sand, sub-angular and sub-rounded, with medium organic content within the topsoil. The findings are consistent with Gozzard (1978) environmental geology mapping.

Water level monitoring was undertaken on 10 October 2024 at the four installed bores, and one Department of Water and Environmental Regulation (DWER) bore within close proximity to the site. The monitored DWER bore (HS94A) has been recorded since 2008 which allows for onsite groundwater measurements to be referenced to long term local groundwater records for consistency and calculation of the average annual maximum groundwater level (AAMGL) for the site.

A plan showing the location of all groundwater monitoring bores is provided as Figure 1.

2. MONITORING RESULTS AND AAMGL/MGL CALCULATION

The groundwater levels recorded at each monitored bore are shown in Table 1. The AAMGL and MGL for the DWER bore with long term record (HS94A) are presented in Table 2 and Table 3 respectively for the extent of its record (2008-2024) which is considered representative of current climate conditions.

The 10 October 2024 groundwater reading for bore HS94A was compared against its calculated AAMGL and MGL values for the period 2008-2024. The result of the comparison is shown in Tables 2 and 3 respectively. The difference between the 2024 winter reading and the calculated AAMGL/MGL was then used to estimate AAMGL/MGL groundwater levels for site bores, and these adjusted values are presented in Table 4.

The AAMGL ranges from 12.00 mAHD at bore GW3 to 12.68 mAHD at bore GW1. Similarly, the MGL at the site bores ranges from 12.23 mAHD to 12.91 mAHD. Figure 2 shows the site AAMGL contour map based on the calculated values for each site bore, with regional groundwater flow generally towards the low-lying areas to the west of the site.

Using LiDAR DTM data from DWER and a topographic survey conducted by MNG, the clearance above the calculated AAMGL and MGL at the site varies significantly across the site (Figure 3). In the southwestern corner, the AAMGL and MGL is approximately at natural surface, while in the elevated central region, the AAMGL clearance ranges up to 3.6m.

It should be noted the Department of Water 2015 Selection of Future Climate Projections for Western Australia report indicates further annual rainfall reduction in the region of approximately 10% from current levels is expected to 2050 (median climate projection), indicating future groundwater levels are likely to be lower than estimated in this report.

Table 1: Groundwater Level Monitoring Results

Bore	Installed	Easting	Northing	Top of Casing mAHD	Natural Surface mAHD	Groundwater Level 10/10/2024 mAHD
GW1	Hyd2o	394743	6397440	13.86	13.58	12.72
GW2	Hyd2o	394685	6397621	13.32	12.90	12.43
GW3	Hyd2o	394394	6397368	12.92	12.52	12.04
GW4	Hyd2o	394740	6397036	13.33	12.96	12.41
HS94A	DWER	394982	6397627	14.41	13.82	12.83

Table 2: DWER Bore AAMGL

DWER Bore	Monitoring Period	Groundwater Level (m AHD) 10/10/2024	AAMGL (2008-2024) (m AHD)	Correction Factor for Site Bores to AAMGL (m)
HS94A	2008-2024	12.83	12.79	-0.04

Table 3: DWER Bore MGL

DWER Bore	Monitoring Period	Groundwater Level (m AHD) 10/10/2024	MGL (2008-2024) (m AHD)	Correction Factor for Site Bores to MGL (m)
HS94A	2008-2024	12.83	13.02	+0.19

Table 4: Estimated Site Bore AAMGLs and MGLs

Bore	Natural Surface (m AHD)	Groundwater Levels 10/10/2024 (m AHD)	AAMGL (m AHD)	MGL (m AHD)
GW1	13.58	12.72	12.68	12.91
GW2	12.90	12.43	12.39	12.62
GW3	12.52	12.04	12.00	12.23
GW4	12.96	12.41	12.37	12.60

3. ESTABLISHMENT OF MINE FLOOR LEVEL

Water Quality Protection Note 15: Basic Raw Materials Extraction (DWER, 2019) requires an adequate vertical separation to be provided between the base of extraction and the highest groundwater level to protect water quality and prevent evaporation loss, during and after extraction. It is stated that this vertical separation distance will be determined in the planning and approval process, and as such will be supported by this report.

Setting of any mining excavation level also requires consideration of any future land use following the completion of mining works. As such considerations should be made based on the zoning of the site as 'rural' in the Shire of Murray's latest planning scheme.

Given Hyd2o have previously received DWER advice for a 0.3m separation to MGL requirement based on sand mining works over land with similar relevant considerations, and given a difference for the nearby DWER bore of approximately 0.2m from AAMGL to MGL, a 0.5m clearance above AAMGL is considered appropriate to adopt for the site in relation to establishing a suitable mine floor level.

4. WETLAND PROTECTION

The site is covered partially by multiple use wetlands on its north, west and south boundaries. Conservation category wetlands are located adjacent to the site boundaries at northwest, southwest and northeast (Figure 4).

The mining area will be separated from the conservation category wetlands by the required buffers, with no buffer requirements for the multiple use wetlands.

Given the sandy profile of the site it is likely that water is infiltrated at source and there is little surface runoff contribution currently directed to the wetlands. This, along with mapped groundwater levels, would indicate that the mapped wetlands are primarily expressions of groundwater, and as such the post mining topographic levels of the development area will not have any adverse effect on the hydrology of the surrounding wetlands.

5. CONCLUSIONS/RECOMMENDATIONS

This report has been prepared by Hyd2o to support the establishment of extractive industries (sand) mine floor level at Lot 1 Corio Rd.

The data collected from the site's monitoring bores in winter 2024 and adjacent DWER long term bore HS94A, has enabled the AAMGL and the MGL to be mapped across the site. The calculated AAMGL ranged from 12.00 mAHD at bore GW3 to 12.68 mAHD at bore GW1, with the MGL ranging from 12.23 mAHD to 12.91 mAHD.

The establishment of a mine floor level at 0.5 m above the mapped AAMGL is considered appropriate based on agency guideline documentation and the sites rural zoning.

It is recommended that ongoing groundwater monitoring be undertaken during the mine life and this data be used to refine groundwater mapping to reflect current climate conditions and with a view to optimising resource extraction and protecting groundwater resources and wetlands.

6. REFERENCES

Department of Water and Environmental Regulation, 2019. Water Quality Protection Note 15: Basic Raw Materials Extraction.

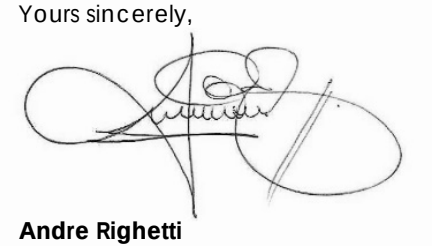
Department of Water and Environmental Regulation, 2024. Water Information Reporting. Accessed online November 2024.

Department of Water 2015, Selection of Future Climate Projections for Western Australia, Water Science Technical Series, Report no. 72, Department of Water, Western Australia.

Gozzard, J.R., 1978. Pinjarra Sheet 2032 I, Environmental Geology Series. Geological Survey of Western Australia, Department of Minerals and Energy, Perth.

Should you have any queries regarding this report, please do not hesitate to contact Andre Righetti or Sasha Martens of this office.

Yours sincerely,



Andre Righetti
Environmental Hydrologist

Attachments

This document is published in accordance with and subject to an agreement between Hyd2o and the Client for whom it has been prepared, and is restricted to those issues that have been raised by the Client in its engagement of Hyd2o. It has been prepared using the skill and care ordinarily exercised by hydrologists in the preparation of such documents.

Hyd2o recognise site conditions change and contain varying degrees of non-uniformity that cannot be fully defined by field investigation. Measurements and values obtained from sampling and testing in this document are indicative within a limited timeframe, and unless otherwise specified, should not be accepted as conditions on site beyond that timeframe.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by Hyd2o and the Client does so entirely at their own risk. Hyd2o denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

FIGURES

Date: 29/11/2024 Job No. H24068

Site Boundary

Groundwater Monitoring Bores

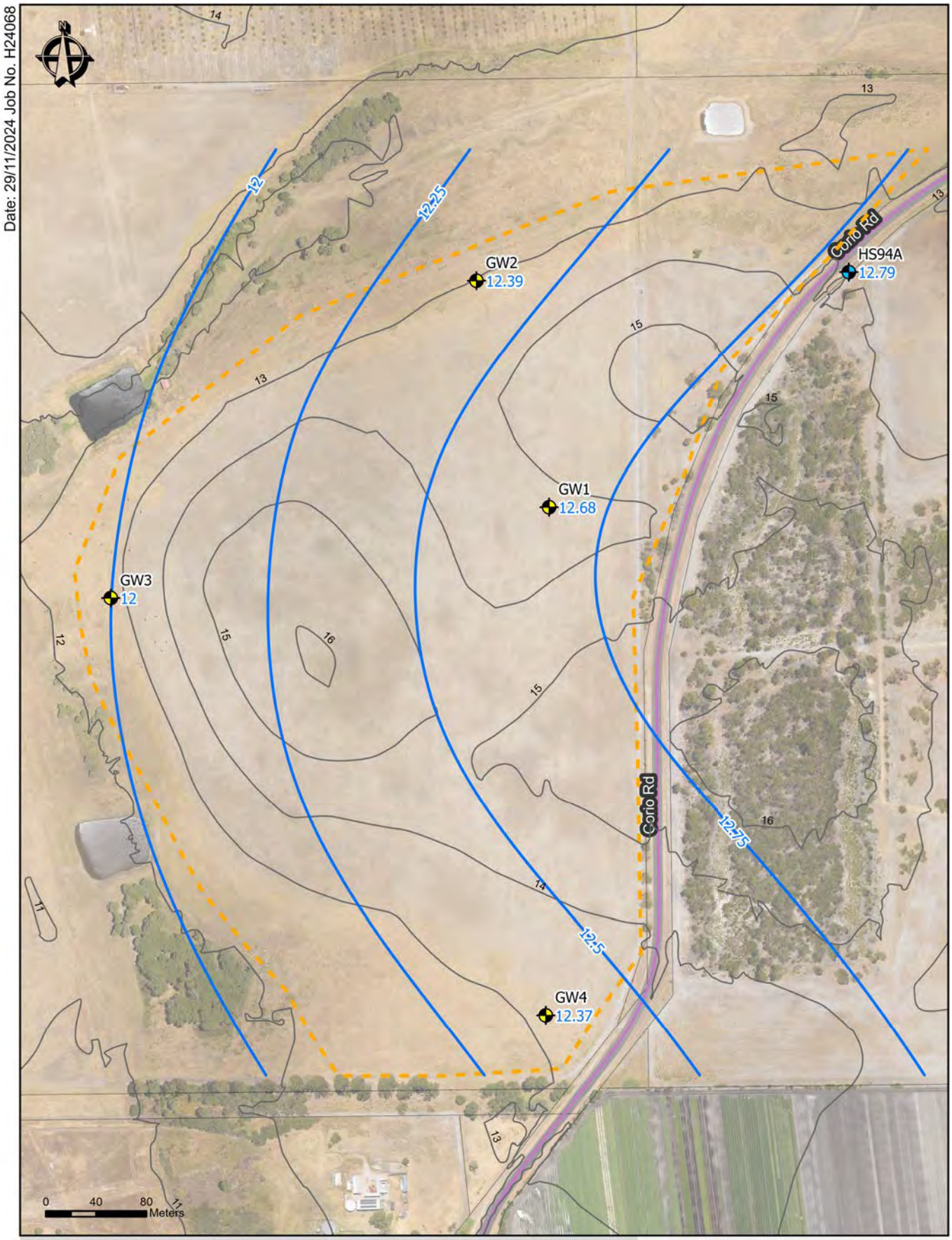
DWER Groundwater Monitoring Bore

hyd2o

Lot 1 Corio Rd Hydrological Report

Groundwater Bore Locations

Figure 1

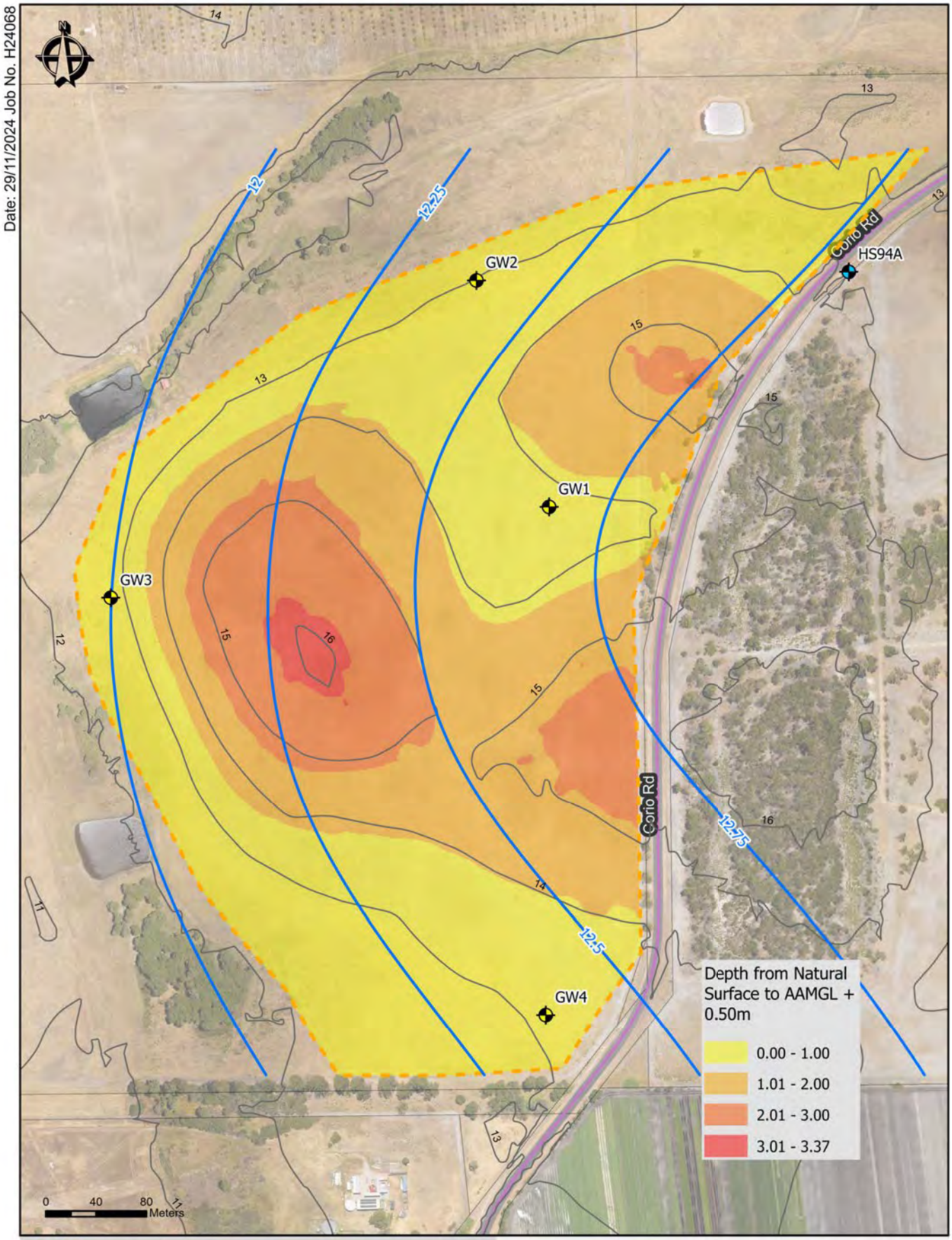


hyd2o

Lot 1 Corio Rd Hydrological Report

AAMGL Contour Mapping

Figure 2



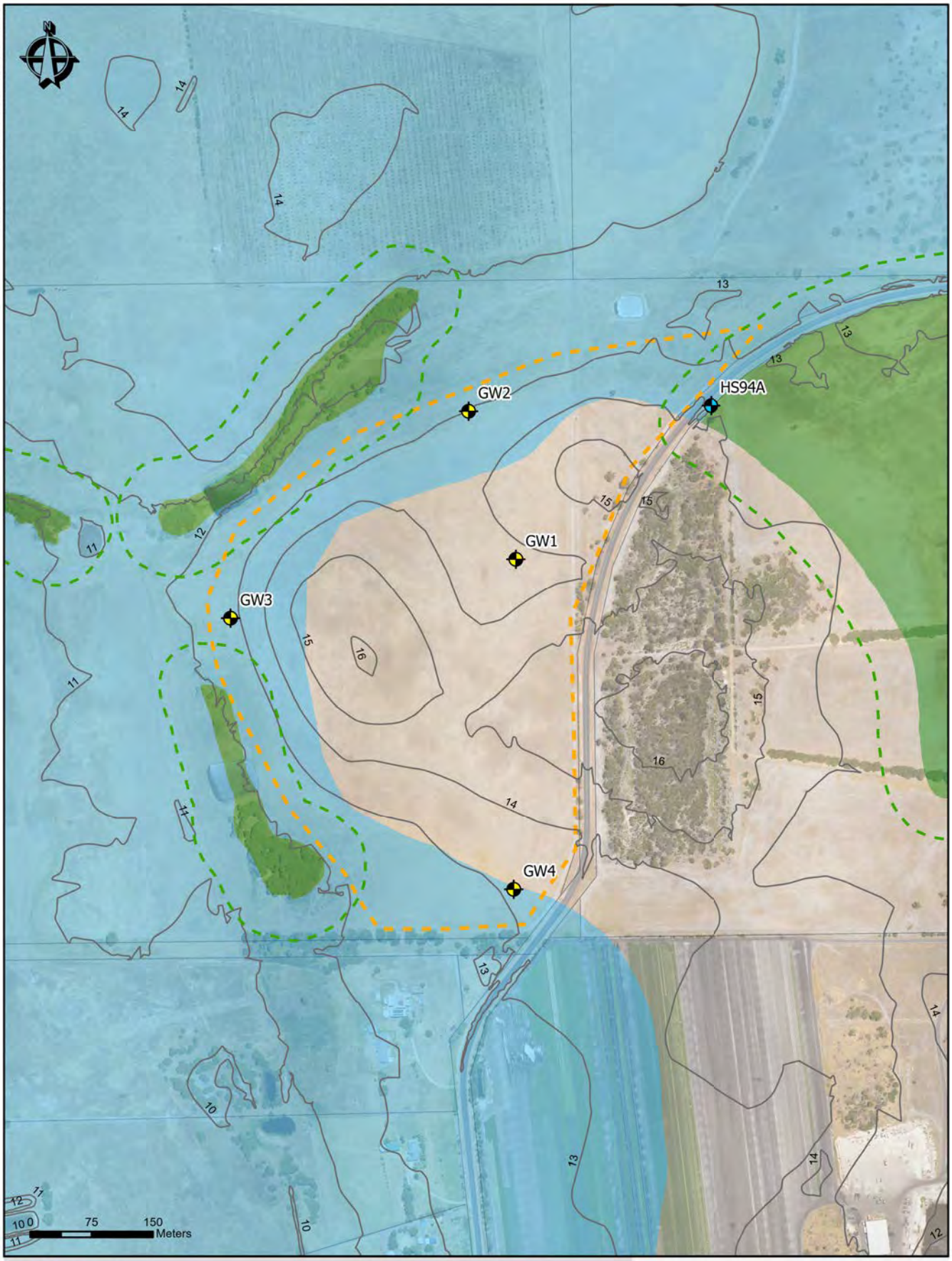
hyd2o

Lot 1 Corio Rd Hydrological Report

Depth from Natural Surface to AAMGL + 0.50 m

Figure 3

Date: 29/11/2024 Job No. H24068



Site Boundary
Groundwater Monitoring Bores
DWER Groundwater Monitoring Bore
DWER Topography Contour (mAHD)

Geomorphic Wetlands of SCP
Conservation Category Wetlands
Multiple Uses Wetlands
50m CCW Buffer

hyd2o

Lot 1 Corio Rd Hydrological Report

Wetlands Plan

Figure 4

ATTACHMENT A
Lithological Logs

Lithological Log

Hyd2o
Suite 1 387 Hay St
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	**10/10/2024**	Job Number :	H24068	Bore Name	
Client :	**G&G Corp**	Start Hole :	**10:00**		
Project:	**Lot 1 Corio Rd**	End Hole :	**11:00**	**GW1**	
Easting	**394742.8687**	Logged by :	**AFR**		
Northing	**6397440.312**	Total Depth :	**1.5**		
Datum:	GDA94	RL Top of Casing :	**13.863**		
Drill type:	Auger	RL Nat Surface :	**13.583**		
Hole diameter:	8 cm				

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey	Medium to Coarse	Sand	Medium	Dry	
				1.0m	Grey Light Grey			None	Moist	
				1.5m					Saturated	end of hole at 1.50 m
				2.0m						
				2.5m						
				3.0m						
				3.5m						
				4.0m						
				4.5m						
				5.0m						

COLOUR : Black, White, Beige
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	10/10/2024
Stickup above NS (m)	
Water Level bTOC (m)	
Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 1 387 Hay St
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	**10/10/2024**	Job Number :	H24068	Bore Name	
Client :	**G&G Corp**	Start Hole :	**11:10**		
Project:	**Lot 1 Corio Rd**	End Hole :	**12:00**	**GW2**	
Easting	**394685.048**	Logged by :	**AFR**		
Northing	**6397620.514**	Total Depth :	**1.0**		
Datum:	GDA94	RL Top of Casing :	**13.319**		
Drill type:	Auger	RL Nat Surface :	**12.896**		
Hole diameter:	8 cm				

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey Black	Fine to Medium	Sand	High	Dry	
				1.0m	Grey	Medium to Coarse		None	Moist	some clay content
									Saturated	end of hole at 1.0 m
				1.5m						
				2.0m						
				2.5m						
				3.0m						
				3.5m						
				4.0m						
				4.5m						
				5.0m						

COLOUR : Black, White, Beige
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	10/10/2024
Stickup above NS (m)	
Water Level bTOC (m)	
Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 1 387 Hay St
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	**10/10/2024**	Job Number :	H24068	Bore Name	
Client :	**G&G Corp**	Start Hole :	**12:10**		
Project:	**Lot 1 Corio Rd**	End Hole :	**13:00**	**GW3**	
Easting	**394394.0654**	Logged by :	**AFR**		
Northing	**6397367.665**	Total Depth :	**1.1**		
Datum:	GDA94	RL Top of Casing :	**12.919**		
Drill type:	Auger	RL Nat Surface :	**12.515**		
Hole diameter:	8 cm				

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey Black	Fine to Medium	Sand	High	Slightly Moist	
					Dark Grey			Low	Moist	some clay content
				1.0m	Grey	Fine to Coarse		None	Saturated	end of hole at 1.1 m
				1.5m						
				2.0m						
				2.5m						
				3.0m						
				3.5m						
				4.0m						
				4.5m						
				5.0m						

COLOUR : Black, White, Beige
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	10/10/2024
Stickup above NS (m)	
Water Level bTOC (m)	
Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 1 387 Hay St
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	**10/10/2024**	Job Number :	H24068	Bore Name	
Client :	**G&G Corp**	Start Hole :	**13:45**		
Project:	**Lot 1 Corio Rd**	End Hole :	**14:30**	**GW4**	
Easting	**394740.232**	Logged by :	**AFR**		
Northing	**6397035.765**	Total Depth :	**1.1**		
Datum:	GDA94	RL Top of Casing :	**13.334**		
Drill type:	Auger	RL Nat Surface :	**12.958**		
Hole diameter:	8 cm				

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey Black	Fine to Coarse	Sand	Medium	Dry	
				1.0m	Grey	Medium to Coarse		None	Moist	
									Saturated	end of hole at 1.1 m
				1.5m						
				2.0m						
				2.5m						
				3.0m						
				3.5m						
				4.0m						
				4.5m						
				5.0m						

COLOUR : Black, White, Beige
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	10/10/2024
Stickup above NS (m)	
Water Level bTOC (m)	
Water Level bNS (m)	