Excavation and Rehabilitation Management Plan
Sand and Gravel Pits

Lot M1096, Smith and Bobakine Rd
Burlong

Shire of Northam

SUMMARY

This Management Plan addresses the potential environmental impacts and proposed management strategies related to sand and gravel excavation.

The document has been prepared primarily to satisfy the requirements of the Shire of Northam planning and Extractive Industries requirements.

The proposal achieves the purpose of extracting a valuable resource in line with Statement of Planning Policy No 2, Environment and Natural Resources Policy and 2.4 Basic Raw Materials.

Whilst silica sand is very common on the Swan Coastal Plain, it is not common in the local area and east of the Darling Scarp.

Lot M1096 is not identified in Statement of Planning Policy No 2.4 as a Basic Raw Materials Resource but that is not surprising because SPP 2.4 only identified existing quarries and did not in this area seek to identify new resources in this area.

Even though it is small Lot M1096 represents a significant regional sand resources in the Northam Shire.

The sand and gravel will be used for the local community for sand, for sand pads, concrete products, road making and construction materials, there would be no extraction.

The proposed excavations are small and will occupy about 1 hectare of active pit each at any one time.

The final contours for the sand pit will be 3 metres below natural ground level with perimeter batter slopes at no greater than 1 : 4 vertical to horizontal.

For the gravel excavation maximum depth will be 1 – 2 metres below natural ground level with perimeter batter slopes at no greater than 1 : 4 vertical to horizontal.

Both quarries are to have a small surface footprint and will be worked progressively in stages with rehabilitation following excavation.

Excavation is proposed to operate from the floor of the pit working towards the east and west. There are only two nearby sensitive premises at a distance of 500 – 200 metres to the edge of the sand pit, which is in excess of currently operating sand and limestone pits in the Perth Metropolitan Area. All other sensitive premises comply with the EPA generic buffers. The gravel resource is isolated from dwellings.

Operations will be intermittent, with excavation on perhaps only 30 – 50% of the days available.

The sites are cleared apart from 8 Marri *Eucalyptus calophylla* trees.

An access road is to be formed across Lot M1096 to intersect Smith Road near Great Eastern Highway and therefore avoiding impact on nearby dwellings.

PROJECT SUMMARY

ASPECT	PROPOSAL CHARACTERISTIC
EXCAVATION	
Total excavation area	10 hectares sand 5.5 hectares gravel
Potential total disturbance area	15.5 hectares
Current disturbance area	0.1 hectares
Existing pit footprint	0.1 hectares
Resource Extraction	5 – 10 000 tonnes per year sand 5 – 10 000 tonnes per year sand
Total estimated resource	300 000 tonnes sand 80 000 tonnes gravel
Life of project	20 years
Area mined per year	1.0 ha sand and 1.0 ha gravel
Dewatering requirements	None
Maximum depth of excavations	2 metres for gravel 4 metres for sand
Area cleared per year	8 trees on sand resource
Total native vegetation to be cleared	8 trees on sand resource
PROCESSING	
sand and gravel	Nil
Water requirements	Minimal, maximum 1 000 kL
Water supply source	Dam on site or scheme water
INFRASTRUCTURE	
Total area of plant and stock	Located within excavation footprint
Area of settling ponds	Not required
Fuel storage	Mobile tankers will be used in similar manner to farm machinery.
TRANSPORT	
Truck movements	Intermittent with between 1 – 5 loads per day on 30 – 50% of days.
Access	New access road from Smith Road
WORKFORCE	
Construction	2
Operation	2
Hours of operation	Monday - Saturday 7.0 am to 6.00 pm excluding public holidays.

PROJECT MANAGEMENT SUMMARY

Factor	Summary	Reference
Mining Operations	• Excavation methods will be similar in operation and scale to other local gravel and sand pits. • Excavation will be intermittent and conducted in campaigns. • Small scale sand and gravel extraction.	• 5.0 Mining Operations • See also Project Summary
Biodiversity Management Flora	• The gravel resource is cleared. • 8 trees are required to be cleared from the sand excavation area.	• 3.1 Vegetation and Flora • 6.1 Biodiversity Management
Biodiversity Management Fauna	• See above	• 3.2 Fauna • 6.1 Biodiversity Management
Plant Pathogens	• There is unlikely to be any impact, and there is a low risk of introducing plant diseases. • A Plant Pathogen Management Plan is in place.	• 6.1.5 Plant Pathogen Management Plan
Weeds	• There is unlikely to be any impact and low risk of introducing new weed species. • A Weed Management Plan is in place.	• 6.1.6 Weed Management Plan
Water Management	• Water for dust management will be taken from the dam on site. • Dewatering is not required.	• 6.2 Water Management
Fuel and Maintenance	• Fuel will be supplied from mobile tankers in a manner similar to normal agricultural practices. • A Refuelling and Maintenance Management Plan is proposed.	• 6.2.8 Refuelling and Maintenance
Visual Management	• The site is set back from roads and dwellings with existing an proposed tree belts to be planted. • Visual management procedures will be used to reduce the visual impact from dwellings and roads. • A new access road will be formed directly to Smith Road away from local roads and dwellings.	• 6.3.1 Visual Management
Noise	• The two closest dwellings are 230 – 500 metres from the sand excavation and over 500 metres fro all other dwellings and the gravel excavation. • Noise management procedures, screening and bunding are proposed for all parts of the operations	• 6.3.2 Noise Management
Drilling, Blasting and Screening	• Not required	• 6.3.2 Noise Management
Dust	• Dust is managed for Health and Safety under the *Mines Safety and Inspection Act 1994.* • Dust management procedures are proposed for all aspects of the operations to protect both the staff and environment. • A Dust Management Plan is proposed.	• 6.3.3 Dust Management
Fire	• Fire is seen as no greater risk than on local farms.	• 6.3.4 Fire
Native Title	• Not applicable	• 4.3 Heritage
Mine Closure	• All equipment will be removed from site at the completion of activities and the disturbed land contoured into a form compatible with the surrounding areas.	• 7.0 Mine Closure Plan
Rehabilitation	• Rehabilitation to a return to productive agricultural land is proposed. • A Rehabilitation Plan has been developed.	• 7.0 Mine Closure Plan

CONTENTS

FIGURES

1.0 BACKGROUND INFORMATION

1.1 Land Ownership and Agreements

Lot M1096 Smith and Bobakine Road, Burlong, Shire of Northam, is owned by Extreme Conracting Pty Ltd

Lot M 1096 Smith and Bobakine Roads, Burlong, Shire of Northam

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1.2 Proponent

Extreme Contracting Pty Ltd is a locally owned family run company who have been operating the existing Exractive Industries Licence granted in 2011

The address for correspondence is:

Extreme Contracting Pty Ltd
PO box 1013
Northam WA 6401

1.3 Project Objectives

The objective of this pit is to ensure resources for the local community continue to remain available.

This Management Plan addresses the potential environmental impacts and proposed management strategies related to sand excavation.

The document has been prepared primarily to satisfy the requirements of the Shire of Northam planning and Extractive Industries requirements.

The proposal achieves the purpose of extracting a valuable resource in line with Statement of Planning Policy No 2, Environment and Natural Resources Policy and 2.4 Basic Raw Materials.

Importance and Rationale

Whilst silica sand is very common on the Swan Coastal Plain, it is not common in the local area and east of the Darling Scarp.

Lot M1096 is not identified in Statement of Planning Policy No 2.4 as a Basic Raw Materials Resource but that is not surprising because SPP 2.4 only identified existing quarries and did not in this area seek to identify new resources in this area.

Even though it is small Lot M1096 represents a significant regional sand resources in the Northam Shire.

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.

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, provided good management is used.

The total amount of sand available for long term development within the local area is severely restricted. The Chamber of Commerce and Industry 1996, considered the need for sand and the potential sterilisation of resources. The Chamber of Commerce and Industry updated the assessments of basic raw materials in 2008.

With sand restricted in the Shire of Northam, there is a need to preserve and utilise all sources in a staged manner to ensure future supplies for the community.

Research on the sand resources can be found in the following;

- Abeysinghe P B, 2003, *Silica Resources of Western Australia*, Geological Survey of Western Australia, Mineral Resources Bulletin No 21.
- Western Australia, Western Australian Planning Commission*, Statement of Planning Policy 2.4, Basic Raw Materials.*
- Chamber of Commerce and Industry, 1995 and 1996, *Managing the Basic Raw Materials of Perth and the Outer Metropolitan Region*, Parts 1 and 2.
- Chamber of Commerce and Industry, 2008, *Basic Raw Materials Access and Availability*, 1996 - 2008.
- *State Gravel Supply Strategy (1998).*
- Western Australian Planning Commission, Statement of Planning Policy 2.4, Basic Raw Materials.
- Peel Region Scheme, *Strategic Minerals and Basic Raw Materials Resource Policy*, October 2002.

As noted above the sand is a community resource and is only taken because the community needs the resource. If the sand is not taken from this resource, it must be taken from elsewhere, which may involve land clearing and probably longer transport runs with consequent greenhouse gas penalties.

1.4 Aims of the Proposal

The aims of the proposal are to;

- Secure a valuable resource required by the community.
- Provide a supply of sand and gravel for the construction industry to be used in the Shire of Northam and local area.
- Extract sand and gravel prior to it being sterilised by future development, in line with Statement of Planning Policy No 2.4, Basic Raw Materials.
- Provide a supply of white and yellow silica and fill sand.
- Provide a supply of gravel for local roads.
- Comply with Statement of Planning Policy No 2.4 Basic Raw Materials, and Rural Land Policies for the Metropolitan Area, all of which state that basic raw materials should be taken prior to sterilisation of the area by development.
- Enable the site to be used for Rural purposes or potentially Rural Living at some point in the future following the completion of sand excavation.

1.5 Location

The sand lies near Searle Drive and was excavated in a minor way in the past. It is set well back from Smith and Bobakine Roads.

The gravel resource is set back from the roads.

1.6 Site Plans

Site plans are shown in the attached Figure 2.

2.0 GEOTECHNICAL ASSESSMENT

2.1 Geology and Geomorphology

The sand is an isolated pocket of alluvial sand based on the grain size and form that is likely to be Eocene in age and related to the palaeochannels that occur in the wider area.

The sand has been left higher on a slope as erosion has removed some of the surrounding regolith over the years.

Gravel also caps the low plateau remnants, and forms the gravel resource to the east.

Both deposits represent remnants of an old erosion surface.

There may also have been some reworking of the sand by aeolian processes in more recent times.

The sand occupies a small remnant pocket that sits on weathered granite basement regolith of brown loam soils. A basal gravel layer occurs at the sand loam interface.

2.2 Description of the Resource

The sand consists of white and yellow sand to a depth of 2 – 4 metres.

Laterite (ferricrete) gravel with minor associated duricrust has a thickness of normally 1.0 – 2.5 metres over duricrust and loam clay subsoils.

2.3 Soils

Soils in the local area have been mapped on a broad scale by Lantzke and Fulton, undated. Whilst the sand is not specifically listed the site is shown as Kokeby Soils “Gently undulating hillslopes (2 – 6%) containing pale sandy surfaced soils with some gravelly ridges.

The gravel resource area is listed as Yalanbee, although the size of the gravel does not look like most of the normal Yalanbee soils; Yalanbee “undulating Darling Range Plateau with long smooth slopes (1 - 8%) containing buckshot gravel soils. This unit often occurs above a breakaway and may have laterite boulders on the surface.”

The gravel resource is gravel over brown granite regolith loam.

The soils on the sand resource are siliceous sands. See Appendices for site photographs including soils.

2.4 Climate

The local area has hot summers with cool moist winters.

Weather is recorded at Northam.

Average monthly maxima range from 17^{o}C (July) maxima to 34^{o}C (January) with average monthly minima ranging from 5^{o}C (July) to 17^{o}C (January).

Rainfall for the area is 433 mm for Northam but this is inconsistent with the local area of Bakers Hill which has 586 mm and is likely to be more representative.

Winds are from the east on summer mornings and south west in the afternoons. Winter winds are more variable. Some strong northerly winds occur ahead of weather changes and cause most of the wind risk.

2.5 Hydrology

2.5.1 Surface Hydrology

There is no surface water runoff as the site is gravel - sandy and porous.

A dam is located east of the gravel source that will be used to supply water for dust suppression as required.

A small drainage line commences at the base of the breakaway at the eastern edge of the gravel resource and drains to Smith Road. This will only flow in storm events.

2.5.2 Groundwater and Water Protection Areas

The site has groundwater at depth, well below the base of the resources.

Groundwater will be at the granite basement and will vary according to the undulations in that basement. No groundwater is locally expressed on the surface as seeps.

There is no evidence of groundwater or surface water in the base of the small sand excavation which is cut to gravel some 3 metres deep.

2.6 Acid Sulfate

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 and conditions and risk applied in many areas where there is no geological risk or evidence of acid sulfate.

The most definitive survey procedure was produced by the Acid Sulfate Soil Management Advisory Committee NSW, 1998, in their *Acid Sulfate Manual.* This Manual forms the basis for all assessment procedures in Australia, including those adopted by the Western Australian Planning Commission and the Department of Environment and Conservation.

The *Acid Sulfate Manual* adopts the procedure of reviewing the published data followed up by field assessment, which has been completed for this site. If a geological risk is determined, then a Preliminary Acid Sulfate Assessment is conducted.

A preliminary Acid Sulfate Assessment is appended to this Excavation and Rehabilitation Management Plan, even though geological site investigations reveal that this step is unnecessary.

The site is high in the landscape in highly weathered sand and gravel which is yellow and brown indicating high oxygen levels.

There will be no excavation below the water table.

2.7 Geotechnical Design Implications

The resource of sand and gravel are shallow in depth with minimal overburden. They are highly oxideised and lie well above the regional and local groundwater elevations.

Excavation of the sand and gravel are in many ways similar in machinery and geotechnical issues to the agricultural activities that have been carried out on site for many years.

The only design implications are to approach the face of the sand pit perpendicular to the face, when digging with a loader.

Other management implications are similar to on farm activities and relate to dust and erosion of disturbed soils.

3.0 BIODIVERSITY

3.1 Vegetation and Flora

The gravel resource is cleared pasture.

The sand resource is cleared and was pasture, however due to the reduced soils moisture available in the sand was planted to Tagasaste some years ago.

There are 8 Marri Trees scattered across the sand resource.

3.2 Fauna

The site is pasture with little or no native vegetation apart from scattered regenerating native plants. Native fauna is likely to be severely depleted on this pasture.

Large areas of native vegetation adjoin to the west and south which will provide habitat or refuge for any displaced species.

3.3 Wetlands

There are no wetlands near the resource area.

3.4 Stygofauna and Troglofauna

EPA Guidance 54, concentrates on Stygofauna, which occur in caves and "are aquatic subterranean animals, found in a variety of groundwater systems".

Troglofauna occur in air chambers in underground caves or smaller voids.

Caves do not occur in gravel and sand regolith developed on the weathered granite regolith.

There is therefore no risk of troglofauna or ground fauna that live in crevices occurring on the excavation site or within the resource.

4.0 SOCIAL ENVIRONMENT

4.1 Planning Issues

4.1.1 Alternative Resources

The amount of sand required for the Northam local area is increasing because of the nature of the approved and future developments, strategic urban areas and rural living subdivisions.

Sand is relatively uncommon locally but gravel is common.

Even so, the amount of sand and gravel available in these resources is limited and when the longer term is considered, these resources will be exhausted relatively quickly.

Environmentally it is better to utilise existing disturbed land rather than commence new activities in undisturbed areas.

Other resource, particularly of gravel, may have to require the clearing of native vegetation.

The other resource may also have to be transported much further, leading to increased costs and greenhouse gas penalties.

4.1.2 The Site and Land Zonings

- **Current Land Use and Land Zonings**

The site lies on Rural Zoned land. A small sand quarry occurs on site.

- **End Use**

The extraction of gravel and sand is an interim land use with a return to rural use. It may be possible that at some time in the future Special Rural lots are able to be subdivided.

The reconstructed land surface will be suitable for both a rural and rural living end use.

4.1.3 Surrounding Landuses and Buffers

- **Separation to Dwellings**

The site has been used for pastoral purposes for many years.

There are some nearby rural living/Special Rural dwellings, to the north and west.

Statement of Planning Policy No 2.5, Agricultural and Rural Land Use Planning, makes provision for the extraction of basic raw materials. 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 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.

A number of Government Policies relate to buffer distances and the protection of basic raw materials. Statement of 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.

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.

Based on the nature of the gravel, equipment used and excavation methods, the extraction of natural gravel is most similar to sand excavation. Therefore a generic buffer of 300 – 500 metres is appropriate. The Guidance states that for quarries other than hard rock, where crushing, milling and grinding occur, a site by site buffer is appropriate.

The closest dwellings to the gravel resource are 800 metres. Gravel is excavated with a loader, loading directly to a road truck, but as the resource is shallow the loader will work 1 – 2 metres below natural ground surface, behind low bunds of overburden and topsoil that have been formed by pushing from the resource.

Sand is excavated 3 – 4 metres below natural ground level behind low bunds of topsoil and overburden. The only nearby dwellings are to the sand excavation at 500 – 230 metres behind perimeter vegetation on the western boundary.

A loader is similar in size to a farm tractor, and excavation will be intermittent in a similar manner to normal farm operations. Compared to existing sand and limestone pits in Perth where the pits are operated behind screening bunds, the buffers can be as small as 40 – 60 metres. For example Cockburn Cement at Fanstone Avenue in Munster, or Italia Stone Group in Dalison Road and Wattleup Roads, and WA Limestone at Kerosene Lane. These are all approved limestone and sand pits that use bulldozers in continuous or campaign operations.

No bulldozer is proposed for this site in the sand pit. A bulldozer might be used in the gravel pit.

No screening of sand is proposed. Blasting is not proposed.

The walls of the pit perimeter bunding and nature of the landform will be used to reduce noise transmission.

Excavation will be worked from inside out on the floor of the pit working below natural ground level.

40 metre road buffer zones will be retained.

The gravel pit quarry complies with the generic buffer. Existing sand and limestone pits in the Perth Metropolitan area prove that sand excavation can be completed close to dwellings, at much closer distance to those proposed for this site.

BUFFERS			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Adjoining properties	• The excavation is proposed to work below natural ground level. • The excavation of gravel complies with the EPA Generic Buffer Distances. • The method of excavation and landform is able to provide the necessary reductions in impacts such as noise and dust. • Management plans are in place for noise, dust and other potential factors. • Sand excavation will be intermittent and existing pits in Perth demonstrate that excavation can be undertaken without dust or noise impact on sensitive premises.	The Proponent will take the steps necessary to minimise any potential impacts on adjoining land users.	Compliance with the Excavation Management Plan and Noise Regulations.

4.2 Community Consultation

The Project Management Plan will be advertised by the Shire of Northam.

4.3 Heritage

No archaeological sites are known from the area to be excavated and no evidence of aboriginal occupation has been found during excavation. A search of the Department of Indigenous Affairs database did not reveal any known sites.

Should any site be discovered, the Proponent will cease operations in the immediate area pending an assessment by a recognised independent consultant.

HERITAGE			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Aboriginal sites	***Aboriginal Heritage Act 1972-1980*** • 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.	The Proponent will comply with the *Aboriginal Heritage Act 1972-1980*	None required at this time.
European Heritage	• There are no known sites.		

5.0 MINING OPERATIONS

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. Measures to protect the site and minimise the influence of dieback are addressed under Environmental Management.

5.1 Project Summary

PROJECT SUMMARY

ASPECT	PROPOSAL CHARACTERISTIC
EXCAVATION	
Total excavation area	10 hectares sand 5.5 hectares gravel
Potential total disturbance area	15.5 hectares
Current disturbance area	0.1 hectares
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Total estimated resource	300 000 tonnes sand 80 000 tonnes gravel
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Dewatering requirements	None
Maximum depth of excavations	2 metres for gravel 4 metres for sand
Area cleared per year	8 trees on sand resource
Total native vegetation to be cleared	8 trees on sand resource
PROCESSING	
sand and gravel	Nil
Water requirements	Minimal, maximum 1 000 kL
Water supply source	Dam on site or scheme water
INFRASTRUCTURE	
Total area of plant and stock	Located within excavation footprint
Area of settling ponds	Not required
Fuel storage	Mobile tankers will be used in similar manner to farm machinery.
TRANSPORT	
Truck movements	Intermittent with between 1 – 5 loads per day on 30 – 50% of days.
Access	New access road from Smith Road
WORKFORCE	
Construction	2
Operation	2
Hours of operation	Monday - Saturday 7.0 am to 6.00 pm excluding public holidays.

5.2 Extraction and Processing of the Resource

5.2.1 Excavation

Sand

The steps in the excavation of sand are;

Excavation will commence in the east and cut west into the hill.

1. Topsoil will be cleared and transferred directly to an area being rehabilitated. This reduces stockpiles and maintains the viability of the micro-organisms and seed stores in the soil, and assists the rehabilitation program.

2. Where top soil cannot be spread directly, the topsoil will be pushed into bunds along the western boundary of the road buffer. This will create a store for later use.

3. Overburden will then be pushed to form a bund along the western side of some 2 metres high at the buffer to the road.

4. Sand is excavated from a single face.

5. Depth of excavation is to be 2 – 4 metres deep.

6. Excavation will continue to be conducted from the floor of the quarry, behind the face, to assist with noise and visual screening.

7. Sand will be excavated by a loader accessing the face in a perpendicular manner, and then loading to a road truck for transport off site.

8. It is not anticipated that a screening or washing plant will be required.

9. All excavation and mining activities will be contained within the excavation area.

10. The floor of the excavation will be left as a smooth sand surface.

11. At the completion of excavation, no final soil slope on the floor of the excavation will be left greater than 1 : 4 vertical to horizontal. The batters will be graded to ensure the final slopes form an interim stable land surface in compliance with the *Mines Safety and Inspection Act (1994) and Regulations (1995).* Figure 8.

12. Rehabilitation will progressively follow mining, with completed areas of the excavation being revegetated as soon as practicable.

13. Rehabilitation will progressively follow excavation wherever possible. The proposed form and small size of the pit means that there will be little ability to rehabilitate land until the excavation is well advanced. However there will be potential to backfill and replant excavated faces as they are progressively completed.

Gravel

1. Topsoil is to be pushed to the edge of the pit into bunds for use in land rehabilitation. If possible the topsoil will be spread directly onto an area of rehabilitation, otherwise it is to be stored in low dumps approximately 0.5 metres high. As excavation progresses the stored topsoil will be progressively used for rehabilitation.

2. Overburdenwill be scraped or pushed from the surface to form perimeter bunds, which will be pushed back into the pit and spread during rehabilitation at the completion of each stage of excavation.

3. The overburden bund along the edges of the excavation area will assist with a separation to the pasture and vegetation and act as a water, noise and visual barrier.

4. Excavation of the resource will be worked as an inside out operation. Vehicles will work on the floor of the excavation and work towards the edges of the excavation.

5. The depth of the excavation will depend on the thickness and quality of the resource which is expected to vary from 1 to 3 metres deep, with a reconstructed surface approximately 2 metres lower than the natural surface.

6. Excavation will be conducted in "cells" to ensure that precipitation falling in the pit is contained within the pit. The typical cell is not normally larger than 2 hectares.

7. Extraction in similar pits demonstrates that all surface water can be retained within the void and that no surface runoff from the pit occurs.

8. Water collecting on the excavated area will be retained within the pit area in a temporary sump on the pit floor. The pit cells are designed to retain 1 : 100 storm events. (See 6.2.2 Water Quality).

9. Excavation of natural gravel is carried out using a loader.

5.2.2 Pit Design and Staging

1. Both the sand and gravel pits will be small, with the sand pit worked from east to west. The gravel pit will be worked from south west to north east.

2. The concept pit layout and plan is shown on the attached plans.

3. The area of ground open at any one time for the sand pit is to be approximately 1 hectare with the same for the gravel pit. It is possible that 2 hectares may be required for each pit to fill large contracts or where there is significant variation in the resource quality.

4. Rehabilitation will be progressive, but because of the nature of the excavation will be restricted to completed faces. The majority of the pit will not be able to be rehabilitated until the completion of excavation. Batters will be rehabilitated when formed.

5. Wherever possible, rehabilitation will be continued as areas are completed to ensure that the amount of ground that is open at any one time is minimised. As access is currently through the existing pit, rehabilitation of this pit is not possible at this time.

5.2.3 Final Contours

The final contours for the sand pit will be 3 metres below natural ground level with perimeter batter slopes at no greater than 1 : 4 vertical to horizontal.

For the gravel excavation maximum depth will be 1 – 2 metres below natural ground level with perimeter batter slopes at no greater than 1 : 4 vertical to horizontal.

Both quarries are to have a small surface footprint and will be worked progressively in stages with rehabilitation following excavation.

Operations will be intermittent, with excavation on perhaps only 30 – 50% of the days available.

At the end of excavation any overburden will be used to backfill benches for revegetation. The end use will, however, remain as a void with rehabilitated benched sides in compliance with the safety considerations of *the Mines Safety and Inspection Act 1995* and the requirements and guidelines of the Department of Mines and Petroleum; For example *Guidelines on Safety Bund Walls Around Abandoned Open Pits 1991.*

5.2.4 Processing of the Resource

There will be no need to process the resource.

The gravel will be used as a natural gravel.

The sand will be loaded directly from the face to road trucks.

5.2.5 Stockpiles

Small stockpiles of gravel of up to 5 000 tonnes may be created.

No stockpiles of sand are anticipated.

All stockpiles will be located on the floor of the excavation.

5.3 Timing

The proposed excavation is proposed to be worked over a period of some 5 – 10 years.

The volumes of sand and gravel taken are anticipated to be in the range of 5 000 – 10 000 tonnes per year each.

5.4 Hours of Operation

Hours of operation will be 7.00 am to 6.00 pm Monday to Saturday inclusive, excluding public holidays.

Ancillary activities such as maintenance are conducted outside these hours in line with normal industry practice. These are site restricted activities that are not likely to impact on the local community.

Wide operational hours are necessary to maximise operations and ensure that the full excavation, processing and transport times are available to satisfy community demands for products at certain times.

HOURS OF OPERATION			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Operating times	• Hours of operation will be 7.00 am to 6.00 pm Monday to Saturday inclusive, excluding public holidays.	The proponent will comply with the approved hours of operation.	Compliance with the Excavation Management Plan. Compliance with Licence and operating conditions

5.5 Machinery and Equipment

The following equipment is likely to be used during the excavation of sand and gravel.

Site office/lunchroom	A portable site office/lunchroom is proposed for the management and security of small items when the site is manned.
Toilet system	A serviced portable toilet system will be used if the pit is used for extended campaigns, otherwise normal farm facilities will be used.
Storage shed	A transportable container may be required for the storage of minor maintenance items and lubricants.
Fenced compound	A fenced compound may be used for the storage of mobile plant.
Bulldozer	A bulldozer may be used for pushing, clearing overburden on the gravel resource. In general a bulldozer is anticipated to be used only occasionally if at all.
Water tanker	Used for dust suppression on the access road and working floors as required. This will normally be a converted dump or road truck.
Loader	A loader of the type Komatsu 860 or Cat 950H Open Wheeler or smaller will be used for the excavation and loading of sand
Excavator	Unlikely to be used.
Mobile crushing and screening plant	Not required
Fuel Storage	Vehicles will be refuelled from mobile tankers. There will be no fuel storage at the quarry.

All static and operational equipment will work on the quarry floor to provide maximum sound and visual screening where possible.

All mobile and static plant will be registered or licensed by the Department of Environment and Conservation.

5.6 Access and Transport

A dedicated haul road is in use to access sand and gravel. The haul road will run from the pits to the south eastern corner of Lot M1096.

This will mean that quarry traffic will not go past dwellings in Smith or Bobakine Roads and Searle Drive.

Operations will be intermittent, with excavation on perhaps only 30 – 50% of the days available. On a particular day only 1 or 2 loads may be carted. with perhaps 5 loads on a typical day.

Smith Road is a school bus route, but the small section traversed by trucks will minimise trucks and the bus being on the road at the same time. Management of the trucks can include radio/phone contact with the bus driver, voluntary speed limits and transport times. The access road contacts Smith Road close to Great Eastern Highway

Access onto Great Eastern Highway from Smith Road has adequate site lines and turning radii.

Transport will use the access road, entering Smith Road next to Great Eastern Highway.

Great Eastern Highway is a major transport route. Trucks from the pits will be no different to other traffic.

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

Warning signs for trucks will be used to alert road users through the Shire of Northam and Main Roads.

Trucks are likely to be 25 tonne semitrailer vehicles and small rigid trucks.

5.7 Workforce

The workforce will vary, depending on the level of operation and market demands, but usually 2 persons can be expected to be working on site during an excavation campaign.

5.8 Water Use

Water is to be mainly used for dust suppression. The access road is located away from dwellings and will be formed of gravel, the same as local roads joining Smith Road.

The local roads are not watered or subject to dust suppression. Therefore dust suppression will only be used when there is a risk of dust blowing to the nearest dwelling.

Water will be taken from the dam to the east of the resource area. If this is not sufficient water will be trucked in when dust risk is high.

Potable water will be brought to the site as needed.

5.9 Safety

The site will operate to the *Mines Safety and Inspection Act 1994 and Regulations 1995,* which are administered by the Department of Mines and Petroleum.

The proponent is committed to maintaining a safe working environment.

Safety Management Plans will be used to cover operational procedures which include workforce induction and training to ensure that all employees involved in sand and gravel excavation are made aware of the environmental and safety implications associated with all stages of the mining activities.

Where applicable Safe Operating Procedure Sheets will be prepared and made available for hazards. Workers and staff will be 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.

UHF radio contact is available for all vehicles and the site is within mobile phone range.

See 5.6 Access and Transport for site security and 6.3.4 Fire Management.

SAFETY

Potential Impact	Management	Outcome Commitments	Action Required
Operational Safety	*Mines Safety and Inspection Act 1994 and Regulations 1995.* • The site is within mobile and UHF radio contact. • Safety Management procedures will be implemented prior to commencement. • All workers will be provided with site induction and necessary training prior to entering the site.	The proponent will conform to the requirements of the *Mines Safety and Inspection Act 1994 and Mines Safety and Inspection Regulations 1995.*	DMP is responsible for safety on quarry sites.
Unauthorised Access	*Mines Safety and Inspection Act 1994 and Regulations 1995.* • Warning signs are to be erected around the operating area. • Locked gates, bunding and fences as appropriate will be maintained on site.	The proponent is committed to maintaining a safe working environment.	Compliance with *Mines Safety and Inspection Act 1994 and Regulations 1995* Compliance with operating conditions

5.10 Compliance and other Legislation

5.10.1 Responsible Authorities

A number of local and state authorities are responsible for quarrying of this type or have an interest in its operation.

Shire of Northam

- Provides Planning Consent.
- Issues Extractive Industries Licences.
- Responsible for traffic on local roads.

Department of Mines and Petroleum

- Controls the safety and methods of excavation through the *Mines Safety and Inspection Act 1994.*
- Responsible for overseeing the health and safety of the operations and the administration of the *Mines Safety and Inspection Act 1994 and Regulations 1995.*

Department of Environment and Conservation

- Oversees all significant environmental impacts.
- Licenses any screening plant used in the processing.
- Responsible for flora and fauna conservation.
- Issues Clearing Permits.

Department of Water

- Issues guidelines for water quality management for extractive industries.
- Oversees protection of groundwater and water courses.
- Issues water licences.

Main Roads

- Responsible for construction and maintenance of main roads and the use of these roads by truck traffic.

Department of Indigenous Affairs

- Oversees the Native Title Amendment Act and the *Aboriginal Heritage Act 1972 - 1980*.

6.0 ENVIRONMENTAL IMPACTS AND MANAGEMENT

The likely environmental impacts are minimal on a well managed site. The issues are well known from existing quarries in the Northam and near Perth area.

In order to make each section more self contained the Environmental Management is included at the end of each section.

6.1 BIODIVERSITY MANAGEMENT

6.1.1 Vegetation and Flora

Lindsay Stephens of Landform research conducted a vegetation study of the resource areas on 25 July 2009.

The resource areas are cleared apart from 8 *Eucalypus calophylla* trees on the sand resource area.

Tagasate has been planted on the sand resource area.

6.1.2 Land Clearing

*Clearing is controlled under the **Environmental Protection (Clearing of Native Vegetation) Regulations 2004.** These regulations provide for a number of principles against which clearing is assessed.*

	CLEARING PRINCIPLE *(Schedule 5 Environmental Protection Amendment Act, 1986*
1a	*High Level of diversity*
1b	*Significant fauna habitat*
1c	*Necessary to existence of Rare flora*
1d	*Threatened Ecological Community*
1e	*Significant area of vegetation in an area that has been extensively cleared*
1f	*Wetland or watercourse*
1g	*Land degradation*
1h	*Impact on adjacent or nearby conservation areas*
1i	*Deterioration of underground water*
1j	*Increase flooding*

A Clearing Permit will be requested for taking the 8 trees on the sand resource area.

As well as considering Biodiversity and other conservation issues, the Clearing Principles that have to be satisfied are apparently designed for rural regions and do not address the issues of the metropolitan area or resource needs. Therefore some additional principles need to be added when considering the need for Basic Raw Materials. In an attempt to provide a better balance to the clearing principles those principles have been expanded as listed in the tables below.

The CEO may take into account other matters that the “CEO considers relevant” (*EP ACT 1986 Section 51O*)

Section 51O of the *Environmental Protection Act 1986* requires the CEO to take planning matters into account when making clearing decisions, such as a State Planning Policy.

The resources are small but a vital requirement for construction and development in the Shire of Northam, Town of Northam and local area.

The resources have been identified and therefore require staged use in line with Statement of Planning Policy No 2.4 Basic Raw Materials, and Rural Land Policies for the Metropolitan Area, all of which state that basic raw materials should be taken prior to sterilisation of the area by development.

The proposal therefore has been assessed under the Clearing Principles of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and the additional considerations below to provide an assessment of the likely impacts of the proposal.

	ADDITIONAL CLEARING PRINCIPLES – EXTRACTIVE INDUSTRIES
Environmental Protection Act 1984 Section 51O Planning Matters	
1	*Planning Matters*
Environmental Protection Act 1984 Section 51O Relevant Matters	
2a	*Need for the resource*
2b	*Classification of the resource and existing approvals*
2c	*Availability of alternative resources and the impact of their use*
2d	*Proposed final land use*
2e	*Offsite Environmental impacts if the resource is not used*
2f	*Sound environmental management and rehabilitation*

CLEARING PRINCIPLE *(Schedule 5, Environmental Protection Amendment Act, 1986).*		**COMMENT**
1a	High Level of diversity	• The gravel resource area is cleared • The sand resource area is cleared but planted to Tagasaste. Eight *Eucalyptus calophylla* trees will require clearing. • The proposed clearing will therefore not be at variance with this Principle.
1b	Significant fauna habitat	• The gravel resource area is cleared • The sand resource area is cleared but planted to Tagasaste. Eight *Eucalyptus calophylla* trees will require clearing. • The proposed clearing will therefore not be at variance with this Principle.
1c	Necessary to existence of Rare flora	• No Declared Rare Flora or Priority species were identified in the site study. • The proposed clearing is not at variance with this principle.
1d	Threatened Ecological Community	• The vegetation proposed to be cleared is not listed as a Threatened Ecological Community. • The proposed clearing is not at variance with this principle.
1e	Significant area of vegetation in an area that has been extensively cleared	• The gravel resource area is cleared • The sand resource area is cleared but planted to Tagasate. Eight *Eucalyptus ca*lophylla trees will require clearing. • Remnant vegetation around the gravel resource is to be retained. • The proposed clearing will therefore not be at variance with this Principle.
1f	Wetland or watercourse	• No wetlands or watercourses occur on the resource area.
1g	Land degradation	• Whilst the land will be excavated and the soil removed, the excavation can be managed in a manner that does not lead to dust and water impacts. This Excavation Management Plan has been prepared for the site. • The excavation is to prepare the site for a return to rural use or rural living.

		• Whilst the soil will be degraded, dust and other environmental impacts can be managed so the proposal will only be partly at variance with this principle.
1h	Impact on adjacent or nearby conservation areas	• There are no nearby conservation areas. • The proposal is consistent with this principle.
1i	Deterioration of underground water	• Excavation of gravel and sand is well known with respect to groundwater resources. Sand is extensively mined in the Gnangara Pine Plantation and Jandakot, and limestone and sand in the Hope Valley and Nowergup areas. These operations are managed in a manner to minimise any potential impact on groundwater. • The proposal will not be at variance with this principle if well managed.
1j	Increase in flooding	• The excavations will be internally draining. • There is no potential for flooding and so the proposal is consistent with this principle.

ADDITIONAL CLEARING PRINCIPLES – EXTRACTIVE INDUSTRIES		**COMMENT**
Environmental Protection Act 1984 Section 51O Planning Matters		
1	*Planning Matters*	• The resources have been identified and therefore require staged use in line with Statement of Planning Policy No 2.4 Basic Raw Materials, and Rural Land Policies for the Metropolitan Area, all of which state that basic raw materials should be taken prior to sterilisation of the area by development.
Environmental Protection Act 1984 Section 51O Relevant Matters		
2a	*Need for the resource*	• The sand resource is to replace that which comes from a completed pit in Muresk Road, run by the some proponent. • The sand and gravel is to be used for the construction industry as both concrete sand and fill sand. • Good quality concrete sand is not common locally. • Sand and gravel are only extracted for the community. If the community did not need the materials there would be no extraction. Both are used on developments, both private and public.
2b	*Classification of the resource and existing approvals*	• No existing approvals apply to this resource.
2c	*Availability of alternative resources and the impact of their use*	• There are few alternative resources. Much sand and gravel is already sterilised. They would also require similar soil and vegetation disturbance. • The only alternatives may require greater transport distances and therefore more greenhouse gas generation.
2d	*Proposed final land use*	• The proposed final land use is to return the site to rural use.
2e	*Offsite Environmental impacts if the resource is not used*	• Not taking the resource will result in additional greenhouse gas emissions and road impacts from the additional transport and processing of alternative products. • If this resource is not taken sand, gravel will have to be taken from another site resulting in land clearing on that site.
2f	*Sound environmental management and rehabilitation*	• Extensive environmental and rehabilitation management procedures are proposed to minimise any environmental impact.

		• The site will be returned to native vegetation using local provenance species on an interim basis if significant time delays occur.

FLORA			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Flora	• The amount of ground open at any one time will be minimised. • No Declared Rare or Priority Species or Endangered Communities were detected on site during the vegetation study of the resource area, conducted by Landform Research. • Only 8 trees need to be cleared and the taking of these is unlikely to conflict with the Clearing Principles.	The proponent will restrict alteration to vegetation to the areas outlined in this management plan and stabilise the excavated area pending a decision being made on the final end use of the site.	Undertake the Rehabilitation Program.

6.1.3 Fauna

The site is pasture with little or no native vegetation apart from scattered regenerating native plants. Native fauna is likely to be severely depleted on this pasture.

Large areas of native vegetation adjoin to the west and south which will provide habitat or refuge for any displaced species.

FAUNA			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Fauna	• Apart from 8 *Eucalyptus calophylla* the site is cleared.	The Proponent will restrict alteration to vegetation to the areas outlined in this management plan and implement the rehabilitation plan.	Undertake the Rehabilitation Program.

6.1.4 Wetlands

There are no nearby wetlands.

WETLANDS			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Wetlands	• There are no proposed changes to the water recharge on site.	The Proponent will comply with the Excavation – Rehabilitation Management Plan.	None necessary

6.1.5 Plant Pathogen Management Plan

Dieback of vegetation is often attributed to Phytophthora cinamomi even though there are other Phytophthora species and other diseases such as Armillaria that can cause dieback like symptoms. Microscopic soil-borne fungi of the genus Phytophthora kill a wide range of native plants and can cause severe damage to many vegetation types, particularly those from the families Proteaceae, Epacridaceae, Xanthorrhoeaceae and Myrtaceae.

In most cases dieback is caused by a pathogen which infests the plant and causes it to lose vigour, with leaves dying, and overtime may kill the plant. As such the management of Dieback is essentially related to plant hygiene when coming onto a site and within a site.

There are several guides to the management of Dieback.

- *Department of Environment and Conservation CALM Dieback Hygiene Manual 1992 is a practical guide to Dieback management.*
- *Department of Environment and Conservation CALM Best Practice Guidelines for the Management of Phytophthora cinamomi, draft 2004.*
- *Dieback Working Group 2005, Management of Phytophthora Dieback in Extractive Industries.*
- *Dieback Working Group, 2000, Managing Phytophthora Dieback, Guidelines for Local Government.*

Dieback is only likely to be an issue when equipment is brought to the site from a dieback affected area either through vehicles or plant and soil materials, and therefore the following general principles are applied to Dieback management.

The aim of dieback management during excavation is to minimise the risk of entry of dieback into the site.

In many ways the management of the site for dieback is similar to that for the management of weeds, and the two management practices should be considered together.

Not all potential impacts will apply to all parts of the proposed quarry operations.

- DEC and Dieback Working Group 2005, Guidelines are to be followed.
- Vehicles are to be prohibited from entering remnant vegetation, apart from normal travel along made firebreaks and roads for normal security and maintenance activities.
- Dieback diseases are more likely to be transported under moist soil conditions.
- 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.
- When clearing the vehicles should run around the perimeter and then push inwards and not towards remnant vegetation.
- Remnant vegetation ahead of the stage to be cleared should be quarantined by preventing land clearing vehicles from entering.
- Washdown of vehicles and equipment off site should be prior to arriving on site and to the procedures in DEC Guidelines for Dieback Management.
- No soil and vegetation should be brought to the site apart from that to be used in rehabilitation.
- Plants to be used in rehabilitation should be from dieback free sources.
- Rehabilitated surfaces are to be free draining and not contain wet or waterlogged conditions.
- Illegally dumped rubbish is to be removed promptly.
- No contaminated or suspect soil or plant material is to be brought onto the site.

- When clearing land or firebreaks vehicles are to work from dieback free areas towards dieback areas; or in situations where dieback interpretation is not possible, from areas of higher quality vegetation to areas of lower quality vegetation.

- Roads should be free draining and hard surfaced.

- A split operation will be worked where practicable where the road transport vehicles only access one side of the stockpile or processing area, and excavation vehicles operate on the other side of the stockpiles and processing, reducing the risk of contamination from road transport.

- DEC has determined that material such as sand taken from deeper in the regolith profile where there is no organic and other plant matter carries low risk of spreading dieback. (DEC 2004).

- A hygienic site is to be maintained by not bringing any soil or plant material onto the site except for rehabilitation purposes or from known dieback free areas.

- All plants, seeds and other materials used in rehabilitation will be sourced from dieback free areas.

- The Weed Management Policy will be complied with.

- Topsoil will be cleared according to 7.0 Ongoing Rehabilitation and Mine Closure Plan.

The operational areas lie on an operational farm and normal farm traffic cannot be excluded.

Farm traffic will continue to access the site for normal farm activities, and there will be some times when a farm vehicle will need to access the quarry and vice versa.

Topsoil will be cleared according to 7.6 Rehabilitation Procedures.
The following documents provide guidelines on the management of plant pathogens even though they relate specifically to Dieback.

- *CALM Dieback Hygiene Manual 1992.*
- *CALM Best Practice Guidelines for the Management of Phytophthora cinamomi, draft 2004.*
- Dieback Working Group 2005, Management of *Phytophthora* Dieback in Extractive Industries.

DIEBACK DISEASE			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Dieback Disease	• The management procedures listed above will be followed, even though there is a low risk of dieback because of the low rainfall.	The Proponent will implement and maintain plant pathogen management principles and integrate activities with normal farming operations.	Compliance with this management plan.

6.1.6 Weed Management Plan

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.

The information provided here summarises the key points of the on ground management of weeds that is normally used on this operating farm.

Areas being rehabilitated will be subjected to detailed weed management.

- The Dieback Management Actions will also be used to assist weed management.
- Inspections will 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.
- In autumn the rehabilitated areas will be monitored and a spraying program implemented for the rehabilitated surface prior to additional seeding and planting.
- Large plants will be grubbed out or spot sprayed with a herbicide. Smaller weeds will be sprayed.
- Areas of grass will be sprayed with Fusilade or similar grass selective herbicide. This can occur over the top of rehabilitated areas without significantly setting back the broad leafed species.
- 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 are to be brought to the site apart from that to be used in rehabilitation.
- Plants to be used in rehabilitation are to be free from weeds.
- Illegally dumped rubbish is the major source of weeds and is to be removed promptly.
- No weed contaminated or suspect soil or plant material is to be brought onto the site.
- When clearing land or firebreaks vehicles are to work in conjunction with dieback principles and push from areas of better vegetation towards areas of lower quality vegetation.
- Weeds are to be sprayed with broad spectrum spray prior to planting or seeding in weed affected soils.

- Weed management should work from least affected areas to most affected.
- Declared weeds are to be treated promptly by digging out or spraying.
- Ongoing monitoring of weeds should be undertaken at least annually in autumn, prior to winter rains.

The potential for weeds is less likely to be a problem during excavation.

As noted above the excavation areas lie on an operational farm and normal farm traffic cannot be excluded.

There are normal weed management procedures in place both for general, environmental or Declared weeds. Crop spraying is used as part of normal crop management.

The existing management procedures will continue to be used and integrated with the excavation activities.

Inspections conducted to monitor the presence and introduction of weeds should be carried out on an annual or more frequent basis. On identification, introduced weeds will either be removed, buried, or sprayed with a herbicide. A summary of the types of actions that will be used is listed above, but it should be noted that not all will be used in each situation, but rather the best techniques selected and used to provide the necessary control.

WEED MANAGEMENT			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Weeds	***Agriculture and Related Resources Protection Act 1976.*** • The weed management actions listed above will be used as applicable to manage weeds on the site. • Declared or Environmental weeds will be controlled. • Normal agricultural weed management will be continued.	The Proponent will implement and maintain plant pathogen management principles and integrate activities with normal farming operations	Compliance with this management plan.

6.2 WATER MANAGEMENT

6.2.1 Local Hydrology

The only surface water is runoff from the current land surface.

A small drainage line commences, and a farm dam is located, east of the gravel excavation area.

No groundwater has been intersected in the existing sand pit, and none is expected to be intersected.

Both the gravel and sand pits will be internally draining with no escape of surface water.

6.2.2 Protection of Water Quality

The protection of water whether groundwater or surface water is an important part of the management of quarries. Different types of quarries have different potential impacts which are listed below in general terms. Not all potential impacts will apply to this quarry and the main impacts affecting this site are also listed.

Guidance on the quality of water can be found in;

- *Western Australian Water Quality Guidelines for Fresh and Marine Waters, EPA Bulletin 711, 1993.*
- *ANZECC, 1992, Australian Water Quality Guidelines for Fresh and Marine Waters.*

A number of documents provide guidance on the management and disposal of surface water that can lead to waterways, wetlands and underground water systems. These mainly apply to urban development but the methods are also applicable to the quarrying industry.

- *Department of Resources Development, 1999, Mining Below the Water Table in the Pilbara, Pilbara Iron Ore Environmental Committee.*
- *Engineers Australia 2003, Australian Runoff Quality, National Committee on Water Engineering.*
- *Stormwater Management Manual for Western Australia, Department of Environment WA, 2004.*
- *Guidelines for Groundwater Protection in Australia, ARMCANZ, ANZECC, September 1995.*
- *Environmental Protection Authority Victoria/Melbourne Water, undated, Urban Stormwater, Best Practice Environmental Management Guidelines*
- *Water and Rivers Commission, 1998, Manual for Managing Urban Stormwater Quality in Western Australia.*

Documents specific to the mining and quarrying operations are the DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing.

- *Overview*
- *Minestite water quality monitoring*
- *Minesite stormwater*
- *Mechanical servicing and workshop facilities*
- *Above-ground fuel and chemical storage*
- *Mine dewatering*

The extraction of sand and gravel is a chemically free operation with the only liquids used being lubricants for machinery. Extractive Industries are one of the few industries permitted to operate in Groundwater Source Protection Areas provided a 2 metre vertical buffer is in place.

The proposal complies with Department of Environment and Conservation Guidelines.

IDEAL	OPERATIONAL	COMMITMENTS	ON	ACTIVITIES

PROCEDURES	CONDUCTED ON SITE
• Contain all stormwater on site and only release clean, treated water	• The pits will be internally draining. • All stormwater will collect on the porous floor of the pit and infiltrate into the ground.
• Maintain all plant in good condition	• All mobile and fixed plant is to be maintained in an efficient operational condition.
• Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades, and direct runoff to trapping and filtration device.	• The aceess road to Smith Road is to be formed, graded, wetted down and maintained.
• Recycle water through sediment settling ponds if possible.	• The pit will be internally draining. • As the pit floor will be so porous it will normally be difficult to achieve recycling.
• Provide an approved serviced portable or septic toilet system	• Initially the farm facilities will be used. • At a later date an approved serviced portable toilet might be used.
• Separate extraction, washdown and storm water if water is used	• As stormwater can contain sediment all water will be treated as pit stormwater. • Stormwater from roads is to be shed to the adjoining soils and paddocks.
• Implement a site code outlining requirements for operators and drivers	• Committed to.
• Avoid spillages on roads and clean up promptly	• This forms part of the normal operational procedures.
• Conduct training programs on pollution minimisation practices	• Site induction and training contains programs dealing with pollution prevention.
• In the event of a spill or adverse incident, activities will be stopped in that area until the incident is resolved	• This is included as part of the normal operational procedures and is proposed.
• All significant adverse incidents are to be recorded, investigated and remediated. A record is to be kept of incidents and the Local Authority and Department of Environment and Conservation notified within 24 hours	• A site record book is to be retained. • Any incidents will be reported annually within 24 hours to the DEC and Shire of Northam.
• Provide an environmental monitoring and audit program.	• An internal monitoring and recording system is proposed for all noncomplicance and complaints.
• Monitor water quality	• As there is no surface water, sampling of that waterbody is not appropriate. • Groundwater pollution risk is recognised as low by the DEC and EPA who permit excavation of sand with a 3 metre separation to the water table in the Gnangara Pine Plantation.
• Provide a complaint and remediation program in the event of non conformities.	• A site record book is to be retained. • All complaints are to be investigated. remediated and recorded in the record book.

• Comply with all operational conditions.	• This is committed to.

6.2.3 Groundwater Protection and Water Use

Groundwater will be at the granite basement and will vary according to the undulations in that basement. No groundwater is locally expressed on the surface as seeps.

There is no evidence of groundwater or surface water in the base of the small sand excavation which is cut to gravel some 3 metres deep.

Salinity

There is no known salinity in the soils of this locality. Salt is normally stored at depth under the laterite duricrust remnant plateau.

This site is further downslope from the plateau remnants where salt is more likely to be stored.

As the resource areas are small and already cleared there will be no additional recharge and no risk of mobilising any salt if it is stored under this site.

Recharge and Water use

As noted above there will be no increase in recharge as the resource areas are already cleared.

6.2.4 Surface Water, Dewatering and Drainage

Sand and gravel are very porous and direct infiltration of rainfall is normal without any detention basins or other collection systems.

Dewatering of the pit will not be necessary because of the porous nature of the base.

There are no watercourses on site or nearby that will be altered or impacted on.

There is no need for defined detention basins.

6.2.5 Acid Sulfate Risk

As noted in 2.6 Acid Sulfate there is no risk of acid sulfate on site or resulting from excavations of this type. The geological conditions are not conducive to the formation of iron sulfide or reducing conditions.

6.2.6 Waste Rock and Tailings Management

There will be no washing of sand or gravel. Subgrade materials will be incorporated into the perimeter bunding and landform restoration.

6.2.7 Waste Materials

- **Unauthorised Access and Illegal Dumping**

The potential for rubbish to be dumped relates mainly to poorly managed sites. Access is to be restricted by maintenance of fences, the continued use as a rural property and setbacks from the boundaries.

Wastes generated will be recycled wherever possible and periodically disposed of at an approved landfill site. Any illegally dumped materials are to be removed promptly to an approved landfill or other suitable site, depending on the nature of the material.

- **Solid Domestic and Light Industrial Wastes**

All solid domestic and light industrial wastes will be stored in commercial waste storage containers and/or removed to an approved landfill facility. There will be no waste disposal onsite. Waste storage containers will be sealed so that rainfall cannot enter, therefore preventing the formation of leachates.

- **Domestic Wastewater Disposal**

On farm toilet facilities are proposed to be used. It is possible that at some point in the future a serviced portable toilet system could be used when the site is manned.

6.2.8 Refuelling and Maintenance

The protection of water from fuels and other chemicals is an important part of the management of quarries. Different types of quarries have different potential impacts which are listed below in general terms. Not all potential impacts will apply to this quarry and the main impacts affecting this site are also listed

Extraction of sand and gravel is a clean operation in the nature of the risk to groundwater. No chemicals are used apart from normal lubricants, which is similar to sand excavation, and sand excavation is one of the few industries that are permitted to operate in a Priority 1 Public Drinking Water Source Area, indicating the clean nature of the activity. See Department of Water *Land Use Compatibility in Public Drinking Water Source Areas.*

All spills are to be cleaned up in accordance with the summarised procedures above and the Management Plans which are summarised below.

Documents specific to the fuel and maintenance are the DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing

- *Mechanical servicing and workshop facilities*
- *Above-ground fuel and chemical storage*

A list of the management actions for maintenance is provided above under 6.2.2. The actions will be used where applicable and as the opportunity presents to maintain water quality on this site.

The excavation program is no different to normal agricultural activities on site with maintenance of vehicles used in agriculture and the use of farm products.

- Fuel and maintenance will be carried out in accordance with the DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing, *Mechanical servicing and workshop facilities* and *Above-ground fuel and chemical storage*.

- Soils and hardstand such as those on this site are adsorptive. The main risk of contamination is the minor drips that occur during the removal of hoses etc. Minor spills are quickly degraded by soil microbial matter.

- 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.

- Refuelling and lubricating activities are to occur in designated areas, 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).

- Waste substances and chemicals will be stored in accordance with the Site Waste Guidelines.

- Transport chemicals in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

- 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 Shire of Northam, DEC and DOW notified within 24 hours of an incident.

- 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 soil, sand or grave will be scooped up and removed to an approved landfill or other approved site.

Fuel Storage

Currently it is proposed to use mobile tankers to refuel mobile and fixed plant when the site is manned.

Fuel management will be no different to normal rural operations of tractors and harvesters.

Dangerous Goods and Hazardous Substances

There is no transport, storage or handling of hazardous materials involved in sand and gravel extraction.

Vehicle Maintenance

The excavation program is no different to normal agricultural activities on site with maintenance of vehicles used in agriculture and the use of farm products.

All major servicing of vehicles will be conducted off site. Wastes generated from excavation and processing activities will be collected and removed off site weekly to an approved landfill site.

- Any waste chemicals derived during routine maintenance activities will be stored in appropriately sealed containers within a designated storage area or taken from site and disposed of at an approved facility.

- 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.

- There is not proposed to be any wash down of mechanical equipment.

- Accidental spill containment and cleanup protocol will be implemented as necessary.

- The site will be maintained in a tidy manner by removing all rubbish regularly offsite.

WATER QUALITY			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**

General Management	*DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing* • *Overview* • *Minestite water quality monitoring* • *Minesite stormwater* • *Mechanical servicing and workshop facilities* • *Above-ground fuel and chemical storage* • *Mine dewatering* • Management procedures outlined above will protect water quality. • All spills are to be cleaned up as described in the Management Plan above	The Proponent will maintain the relevant water protection policies to minimise the potential for alteration to surface or ground water.	Compliance with the Management Plan.
Surface water	• There will be no surface water runoff and no dewatering. All water will be contained within the pit and allowed to infiltrate into thesand and gravel.	None necessary.	Compliance with the Management Plan.
Ground water	*DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing* • Interpretation of the geology and hydrology, shows that there will be no significant alteration to the groundwater regime. • The excavations will be no different to normal farming in terms of risk. • Complies with all Government Policies. • The management actions listed above will be complied with. • The operational procedures are the same as those used by other local gravel and sand excavators. • No fuel will be stored on site. Mobile tankers will be used.	The Proponent will maintain the relevant water protection policies to minimise the potential for alteration to surface or ground water.	Compliance with the Management Plan.
Salinity	• No evidence of surface water or salinity.	None necessary.	None necessary at this time
Waste Materials	***DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing*** • Normal farm toilet facilities will be used. • A serviced portable waste water system may be used on site in the future. • No liquid or solid wastes will be disposed of on site. • All waste will be collected and either recycled or disposed of at an approved waste disposal site.	The Proponent will maintain the relevant water protection policies to minimise the potential for alteration to surface or ground water.	Compliance with the Management Plan.

6.3 ATMOSPHERIC POLLUTION AND NOISE

6.3.1 Visual Managemen

Visual Impact can occur in a number of circumstances, by the operation being set too high in the landscape, by being too close to neighbours and by insufficient visual protection.

There are a number of management actions that can be taken in quarries to minimise visual impact and these will be used wherever possible. The general management actions are summarised below together with the visual impact issues that relate to this site. The actions will be used where applicable and as the opportunity presents to minimise visual impact.

The operations are located on gently rising ground set back from most roads and dwellings.

The area most susceptible to visual impact is the dwelling in Searle Drive to the west of the sand excavation.

The sand pit will be worked from east to west to provide maximum screening.

The excavation operations will incorporate the procedures listed above wherever possible to minimise visual impact from on site activities.

Low perimeter bunds of overburden will be constructed to assist visual screening.

The pits will be stabilised by the use of top soil as discussed in 70 Ongoing Rehabilitation and Mine Closure.

Excavated areas will be progressively rehabilitated as they are completed when possible.

The pits will both operate below natural ground level surrounded by existing vegetation with additional screening vegetation to be planted along Searle Road. A perimeter bund will be created from overburden prior to excavation to provide visual screening. Topsoil will be added to the bund to provide a cover of vegetation.

The Proponent will incorporate the procedures listed below wherever possible to minimise visual impact from on site activities.

The excavation will operate from the floor of the pit behind the existing faces, which will assist visual screening. Excavation will push towards the perimeters behind the existing faces, with the floor being progressively lowered.

IDEAL OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE
• Locate exposed features behind natural barriers and landform.	• The pits are to be located behind perimeter bunding and vegetation.
• Operate from the floor of the pit below natural ground level.	• This proposed. • The pit is to be worked from the inside out.
• Avoid breaks in the skyline due to workings and haul roads.	• The access road will be through the centre of the paddock.
• Push overburden and interburden dumps into positions where they will not be seen or can form screening barriers.	• Perimeter bunds are to be formed from overburden.
• Construct screening bunds and plant tree and shrub screens to reduce visual impact.	• Perimeter bunds are to be formed from overburden. • Existing trees are in place and will be added to on the west of the sand excavation.
• Stage workings and progressive rehabilitation to provide visual protection of later activities.	• This is proposed. See attached plans.
• Cover barriers and landscaping with forms, colours and textures compatible with the natural environment.	• The operations will be located on the floor of the pits so this is less applicable.

• Adopt good house cleaning practices such as orderly storage and removal of disused equipment or waste.	• Waste is to be regularly removed off site to an approved waste facility. • Where possible, used products will be recycled.
• Provide progressive rehabilitation of all completed or disturbed areas.	• This is proposed.
• Minimise the amount of ground used at any one time.	• This is proposed, with the open area being 1 hectare for the sand and gravel pits, moving progressively across the footprint followed by rehabilitation. • Some adjustments to 2 hectares each may be required because of potentially different rates of excavation and resource quality.
• Install fences and gates which are compatible with the style of the area.	• Gates and fences are in place and are to be maintained.
• Minimise offsite impacts of night lighting.	• Night operations are not proposed.
• Paint and maintain buildings exposed, plant and equipment with low impact colours.	• No permanent fixtures are anticipated on site. • A portable seatainer may be used on a temporary basis located on the floor of the pit or behind vegetation.
• Locate roads and access to prevent direct views into the site	• The access road is proposed to be along the western edge of the resource area.
• Locate buildings, plant and stockpiles in areas of low visual impact and maintain appropriate size.	• No permanent fixtures are anticipated on site. • A portable seatainer may be used on a temporary basis located on the floor of the pit or behind vegetation.
• Provide temporary revegetation of road embankments and disturbed areas as soon as practicable.	• Rehabilitation is proposed to follow excavation.
• Control weeds and maintain amenity planting.	• A weed control program is proposed. • Progressive revegetation and screening belts of trees are proposed.
• Ensure transport vehicles do not spill material on public roads and ensure prompt cleanup if it occurs.	• Company practices and drive/operator training address the need to minimise spill by ensuring the trucks are not overloaded or material is not left on the outside of trays. • Collection of spills is carried out when reported. • Drivers are instructed to be responsible for their loads. • All loads are required by company policy to be covered, or secured.

Light Overspill

It is not proposed that the facility will operate at night.

VISUAL MANAGEMENT			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Neighbours or road users.	• It is not proposed that the facility will operate at night.	Not applicable	Not applicable

6.3.2 Noise Management

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 areas are not subjected to noise levels exceeding 45 dBA for more than 10% of the time, 55 dBA for more than 1% of the time and never exceeding 65 dBA during normal working hours. There are penalties for tonality of 5 dB, modulation 5 dB and 10 dB for impulsiveness, although impulsiveness is not likely to be relevant.

Occupational noise associated with the quarrying processes falls under the Mines Safety and Inspection Act 1994 and Regulations 1995. 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. Regular site audits of quarry and mining operations are normally conducted by the Department of Industry and Resources.

The excavation operations will incorporate the procedures listed below wherever possible to minimise noise emanation from on site activities.

The excavation is designed to operate from the floor of the pit set well back from local roads and dwellings.

The main impact risk is to the dwellings in Searle Drive. The only nearby dwellings are to the sand excavation at 500 – 230 metres behind perimeter vegetation on the western boundary. All other buffers are large.

Overburden will be used to form noise screening bunds around the perimeter of the excavations.

All static and processing equipment will be located on the quarry floor 2 - 3 metres below natural ground level, to provide maximum shielding.

Normal sand and gravel excavation is a relatively quiet operation screened by the walls of the quarry.

Methods of extraction are not expected to be any different to excavation on local quarries. The sand and natural gravel will be loaded directly to road truck by a loader. The operation is little different to that of a farm tractor.

Operations will be intermittent, with excavation on perhaps only 30 – 50% of the days available.

All equipment will be fitted with noise shields and efficient silencers. Workers will be inducted and trained for operation on the site and provided with the correct noise protection equipment.

Excavated areas will be progressively rehabilitated as they are completed.

Blasting

Blasting is not proposed or required.

Normal Quarry Management

There are a number of management actions that can be taken in quarries to minimise noise generation or travel and these will be used wherever possible. The general management actions are summarised below together with the potential noise impact issues that relate to this site. The actions will be used where applicable and as the opportunity presents to minimise noise on this site.

The following table summaries the methods that are normally used in quarries to minimise unacceptable noise generation.

IDEAL OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE
• Comply with the *Environmental Protection (Noise) Regulations 1997.*	• The Proponent is committed to compliance at all dwellings and has designed the

	excavation accordingly. • The excavation complies with the EPA generic buffer guidelines for all dwellings apart from that in Searle Drive. • The separation to two dwellings in Searle drive of 230 to 500 metres is greater than that for a number of pits operating in the Perth Metropolitan Area without complaint. • The sand will be excavated intermittently from behind the face at a distance of 230 – 500 metres.
• Maintain adequate buffers to sensitive premises.	• See above. • The Hope Valley – Wattleup limestone quarries operate closer than 100 metres behind perimeter bunding in full compliance with the Noise Regulations.
• Locate exposed features behind natural barriers and landform.	• Screening bunds and vegetation within the buffers exist or are proposed around the perimeter. • Excavation and processing will be conducted on the floor of the pit at least 2 metres below natural ground level and the bunds, which will provide acoustic screening.
• Operate from the floor of the pit below natural ground level.	• This is proposed.
• Push overburden and interburden dumps into positions where they can form screening barriers.	• This is proposed.
• Design site operations to maximise the separation and protection from sensitive premises.	• This is proposed.
• Maintain all plant in good condition with efficient mufflers and noise shielding.	• The Proponent is committed to this.
• Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	• The access road will be constructed and maintained in good condition. • The location of the access road is to minimise impact on local residents
• Implement a site code outlining requirements for operators and drivers.	• This is committed to with site induction and training for all personnel for all parts of the operations.
• Design the operations to provide enhanced landform and constructed noise screening.	• The site already has screening and the operations have been designed to minimise impact on local residents.
• Shut down equipment when not in use.	• This is committed to save fuel and maintenance costs in addition to noise minimisation.
• Scheduling activities to minimise the likelihood of noise nuisance.	• Quarrying and processing operations are to be conducted during normal working hours between 7.00 am to 5.00 pm, Monday to Saturday. • Operations will only occur on 30 – 50% of days. • On a particular day only 1 or 2 loads may be carted. With perhaps 5 loads on a typical day.
• Fit warning lights, rather than audible sirens or beepers, on mobile equipment wherever possible.	• Lights or low frequency frog beepers are to be used rather than high pitched beepers to restrict noise intrusion.
• Use transport routes that minimise community disruption.	• Transport will use the access road, entering Smith Road next to Great Eastern Highway.
• Avoid the use of engine braking on product delivery trucks in built up areas.	• Great Eastern Highway is a major transport route. Trucks from the pits will be no different to other traffic.

• Minimise and conduct at the least disruptive times, non day to day activities such as vegetation, topsoil or overburden stripping on exposed ridgelines.	• Quarrying and processing operations are to be conducted during normal working hours between 7.00 am to 5.00 pm, Monday to Saturday.
• Provide a complaints recording, investigation, action and reporting procedure.	• A complaints recording and investigation procedure will be maintained.
• Conduct training programs on noise minimisation practices.	• The Proponent will conduct site induction and training for all personnel.
• Provide all workers with efficient noise protection equipment.	• All personal noise protection equipment is provided to staff.

NOISE			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Noise may impact on neighbours	*Environmental Protection (Noise) Regulations 1997.* • The quarry complies with the Generic EPA Buffer Guidelines for all but one dwelling. • The distance to the closest two dwellings will be 230 – 500 metres for the sand excavation, which is in excess of a number of sand quarries in Perth. • All mobile plant and stockpiles will be located on the floor of the quarry. • Every effort will be made to minimise the noise impact using appropriate methods from those listed above.	The Proponent is committed to minimising noise emissions and will implement the measures outlined. The Proponent and operator will comply with the *Environmental Protection (Noise) Regulations 1997.*	None necessary at this time. Ongoing
Blasting	• Blasting is not proposed.		
Workers	*Mines Safety and Inspection Act 1994 and Regulations 1995.* • All workers will be supplied with the correct noise protection equipment. • Workers will be inducted to the site and instructed in the use of noise protection equipment and the potential hazards and minimisation.	Noise management implemented by the Proponent will comply with the provisions of the *Mines Safety and Inspection Act 1994 and Regulations 1995.*	All workers will be supplied with adequate noise protection equipment as required when operating machinery. Ongoing

6.3.3 Dust Management Plan

Excessive dust has the potential to impact on both the workers and the adjoining land.

Dust can originate from a number of operations and may impact on onsite workers, or travel offsite. Potential dust impacts are addressed by reducing the dust generated from the quarrying, processing and transport operations.

Dust emissions fall 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. A draft Dust Management Guideline on the development and implementation of a dust management program has just been released for comment by the Department of Environment and Conservation (May 2008). This mainly relates to monitoring.

Occupational dust associated with the quarrying processes falls under the Mines Safety and Inspection Act 1994 and Regulations 1995 overseen by the Department of Occupational and Consumer Employment Protection.

There are a number of management actions that can be taken in quarries to minimise dust generation or travel and these will be used wherever possible. The general management actions are summarised below together with the potential dust issues that relate to this site. The actions will be used where applicable and as the opportunity presents to minimise dust on this site.

Excessive dust has the potential to impact on both the workers and the adjoining land. From sand and gravel extraction the main particles are sand sized particles from the sand itself and from the gravel. These are normally in excess of 0.5 mm and have a capability of moving by saltation and do not travel far, being easily stopped by vegetation, pasture, small banks or other features.

Dust could be a potential problem during land clearing and reinstatement and during excavation in the summer months. Dust from organic humic matter can be generated during land clearing and restoration of topsoils.

The greatest risk though is from finer dust that can be generated from traffic situations where finer clay sized particles are present. The access road will be gravel and dust generated from the access road will be the same as that from normal gravel roads which occur locally such as Bobakine Road, Norwood Road and Searle Drive, all of which are gravel.

The access road is to be located away from dwellings, and, with the minimum distance available to the closest dwelling of 400 metres rapidly increasing to over 1 km, the risk of dust from transport along the access road is regarded as very low. Distances to other dwellings from the access road are in excess of 1 km.

The access roads will be formed from gravel in the same manner as local roads.

Sand does blow by saltation, but, being in the base of the pit, wind velocities are low and the grains will not be able to escape from the pit.

The prevailing winds are from the south west, particularly in the afternoon in summer with easterly winds more predominant in the mornings. Winter winds are more variable.

The most likely time for dust to become an issue is during activity on summer mornings when winds are easterly, blowing towards a dwelling in Searle Drive. With operations below natural ground level, protected by landform, vegetation, bunding and buffers, it is unlikely that dust will impact on nearby residences.

It should be remembered that the most significant potential dust impact is occupational dust which requires good environmental and health and safety management and is regulated by the *Mines Safety and Inspection Act 1994 and Regulations 1995*. When occupational dust is managed then environmental dust is also minimised.

Overburden will be used to form screening perimeter bunds. The vegetation in the parkland pasture and remnant vegetation will assist in dust management, by trapping particles.

A water tanker may be required on site during excavation when there is a risk of generating excessive dust. The water will be used to settle dust on the pit floor and to reduce the dust emanating from any crushing operation.

Apart from the initial land clearing and surface reinstatement, all operations will be conducted below natural ground level. Bearing in mind the distances involved and the dust suppression methods in place, dust should not impact on any dwellings.

Dust emissions fall under the *Guidance for the Assessment of Environmental Factors, EPA, March 2000*. However an assessment of the dust risk can be made using the *Land development sites and impacts on air quality*, Department of Environmental Protection Guidelines, November 1996 which reveal that the risk of dust impacting on the closest dwelling is as listed below.

It must be remembered that this guideline is not really appropriate for quarries. It was developed for subdivision earthworks at a time when dust management was a lower priority.

All quarries have active and comprehensive dust management procedures in place and are required to do so to protect visual amenity and their staff. The Guidance has been used, but factored in is a reasonable amount of dust management. Using the normal dust management there is a negligible risk of dust impacting on sensitive premises..

Activity	**Calculated Score**	**Allocated Risk of Dust**
Land clearing and excavation	252 for closest dwelling	Low
	Other dwellings	Negligible

A number of ideal dust management procedures apply to quarries. These are listed in the following table with a comment on how the Proponent will manage the potential issue.

- The trigger for dust management will be generation of visual dust.
- The site supervisor is normally the loader driver who is in the best position to assess dust generation and to direct remediation.
- No visible dust will cross the lot boundaries.
- On site operators are instructed to visually monitor dust, report and treat any visible dust.

IDEAL OPERATIONAL PROCEDURES	**COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE**
General	
• Comply with the provisions of the *Mines Safety and Inspection Act 1994 and Regulations 1995.*	• The Proponent will comply with the Act and regulations.
• Maintain adequate buffers to sensitive premises.	• All but one dwelling comply with the EPA generic buffer guidelines. • Extensive management procedures are proposed to minimise any impact risk on the closest dwelling.
• Locate activities behind natural barriers, landform and vegetation.	• This is proposed.
• Work below natural ground level.	• This is proposed.
• Push overburden and interburden dumps into positions where they can form screening barriers.	• This is proposed.
• Plant screening barriers with trees.	• Vegetation buffers are already in place. • Additional planting is proposed for Searle Drive.
• Design operational procedures and staging, to maximise the separation to sensitive premises.	• This is proposed. • The excavation complies with the EPA generic buffer guidelines for all dwellings apart from two in Searle Drive. • The separation to two dwellings in Searle drive of 230 to 500 metres is greater than that for a number of pits operating in the Perth Metropolitan Area without complaint. • The sand will be excavated intermittently from behind the face at a distance of 230 – 500 metres.
• Design the excavation to provide enhanced landform and constructed dust screening.	• This is proposed.
• Schedule activities such as vegetation,	• This is proposed.

topsoil or overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	
• Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat.	• The access road will be gravel like all rural roads. • The access road is located well away from all dwellings. • Activity in the pits will be minimal. • A dedicated water truck may be used in times of excessive dust risk.
• Use landscape screening, wind breaks and tree belts.	• Vegetation buffers are already in place. • Additional planting is proposed for Searle Drive.
• Provide a complaints recording, investigation, action and reporting procedure such as Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996.	• A record of all dust complaints will be maintained together with the mitigation measures to be used to reduce the dust impacts. • All complaints relating to dust will be investigated immediately on receipt of a complaint. Appendix 3 of *Land development sites and impacts on air quality*, Department of Environmental Protection Guidelines, November 1996, will form the basis of the methods on which a complaint on dust is dealt with.
• When winds are sufficiently strong to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.	• This policy is to be implemented and is normal company policy. • In the event of dust management not being able to be achieved, such as a bore breakdown or exceptional weather conditions, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining land holders.
• Conduct training programs on dust minimisation practices.	• The Proponent uses on site induction and training to all personnel at all operations.
Quarrying	
Ensure the drill is provided with dust extraction and shielding.	• Drilling will not be required.
Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	• The only road will be the access road, which is located well away from dwellings and will be maintained • The access road will have self imposed speed limits. • The access road will be formed in the same manner as local gravel roads.
Provide air conditioned closed cabins on plant.	• All vehicles operating on site are to be air conditioned.
Limit speed on haul roads.	• There will be no haul roads. See above.
Plant - Processing	
• Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	• There will be no haul roads. See below. • This will be applied to the access road.
• Treat processing areas with water sprays.	• There is not anticipated to be any processing on site.
• Provide air conditioned closed cabins on plant	• These are used for on site operational mobile plant.
• Limit speed on haul road	• Strict speed limits will be applied for safety and site management through signage and/or staff induction.
• Maintain all plant in good condition.	• This is committed to.
• Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate.	• No processing is proposed.

• Shut down equipment when not in use.	• The Proponent uses this policy to save fuel and maintenance costs in addition to noise minimisation.
• Limit drop heights from conveyors and dump trucks.	• This will be implemented even though there is no processing on site.
• Provide monitoring and supervision of the processing and other practices on site.	• Operators are instructed to visually monitor dust, report and treat any visible dust. • Faults will be repaired promptly. • Regular maintenance programs for all dust suppression equipment will be used. • Regular emptying of any dust collection devices and the renewal of any filter devices will be used. • Dust management and monitoring will form part of the site induction programs.
• In the event of dust management not being able to be achieved, such as a bore breakdown or exceptional weather conditions, the dust generating activities will be stopped until conditions improve.	• This is committed to.
Transport	
• Maintain a Dust Management Plan.	• This section constitutes the Dust Management plan.
• Maintain access roads in good condition (free of potholes, rills and product spillages).	• The only road will be the access road, which is located well away from dwellings and will be maintained • The access road will have self imposed speed limits. • The access road will be formed in the same manner as local gravel roads.
• Water and/or treat access and haul roads and paved areas using a water tanker or sprinkler system.	• The only road will be the access road, which is located well away from dwellings and will be maintained • The access road will have self imposed speed limits. • The access road will be formed in the same manner as local gravel roads. • A water truck may be used when dust lift off is a potential hazard
• Wet down or cover loads on trucks that are likely to blow during transport.	• This will be used for road trucks. • Trucks will be required to install tarpaulins or cover prior to exiting the quarry.
• Implement a site code outlining requirements for operators and drivers.	• A site code and induction system is proposed for the quarry.
• Maintain road trucks in a clean condition.	• Road trucks are to be maintained in a clean condition. Individual contractors will be encouraged to do likewise.
• Reduce the length of the internal roads by maximising internal servicing efficiency.	• The shortest most safe access roads will be used.
• Providing speed management on hardstand and the road network.	• The Proponent will maintain speed restrictions for safety and site management on all sites.
• Avoid spillages on roads and clean up promptly.	• The Proponent has a policy of covering or wetting down loads and instructs drivers to report and clean up spillages.
• Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport.	• This forms part of normal operational procedures.
• Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	• This forms part of normal operational procedures.
• Use wetting and sealing agents to bind unsealed road.	• It is not anticipated that this will be required, but it remains an option.

Stockpiles	
• Wet down stockpiles using water canon or sprinklers as required.	• Stockpiles will not generally be required and will be small if used. • Gravel is resistant to dust lift off after rain has fallen. • Sand from stockpiles moves by saltation up to 1 metre off the ground and is unlikely to escape the quarry faces as they will be located on the floor of the pit. Stockpiles of sand are not proposed.
• Locate stockpiles behind bunds/ windbreaks or other screening barriers	• This is normal practice.
• Reduce the height of stockpiles. Low flat stockpiles are less likely to be disturbed by wind than high conical ones.	• Stockpiles will not generally be required and will be small if used. • Stockpiles are to be located on the floor of the pits.
• Wash crushed products where possible.	• There will be no crushing.
• Locate coarser products around fine materials to assist wind protection of the finer products that are more likely to blow or contain greater amounts of dust.	• There is not anticipated to be any crushing or screening.
• Provide bunding, fencing and windbreaks around stockpiles and along the tops of bunds.	• This has been factored into the design of the operations.
• Plant the bunds with trees and provide wind breaks.	• Vegetation is already in place and more is proposed to Searle Drive.
• Seal the stockpiles with spray on sealant.	• Stockpiles will not generally be required and will be small if used.
• In extreme conditions stockpiles can be covered although this is often not practical.	• Stockpiles will not generally be required and will be small if used.

In the event of dust management not being able to be achieved, such exceptional weather conditions, the dust generating activities will be stopped until conditions improve, to minimise impact on adjoining land holders.

All complaints relating to dust will be investigated immediately on receipt of a complaint. Appendix 3 of *Land development sites and impacts on air quality*, Department of Environmental Protection Guidelines, November 1996, (or similar) will form the basis of the methods on which a complaint on dust is dealt with.

When winds are sufficiently strong to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.

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

Appendix 3.

Procedures to be adopted following a complaint from a land development site

The procedures to be adopted by the developer following receipt of a dust-related complaint from a member of the public should be as follows:

- Record the details of the complaint as specified below. The complaint form should be retained by the developer and be made available upon request by the local government or an authorised DEP officer.
- Take measures to control any excessive dust by implementing the contingency arrangements which have been specified for the agreed site classification.
- If the developer regards the complaint to be unjustified, then the developer should forward the details of the complaint to the local government within 24 hours.

As a guide, the procedures to be adopted by local government, following receipt of a dust-related complaint from a member of the public or passed on by the developer, should be as follows:

- Record the details of the complaint as specified below or on a local government-approved complaint form. The complaint form should be retained by the local government and be made available upon request to an authorised DEP officer.
- Evaluate the complaint by conducting a visual inspection, preferably as soon as possible, taking into account the prevailing weather conditions which were being experienced at the time the complaint was lodged.
- If the complaint is valid, instruct the developer to take measures to control any excessive dust by implementing the contingency arrangements which have been specified for the agreed site classification.
- If the local government regards the complaint to be unjustified, contact the complainant and inform them of these findings.
- If the local government is unable to resolve the complaint, after exhausting all possible avenues, then the local government may request advice from the DEP.

Appendix 3.

Pollution Incident Report Form - Land Development Sites

Sheet 3

Date: .....(1) **Time:**.....(2) **Received by:** .....(3)

From:

Name:.....(4) Tel. Nº·(s):.....(5)

Address:.....(6)

Area/Suburb:.....(7) Municipality:.....(8)

Name of developer:.....(9)

Address of developer .....(10)

Address of development: .....(11)

Type of complaint (Odour, Dust, Smoke, Noise, Other).....(12)

Details of Incident Received (effect/frequency): .....

.....

.....(13)

Referred to:.....(14) Date: .....(15)

Action Taken/Advice Given/Matter Referred to: .....

.....

.....

.....

.....(16)

Recorded by: .....(17) Date:.....(18)

DUST			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Neighbours	*Guidance for the Assessment of Environmental Factors, EPA, March 2000.* *Land development sites and impacts on air quality, DEP, 1996.* • The potential for dust nuisance is assessed as "Negligible Risk" for all dwellings with the exception of the closest dwelling which at times will be subject to a "Low" Risk. when using normal dust management procedures. • The forms listed "Appendix 3" (*Land development sites and impacts on air quality, DEP, 1996)* above will be used in the event of a complaint on dust. • The Proponent will investigate and act upon any complaint received.	The Proponent will take the necessary steps to manage and contain dust by implementing and maintaining the Dust Management Plan methods listed above.	Compliance with the Dust Management Plan. Ongoing
Workers	*Mines Safety and Inspection Act 1994 and Regulations 1995.* • All workers will have access to efficient dust masks for use as required. • All workers will be instructed in the use of dust minimisation equipment.	The Proponent will take the necessary steps to manage and contain dust by implementing and maintaining the Dust Management Plan methods listed above.	All workers will have access to efficient dust masks for use as required. All workers will be instructed in the use of dust minimisation equipment. Ongoing

6.3.4 Fire Management

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

Normal rural firebreaks will be maintained.

The safety of workers is managed through a Safety Management Plan developed through the Mines Safety and Inspection Act 1994 and Regulations 1995.

There are a number of management actions that can be taken in quarries to minimise fire risk and these will be used wherever possible. The general management actions are summarised below together with the potential issues that relate to this site.

The actions will be used where applicable and as the opportunity presents to minimise fire risk.

- *Restrict vehicles to operational area, particularly on high fire risk days*
- *Comply with vehicle movement bans in summer*
- *Use diesel rather than petrol powered vehicles*
- *Maintain perimeter fire breaks as required*
- *Ensure fire risk is addressed and maintained through the site Safety Management Procedures*
- *Provide an emergency muster area, communications and worker induction and training*
- *Establish on site water supplies for potential use in extinguishing fire*

- *Secure the site from unauthorised access*

The operations are no different to those of normal farm machinery use.

There is less potential fire risk from quarries than other land uses because quarries clear land, and vehicles are restricted to cleared access roads, the pit floor, processing and stockpile areas.

These cleared areas form a natural firebreak. The main risk comes from an external fire in the surrounding vegetation, impacting on the quarry. As such the fire risk is no greater than a rural property.

Fire risk is normally controlled through the *Bush Fires Act 1954* and local authority bylaws.

Perimeter firebreaks will be maintained as necessary

FIRE PROTECTION			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Fire Protection	*Bush Fires Act 1954* Shire of Northam bylaws. • The excavated area provides a natural fire break. • Perimeter firebreaks will be maintained. • Public access to the site will be prohibited. • Water for dust minimisation will be available for fire fighting. • The site is serviced by UHF radio and mobile telephone contact.	The Proponent will ensure the quarry operates to the standards in the *Mines Safety and Inspection Act 1994 and Regulations 1995.* The Proponent will ensure the quarry complies with the local fire safety requirements.	Compliance with requirements. Ongoing

7.0 ONGOING REHABILITATION AND MINE CLOSURE PLAN

7.1 Land Use Policies

The site is zoned Rural.

7.2 End Use

The extraction of sand and gravel is seen as an interim use of the land prior to utilisation of the area by the land holder for Rural and Rural Living future use.

- **Final Contours**

At the end of excavation, any overburden will be used to backfill the site in compliance with the safety considerations of the *Mines Safety and Inspection Act 1994* and the requirements and guidelines of the Department of Mines and Petroleum; For example *Guidelines on Safety Bund Walls Around Abandoned Open Pits 1991.*

The gravel pit will be 1 – 2 metres below natural land surface and the sand pit will be 2 – 3 metres below natural surface, with both pits battered at slopes of less than 1 : 4 vertical to horizontal.

7.3 Mine Closure Considerations

The final land use will be Rural or Rural Living

Rehabilitation will include Plant Pathogen Dieback and Weed Management in addition to monitoring and replanting failed areas.

Appropriate topsoil management is seen to be an important element in achieving successful rehabilitation and plant re-establishment on the restored surface.

Restoration of the land surface will be to productive cropping and grazing.

Rehabilitation should contain Dieback and Weed Management in addition to monitoring and replanting failed areas. There should also be a completion criteria against which the revegetation should be compared.

There are a number of management actions that can be taken in quarries to maximise rehabilitation effort and these will be used wherever possible. The general management actions are summarised below and will be used where applicable and as the opportunity presents.

Restoration will use normal agricultural cropping and seeding practices.

Rehabilitation will progressively follow mining with completed areas of the excavation being revegetated as soon as practicable.

Rehabilitation is to take place during the first winter months to minimise compaction effects.

The site specific issues that relate to this site are also listed to explain how this site compares to the general rehabilitation guidelines.

7.4 Rehabilitation Objectives and End Use

The site is on an existing rural propoery on pasture and Tagasaste and will be retuened to Rural Use.

Ther eis the potential at some future time for Rural Living and the rehabilitated surfce shoudl be compatible with either end use.

Rehabilitation Objectives

The aim of the rehabilitation program is revegetation to productive cropping and grazing land.

The concept excavated floor is proposed to be a flat to gently sloping floor with batter slopes of lower than 1 : 4 vertical to horizontal.

The final land surface will be smoothed to be compatible with the existing natural landform of the area.

As the gravel and sand soils are porous there will be less need for upslope contour or diversion banks to prevent water entering the void.

Appropriate topsoil and overburden recovery and management is seen to be an important element in achieving successful rehabilitation and plant re-establishment on the restored surface.

Completion criteria

Completion Criteria

- Stable post-mining landscape, and the minimisation of wind and water erosion.
- Provide for the protection of the local groundwater resource in terms of both quality and quantity.
- Provide a self sustaining cover of pasture.
- Achieve clumps or belts of trees and shrubs at the rate of 20 per hectare in strategic areas that will not compromise agriculture.
- Achieve weed species at levels not likely to threaten the pasture and land uses.

Vegetation Clearing

1. The only trees are eight isolated Eucalyptus calophylla and Tagaste. Pasture will be taken with the topsoil.

Topsoil and Overburden Removal

2. Where possible topsoil and overburden will be directly transferred from an area being cleared to an area to be rehabilitated.
3. 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.
4. If direct transfer is not possible the vegetation is to be stored in low dumps to 1 metre high for later spreading.
5. Overburden and interburden should be removed and stored separate from topsoil.

6. Overburden, as subgrade gravel, will be pushed to the perimeters of the excavation, to assist with visual and noise screening. From there it can be used for the rehabilitation process.

7. Excavation will be worked progressively in the stages as shown on the attached plan.

8. Where possible topsoil clearing will be undertaken in wetter months.

Landform Reconstruction and Contouring

1. All buildings, equipment and machinery will be removed from site.

2. The final landform will be formed to the interim final concept plan.

3. The land surface will be left flat to gently sloping floor with batter slopes of lower than 1 : 4 vertical to horizontal.

4. The land surface will be formed to the requirements of the *Mines Safety and Inspection Act 1994 and Regulations 1995* as a final land surface.

5. The excavated floor will be deep ripped in two directions. The width between rip lines will be 1 metre intervals.

Planting substrates should be left rough to encourage rainfall infiltration.

Erosion of sloping surfaces can be minimised by leaving the surface soft, rough and undulating, with the undulations running along contour.

The final machinery run should be along contour and not down slope.

6. A minimum of 300 mm of overburden will be spread over the surface where available to provide a substrate for agricultural soils, followed by topsoil.

Pre-Planting/Seeding and Weed Control

1. Pre-seeding weed control is only likely to be required where topsoils are used that contain weed species. As the current land use is pasture it is not anticipate that weed control will be other than normal agriculture practice.

2. In May, after the first autumn rains, check for broadleaf weed germination.

3. If required, weed control will normally only be conducted after overburden and topsoil have been spread and any seeds have been allowed to germinate. Broadscale weed treatment can be detrimental to the germination and growth of some plant species but may be required if the weed load is to be reduced.

4. Any weeds likely to significantly impact on the rehabilitation are to be sprayed with broad spectrum spray or grass specific spray depending on the species involved.

5. Any weeds likely to significantly impact on the rehabilitation will be sprayed with Roundup or similar agriculture 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.

Revegetation

1. The Proponent will spread topsoil to increase the total organic carbon fraction, improving soil properties such as resistance to water and wind erosion and moisture retention.

2. Topsoil provides a useful source of seed for rehabilitation when the correct handling of the topsoil is used, stripped and replaced dry (autumn direct return).

3. 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.

   Topsoil will be spread at depths of 5 cm.

4. Topsoil will be spread directly from an area being cleared where possible, otherwise reclaimed from a topsoil dump.

5. Revegetation will take place during the first winter months following the restoration earth works of each particular section of quarry. Leaving the completed earth works for one season will reduce the success of rehabilitation by at least 50 %, due to compaction effects.

6. Local native trees will be established in clumps or belts of trees and shrubs at the rate of 20 per hectare in strategic areas that will not compromise agriculture planted in June - July. The planting will take place in previously deep ripped ground.

7. Rehabilitation will progressively follow mining with completed areas of the excavation being revegetated as soon as practicable.

Fertiliser

1. Fertiliser is not always required. If used, a fertiliser containing nitrogen, phosphorous and potassium, and trace elements, is recommended to be spread at rates of up to 100 kg/hectare similar to normal agricultural practice, applied to rehabilitation areas in the year of planting. Nitrogen can be provided by using leguminous seed in the seed mix or inoculating with nitrogen fixing microbial material.

2. Further investigation will be needed to determine suitable rates and the timing of fertilisation. 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.

Irrigation

1. Experience on local pasture and revegetation has shown that when completed well there is no need for irrigation of the rehabilitation.

Erosion Control

1. Wind erosion and the movement of sand grains can significantly impact on growth rates unless controlled in susceptible areas. Remedial actions can include but not be limited to; fence wind breaks, spray mulching, cover crops, interim native vegetation or spreading mulch and vegetation.

2. Soil erosion occurs when soil is exposed and disturbed by wind or water. Erosion involves soil particles being detached from areas not adequately protected by vegetation, and moved down-slope. This is not normally a significant problem on flat or gently sloping gravel ites such as this.

3. The soils are very permeable and runoff is normally minimal unless surface materials become non-wetting. Even so experience shows that there is minimal non wetting and surface particle movement under such conditions. The final land surface will be formed to be internally draining to retain precipitation.

4. Gravel soils are not susceptible to wind erosion.

5. Contour/interceptor banks will be constructed to prevent rain from causing excessive soil movement and to manage surface water erosion risk. These will be constructed to normal agricultural standards.

6. For rehabilitation areas, revegetation will take place as soon as possible following landform and soil reconstruction.

Monitoring

1. Rehabilitation should be monitored at least annually to determine growth rates, any factors impacting on revegetation and to compare against the completion criteria.

2. Steps to remedy deficiencies in rehabilitation should be taken during the next planting period.

3. Monitoring and restoration should be undertaken for three years or until completion criteria is achieved.

4. During late summer an assessment of the success of the rehabilitation will be made to determine the rehabilitation requirements for the following winter.

5. Monitoring includes visual assessments and, where necessary, counts to determine the success of the rehabilitation and restoration, as follows;

    - plant density
    - plant growth
    - plant deaths
    - regeneration
    - weed infestation

6. As necessary steps will be taken to correct any deficiencies in the vegetation.

7. Rehabilitation of each stage will be monitored to ensure satisfactory establishment of pasture.

8. In conjunction with the landholder, provide ongoing weed management to identify and treat significant environmental weeds or weeds likely to impact on the rehabilitation.

9. In areas of rehabilitation that do not meet the completion criteria, measures are to be taken to increase the stem density to achieve the completion criteria. This could include but not be limited to;

    - additional seeding,
    - planting additional tube plants,
    - additional use of fresh topsoil.

Species List

Local species to be used for revegetation and screening.

Acacia acuminata
Acacia microbotrya
Acacia saligna
Allocasuarina capestris
Allocasuarina fraseriana
Allocasuarina huegeliana
Eucalyptus accedens
Eucalyptus calophylla
Eucalyptus loxophleba
Eucalyptus marginata
Eucalyptus salmonophloia
Eucalyptus wandoo
Kunzea glabrescens
Kunzea recurva

Hakes prostrata
Banksia attenuata
Banksia grandis
Banksia menziesii

REHABILITATION			
Potential Impact	**Management**	**Outcome Commitments**	**Action Required**
Rehabilitation	• The operator will continue to undertake the rehabilitation, weed management and dieback program outlined above.	The Proponent will rehabilitate the surface as outlined above. Rehabilitation will aim to achieve the completion criteria. Monitoring of the rehabilitation will be undertaken for a period of three years to ensure ultimate compliance with the completion criteria.	Compliance with the rehabilitation program and completion criteria.

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