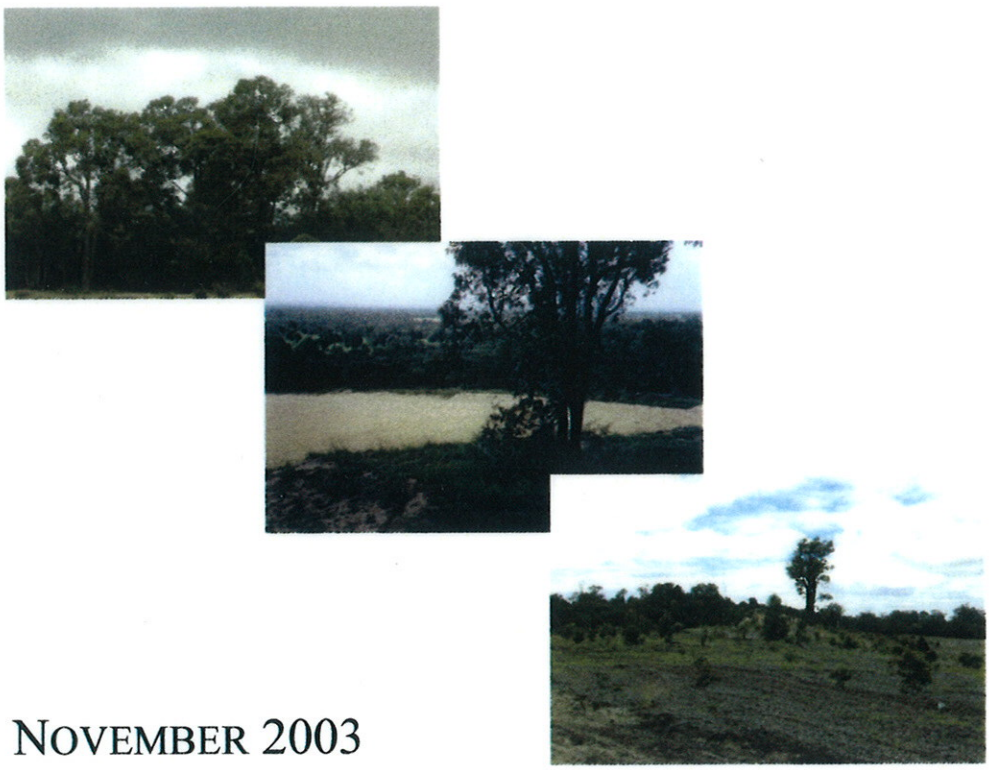
PUBLIC ENVIRONMENTAL REVIEW
SOUTHERN EXTENSION OF LOT 2, CALINUP ROAD SANDPIT GELORUP, SHIRE OF CAPEL



NOVEMBER 2003

PREPARED FOR
PIONEER CONSTRUCTION MATERIALS PTY LTD

BY
MBS ENVIRONMENTAL

MARTINICK BOSCH SELL PTY LTD
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MBS ENVIRONMENTAL
environmental and water resource consultants

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PIONEER CONSTRUCTION MATERIALS PTY LTD

This report has been prepared for **Pioneer Construction Materials Pty Ltd** on the basis of instructions and information provided by **Pioneer Construction Materials Pty Ltd** and therefore may be subject to qualifications which are not expressed.

No other person may use or rely on this report without confirmation in writing from MBS Environmental. MBS Environmental has no liability to any other person who acts or relies upon any information contained in this report without confirmation.

This report has been checked and released for transmittal to **Pioneer Construction Materials Pty Ltd**.

PREPARED BY:
Kirsty Stratford
Senior Environmental Scientist

Signature: [signature] Date: 17/11/2003

CHECKED BY:
Lance Bosch
Managing Director

Signature: [signature] Date: 17/11/2003

INVITATION TO MAKE A SUBMISSION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal. If you are able to, electronic submissions emailed to the DoE/EPA Project Assessment Officer are most welcome.

Pioneer Construction Materials Pty Ltd proposes a southern extension to the current sand extraction operations on Lot 2, Calinup Road, Gelorup. In accordance with the Environmental Protection Act, a Public Environmental Review (PER) has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of eight weeks from 24 November 2003 closing on 19 January 2004.

Comments from government agencies and the public will help the EPA prepare an assessment report in which it will make recommendations to government.

Why write a submission?
A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate your suggestions to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?
If you prefer not to write your own comments, it may be worthwhile joining a group interested in making a submission on similar issues. Joint submissions may help reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all participants' names. If your group is larger, please indicate how many people your submission represents.

Developing a submission
You may agree or disagree with, or comment on, general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:
- clearly state your point of view
- indicate the source of your information or argument if this is applicable
- suggest recommendations, safeguards or alternatives

Points to keep in mind
By keeping the following points in mind, you will make it easier for your submission to be analysed:
- attempt to list points so that issues raised are clear. A summary of your submission is helpful
- refer each point to the appropriate section, chapter or recommendation in the PER
- if you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate

Remember to include:
- your name
- address
- date
- whether you want your submission to be confidential

The closing date for submissions is: 19 January 2004.
Submissions should ideally be emailed to:
tim.gentle@environ.wa.gov.au

OR addressed to:

The Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: Tim Gentle

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1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

Since 1978 Giacci Bros Pty Ltd has been actively engaged in commercial sand extraction from Lot 2, Calinup Road. The sand is of a high quality and consequently Lot 2 is an important source of sand for concrete production. It supplies infrastructure developments throughout the Shire of Capel and adjoining Bunbury-Busselton regions.

Sand extraction operations from the northern and central portions of Lot 2 are nearing completion under an existing Extractive Industries Licence issued by the Shire of Capel. In May 2003, Pioneer Construction Materials Pty Ltd purchased Lot 2 from Giacci Bros Pty Ltd. Prior to this purchase, Giacci Bros Pty Ltd had initiated seeking approval to extract sand from the southern portion of Lot 2. The Environmental Protection Authority (EPA) determined that such a proposal would require a formal environmental assessment, and a Public Environmental Review (PER) level was set.

Upon purchase of Lot 2, Pioneer Construction Materials Pty Ltd proposed to seek approval to continue to extract sand from the southern portion of Lot 2. The proposal will require the clearing of 20 hectares of remnant vegetation south of Gelorup Hill.

1.2 LOCATION

Lot 2, Calinup Road is a private property in the Shire of Capel about one kilometre east of Bussell Highway, about 12 kilometres south of Bunbury and 13 kilometres north of the town of Capel. Access to Lot 2 is via the sealed Calinup Road off Bussell Highway (Figures 1 and 2).

1.3 JUSTIFICATION OF THE PROPOSED EXTENSION

The proposed southern extension of sand extraction operations at Lot 2 is required to access sand resources suitable for building and concrete. Lot 2 has been identified as the nearest sand resource south of Bunbury in the strategic basic raw material resource policy area under State Planning Policy No. 10. The sequential development of such areas is encouraged. The extraction of sand from the southern extension of Lot 2 will not only be able to supply a basic raw resource to surrounding developments and industry but will ensure the appropriate use of the resource before Lot 2 is developed as a residential area. This will ensure the resource is not sterilised. Figure 3 shows the future rural residential and special development zoning of Lot 2 and surrounding areas.

1.4 PROPOSED SAND EXTRACTION OPERATIONS

It is proposed to extract approximately 2.2 million bank cubic metres of sand from 24 hectares (of which approximately four hectares is already cleared of vegetation) over a period of 20 years at an annual rate of about 100,000 to 120,000 bank cubic metres. Sand will be extracted to a maximum depth of 20 metres Australian Height Datum (AHD), which conforms to ground levels of similar landforms of adjoining eastern properties. It is proposed that sand extraction will continue from east of Gelorup Hill and move progressively southwards in 19 sand extraction blocks, each between one and two hectares. Embankments will be reinstated to 1:4 (14°) slopes and the restored landform will be suitable for potential future residential use.

The existing contours, extent, landuse and proposed extension of the sandpit on Lot 2 are shown in Figures 4, 5, 6, 7 and 8.

1.4.1 Setback Limits

A 40-metre setback will be maintained along the western boundary in the vicinity of Gelorup Hill, which will retain the crest and not change the skyline of Gelorup Hill.

Excavation will be limited to a 20-metre setback along the western property boundary south of Gelorup Hill and a 40-metre setback along the southern boundary. Remnant vegetation within the eastern portion of Lot 2 will be maintained by varying the setback limit from between 50 metres and 250 metres along the eastern boundary.

1.4.2 Vegetation Clearing

Only 20 hectares of the 38 hectares or about 52 percent of remnant vegetation on Lot 2 will be cleared progressively for sand extraction purposes. The remnant vegetation that will be retained exceeds the 20 percent recommended by the Department of Agriculture Western Australia and the 30 percent recommended by the Department of Environment to be retained when clearing vegetation. Prior to clearing vegetation, all commercial timber will be salvaged. Progressive rehabilitation will occur and the impact of vegetation clearing will be temporary.

1.4.3 Rehabilitation

Rehabilitation will be progressive and take place immediately behind the excavation front of individual sand extraction blocks. Rehabilitation will consist of terrain reshaping and the re-establishment of native vegetation, particularly trees. The topsoil from the excavation area will be saved and respread over surfaces of restored landforms to allow for establishment of native species from the seed bank in the topsoil. If possible, the stripped topsoil from new sand extraction blocks will be spread immediately onto restored surfaces to avoid double handling and avoid stockpiling. Where necessary, seedlings of native trees and shrubs will be planted to supplement the establishment of vegetation from the seed bank in the topsoil.

1.4.4 Access and Haulage

Sand will be transported from the site in a truck and trailer combination capable of carrying loads of up to 54 tonnes. Up to 15 truck movements are expected per day but this may fluctuate with demand. Most of the sand will be transported to the Bunbury-Capel-Busselton regions via Calinup Road and Bussell Highway. All road-signage warning motorists of trucking associated with the sand operations are already installed for the existing operations.

Access within Lot 2 will be via the existing Calinup Road and southwards along a haul road to the southern portion of Lot 2. Tracks within Lot 2 will be established on a needs basis to meet operational requirements and they will be upgraded as necessary.

1.4.5 Hours of Operation

Working hours within the sandpit area will be confined to the hours of 7 a.m. to 6 p.m. Monday to Friday, and 7 a.m. to noon Saturday, excluding public holidays. These are the same hours as the existing operations.

1.5 LONG-TERM LANDUSE OF LOT 2

The Greater Bunbury Structure Plan (1995) has identified long-term landuses for the continued development of the greater Bunbury area. Lot 2 is shown as a rural residential area north of Calinup Road reserve and a special development area south of Calinup Road. The low-lying south-eastern portion of Lot 2 is shown as rural.

Establishment of native vegetation to return Lot 2 to its pre mining, rural state will occur. Sand extraction operations have also been designed to conform to town planning initiatives as shown in the Subdivision Guide Plan for long-term use (Figures 9 and 10), which has been approved in principle by the Shire of Capel.

1.6 ENVIRONMENTAL FACTORS

1.6.1 Flora and Fauna

The southern extension of the sandpit on Lot 2 is located on the Spearwood Dune System and supports vegetation typical of the Karrakatta Vegetation Complex-Central and South (Figures 11 and 14). This vegetation complex is common in the region with 52 percent of the Karrakatta Vegetation Complex-Central and South remaining within the Greater Bunbury Region Scheme area of which 16 percent is in secure tenure within conservation reserves (Figure 15). Much of the remnant vegetation on Lot 2 is regrowth forest and does not support any declared rare or priority listed flora.

The remnant vegetation to be cleared at Lot 2 contains habitats that are common in the region and do not contain unique or endangered fauna. Consequently, it is unlikely that the vegetation of Lot 2 supports any rare or endangered fauna species.

Eight species of fauna listed as likely to occur at Lot 2 are gazetted under either the *Western Australian Wildlife Conservation Act 1950* or the *Environmental Protection and Biodiversity Conservation Act 1999*. These species have not been observed on the proposed extension area of Lot 2 or adjoining areas. The proximity of the proposed extension to the current sand extraction operation is expected to reduce the likelihood of any of these species occurring on Lot 2.

Vegetation clearing will be undertaken progressively and will be kept to the minimum required. Progressive clearing will:

- Minimise the area of disturbance and vegetation loss at any one time; and
- Provide the opportunity for fauna species, which may occur on site, to relocate to the undisturbed areas.

Progressive rehabilitation will also be undertaken; once this vegetation has successfully re-established it is expected that fauna species will return.

1.6.2 Surface Water, Groundwater and Drainage

Lot 2 is underlain by free draining sand and does not support any natural drainage systems or wetlands. Because of the free draining nature of the soil surface, water runoff is minimal and no erosion occurs. Progressive mining, with an advancing mining face followed closely by landform restoration and rehabilitation, ensures that at any given time only a few hectares will be actively impacted. All stormwater will be contained within the layout of the sandpit and will not drain to the east. Consequently, the proposed sand extraction operations will have no impact on the existing drainage system or surface water bodies located east of Lot 2 (Figure 12).

Groundwater flow is generally in a westerly direction and discharges to coastal swamps and the ocean. Sand extraction operations do not require the storage of fuels, oils and lubricants on site. As this is a dry mining process there is no need for tailings storage facilities or to intercept the water table. The proposed operations will finish at 20 metres AHD, which is more than two metres above the groundwater level within the southern portion of Lot 2 (Figure 13). They should have no adverse impacts on the quality and quantity of the groundwater of Lot 2 or within the adjoining area.

1.6.3 Noise Abatement Measures

The proposed operations will be managed to ensure that noise is not a public nuisance. Operations will be minimised by locating most activities on the floor of excavations, which for the most part will be surrounded by dense vegetation. Appropriate mufflers will be fitted to all machinery. The proposed extension will not result in any increase in noise from that produced by existing sand extraction operations on Lot 2. The proposal is also to progressively move south to extract sand, therefore moving away from the residential areas to the north. The hours of operation are such that noise will not be emanating from operations outside normal working hours.

1.6.4 Dust Suppression

Calinup Road was sealed between Bussell Highway and Lot 2 in March 2000 as part of a commitment to undertake future sand extraction operations on Lot 2. The sealing of Calinup Road has eliminated dust problems associated with trucking along this road. Tarpaulins to prevent the generation of dust during transport will cover all trucks carting sand from Lot 2.

The proposed extension will not result in any increased dust generation because any activity from the extension will replace similar activities occurring in the current sand extraction area. Sand extraction and rehabilitation with planting of native species within the northern portion of Lot 2 is nearing completion. Over time this vegetation will act as a windbreak and reduce wind velocities and turbulence, thus reducing dust generation. Progressive rehabilitation of completed sand extraction blocks immediately north of the active extraction blocks will provide further vegetation cover over time.

Clearing vegetated areas ahead of sand extraction will be kept to a minimum and rehabilitation will follow closely behind the excavation front. The nearest sand excavation will be more than 500 metres from any of the existing residences located north of Lot 2. This separation distance will increase as the operations progress south within Lot 2. The vegetation retained within the setbacks and the elevated ridgeline west of Lot 2 will protect the sandpit from prevailing south-westerly winds.

1.6.5 Impacts on Visual Amenity of the Area

Lot 2 is not readily visible from the surrounding areas due to its position in the landscape and the presence of trees on and adjacent to the area. Vegetated setbacks will continue to reduce the visual impact from sand extraction on Lot 2. Sand extraction will occur progressively with only a small active area occurring at any one time. With restoration and re-establishment of native vegetation in the northern portion of Lot 2 including the eastern slopes of Gelorup Hill, and the proposed progressive rehabilitation of the southern extension areas, the visible impact from the surroundings is expected to be minimal.

A visual impact assessment using computer imagery modelling has demonstrated that extraction of sand will only be visible on the uppermost eastern slopes of Gelorup Hill at distances exceeding 0.5 kilometre. The Seen Area (the area from which the proposed southern sandpit extension may be seen) lies to the east of Gelorup Hill and the north-south ridgeline.

The Seen Area comprises rural land which has a low sensitivity level, and Gelorup Hill, which is marginally visible from the town of Boyanup, the Bunbury-Boyanup Road and the South Western Highway between eight and 10 kilometres east of Lot 2. There will be no significant long-term visual impact on Gelorup Hill because the proposed sand extraction will not affect or lower the crest of the hill or the ridge on which it is located. The hill will remain as a prominent feature in the region. Vegetation setbacks will be retained to minimise visibility of the operations from adjacent properties.

1.7 SUMMARY OF COMMITMENTS

The environmental commitments made by Pioneer Construction Materials Pty Ltd are summarised below and described in Table 11 (Section 9):

Commitment 1	Development of an Environmental Management Plan to include the southern extension.
Commitment 2	Implement the Environmental Management Plan.
Commitment 3	Minimise the visual impact of the southern sandpit extension through rehabilitation, retaining vegetation setbacks and undertaking progressive clearing and rehabilitation to ensure that only a small area is disturbed at any one time.
Commitment 4	Develop a detailed rehabilitation and mine closure plan.
Commitment 5	Implement the rehabilitation and mine closure plan.

1.8 SUMMARY OF ISSUES AND ENVIRONMENTAL FACTORS

The environmental factors for the proposed southern extension of the Lot 2, Calinup Road sandpit as determined by the EPA together with the proposals for their management are summarised in Table 1.

Table 1
Summary of Environmental Factors and Management

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Integrating Process					
Biodiversity	Maintain biological diversity where that represents the different plants, animals and microorganisms, the genes they contain and the ecosystems they form, at the levels of genetic diversity, species diversity and ecosystem diversity. Through studies carried out for the following environmental factors, demonstrate that biodiversity will not be compromised by this proposal.	Vegetation community types and species recorded on the property are widespread over much of the southern Swan Coastal Plain and are not considered to be threatened. Previous disturbance to the property and the presence of farmlands and other disturbance factors adjacent to the property have reduced viable ecological processes provided by the existing vegetation.	Ecosystems on the property will be temporarily reduced or removed as a result of the development. At a regional level, a number of reserves occur that represent the vegetation types of Lot 2. These Department of Conservation and Land Management (DCLM) Lands cater for conservation and biodiversity.	Vegetation clearing will be undertaken in stages to minimise the area of disturbance at any one time. Approximately 18 hectares, 48 percent of the remnant vegetation on the site, will be retained.	No impact on biodiversity due to the existence of similar vegetation and habitats in nearby reserves.
Biophysical					
Vegetation Communities	Maintain species diversity, geographic distribution and productivity of vegetation communities.	Lot 2 has been mapped as the Karrakatta Vegetation Complex-Central and South. The regional importance of the vegetation on the property is considered to be low as a result of previous disturbance and its disjunct location in respect to other areas of similar vegetation.	The proposal will remove 20 hectares of vegetation progressively over a 20 year period. This constitutes approximately 0.6 percent of the Karrakatta Vegetation Complex remaining within a 15 km radius of Lot 2. The regional significance of the vegetation on Lot 2 is low due to known extent in reserves.	Progressive rehabilitation will be undertaken using topsoil that will retain a seed source of native vegetation. Approximately 18 hectares of vegetation will be retained.	Low to no regional implications. Temporary loss of 0.6 percent of habitat on a local scale.
Declared Rare and Priority Flora Species	Protect declared rare and priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950.*	No rare or priority flora species have been located on the property. Ten rare and priority species are known to occur within the wider area.	No impact is predicted as no declared rare or priority species have been recorded at Lot 2.	No impact as none present.	No impact as none present.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Specially Protected (Threatened) and Priority Fauna	Protect Specially Protected (Threatened) and Priority fauna and their habitats consistent with the provisions of the *Wildlife Conservation Act 1950.*	Eight species of Specially Protected (Threatened) and Priority fauna are known to occur within 30 km of the property. The priority 4 species *Macropus irma* was recorded at Lot 2. The existing sand extraction operations, adjacent residential areas and previous rural activities reduce the likelihood of priority species or large populations of these species occurring on Lot 2.	Progressive clearing of 20 hectares of vegetation has the potential to reduce the available habitat of threatened and priority species. Habitat is provided however in nearby DCLM reserves.	Rehabilitation will re-establish habitat in the long term. Progressive clearing will minimise disruption and dislocation of fauna.	Low to no regional impact. Low regional implications due to the extent of reserves within the region.
Landform	Establish stable, sustainable landforms consistent with the intended post-mining landuse and surroundings.	The property is located on the Swan Coastal Plain and contains two distinct landform units, namely the Spearwood Dune Unit and the Pinjarra Unit. The property is located along a gently undulating ridge that comprises Gelorup Hill. Proposed areas for sand extraction consist of east facing hill slopes and low rises.	Potential loss of eastern slope relief from Gelorup Hill and the spur line further south with resulting depression within the north-south central portions of the site.	A post-mining landform will be created which will facilitate rural residential landuse that conforms to the requirements of the Greater Bunbury Structure Plan 1995. A Subdivision Guide Plan demonstrating the future development of Lot 2 was given in-principle, support by the Shire of Capel in June 2001. Low-lying areas will maintain natural remnant vegetation. The ridge will still be a feature of the end landform structure.	Creation of a rehabilitated landform that will be suitable for future development of rural-residential blocks and for rural/special purpose land. Approximately 18 hectares will remain as native vegetation after sand extraction has been completed.
Rehabilitation	Ensure proposal area and any other area affected by the proposal is rehabilitated to a standard consistent with the intended post-mining long-term landuse.	The existing vegetation on Lot 2 is open woodland and has been mapped as the Karrakatta Vegetation Complex-Central and South. The existing landuse is rural and extractive industry with a proposed future landuse of rural-residential.	Potential loss of vegetation cover resulting in decreased scenic value and low visual amenity of the site as well as reduced potential for sequential development.	Progressive rehabilitation will be carried out in accordance with a rehabilitation plan. Success of rehabilitation will be reviewed and results incorporated into future rehabilitation plans.	Visual impact will be minimised through progressive rehabilitation that has the potential to provide habitat for native fauna, which will be an interim landuse until future residential development of the site occurs.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Wetlands	Maintain the integrity, functions and environmental values of wetlands.	Wetlands classified as sumplands and palusplains are located on the plain, east and south of the property as well as further to the west of the Gelorup Hill ridgeline. No wetlands of international, national or regional importance are located on the property.	No natural wetlands will be directly or indirectly impacted by this proposal.	No impacts because free draining soils will not result in surface runoff to the east and the groundwater through-flow is to the west away from nearby eastern wetlands.	No impact on adjacent wetlands.
Pollution Management					
Particulates/ Dust	(i) Ensure that particulate emissions, both individually and cumulatively meet appropriate criteria and do not cause environmental or human health problems; and (ii) Use all reasonable and practicable measures to minimise the discharge of particulate wastes.	Area to be extracted is covered in open woodland vegetation and dust emissions are minimal to non-existent. The existing sand extraction operations have the potential to produce dust.	Sand extraction and trucking has the potential to increase airborne particulate concentrations at the residences located more than 500 metres to the north of the northern limit of the extended sand extraction areas.	Progressive re-establishment of vegetation on mined surfaces, use of tarpaulins to cover loads, the sealing of Calinup Road and the naturally coarse nature of the sand all help minimise dust and particulate emissions. Area to be extracted is to the east and below the vegetated ridgeline and is therefore less susceptible to the prevailing winds. Active sand extraction areas will be kept to a minimum. Furthermore, sand extraction will progress south away from residential areas therefore minimising the potential for extraction to have any particulate material impact.	Negligible impact in the local or regional atmosphere.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Greenhouse Gases	(i) Ensure that greenhouse gas emissions both individually and cumulatively meet appropriate criteria and do not cause an environmental or human health problem; and (ii) Use all reasonable and practicable measures to minimise the discharge of greenhouse gases.	Greenhouse gases are generated as a result of vegetation clearance and vehicle emissions (extraction and transport machinery).	Greenhouse gases will be emitted from vehicles used in the mining and transport operations and as a result of clearing of vegetation.	Revegetation activities will assist in absorbing greenhouse gases emitted, particularly carbon dioxide.	Calculated emissions over the 20-year life of the project indicate that 1757 tonnes of carbon dioxide will be emitted. No guidelines exist to determine whether this amount is of significance.
Groundwater Quality and Quantity	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance, are protected consistent with the ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.	The property is not located within any main groundwater catchment area. Monitoring of onsite piezometers indicate groundwater is present within the southern portion of Lot 2 at a maximum high groundwater level of 17.8 metres AHD. Groundwater levels have not been affected by the existing sand extraction activities and only fluctuate between one and two metres during the seasons. The water quality is moderately brackish.	Groundwater levels on Lot 2 will not be adversely affected by the proposed activities. Landform modifications will not affect local or regional hydrogeological regimes.	The depth of excavation will be limited to 20 metres AHD, which is a minimum of two metres above the groundwater table. Regular monitoring of water levels will be undertaken. Vehicles will be maintained off site at workshops in Bunbury. No diesel, petrol, oil or lubricants will be stored or discharged on site and all onsite machinery such as the loader and screener will be fuelled from mobile tankers.	No impact on local or regional groundwater levels.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Surface Water Quality	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance, are protected consistent with the ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.	No well-defined drainage lines exist on the property. A natural depression traversing the property from the south-west to the north-east forms a focal point for collecting surface runoff. Due to the free-draining nature of the soil most surface water is quickly leached through the profile. Surface runoff drains to the east and south of the property because the site is located along a ridgeline that forms the head of the local catchment. An agricultural dam is located south-east of the property.	Because of the free-draining nature of the soils, surface runoff is minimal and there are no potential impacts.	All drainage will be contained within the sandpit layout area.	No impact on the adjacent agricultural dam or regional surface water quality. Surface water hydrology will be unchanged.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Noise	Ensure that noise impacts emanating from the proposal comply with the statutory requirements and acceptable standards.	Noise is generated by sand extraction activities currently operating on the property, however this is minimal. Current operations are restricted to the hours 7am-6pm Monday to Friday and 7am-noon Saturday. Noise limits specified within the Environmental Protection (Noise) Regulation 1997 are being met. There are no residences within 500 metres.	Potential increase of noise levels at nearby residence if noise management measures are not implemented.	This proposal is to continue sand extraction within the current production rates and not to increase production, therefore noise levels should be similar to those that currently exist. Limitation of working hours (excavation and transportation activities) and the distance between the residences and operations have ensured noise limits specified in the Environmental Protection (Noise) Regulations 1997 have been and will continue to be met. The equipment used on site is fitted with noise abatement measures. The screening and earthwork operations will, for most of the time, be located on the sandpit floor below adjoining property ground levels, thereby reducing any noise emissions from the sandpit.	The proposal will produce the same noise levels as those of the current extraction therefore no additional impact will occur.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Social Surroundings					
Visual Amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal.	Gelorup Hill is the main scenic feature of the area and is considered to be a local landmark. Lot 2 is vegetated and is located on the eastern side of the north-south ridgeline and is screened from the west and Bussell Highway.	Sand extraction has the potential to reduce the visual amenity of Gelorup Hill and the ridgeline when viewed from the east.	The north-south ridgeline, upper eastern hillslopes and the crest of Gelorup Hill will be retained and the lower eastern hillslope of Lot 2 will be battered to ensure a stable landform. Vegetation setback areas between 50 and 250 metres wide along the eastern boundary will ensure that the extracted eastern hillslopes will not be visible from adjacent properties. The skyline as viewed from both the west and the east will remain unaffected. Progressive clearing and subsequent rehabilitation with topsoil will ensure that only minimal areas of disturbance will occur at any one time and therefore minimise the area of disturbance visible at a distance from the east.	The reduction in visual amenity will be slight and temporary, meeting the EPA's objectives.

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Road Transportation/ Traffic	(i) Ensure that the increase in the traffic activities resulting from the project does not adversely impact on the social surroundings; and (ii) Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and MRWA requirements.	Extracted sand is transported in trucks and trailers via the sealed Calinup Road and the Bussell Highway. Up to 15 truck movements of about 54 tonnes each are conducted daily. All appropriate signage has been established under the current operation and the entire length of Calinup Road between Lot 2 and Bussell Highway has been sealed. Changes to current transport activities are not proposed.	No potential for increased road traffic movements or deterioration in road quality because the traffic rate from site will remain unchanged.	Traffic movements will not increase because production levels are not planned to increase. Road maintenance will be continued in accordance with current processes.	No local or regional impact.
Indigenous and Non-Indigenous Cultures	(i) Ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972;* (ii) Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area; and (iii) Comply with statutory requirements in relation to areas of cultural or historical significance.	No Aboriginal or European Heritage sites have been identified on Lot 2. Three isolated artefacts were located on the property but are not considered to be of any significant value.	No likely impacts on Indigenous or Non–Indigenous culture as no sites have been identified.	If any archaeological sites are discovered during sand extraction activities they will be reported in accordance with the provisions of the *Aboriginal Heritage Act 1972.*	No impact.

2. INTRODUCTION

2.1 BACKGROUND

Pioneer Construction Materials Pty Ltd proposes to continue to extract sand from Lot 2 Calinup Road, a private property in the Shire of Capel about 12 kilometres south of Bunbury (Figures 1 and 2).

Since 1978, sand has been extracted by Giacci Bros Pty Ltd from the northern and central portions of Lot 2 under a 21-year Extractive Industries Licence (which expired in July 1999) and currently under an interim Extractive Industries Licence which allows for extraction of sand within areas of previous sand extraction and clearing. The interim licence expired in December 2002 and an application was submitted to and approved by the Shire of Capel to extend this licence for a further one year. In May 2003, Pioneer Construction Materials Pty Ltd purchased Lot 2 from Giacci Bros Pty Ltd.

Lot 2 is a major source of sand for infrastructure development and concrete production in the region. The current sand extraction operations and a previous drilling programme for mineral sands has revealed an extensive source of high quality sand that is, at present volumes of extraction, capable of supplying developments throughout the Shire of Capel and the balance of the Bunbury-Busselton region for a further 20 years.

An application was submitted on 2nd February 1999 to the Shire of Capel requesting an Extractive Industries Licence to extend the extraction of sand to the southern portion of Lot 2. At the same time a Notice of Intention to clear 30 hectares of vegetation was issued to the Commissioner for Soil and Land Conservation of the Department of Agriculture Western Australia. The Commissioner for Soil and Land Conservation advised in a letter of 4 May 1999 that the proposal had been referred to the Environmental Protection Authority (EPA) for further assessment. The EPA assessed (Assessment No. 1301) on 29 October 1999 that the likely environmental impacts of the proposed clearing of 30 hectares of land warranted a formal level of assessment, which was set at Public Environmental Review (PER). Draft guidelines for the preparation of the PER were issued by the Department of Environment on 14 December 1999 and are provided in Appendix 1.

A public meeting with residents living in the vicinity of Lot 2 was held in March 1999 to discuss the proposal and address any concerns. An information letter and project summary was issued in November 2000 informing the residents of the amended proposal and individual follow-up meetings were held to address specific concerns. The PER outlines an environmental appraisal of Lot 2 and describes the design, operation and management of the sandpit. This addresses each of the environmental factors raised by the EPA and those of other interested parties. Pioneer Construction Materials Pty Ltd will pursue the approval to extract sand from the southern portion of Lot 2.

This report accompanies the new Application for an Extractive Industries Licence. It outlines the proposed operations and provides particular detail with respect to environmental management.

2.2 OBJECTIVE

The main objective of this report is to provide all information required by the EPA, the Shire of Capel and other stakeholder authorities and agencies to secure approval for an extension of the Extractive Industries Licence for Lot 2 Calinup Road. For this purpose the report:

- Outlines the existing environment and sand excavation operations.
- Describes the proposed works and excavation programme.
- Identifies the potential environmental and social impacts of the proposed sand excavation operations.
- Outlines the design and management details employed to avoid or minimise potentially adverse impacts.
- Details the rehabilitation and mine closure programme.
- Describe the future residential landuse of Lot 2.

2.3 THE PROPONENT

The Proponent, who is the landowner of Lot 2, is Pioneer Construction Materials Pty Ltd (ABN 90 009 679 734), a private company, which is registered in Western Australia. The address of Pioneer Construction Materials Pty Ltd is:

123 Burswood Road
VICTORIA PARK WA 6100

Western Region General Manager: Mr Daniel Cooper

2.4 LOCATION

Lot 2 Calinup Road is in the Shire of Capel, approximately 12 kilometres south of Bunbury, 13 kilometres north of Capel and one kilometre east of Bussell Highway. Refer to locality map (Figure 1).

From Figure 2 it can be seen that Calinup Road joins the north-western portion of Lot 2, linking it to Bussell Highway. The undeveloped reserve of Calinup Road continues and crosses the northern portion of Lot 2. Cokelup Road runs alongside the western boundary of the property.

The property is described in the Certificate of Title (Vol. 1356; Folio 756) as:

Boyanup Agricultural Area Lot 166 and being Lot 2 on Diagram 45139.

The property is 58.7 hectares in area and the central and southern portions of Lot 2 contain commercially valuable sand.

2.5 LANDUSE AND ZONING

2.5.1 Existing Landuse and Zoning

Lot 2 is situated in a rural area. Land to the north and north-west of Lot 2 is zoned rural residential while the land to the south, west and east is zoned rural. The relevant portion of the town planning scheme showing the landuse zoning of the areas within the vicinity of Lot 2 is shown in Figure 3.

The landuse of Lot 2 is exclusively sand extraction. Sand has been extracted from Lot 2 since 1978 by Giacci Bros Pty Ltd under an Extractive Industries Licence issued by the Shire of Capel. The property was purchased by Pioneer Construction Materials Pty Ltd in May 2003. The areas of sand extraction are shown in Figure 4 and the status of existing landuse of Lot 2 is shown in Figure 5. Lot 2 is located in a region that is recognised for its high quality sand and has been incorporated in the State Planning Policy No. 10 as a policy area designated for basic raw materials.

The property is bordered to the south, west, north-east and south-east by mixed Jarrah *Eucalyptus marginata* and Marri *Corymbia calophylla* forest. To the east and south-east is grazing on parkland cleared pastures. The aerial photograph (Plate 1) shows the locations and distribution of the landuse.

There are 19 dwellings located within 500 metres of the northern boundary of Lot 2, the nearest of these being 50 metres from the northern boundary and about 550 metres from the areas of future sand extraction as described in the proposal.

2.5.2 Future Zoning

The Greater Bunbury Structure Plan (1995) has identified long-term landuses for the continued development of the greater Bunbury area. Lot 2 is located within the Beridup BU8 Planning Unit and is shown as a Rural Residential Area north of the existing Calinup Road Reserve and a Special Development Area south of Calinup Road. The low-lying south-eastern portion of Lot 2 is shown as rural. This zoning is shown in Figure 3.

The identified future use for the Beridup BU8 Planning Unit is as a rural-urban transition area with amenity areas within it. The main planning policy for this unit is to assess future development potential within the Special Development Area and ensure that any interim development or landuse does not compromise that identified future use. Further landuse and town planning details are provided in Appendix 2.

2.6 TIMING OF SAND EXTRACTION OPERATIONS

Currently sand extraction is being undertaken under an interim Extractive Industries Licence issued by the Shire of Capel, which expires on 31 December 2003. An estimated 150,000 bank cubic metres of sand reserve is still available within the existing cleared areas of Lot 2 that is not subject to a formal assessment by the EPA.

Once environmental approval has been received from the EPA to clear vegetation within the southern portion of Lot 2, a long-term Extractive Industries Licence will be sought from the Shire of Capel to extract sand for the remaining life of the sandpit, which is estimated to be 20 years. The long-term licence will replace the interim licence.

2.7 JUSTIFICATION AND PURPOSE

2.7.1 Development of the Bunbury-Capel-Harvey Region

The Bunbury-Capel-Harvey region is recognised as one of the fastest developing areas in the state. This has been highlighted by development of a number of planning documents designed to facilitate a co-ordinated approach to landuse planning and better manage the region's resources in light of development pressures of the area. These documents include the Draft Greater Bunbury Region Scheme (August 2000), the Bunbury-Wellington Region Plan and the Industry 2030-Greater Bunbury Industrial and Port Access planning document. Further details are in Appendix 2.

Much of the area is also recognised as a strategic minerals and basic raw materials resource policy area. Lot 2 Calinup Road lies within this policy area. It is recognised that basic raw materials such as sand are important commodities for the Western Australian economy and in facilitating growth and development in these areas.

For this reason such areas should not be sterilised by incompatible development and landuses. The ability to provide raw materials from close proximity to areas currently being developed for either residential or industrial areas that support Bunbury port and other industries in the area is highly desirable. The sequential development of such areas should therefore be encouraged. The extraction of sand from Lot 2 will not only be able to supply a basic raw resource to surrounding developments and industry but will ensure the appropriate use of this resource before Lot 2 is developed as a residential area. This will ensure that such a resource does not become sterilised.

2.7.2 Supply and Demand for Sand

Basic raw materials such as sand are essential products for local construction, road building, residential developments and agriculture. Such development is progressing towards Lot 2 from the north and there are a number of other areas either currently or scheduled in the near future for development in the Bunbury-Capel region. The sand extracted from Lot 2 will be able to supply a portion of the sand resources expected to be required for these developments.

The Western Australian Planning Commission's State Planning Policy No. 10 'Basic Raw Materials' recognises that the availability of basic raw material resources close to Perth is declining as the city expands. This suggests that demand for basic raw materials, particularly building sand and concrete sand from areas outside the metropolitan area, is increasing. While it is expected that the majority of the sand extracted from Lot 2 will be required to support local markets within the Bunbury-Capel region, the decrease of such a resource in the metropolitan area indicates the level of demand for this product. It also highlights a need to ensure that such a resource be appropriately used before the area is sterilised by further development.

2.7.3 Benefits of the Sandpit

The current sandpit is fully operational and provides an ongoing service to a large market within the Bunbury-Capel-Busselton region.

It is proposed to extract a further 2.2 million bank cubic metres of sand from 24 hectares (of which four hectares is already cleared) over a period of 20 years. This may be equated to a sand extraction rate of approximately 110,000 bank cubic metres of sand per hectare of vegetation clearing, which results in an extremely productive sandpit. There are a number of regional advantages of extending the use of Lot 2 as a sandpit, namely:

- Optimum usage of land and sand resource in an area identified as being a basic raw material resource policy area.
- Minimal clearing of existing vegetation for new extractive areas.
- Optimum usage of existing cleared land in the vicinity of Gelorup Hill because extraction will now extend further west of the existing licensed western limit.
- The sandpit facility already exists and institutional arrangements are in place.
- The post-mining landuse is designed to provide a substantial number of residential lots.

2.7.4 Alternative Sources

Other areas within the Greater Bunbury region have been identified as potential areas for basic raw materials in the State Planning Policy No. 10, Strategic minerals and Basic Raw Materials Resource Policy. Lot 2 is the nearest designated sand resource south of Bunbury, of the policy areas identified, and is therefore an appropriate resource to supply market demand in the ongoing development of the Bunbury area. As development in the Gelorup areas is predicted to move south, it is important that this area is extracted prior to this southward development to ensure the resource is not sterilised.

The existing sand extraction operations located on the west facing hillslopes of Gelorup Hill to the west and south-west of Lot 2 provide similar and complimentary sand supplies. The sand reserves of these sandpits are likely to become depleted over a similar timeframe as Lot 2, at which time the entire Gelorup Hill area may be redeveloped for residential purposes.

Alternative identified sources of sand located further south of Bunbury also require substantial clearing of native vegetation prior to development. In the future these areas will most likely

come under increasing pressure to be developed as residential development extends further southwards.

3. THE PROPOSAL

3.1 KEY CHARACTERISTICS

The key characteristics of the proposed southern extension of the Lot 2 sandpit are summarised in Table 2.

Table 2
Key Characteristics of the Proposed Southern Extension to Lot 2 Calinup Road Sandpit

Element	Description
Life of sandpit	20 years (continual operation)
Size of sand reserve	2.2 million bank cubic metres (upper limit)
Area of disturbance (including access): • Existing cleared area (central area) • Vegetation requiring clearing (southern area)	 Four hectares 20 hectares
Hours of operation	7 a.m. to 6 p.m. Monday to Friday and 7 a.m. to noon Saturday, excluding public holidays
Infrastructure/ancillary equipment/facilities:	
• Internal access roads	Five-metre wide with limestone gravel base course
• Earthmoving equipment	D9 front end loader for excavation and loading of haulage trucks
• Mobile dry screen and conveyor	
• Transportable cribroom/chemical toilet	
Sand extraction rate	180, 000 bank cubic metres per year (upper limit)

Sandpit details:
• Depth of excavation
• Setback limits:
  • Eastern Boundary
  • Southern boundary
  • Western Boundary
  - In vicinity of Gelorup Hill
  - Adjacent to Cokelup Road
• Finished slope of embankments
	
	20 metres AHD
	
	50 to 250 metres (minimum)
	40 metres (minimum)
	
	40 metres (minimum)
	20 metres (minimum)
	1:4 (14°) (maximum)

Excavation staging	Three-hectare excavation blocks (maximum)
Sandpit access	Via existing Calinup Road
Post-mining landform	The restored landform will be suitable for future residential development

3.2 DESIGN CRITERIA

3.2.1 Extractive Industries By-Laws and Requirements

The configuration of the sandpit is determined by the following design criteria:

- **Depth of excavation**
  The Water and Rivers Commission requires a minimum of two metres separation above the maximum high groundwater level.
- **Setback limits**
  Setback limits as contained in Clause 15 of the Government Gazette (18 March 1994) for the Shire of Capel Extractive Industries By-Law (Local Government Act 1960) states the following:

  'Subject to any licence conditions imposed by the Council, a person shall not, without the written approval of the Council, excavate within –

  (a) 20 metres of the boundary of any land on which the excavation site is located;

  (b) 20 metres of any land affected by a registered grant of easement;

  (c) 40 metres of any road; or

  (d) 40 metres of any watercourse.
- **Finished slopes of embankments**
  Dependant on geotechnical stability, drainage, vegetation type to be established and future landuse. Slopes will have batters of 1:4 or less.
- **Layout**
  Controlled by landform, vegetation clearing requirements, adjoining landuses and long-term landuse of Lot 2.

3.2.2 Optimisation of Sand Extraction in Areas Requiring Vegetation Clearing

A key objective of this proposal is to minimise clearing of native vegetation and optimise extraction of high-quality sand while ensuring the post-mining landform conforms to its potential long-term landuse of residential. It is recognised that the best quality sand is obtained over the more elevated portions of the site and where the landform is either a hilltop, hillside or spur; thereby maximising the volume of the sand reserve available.

The retention of vegetation takes into account the:

- EPA's position on clearing of native vegetation. Position Statement Number 2 (December 2000), Environmental Protection of Native Vegetation in Western Australia.
- Guideline for Vegetation Clearing (September 1997) issued by the Department of Agriculture Western Australia.
- Objective 7.1 of the National Strategy for the Conservation of Australian Biological Diversity.

The EPA threshold level for vegetation removal is 30 percent of the pre-clearing extent of the vegetation community.

3.3 PROPOSED SANDPIT DESIGN AND LAYOUT

3.3.1 Nature and Estimated Duration of the Proposed Operations

It is proposed to extract approximately 2.2 million bank cubic metres of sand from 24 hectares (of which approximately four hectares is already cleared of vegetation) over a period of 20 years. Sand extraction will vary annually according to demand with typical annual rates of between 100,000 and 120,000 bank cubic metres and an expected upper limit of 180,000 bank cubic metres per year. Sand will be extracted to a maximum depth of 20 metres AHD, which conforms to the ground levels of similar landforms of the adjoining eastern properties. It is proposed that sand extraction will continue from east of Gelorup Hill and move progressively southwards in sand extraction blocks, each less than three hectares. Embankments will be reinstated to 1:4 (14°) slopes and the restored landform will make provision for the future landscaping for potential residential use.

The sandpit layout and extraction blocks are shown in Figure 6, the final contours of the sandpit are in Figure 7 and typical cross sectional views are in Figure 8.

3.3.2 Setback Limits

The setback limits of the sandpit are based on extraction of sand as follows:

- **In vicinity of Gelorup Hill:** Sand will be excavated from the eastern and south-eastern slopes of Gelorup Hill and will be limited to a 40-metre setback from Cokelup Road on the western boundary. Extraction of sand to the 40-metre setback will not change the skyline of Gelorup Hill.
- **Western Boundary of Southern Portion of Lot 2:** A minimum 20-metre setback will be maintained from the existing Cokelup Road south of Gelorup Hill.

  A Subdivision Guide Plan for Long-Term Residential Use showing the relocation of Cokelup Road (Figure 9) has been given approval, in principle, by the Shire of Capel Council (Appendix 2). Following the relocation of Cokelup Road the Extractive Industries requirements for a 20-metre setback limit for common property boundaries will be achieved.
- **Southern Property Boundary:** A minimum 40-metre setback will be maintained.
- **Eastern Property Boundary:** Remnant vegetation within the eastern portion of Lot 2 will be maintained by varying the extent of excavation between 50 metres and 250 metres from the eastern boundary.

3.4 VEGETATION CLEARING

Vegetation will be cleared as follows:

- **Initial clearing:** About one hectare around the eastern crest and upper slopes of Gelorup Hill. This will allow excavation of sand extraction Blocks 1 to 4 over about a five-year period.
- **Progressive clearing:** Between one and two hectares annually for each of sand extraction Blocks 5 to 19 as operations move southwards.

In total, about 18 hectares of vegetation will be retained; consisting of areas around the western crest of Gelorup Hill, along the ridge forming the western boundary of Lot 2, a substantial area of remnant vegetation within the eastern and southern portions of Lot 2 and two smaller areas within the northern portion of Lot 2.

Prior to clearing vegetation, all commercial timber will be salvaged. Where possible, vegetation will be mulched to minimise the requirement for burning.

3.5 TOPSOIL MANAGEMENT

Where topsoil does occur on areas of proposed sand extraction it will be removed for rehabilitation at the beginning of each extraction period to a depth of about 15 centimetres. If possible, the stripped topsoil will be spread immediately onto restored surfaces to avoid double handling and stockpiling. Where this is not feasible then the topsoil will be stockpiled in maximum two-metre high windrows for future rehabilitation.

The topsoil will be removed using earthmoving machinery such as scrapers and/or bulldozers.

3.6 EXTRACTION METHOD

Following removal of vegetation and topsoil the overburden sand will be pushed into stockpiles to expose the yellow sand. The yellow sand will usually be excavated down the sand profile using a D9 front-end loader to select sand type and allow blending of different sand types to meet specific requirements. The sand will be screened and stockpiled for subsequent transport off site. Fill-sand will be excavated and loaded directly from stockpiles pushed up from overburden or lower quality sand that will be selected from the excavation front.

3.7 ACCESS AND HAULAGE

Sand will be transported from the site in a truck and trailer combination capable of carrying loads of up to 54 tonnes. Up to 15 truck movements may occur per day but this will fluctuate

with demand. Most of the sand will be transported to the Bunbury-Capel-Busselton regions via the sealed Calinup Road and Bussell Highway. All road-signage warning motorists of trucking associated with the sand operations has already been installed as part of existing operations.

Access within Lot 2 will be via the existing Calinup Road Reserve and southwards along a proposed haul road to the southern portion of Lot 2. Tracks within Lot 2 will be established on an as-needs basis to meet operational requirements. They will be upgraded and/or rehabilitated as necessary.

3.8 METHODS TO BE EMPLOYED AND ONSITE OPERATIONS

3.8.1 Infrastructure

No fixed buildings or ablution facilities are proposed. A mobile office and a portable toilet are located on Lot 2 for the current extraction of sand. These facilities will be retained.

3.8.2 Communications

Mobile phones and radio will be used on the site allowing operators to communicate with Pioneer's basalt quarry, in Bunbury.

3.8.3 Onsite Maintenance of Vehicles

All vehicles will be maintained at Pioneer's basalt quarry workshop in Bunbury.

3.8.4 Fuel and Lubricants

No diesel, petrol, oil or lubricants are stored or discharged onsite. All onsite machinery and vehicles will be fuelled from mobile tankers.

3.8.5 Domestic Waste

All domestic waste will be collected in bins and delivered to the nearest waste disposal site nominated by the Shire of Capel for approved disposal.

3.8.6 Type of Equipment to be Used

Scrapers and bulldozers will be used to remove, stockpile and replace topsoil. Sand is excavated by a D9 front-end loader and this sand material is screened in a mobile screening plant. This method of excavation and screening will be retained.

3.8.7 Hours of Operation

Working hours within the sandpit area and transportation of machinery will be confined to the hours of 7 a.m. to 6 p.m. Monday to Friday and 7 a.m. to noon Saturday, excluding public holidays. These are the same hours as the existing operations.

3.9 REHABILITATION

Rehabilitation will be progressive and take place immediately behind the excavation front of each individual sand extraction block. Rehabilitation will consist of terrain re-shaping and the re-establishment of native vegetation. The topsoil from the sand extraction area will be saved and re-spread over surfaces of restored landforms to allow for establishment of native species from the seedbank in the topsoil. If possible, the stripped topsoil from a new sand extraction block will be spread immediately onto restored surfaces to avoid double handling and avoid stockpiling. Where necessary, seedlings of native trees and shrubs will be planted to supplement the establishment of vegetation from the seedbank in the topsoil.

3.10 POST-MINING LANDFORM AND LONG-TERM LANDUSE

Lot 2 is an area recognised in the strategic planning framework as being part of a long-term development corridor (Refer to Section 2.5 and Appendix 2 of this report). It is also noted that Lot 2 lies within a recognised basic raw materials resource zone. The value of the existing extractive material on Lot 2 must be balanced with the value of the long-term use of the property.

Pioneer Construction Materials Pty Ltd recognises that while the primary activity for Lot 2 at this stage is appropriate extraction of sand resources, this extraction must develop in a manner consistent with the intended surrounding development that does not inhibit the long-term development of Lot 2 for which it has been classified.

A rehabilitation plan will be developed to address the progressive rehabilitation of Lot 2. In addition a Subdivision Guide Plan (Figure 9) has been developed to provide for the maximum level of sand extraction south of Calinup Road reserve while ensuring there is sufficient land available for redevelopment.

The purpose of the Subdivision Guide Plan is to show in an indicative manner how it would be possible to develop the land after extraction has been completed. It recognises the continued short-term use of the site will be for the purpose of sand extraction. The final design will also reflect the long-term use as being for residential development. Further details of the strategic planning framework that encompasses Lot 2 and the Subdivision Guide Plan are provided in Appendix 2.

At a meeting of 27 June 2001 the Shire of Capel Council, in giving consent for an interim Extractive Industries Licence, advised in a letter dated the 6 July 2001 '*You are advised that support in principle is given for the Subdivision Guide Plan which incorporates the*

rationalisation of Gelorup Hill, relocation of Cokelup Road, realignment of Calinup Road and provisional internal road layout for Lot 2; but that this is subject to the favourable approval of the long term licence application by the Department of Environmental Protection.'

The post-mining landform of the sandpit as shown in Figure 7 has been designed to conform to these town planning initiatives as developed in the Subdivision Guide Plan (Figure 9). The Subdivision Guide Plan provides details of the potential re-landscaped landform of Lot 2 with finished slopes of 1:6 to 1:10. A regional contour plan (Figure 10) shows these long-term final contours. Development is summarised as follows:

- **North of the existing Calinup Road reserve:** Create seven rural residential lots.
- **South of the existing Calinup Road reserve:** On completion of the proposed sand extraction operations the restored landform will suit future residential development as identified in the Greater Bunbury Structure Plan for Special Development Areas. Approximately 37.5 hectares of land will be developable for residential purposes.
- **The low-lying areas adjacent to south-eastern portion of Lot 2:** Original vegetation to be retained for possible future public open space.

In January 2000 a submission under the Greater Bunbury Developers Intentions Survey was made to the Western Australian Planning Commission by Town Planning Consultants Thompson McRobert Edgeloe on behalf of the then property owner, Giacci Bros Pty Ltd, to ensure Lot 2 was included in the Land Release Plan for the Greater Bunbury Region to reflect future landuses.

4. EXISTING ENVIRONMENT

4.1 CLIMATE

Lot 2 is situated in the Mediterranean climate zone of Western Australia with wet, mild winters and hot dry summers. Mean monthly maximum and minimum temperatures for nearby Bunbury range from 17°C to 28°C and 8°C to 15°C respectively. Climatic data for Bunbury is presented in Table 3.

Table 3
Climatic Data for Bunbury

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Long term Mean*													
MAX (°C)	28	28	26	23	20	18	17	17	18	20	23	26	-
MIN (°C)	15	15	14	12	10	9	8	8	9	10	12	14	-
Rainfall (mm)	11	12	22	46	128	183	171	124	80	54	26	14	871
1999 Data*													
MAX (°C)	29	31	27	27	21	18	18	18	18	20	25	30	-
MIN (°C)	15	16	15	13	12	10	8	8	8	9	12	16	-
Rainfall (mm)	3	0	17	18	240	246	182	113	92	76	1	7.2	995.6

* Source Bureau of Meteorology Bunbury P.O. records 1877-1985
# Source: Bureau of Meteorology Bunbury Turf Club records for 1999

The long-term average annual rainfall for Bunbury is 871 millimetres with rainfall occurring predominantly during the period May to October. The average annual pan evaporation is 1,900 millimetres and exceeds the average annual rainfall of 871 millimetres by 1,029 millimetres.

The summer wind pattern of the region is dominated by local onshore (sea breeze) and offshore (land breeze) winds, with light south-easterlies in the early hours of the morning and at night and stronger south-westerlies present during the day. The winter wind pattern is dominated by the eastward progression of rain-bearing low pressure systems and associated cold fronts with north-westerly storms.

4.2 GEOLOGY AND LANDFORMS

The geology and landforms of the Darling System have been described and mapped by the Department of Mines (1978), Churchward and McArthur (1978) and more recently by Barnesby and Proulx-Nixon (2000).

Lot 2 is situated within the Perth Basin, which extends approximately 20 kilometres eastwards from the coast to the Darling Fault. The Perth Basin is made up of five major geomorphological provinces of which Lot 2 is situated on the Swan Coastal Plain. The Swan

Coastal Plain is in turn comprised of 22 landform units. Within the vicinity of Lot 2 two landform units occur; Spearwood Dune and Pinjarra units. These two units are described in Table 4 and the respective locations within Lot 2 are illustrated in Figure 11.

Table 4
Project Area Landform Units

Landform Unit	Regional Location	Project Area	Terrain	Soils
Spearwood Dune	Forms a narrow belt, approximately three kilometres in width, with its western boundary located parallel to and approximately one kilometre from the coast.	Covers the western and central portions of Lot 2.	The terrain has developed from Pleistocene deposits of Tamala Limestone and is comprised of a series of gently to moderately undulating dunes, ridges and plains.	Deep, well-drained, yellow-brown siliceous sands. In places this unit may vary to areas containing stony plains and low ridges with deep yellow sands and brown siliceous sands with common limestone outcrops (Churchward and McArthur, 1978).
Pinjarra	Large soil-landscape unit occurring south of Bunbury, extending from the Spearwood Dune Unit near the coast to the eastern boundary of the Swan Coastal Plain.	Covers a small portion of the low-lying eastern portion of Lot 2.	Broad low relief plain comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium.	Acidic, mottled, yellow duplex soils comprising shallow pale sand to sandy loam over clays that are poorly drained.

The southern portion of Lot 2 comprises the southern and eastern hillsides of Gelorup Hill and an eastward sloping spur separated by a low-lying eastward sloping depression. The western limit of Lot 2 comprises the ridgeline and the eastern limit comprises low rises and a broad plain.

4.3 SOILS

The soils of Lot 2 comprise a mixture of aeolian sands known collectively as the Karrakatta Sand Unit, which is a subunit of the Spearwood Dune Unit. The Karrakatta sands are described as being free-draining yellow or grey sands occurring with varying depths over limestone. A detailed morphological description of Karrakatta sands given by McArthur and Bettenay (1960) indicates that at the surface of the soil profile, the Karrakatta sands are dark brownish grey in colour with a progression to a brownish yellow colour at depths of approximately 50 centimetres, transforming to a pale yellow colour at depths of approximately 110 centimetres. The sands generally consist of loose particles, are very free draining with an acid to neutral pH.

Sand extraction of the northern portion of Lot 2 and the northern and eastern slopes of Gelorup Hill (central portion of Lot 2) to depths of 18 metres AHD has revealed the presence of up to 40-metre thickness of yellow sand with about 1.5 metres of light brownish grey overburden sand and a topsoil cover of less than 100 millimetres.

Sand extraction operations by other operators on the upper west facing slopes of Gelorup Hill and the north-south ridge has exposed similar deposits and thickness of the yellow sand.

Exploration drilling for mineral sands operations south of Gelorup Hill indicated the continuation of the yellow sands south of Gelorup Hill and south of Lot 2.

4.4 SURFACE HYDROLOGY

4.4.1 General Drainage

There are no major drainage lines, creeks, rivers or wetlands on Lot 2 and no dams occur on the property.

The western boundary of Lot 2 forms the watershed with eastward drainage of surface runoff across the property. However, because Lot 2 is underlain by highly permeable sands, most stormwater percolates rapidly through the sands, resulting in almost no runoff. Observations of runoff during operation of the existing pit have shown that little or no surface runoff occurs from either vegetated or active sand-extraction areas.

The nearest surface water flow to Lot 2 is Five Mile Brook, which is approximately 1.5 kilometres north-east of Lot 2.

A wetland is located east of Lot 2 on adjoining Lot 11 (formerly Lot 188). The western extension of this water body has been dammed by an earth embankment and the fringing natural vegetation mostly removed. This dammed area is replenished by annual winter rainfall. The earth embankment is shown in the aerial photograph (Plate 1).

4.4.2 Wetlands

A series of wetlands are located between 150 and 250 metres east and south of Lot 2 (Figure 12, Plate 1). These wetlands have been previously mapped by Hill *et al* (1996) as part of a study of the wetlands of the Swan Coastal Plain. These wetlands have been gazetted under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP lakes) and are categorised as being in the multiple-use category. Wetlands classified as multiple use tend to be wetlands that retain few natural attributes important for natural wetland function. The general management objectives for multiple-use category wetlands are the use, development and management of these wetlands in the context of surrounding landuses and planning. The two wetlands east of Lot 2 are currently protected through their EPP listing.

Cokelup swamp is a wetland located to the west of Gelorup Hill and approximately 750 metres west of Lot 2 (Figure 12), (Plate 1). Cokelup swamp is also listed as an EPP wetland. The outer northern fringe of Cokelup swamp is categorised as multiple use, however the majority of the wetland core has been categorised as conservation. Conservation category wetlands are wetlands that support high levels of natural functions and attributes. The management objectives for conservation category wetlands are to protect the natural functions

and attributes of the wetland through reservation. The protection of Cokelup swamp is facilitated through its EPP listing.

The wetlands in the vicinity of Lot 2 are recognised by Hill *et al* (1996) as sumplands and palusplains. The geomorphic definitions of these specific types of wetlands (Semeniuk, 1987) are as follows:

- **Sumpland:** Seasonally inundated basin of variable size and shape irrespective of vegetation cover. Otherwise known as a swamp.
- **Palusplain:** Seasonally waterlogged flat.

There are no wetlands of international, national and regional importance on Lot 2. The EPP lakes within 150 metres east of the site are multiple-use category wetlands, are seasonal and are not nominated as having high ecological functions.

4.5 GROUNDWATER

4.5.1 Local Hydrogeology

The Bunbury Shallow-Drilling Groundwater Investigation by D.P. Commander (1982) describes the regional hydrogeology of the greater Bunbury-Capel-Boyanup area.

The hydrogeology within the vicinity of Lot 2 comprises a Superficial Formation aquifer to depths of between zero and minus 10 metres AHD that directly overlies the Yarragadee Formation aquifer. Water table elevations of the Superficial Formation aquifer vary from 15 metres AHD east of Gelorup Hill to 10 metres AHD west of Gelorup Hill (Figure 13).

Groundwater flow is generally in a westerly direction and discharges to coastal swamps and the ocean. Recharge to the Superficial Formation aquifer is mostly from rainfall and the average seasonal variation in the elevation of the water table is less than one metre. The groundwater tends to be moderately brackish in the area, with total dissolved solids concentrations less than 1,000 milligrams per litre. Groundwater from the Superficial Formation aquifer is used for some domestic use for the rural residential blocks and domestic on-farm and stock supply water in the rural areas.

The Yarragadee Formation aquifer is a major fresh groundwater flow system that extends throughout the Perth Basin in the Bunbury area and is up to 1,000 metres deep. The groundwater is used for town-water supply, industry and mineral sand processing.

4.5.2 Groundwater Levels

Water level monitoring piezometers 1 and 2 were installed in the northern central areas of Lot 2 (Figure 4) in October 1998. Groundwater levels measured in the piezometers are set out in Table 5 below.

Table 5
Groundwater Levels (mAHD) within Northern Portion of Lot 2

Date Measured	Piezometer 1	Piezometer 2
27 October 1998	7.61	7.47
9 November 1998	7.8	8.4

* *These piezometers have now been removed due to progression of sand extraction.*

These results indicate a maximum high groundwater level of about nine metres AHD. The groundwater levels measured in the piezometers are similar to regional groundwater levels as extrapolated from the Water and Rivers Commission's regional mapping of groundwater levels, and as shown in the Commander (1982) investigation report (Figure 13).

Two additional water level monitoring piezometers 3 and 4 were installed in December 1999 in the southern portion of Lot 2 (Figure 4) within the low-lying areas west of the wetland located on Lot 11. Measurements undertaken to date are set out in Table 6 below.

Table 6
Groundwater Levels (mAHD) within Southern Portion of Lot 2

Date Measured	Piezometer 3	Piezometer 4
17 November 1999	17.8	17.25
27 April 2000	Dry at 17.5	Dry at 16.9

These groundwater levels indicate a maximum high groundwater level of 17.8 metres AHD to the west of the wetland.

The variation in groundwater levels across Lot 2 may be attributed to local geological variations in the Superficial Formation with limestone underlying the northern portion of Lot 2 and the wetland occurring east of the southern portion of Lot 2.

The guidelines of the Water and Rivers Commission for extractive industries require written permission should an excavation encroach within two metres of the highest (end of wet season, that is, November) groundwater table. The proposal is to excavate sand to a depth of 20 metres AHD, which is 2.2 metres above the maximum groundwater level. This meets the guidelines of the Water and Rivers Commission.

4.6 VEGETATION AND FLORA

4.6.1 Regional Vegetation Description

Landforms, soils and vegetation of the Swan Coastal Plain have been mapped in terms of landscape units by Churchward and McArthur (1978), Heddle *et al* (1978) and most recently by Barnesby and Proulx-Nixon (2000). Each landscape unit of the Swan Coastal Plain is characterised by a unique composition and structure of vegetation. Soil type and the landform on which the vegetation occurs predominantly govern the distribution pattern of vegetation.

Lot 2 Calinup Road is located upon the Spearwood Dune System consisting of the Karrakatta Sand Unit as described in Section 4.3 and supports vegetation typical of the Karrakatta Vegetation Complex-Central and South (Figures 11 and 14). Karrakatta Vegetation Complex - Central and South consists predominantly of open forests of *Eucalyptus gomphocephala - Corymbia calophylla* and woodlands of *Eucalyptus marginata* - Banksia spp.

Beard (1990) recognised that the vegetation of the Karrakatta sands varies from north to south according to rainfall. In the north near Lancelin, the vegetation is a mosaic of scrub-heath with a scattering of taller shrubs and stunted *Eucalyptus gomphocephala* (Tuart) trees; whereas in areas south of Lancelin to Yanchep, the vegetation is dominated by Banksia woodlands with scrub-heath and small pockets of Tuart trees. In areas south of Yanchep, the vegetation is dominated by a mixture of tall Eucalypt woodlands over Banksia shrublands/woodlands. The Eucalypt woodland species comprise mainly *Eucalyptus gomphocephala* near the coast and *Eucalyptus marginata* (Jarrah) further inland. In the southern half of the Spearwood Dune System extending to Busselton, the woodlands consist of mixed stands of *Eucalyptus* species trees and other plants known to grow on lime-rich soils leading to areas of Banksia species, *Allocasuarina fraseriana* and *Agonis flexuosa* which dominate as understorey trees in the south.

Floristic communities identified by Gibson et al (1994) and more recently by the Department of Environment (1996) for Lot 2 are 21a and 21c. Community 21a is primarily *Eucalyptus marginata - Banksia attenuata* woodlands, *Eucalyptus marginata, Corymbia calophylla - Banksia attenuata* woodlands or *Banksia attenuata* woodlands. The average species richness in this community is 54.6 species per plot. Half the sites in this community type occur on Bassendean sands while one third occur on the Spearwood system, such as the major portion of Lot 2. Community 21c is significantly less species rich with an average of 40.5 species per plot. This community consists of *Melaleuca presiana, Banksia attenuata, Banksia menziesii, Eucalyptus marginata* and *Corymbia calophylla*. This community tends to occur in more low-lying wetter sites and be largely restricted to the Bassendean system. This community occurs to the east of Lot 2 where the Bassendean and Pinjarra complexes occur.

Gibson *et al* noted that the highest incidence of species endemic to the Swan Coastal Plain was confined to the heavy clay or iron enriched soils of the footslopes on the eastern edge of the plain. Lot 2 is located approximately nine kilometres west of such areas and as such is unlikely to contain a high incidence of endemic flora species.

4.6.2 Regional Vegetation Coverage

Information from the Department of Environment's document 'A Strategy for the EPA to identify regionally significant natural areas in its consideration of the Greater Bunbury Region Scheme (GBRS) portion of the Swan Coastal Plain' states that the total remnant vegetation remaining on Spearwood dunes of the southern Swan Coastal Plain was 34 percent. Thirty percent of the Karrakatta Vegetation Complex-Central and South remain on the southern Swan Coastal Plain. It is estimated that nine percent of this is in secure tenure. Within the GBRS area, 52 percent of the Karrakatta Vegetation Complex-Central and South remain with 16 percent of this in secure tenure.

The Swan Coastal Plain contains 14,729 hectares of remnant Karrakatta Vegetation Complex - Central and South. This proposal requires the clearing of 20 hectares, this equates to 0.14

percent of the remaining Karrakatta Vegetation Complex - Central and South and 0.6% of the Karrakatta Vegetation Complex occurring within a 15-kilometre radius of Lot 2. Rehabilitation of the area with native vegetation will ensure that this will be a temporary loss.

Within a 15-kilometre radius of Lot 2, approximately 12,772 hectares is vegetated and represents 26 percent of the original vegetation coverage as shown by satellite imagery taken in 1996 (Department of Environmental Protection, July 2000). This area also represents vegetation that occurs over a number of different landforms extending from the coast to the eastern edge of the Swan Coastal Plain. Of this vegetated area, 3,412 hectares forms part of the Karrakatta Vegetation Complex-Central and South which in 1996 represented about 59 percent of its original coverage of 5,821 hectares. About 607 hectares (10 percent) of the Karrakatta Vegetation Complex-Central and South is vested and managed by the Department of Conservation and Land Management as a Nature Reserve and National Park within 15 kilometres of Lot 2.

Assuming that large-scale clearing has not occurred since 1996, the vegetation on Lot 2 (approximately 38 hectares) represents 0.3 percent of existing vegetation within a 15-kilometre radius of Lot 2 and 1.1 percent of the existing vegetation on the Karrakatta Vegetation Complex-Central and South.

Within Lot 2 a total of 20 hectares, or 52 percent, of existing vegetation is proposed to be cleared, leaving approximately 18 hectares, 48 percent, of remnant vegetation remaining on Lot 2. The total vegetation clearing of Lot 2, including historic clearing, is 40.7 hectares, which equates to 69 percent clearing with 31 percent vegetation retained on Lot 2.

4.6.2.1 Reserves and Department of Conservation and Land Management (DCLM) Estates

The Tuart Forest National Park occurs within 15 kilometres of Lot 2 and represents vegetation of the Karrakatta and Quindalup soil formations. The northern block of the Tuart Forest National Park occurs mostly on Karrakatta soils with Heddle mapping the majority as Karrakatta Vegetation Complex-Central and South with a small amount of Vasse Vegetation Complex on the western boundary (Figure 14). This portion of the Tuart Forest National Park is located approximately five kilometres south-west of Lot 2 (Figure 15).

The next block of the Tuart Forest National Park is located approximately 12 kilometres south and has been mapped as mostly Karrakatta Vegetation Complex-Central and South with a small amount of Yoongarillup Vegetation Complex on the western boundary.

System 6 reserves are areas within the Darling System region that were recommended as conservation reserves by the Environmental Protection Authority in 1983. These recommendations have been progressively implemented since they were endorsed in 1983. In addition to the Tuart Forest National Park, there are five System 6 reserves that occur within a 15-kilometre radius of Lot 2 (Figure 15). The System 6 reserves are:

- C68-Anglesea Island is located approximately 13 kilometres north of Lot 2, occurs on both Quindalup and Vasse landforms and comprises the Quindalup and Vasse Vegetation Complexes.

- C69-Big Swamp, South of Bunbury, is located approximately 11 kilometres north-west of Lot 2, occurs on both the Quindalup and Vasse landforms and comprises the Quindalup and Vasse Vegetation Complexes.
- C70-The South Bunbury Coastal Land is approximately seven kilometres north-west of Lot 2 occurs on the Quindalup landform and comprises the Quindalup Vegetation Complex.
- C71-Reserve near Dalyellup is approximately one kilometre to the west north-west of Lot 2, occurs on the Karrakatta Sand Unit and comprises the Karrakatta Vegetation Complex-Central and South.
- C86-Dardanup Management Priority Area is located approximately 14 kilometres east of Lot 2 and comprises a number of landform units and associated vegetation complexes including Guildford, Preston, Mungardup and Kingia.

Lot 2 is located within a vegetative pocket that is isolated from these areas and therefore does not form a corridor between them.

Remnant vegetation encompassing the southern extension of the Karrakatta Sand Unit is located in the two blocks of the Tuart Forest National Park and in the System 6 reserve C71. The species composition differs slightly between these sites and Lot 2. The general species and species structure are similar and are classified as the same vegetation complex. The diversity of the taxa occurring on Lot 2 is therefore well represented in these areas as well as other reserves, road reserves and other areas of remnant vegetation in the general region. This vegetation complex is widespread over much of the Swan Coastal Plain. The Greater Bunbury Region Scheme has also proposed a number of areas to be zoned Regional Open Space and it is likely that more areas of remnant vegetation will be protected in the general area in the future. For this reason, the remnant vegetation occurring on Lot 2 is not considered to require any special protection from clearing.

4.6.2.2 Ecological Links

A potential link between Dalyellup and the Preston River has been identified by Gibson et al 1994. Given that Lot 2 lies between Dalyellup and the Preston River, the area may be considered as a possible portion of this ecological link. While the values of the vegetation on Lot 2 are not considered to be high, the proposal will result in a substantial band of vegetation being retained on the eastern boundary and to the south of the property. This will retain a link between the wetlands to the east and the areas to the south and west. There has been no indication as to how an ecological link between Dalyellup and Preston River will be developed; this needs to be conducted as part of a regional planning process by the State Government.

Gelorup Hill and the ridge are considered to have high scenic quality based on landform and natural landscapes. Gelorup Hill is also considered to be a local landmark. Much of this scenic quality was impaired by earlier sand extraction operations and establishment of a communication tower within the area. However, since 1998 rehabilitation works north of Calinup Road have considerably reduced these impacts. Only the eastern slopes of Gelorup Hill will be extracted; the western slopes of Gelorup Hill will not be extracted. Once the rehabilitation of Gelorup Hill is undertaken in the future, following completion of the sand

extraction operations and indigenous trees and shrubs become re-established, this scenic quality will return. The value of Gelorup Hill is recognised and discussed further in Section 7.1.

4.6.2.3 Threatened Ecological Communities recognised by the Department of Conservation and Land Management

The Department of Conservation and Land Management (DCLM) database of threatened ecological communities was searched in March 2000 in the presence of Ms Val English from DCLM. One threatened community (MANEA01) was located and occurs approximately 10 kilometres north-north-east of Lot 2.

From the results of this database search and from a search of the Environmental Protection and Biodiversity Conservation database, it can be concluded that the proposed clearing of vegetation and excavation of sand on Lot 2 will not impact any recognised threatened ecological communities.

4.6.3 Vegetation and Flora of Lot 2

4.6.3.1 Methodology

Botanical surveys of Lot 2 were undertaken by Dr Ray Cranfield, in the company of an environmental scientist of Martinick Bosch Sell Pty Ltd (formerly Martinick McNulty Pty Ltd). The first survey was undertaken in February 1999 to assess plant communities, species composition and habitats.

Five landscape units were defined from aerial photography, all of which are components of the Karrakatta Vegetation and Landform Complex (Figure 16). One site within each of the five landscape units was selected to undertake the following activities:

- Confirm and ground truth the distribution and mapping of landscape units of Lot 2.
- Assess vegetation communities using Muir's Vegetation Classification and describe them on the basis of structural characteristics, common floristic composition, mean vegetation health and life form density classes.
- Identify and record all plant species within unbounded transects covering 30 metres. Unknown or doubtful taxa were collected and identified using the current available data. Dr Ray Cranfield later verified all species.
- Search for the presence of rare and priority listed flora and introduced flora.
- Evaluate vegetation communities on the basis of maintaining viable ecological processes, conserving genetic diversity of the wider region and the survival of natural values as per principles and criteria developed by Safstrom and Craig (1996).
- Identify and assess habitats of local or regional importance using Muir's Rapid Habitat Assessment System (1996).

As some species are less evident in February (that is, the P4 species *Caladenia speciosa*), a second survey to assess species composition with a particular focus on declared rare and priority species, was undertaken in October 2000.

4.6.3.2 Landscape Units of Lot 2

The five landscape units surveyed and mapped on Lot 2 (Figure 16) were assessed using Muir's Vegetation Classification System, which included the assessment of vegetation health and life form density classes (Appendix 3). A description of the five landscape units is contained in Table 7. Full species lists and descriptions for each landscape unit are contained in Appendix 4 and photographs of the landscape unit are presented in Plates 2 to 10.

4.6.3.3 Flora of Lot 2

Sixty-seven native species were recorded on the property of which 12; *Agonis flexuosa*, *Banksia attenuata*, *Conostylis aculeate*, *Corymbia calophylla*, *Davesia divaricata*, *Eucalyptus marginata*, *Hibbertia hypericoides*, *Lepidosperma squamatum*, *Leucopogan propinquis*, *Macrozamia riedlei*, *Phyllanthus calycinus* and *Xanthorrhoea brunonis* occurred across the site in all landscape units. Thirty-seven of the 67 native species recorded on Lot 2 however, only occurred in one of the five landscape units.

Landscape unit A, which occurs over the main apex of the north-south alignment ridge and upper slopes had the highest number of native species at 44, while landscape unit D that consists of the lower-lying to gently undulating areas in the south-east corner of Lot 2 had the lowest species diversity with only 16 native species being recorded.

A total of eight weed species were recorded on site with landscape unit D being the only landscape unit where no weed species were recorded. A full species list is presented in Appendix 4.

Table 7
Landscape Units of Lot 2

Landscape Unit	Unit Description	Geomorphic Unit	Soils	Native vegetation	Life Form Density Classes
A	Sandy rises and hill slopes supporting mixed Eucalypt –Xylomelum woodlands over open scrub and heath.	Hilltop.	Grey-brown surface sands over deep yellow sand.	Open woodland of sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees over open low woodland consisting mainly of *Xylomelum occidentale*, *Agonis flexuosa* and *Banksia attenuata.* Tree cover 10-30%, health rating 4. 48 species recorded during field surveys including four weed species.	10
B	Gentle depressions supporting mixed Eucalypt-Banksia woodlands over low open thickets and shrublands.	South-east facing hillside and saddle area with gentle depression.	Grey-brown surface sands over deep yellow sand.	Open woodland of very sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees over open low woodland of *Agonis flexuosa, Banksia attentuata* and *Banksia grandis*. Tree cover 2-10%, health rating 4. 37 species recorded during field surveys including two weed species.	11
C	Low gentle elevations supporting mixed Eucalypt-Agonis-Banksia woodlands over low open scrub.	Gently sloping east facing hillside.	Grey-brown surface sands over deep yellow sand.	Open woodland of very sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees over open low woodland of *Agonis flexuosa, Banksia attenuata, Banksia grandis* and *Xylomelum occidentale* trees. Tree cover 2-10%, health rating 4. 30 species recorded during field surveys including two weed species.	11
D	Gently undulating terrain supporting Eucalypt-Banksia woodlands over mixed low open scrub.	Valley head depression.	Grey-brown surface sands over deep yellow sand.	Open woodland of very sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees over low woodland of *Banksia attenuata, Banksia grandis, Agonis flexuosa* and *Xylomelum occidentale*. Tree cover 2-10%, health rating 4. 16 species recorded during field surveys.	11
E	Low fringing dampland supporting mixed open woodlands over mixed low open shrublands.	Valley head depression and low-lying area.	Grey-brown surface sands over deep yellow sand.	Low open woodland of very sparsely scattered *Agonis flexuosa, Banksia attentuata, Corymbia calophylla, Eucalyptus marginata, Nuytsia floribunda* and *Xylomelum occidentale* trees. Tree cover 2-10%, health rating 4. 29 species recorded during field surveys including five weed species.	10

4.6.4 Rare and Priority Listed Flora

A total of 67 endemic species were recorded on the property and eight weed species were also recorded. No declared rare or priority species were recorded on the property. Rare and priority taxa, although occurring in the coastal plain area, tend to occur in the highest incidence on heavy clay soils rather than on the southern Spearwood Dune System.

A search of the Environmental Protection and Biodiversity Conservation (EPBC) Act database in both January 2001, October 2002 and July 2003 showed that one species of flora, *Caladenia arrecta* listed as vulnerable under the EPBC Act may occur in the area. *Caladenia arrecta* was not recorded on the site during either survey conducted at Lot 2.

In July 2000, a search of the database of rare and protected flora held by the Department of Environment indicated that eight such flora species occur within the Karrakatta Vegetation Complex within a radius of approximately 15 kilometres from Lot 2. Three of the eight flora species are recognised as Priority three (poorly known) taxa and the remaining five flora species are recognised as Priority four (rare) taxa. No information was given to the identity of the flora species. There are three locations within the 15-kilometre radius of Declared Rare Flora (DRF) recordings, these occur between seven and 11 kilometres south of Lot 2 but occur on either the Southern River or the Guildford Vegetation Complex.

A search for listed priority and rare flora on Department of Conservation and Land Management's and WA Herbarium's databases was undertaken on a 300 square kilometre area covering 15 kilometres north and south of Lot 2 and five kilometres west and east. This search resulted in 10 rare and priority flora species being found to occur within the wider region of Lot 2. These 10 rare and priority taxa are listed in Table 8.

Table 8
Rare and Priority Listed Flora Known to Occur Within the Wider Region of Lot 2 Calinup Road

Taxa	Conservation Code*	Typical Environ
Acacia flagelliformis	P4	Wet areas and sandy soils
Acacia semitrullata	P3	Swampy areas including plains, sandy soils
Aponogeton hexatepalus	P4	An aquatic wetland species often found in clayey soils
Caladenia speciosa	P4	Species found on sandy soils
Drosera marchantii subsp. marchantii	P4	A wetland species found on laterite soils
Dryandra squarrosa subsp. argillacea	R	Wet areas and clayey soils
Eleocharis keigheryi	R	A semi-aquatic wetland species found on clayey soils
Franklandia triaristata	P4	Sandy soils
Synaphea hians	P3	Sandy soils and various habitats
Synaphea stenoloba	R	A wetland species found on sandy clay soils

* *Based upon the Department of Conservation and Land Management's classifications for rare and priority taxa as at July 2003.*

Acacia flagelliformis, Acacia semitrullata, Aponogeton hexatepalus, Drosera marchantii subsp. marchantii, Dryandra squarrosa subsp. argillacea, Eleocharis keigheryi and *Synaphea stenoloba* are species that tend to occur in wetland and swampy habitats. These habitats do not occur on Lot 2 and it is unlikely that these rare and priority listed flora will occur. These species were not recorded at Lot 2 during either of the two site flora and vegetation surveys that were undertaken.

The species *Synaphea hians,* which can be found on sandy soils and habitats, is known to grow on more stable soils than the sand ridge system and was not recorded at Lot 2 during either of two site flora and vegetation surveys.

Franklandia triaristata occurs on sandy soils in areas south of Lot 2, but does not occur on the Karrakatta Sand Unit and was not recorded at Lot 2. *Caladenia speciosa* is possibly the only priority listed flora species that could occur on Lot 2. The flowering period for this species occurs between September and October after which the plant dies down to an underground rhizome.

In addition, the Department of Environment has indicated that *Jacksonia sparsa* and *Lasiopetalum membranaceum* may occur in the area.

No rare or priority flora were located on Lot 2 during the February 1999 vegetation survey. This survey was undertaken outside the flowering period of *Caladenia speciosa.* Consequently, a follow-up vegetation survey specifically aimed at identifying rare and priority listed flora was undertaken in October 2000; none were found. No rare or priority flora have been found on Lot 2.

Podocarpus drouynianus, a typical southern forest species, was located in Landscape Unit B on Lot 2, around the southern base of Gelorup Hill. This is of some interest because this is near its most northern distribution limits. This species, however, can be readily found forming large populations in southern forest areas and is not considered to be under any threat. The retention of the western slope of Gelorup Hill will provide the opportunity for a number of *Podocarpus drouynianus* to be retained on Lot 2.

4.6.5 Dieback Status of Forest Area

Lot 2 consists of deep well-drained sands that are not conducive to development of *Phytophthora cinnamoni* (dieback). During the February 1999 vegetation survey, a period of high stress levels, no signs of dieback were observed. *Eucalyptus marginata* trees observed on Lot 2 showed signs of tip damage that was the result of other damaging agents and not *Phytophthora cinnamoni.* Other plants that are susceptible to dieback, especially *Banksia attenuata* and *Banksia grandis*, did not show signs of infestation and are considered not to be under any threat of being infected.

4.6.6 Weeds

Eight weed species were located within the southern portion of Lot 2 during the February 1999 and October 2000 surveys. These weed species are not associated with the excavation of sand or other associated activities. Of these eight weeds, five are annual grass species, namely *Anagallis arvensis, Briza maxima, Erhartia lengifolia, Hypochaeris glabra* and *Vulpia myuros*, one is a shrub species, *Phytolacca octandra,* and the remaining two are herb species, *Lotus uliginosus* and *Monadenia bracteata.* It is anticipated that the south-east boundary of Lot 2, which is adjacent to farmland, may influence an increase in the number of annual weed species. No declared weed species have been recorded at Lot 2.

4.6.7 Evaluation of Vegetation on Lot 2 Calinup Rd

The retention of native vegetation is important for maintaining ecological processes, conserving the genetic diversity of the region and survival of natural values (Safstrom and Craig, 1996). The vegetation assessments undertaken on Lot 2 demonstrate that the vegetation does not contribute valuably to either of these factors.

On a regional scale, the importance of vegetation on Lot 2 and the survival of its natural values are greatly reduced by its relative size, the amount of existing and previous disturbance and its already disjunct position in relation to other similar areas of remnant vegetation. Vegetation community types and species recorded on Lot 2 are widespread over much of the southern portion of the Swan Coastal Plain and are not considered to be a threatened community type.

The presence of farmlands and other disturbance factors adjacent to Lot 2 have already established artificial barriers in and near Lot 2 that have reduced the viable ecological processes provided by the vegetation. These barriers prevent or restrict all but very mobile fauna from accessing this area of vegetation, while less mobile fauna may become contained within the barriers and eventually start to decline in population. Generally, as health and viability of native vegetation declines, it is anticipated that the spread of weed species will

increase; it is envisaged that similar processes may occur at Lot 2 if it is not managed correctly.

At this stage vegetation on Lot 2 is in good condition with a reasonable degree of species diversity, of moderate health. The ability to manage the remaining vegetation on Lot 2 will be increasingly difficult with continued development in surrounding areas. The areas to the east of Lot 2 have been cleared extensively and the EPP wetlands that occur to the east have been modified; one being dammed. These wetlands have therefore been categorised as multiple-use wetlands and their natural values and function is considered to be low. While extensive clearing has not occurred on the properties to the south and the west, disturbance is still apparent, particularly to the west where sand mining has taken place.

Cokelup Swamp, an EPP wetland to the west of Lot 2, is classified as being partly multiple-use and partly conservation-category wetland. Sand extraction has occurred on the eastern edge of this wetland between it and Lot 2. While vegetation on Lot 2 and surrounds is not considered to be of high health, retention of 18 hectares on Lot 2 will provide a link to vegetation of surrounding properties, particularly to the south. It may therefore contribute to a regional ecological link between Dalyellup and the Plateau. With clear management objectives during sand extraction, suitable protection can occur for the 18 hectares of vegetation that will remain on Lot 2.

The height of Gelorup Hill appears to have no direct influence on the flora or its diversity, which is similar in nature to the remainder of the site. The representation of this vegetation community type in the southern Swan Coastal Plain is secure at present due to the coverage of extensive areas within the wider region of Lot 2. The conservation reserves found in the wider region represent the species located on Lot 2, which are also well represented on other areas of remnant vegetation. *Podocarpus drouynianus*, a typical southern forest species, was located in Landscape Unit B on Lot 2, around the southern base of Gelorup Hill. This is of some interest because this is near its most northern distribution limits. This species however, can be readily found forming large populations in southern forest areas and is not considered to be under any threat. The retention of the western slope of Gelorup Hill will provide the opportunity for a number of *Podocarpus drouynianus* to be retained on Lot 2. The retention of the western slopes of Gelorup Hill will also provide a continuation of a ridgeline, considered to be of high value, which extends north-south.

The 20 hectares that will be cleared on Lot 2 equates to 0.14 percent of the remaining Karrakatta Vegetation Complex - Central and South that remains on the Swan Coastal Plain. The commitment to rehabilitate the area using native species ensures that this will only be a temporary loss.

4.6.8 Habitat Assessment

The individual habitats assessed on Lot 2 are mainly of one type with a small variation being expressed in Landscape Unit A. The vegetation on Lot 2 is generally open woodland composed of about 11 different understorey vegetation strata. The composition of this stratum shows few species variations, and in most instances is similar throughout. Landscape Unit C appears to be a remnant open woodland type and may have extended into the lower eastern areas adjacent to Lot 2, now farmland (Figure 16).

Muir's Rapid Habitat Assessment System shows that the existing vegetation on a whole provides only one habitat type, but may encompass several suitable microhabitats of specialised importance. These microhabitats can benefit both flora and fauna such as cryptogams, invertebrates and some of the smaller macro vertebrates.

The exposed and free-draining condition of this area makes this habitat suitable only for occasional usage by large fauna. The virtual absence of nesting hollows provides an indication that the area is not suitable for many fauna species and helps identify which fauna may use or only visit the site. Frequency of fires in the area appears to be normal and is not thought to be contributing to any decline of habitat because seedlings and saplings were present. The low presence of weedy species indicated that the health of existing habitat is good and reflects the impact of present disturbance factors upon the area.

It is expected that nectar and insect-eating birds would use this area as a source of food during peak flowering periods (usually from September to October). Seed eaters would also use this area as a food source at certain times.

4.7 FAUNA

4.7.1 Regional Fauna

A search of the fauna database managed by the Western Australian Museum was undertaken in April 2000 and May 2003 to provide information on mammals, reptiles and amphibians known to occur within the wider region of Lot 2. This investigation was also to supplement field observations. In addition a search of the Threatened Fauna Database, managed by the Department of Conservation and Land Management, was undertaken in May 2003.

Bird, reptile and mammal records were also examined for a number of sites in the general region. These include records from the:

- Capel Wetland Centre and Capel Nature Reserve, 20 kilometres to the south, where observations have been made continuously since the mid 1980s (Doyle 2000, Bamford 1997);
- Ludlow Tuart Forest 25 kilometres to the south;
- Gwindinup area 15 kilometres to the south-east; and
- Kemerton area 30 kilometres to the north (M.Bamford, unpub. data).

In addition, there are several published reports on fauna in the general area, including How et al. (1987) and Storr and Johnstone (1998). Observations and these supplementary sources of information were used to create lists of species expected to occur at the site.

Taxonomy and nomenculture for fauna species used in this report generally follow Aplin and Smith (2001) for amphibians and reptiles, How et al. (2001) for mammals and Johnstone (2001) for birds. Alternative names, including common names recommended for national and international use by Christids and Boles (1994) for birds, are also used.

Vermin species that are likely to be found in the locality of Lot 2 include cats, foxes, mice, pigs, rabbits and rats.

4.7.2 Fauna Survey

Fauna surveys were undertaken by Martinick McNulty Pty Ltd in May 2000 (daytime search), June 2001 (late afternoon and night search) and by Bamford Consulting Ecologists in May 2003. During these visits information on fauna species present, vegetation and general habitat characteristics were collected. Attention was given to nesting and burrow habitats, scratchings and diggings, which may have been evident in the tree canopy and also at ground level. Particular attention was given to the identification of habitats suitable for specially threatened and priority fauna.

During the daytime search in May 2000 the property boundary and three transects at intervals of approximately 200 metres from west to east across Lot 2 were traversed. During the evening survey the property boundary of Lot 2 was traversed along with random transects across the property. Numerous rabbit burrows and wallaby scats were observed throughout the property.

A more thorough fauna assessment was conducted by Bamford Consulting Ecologists in May 2003. The fauna assessment conducted by Bamford Consulting Ecologists involved both desk top studies, which included a search of the DCLM database, and a daytime search of the property. The property was traversed along random transects and fauna observed and potential fauna habitats were recorded. Detailed results of this fauna assessment are presented in Appendix 5.

Table 9
Fauna Observed at Lot 2, Calinup Road

Form	Species	Common name	Conservation Status
Reptiles	*Menetia greyii*	Dwarf Skink	
	Tiliqua rugosa	Bobtail	
Birds	*Acanthiza apicalis*	Inland Thornbill	
	Barnardius zonarius	Australian Ringneck	
	Colluricinda harmonica	Grey Shrike thrush	
	Corvus coronoides	Australian Raven	
	Dacelo novaeguineae	Laughing Kookaburra	Int
	Ecpsaltria griseogularis	Western Yellow Robin	CS3
	Gerygone fusca	Western Greygone	
	Grallina cyanoleuca	Magpie lark	
	Gymnorpina tibicen	Australian Magpie	
	Hirundo neoxena	Welcome Swallow	
	Malurus splendens	Splendid Fairy wren	

Form	Species	Common name	Conservation Status
	Melithreptus lunatus	White napped Honeyeater	
	Ninox novaeseelandiae	Southern Boobook Owl	
	Pachycephala peatoralis	Golden Whistler	CS3
	Pachycephala rufiventris	Rufous Whistler	
	Pardalotus punctatus	Spotted Pardalote	
	Petroica multicolour	Scarlet Robin	
	Phaps chalcoptera	Common Bronzewing	
	Purpureicephalus spurius	Red capped Parrot	
	Rhipidura fulignosia	Grey Fantail	
	Sericornis frontalis	White browed scrubwren	
	Zosterops lateralis	Silvereye	
Mammals	*Macropus fulginosus*	Western Grey Kangaroo	
	Macropus irma	Brush Wallaby	P4
	Oryctolagus cuniculus	Rabbit	Int

** Int: Introduced species CS3; species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution.*

The Priority 4 species *Macropus irma* was recorded at Lot 2. This species is highly mobile.

No species of frog were observed during the site inspection but five species are considered likely to occur within the area based on the habitat present. None of the frog species expected to be present are of conservation significance at any level and are widespread in the South West.

Only two reptile species were observed during the site inspection, however a total of 33 reptile species may be present on the site. Neither species of reptile recorded on the site is of conservation significance.

Of the reptile species listed as possibly present based on habitat, one, *Morelia spilota imbricata* (South West Carpet Python) is listed on Schedule 4 of the WA Conservation Act 1950. Despite extensive field work in the vicinity it has never been recorded and its presence on Lot 2 seems unlikely.

Lot 2 may support 81 species of birds however only 22 have been observed. Of the 22 species observed on site none are listed under any Act. However, three of the species expected to occur on site are listed, these being:

- Peregrine Falcon (Schedule 4 of the WA Wildlife Conservation Act).
- Carnaby's Black Cockatoo (Schedule 1 – Endangered under the WA Wildlife Conservation Act and Endangered under the EPBC Act).

- Baudin's Black Cockatoo (Schedule – Vulnerable under the WA Wildlife Conservation Act and Vulnerable under the EPBC Act).

Two other species, the Barking Owl (the South West population is listed as Priority 2 by DCLM) and the Masked Owl (listed as Priority 4 by DCLM) are also likely to occur on the site.

No trees containing exceptionally large nest hollows such as may be used by ducks, the Peregrine Falcon, Barking Owl or Masked Owl were observed. One large stick-nest was observed in the south of Lot 2, but it is likely to be used by a more common bird of prey such as the Whistling Kite.

The Brush Wallaby, listed as Priority 4 by DCLM, was recorded on the site. It is likely that the Brush Wallaby is part of a local population that occurs through native vegetation lying east and west of Lot 2.

Two mammal species, listed as likely to occur on the site, are listed under both the EPBC Act and the WA Wildlife Conservation Act 1950, these being the Chuditch (Schedule 1 – Vulnerable under the WA Wildlife Conservation Act and Vulnerable under the EPBC Act) and the Western Ring-tailed Possum (Schedule 1 – Vulnerable under the WA Wildlife Conservation Act and Vulnerable under the EPBC Act). In addition, the Brush-tailed Phascogale (listed as Priority 3 by DCLM), Quenda (Priority 4 – conservation dependent) and the False Pipistrelle (Priority 4) are also listed as likely to occur in the area.

Clearing of vegetation on Lot 2 will be undertaken in stages, which will provide the opportunity for species to move ahead of clearing and relocate into other areas. In addition, approximately 18 hectares of vegetation will not be disturbed and will be retained within the setback areas of Lot 2 (Figure 7). This will provide an opportunity for any fauna species that may be present to move into these areas as sand extraction progresses. Progressive rehabilitation of the site will also provide the opportunity for species to recolonise the area from these adjacent vegetated sites once rehabilitation has occurred.

4.7.3 Specially Protected (Threatened) and Priority Fauna

An online search of the Environment Australia managed Commonwealth Environment Protection and Biodiversity Conservation database was conducted in January 2001 and again in October 2002 to determine if fauna of national significance were located within the project area. The database listed one migratory species and five threatened species under the *Environment Protection and Biodiversity Conservation Act, 1999*, which may occur in the area.

Table 10
Fauna Species Listed Under the EPBC Act

Species	Type	Common Name	Conservation Status	
			WA Notice	EPBC Act
Dasyurus geoffroii	Mammal	Chuditch	Schedule 1	Vulnerable
Pseudocheirus occidentalis	Mammal	Western Ringtail Possum	Schedule 1	Vulnerable
Setonix brachyurus	Mammal	Quokka	Schedule 1	Vulnerable
Calyptohynchus baudinii	Bird	Baudin's Black Cockatoo	Schedule 1	Vulnerable
Calyptohynchus latirostris	Bird	Carnaby's Black Cockatoo	Schedule 1	Endangered
Haliaeetus leucogaster	Bird	White Bellied Sea Eagle	-	Migratory Sp.

In the fauna surveys conducted on Lot 2, no species listed under the *Environmental Protection and Biodiversity Conservation Act, 1999* were recorded.

A possible Western Ring-tailed Possum drey was observed during the May 2003 survey. This species is locally common in the Bunbury to Busselton region, particularly where peppermint trees form a continuous canopy. Although peppermints were present in the mid-storey on Lot 2, they did not form a continuous canopy and only one probable drey was located. This suggests that Ring-tailed Possums, if present on site, are only present at low densities and are possibly visitors rather than residents of the area.

The Chuditch (Vulnerable under the EPBC Act) are known to occur in the wider area and may visit Lot 2. The Chuditch, however, was not recorded at the site during any of the site inspections.

Both Carnaby's Black-Cockatoo (Endangered under the EPBC Act) and Baudin's Black-Cockatoo (Vulnerable under the EPBC Act) may be non-breeding visitors to the area because suitable forage habitat exists. Neither species was recorded at Lot 2 during any of the site inspections.

4.8 ABORIGINAL CULTURAL HERITAGE SITES

A search of the Register of Aboriginal Sites of the Department of Indigenous Affairs indicated one archaeological site (Site 4881) recorded in 1978, about 750 metres to the north of Lot 2. This site, comprising several quartz waste flakes, was located on yellow sand near a soccer field east of the Bussell Highway. No diagram or site sketch was provided to accurately locate this site and the information that was provided in the records was noted by the Department of Indigenous Affairs to be '*insufficient for confidently determining the location of the site*'. There is no soccer field located near or within Lot 2.

An archaeological survey of Lot 2 was undertaken in May 2000 by archaeologist Darren Cooper of Martinick Bosch Sell Pty Ltd (formerly Martinick McNulty Pty Ltd). No archaeological sites were located although three isolated artefacts were located on an exposed sand face within the Calinup Road survey area. These were not considered to be of any significant archaeological value. A copy of the report for the archaeological survey was

forwarded to the Department of Indigenous Affairs in December 2000 (Appendix 6). The report was accepted by the department and no issues or concerns were raised (Appendix 6).

4.9 NATIVE TITLE

The National Register of Native Title Claims managed by the National Native Title Tribunal was searched in April 2000. Martinick Bosch Sell Pty Ltd (formerly Martinick McNulty Pty Ltd) was advised that Lot 2 occurred within the Gnaala Karla Booja Native Title Claim WC98/58.

Lot 2 is freehold land and is therefore not subject to any Native Title Claims.

4.10 EUROPEAN HERITAGE SITES

In March 2000 the Heritage Council of Western Australia undertook a search for European Heritage Places registered within the Shire of Capel. The search indicated that 174 places were registered on the Shire of Capel's Municipal Inventory with two of these places on the State Register of Heritage Places and one on the Register of the National Estate. None of these registered places occur within or are adjacent to Lot 2.

5. PUBLIC CONSULTATION

5.1 BACKGROUND

The EPA requires evidence of a satisfactory consultation mechanism that demonstrates consultation has been undertaken and that relevant environmental concerns have been addressed in the design and management of the proposed southern extension of Lot 2 Calinup Road sandpit.

A public consultation programme was undertaken to consult with:

- Shire of Capel.
- Residents.
- State Government departments, agencies and organisations.
- Special interest groups such as the Conservation Council of Western Australia.

The public consultation programme was designed to:

- Inform the public about the proposed southern extension to the sandpit.
- Record potential concerns, issues and recommendations.
- Aid in preparing the design and management of the proposed southern extension, ensuring that public concerns are addressed.
- Provide feedback.
- Establish meaningful and ongoing dialogue.

The public consultation included:

- Public meeting with residents.
- Information letters with a project summary issued to residents living in the vicinity of Lot 2.
- Individual meetings with representative for the Gelorup residents and other residents who responded to the information letter.
- Several telephone discussions and meetings with the operations and town-planning managers of the Shire of Capel.
- Meetings with government agencies and key interest groups to discuss the proposal and receive responses to a draft copy of the PER.

5.2 RECORD OF PUBLIC CONSULTATION

A list of the individuals, organisations, groups and agencies that were consulted is given in Table 11. This list was established through discussions with the Department of Environment and the Shire of Capel.

Table 11
People and Organisations Consulted about the Development of the Southern Extension of Lot 2 Calinup Road Sandpit

Person	Group	Position	Location	Method of Consultation	Written Response Received
Mr Ian Cocker Mr Glen Bishop	Shire of Capel	Manager Operational Services Manager Planning and Development Services	Capel	In person. In person.	No Yes
Mr Peter Hanley	Department of Conservation and Land Management (DCLM)	Regional Planning Officer	Bunbury	In person.	No (phone call only)
Ms Rachel Siewert & Ms Julie Baker*	Conservation Council of Western Australia	Conservation Council WA Co-ordinator	West Perth	In person.	Yes
Ms Tanya Farnsworth	Gelorup Residents	Representative	Gelorup	In person, phone and mail	No
Mr David Bills	Department of Environment (Regional Office) (DoE)	Environmental Officer	Bunbury	In person, phone and mail	Yes (in conjunction with WRC-Bunbury)
Mr Henry Sieradzki	Water and River Commission (Regional Office) (WRC)	Water Allocation Officer	Bunbury	In person.	Yes
Mr Robert Sherwood	Department of Mineral and Petroleum Resources (Regional Office)	District Inspector of Mines	Collie	By phone and mail.	No (phone call only)
Mr Andrew Watson	Soil Conservation Commission	Deputy Commissioner of Soil Conservation	South Perth	In person.	Yes (e-mail)
Mr Brendan Kelly	South West Environment Centre (SWEC)	Convenor	Bunbury	In person.	Yes
Mr Andrew Mack	Department of Environment (DoE)	Environmental Officer	Perth	In person, phone and mail	Yes

** Former Executive member, no longer affiliated with the Conservation Council of Western Australia.*

5.2.1 Public Meeting

A public meeting was held at the Gelorup Community Centre on the 23 March 1999 in response to a letter of 15 February 1999 (Appendix 7) from residents expressing concern over the proposed clearing of 30 hectares of vegetation and an application for a long-term Extractive Industries Licence. The meeting was attended by residents, representatives of Giacci Bros Pty Ltd and the Shire of Capel.

The letter raised four issues, namely:

- Dust from Calinup Road.
  Subsequently resolved by sealing Calinup Road in March 2000.
- Hours of Operation.
  To comply with Extractive Industries Licence and Environmental Management Plan.
- Potential impact of land clearing and sand extraction on community and nature.
  Addressed in the PER.
- Effect on water table.
  Addressed in the PER.

Additional concerns raised at the meeting included:

- Windblown sand onto the north-east adjoining property.
  Sand extraction completed in 2000 and the northern areas have been rehabilitated and mulched.
- Access to Calinup Public Road.
  Access to Calinup Road east of Lot 2 will be maintained.
- Noise from trucking along Calinup Road.
  Subsequently resolved by sealing Calinup Road in March 2000.
- General noise from operations.
  To comply with Extractive Industries Licence and the Environmental Management Plan.
- General safety.
  To comply with Extractive Industries Licence and the Environmental Management Plan.

The meeting was conducted in a cordial manner and it was resolved that all these concerns would be taken into account by the Shire of Capel during the assessment and processing of the Extractive Industries Licence application.

5.2.2 Information Letters to Residents

An information letter with project summary (Appendix 7) was issued on the 6 November 2000 to 31 residents living in the vicinity of Lot 2. A list of the residents' names and contact details are provided in Appendix 7.

During the preparation of the information letter and project summary, comments were requested from Mrs Tanya Farnsworth (formerly McGovern) who is a representative for the Gelorup residents. The purpose of the letter and project summary was to inform residents of the proposal to extract sand from the vegetated areas south of Gelorup Hill, to describe the

potential environmental impacts and methods to manage such impacts. The residents were requested to study the proposal and to contact Martinick McNulty to discuss the proposal or record a concern, issue or recommendation. Three residents responded to the information letter, each of whose properties adjoin Lot 2 as follows:

- Mr Peter and Mrs Cheryl Dillon of Lot 167 - adjoins the north-eastern property boundary of Lot 2. Consultation included a telephone discussion on 20 November 2001, a site meeting of the 21 November 2000 and an exchange of letters.
- Mr Ron Roberts of Lot 186 adjoins the southern property boundary of Lot 2. Consultation included a telephone discussion on 17 November 2000, a site meeting on 21 November 2000 and an exchange of letters.
- Mr James Smith of Lot 3 (formerly Lot 100) adjoins the eastern property boundary of the southern portion of Lot 2. Consultations included a telephone discussion on 22 November 2000 and an exchange of letters.

A second letter to the residents was issued on the 31st of January 2003 to provide residents living in the vicinity of Lot 2 with an update on the project. A copy of the letter is provided in Appendix 7. One response was received as follows:

- Messrs Payne and Shield of Lot 677 - adjoins the western boundary of Cokelup Road. Consultations included a telephone discussion on 14 February 2003 and an exchange of letters with Messrs Payne and Shield and Mr Shield's lawyer, Mr Gary Nixon.

Correspondence is provided in Appendix 7 and the concerns raised by these residents are discussed in Section 5.3.

5.2.3 Meeting with the Representative for the Gelorup Residents

A meeting was held on 15 November 2000 with Mrs Tanya Farnsworth to discuss the proposal to extend the sand extraction operation south of Gelorup Hill and to consider any issues, concerns or recommendations that she or any other residents may have.

In respect to the existing or proposed sand extraction operations, Mrs Farnsworth confirmed that she maintains contact with residents and receives feedback in regard to the sand extraction operations. She reported that many residents have responded positively to the sand extraction operations and especially in respect to the absence of noise and dust from trucks using Calinup Road, which was sealed in March 2000.

Mrs Farnsworth expressed her appreciation on being consulted and was satisfied with the proposed measures to minimise and manage the potential environmental impacts of the proposed sand extraction within the southern portion of Lot 2.

She has no objections to the proposed post-mining landform of Lot 2 for future long-term residential use and rezoning of the northern portion of Lot 2 for rural residential subdivision.

5.2.4 Meeting with the Shire of Capel

A meeting was held on 27 April 2000 with Mr Glen Bishop, Head Town Planner for the Shire of Capel, to ascertain the current thinking and requirements of the shire in regard to the long-term landuse of Lot 2.

The merits and requirements for different areas of Lot 2 were discussed and the following points were included for consideration in future sand extraction proposals south of Calinup Road reserve:

i) **Gelorup Hill:** The Shire of Capel acknowledged that the major landscape views to be afforded by Gelorup Hill will be from the west; from Bussell Highway looking east. As Lot 2 is located east of Gelorup Hill, any future sand extraction from the eastern slopes of Gelorup Hill will not impact on these views. Gelorup Hill also provides an elevated vantage point providing views eastwards over the wetlands and to the Darling Range. This vantage point and regional views will not be affected by the proposed sand extraction on a long-term basis.

The Shire of Capel acknowledged that any future residential development on the hill slopes of Gelorup Hill will result in a loss of regional landscape values. It was concluded that any disturbance to the eastern slopes of Gelorup Hill from sand extraction will not adversely impact on the longer-term residential landuse, subject to suitable grades and landform being achieved.

ii) **South of Gelorup Hill:** The Shire of Capel recognises this area as having potential for higher density residential development. It thereby wishes to maximise residential values of the elevated land within Lot 2 and the potential recreational amenity of the adjoining wetlands and lower lying areas.

A design floor level of 20 metres AHD is considered by the Shire of Capel to be consistent with the future residential landuse.

iii) **Cokelup Road-South of Calinup Road Reserve:** Cokelup Road is approximately two kilometres long and links Calinup Road to Brookdale Road. Cokelup Road is located on the ridgeline adjacent to the western boundary of Lot 2, which is approximately 1,150 metres long and provides the only access to Lot 677 and alternative access to Lots 186 and 187 that can also gain access from Brookdale Road.

The Shire of Capel recognises that Cokelup Road is not a major link road and that it provides limited access. Alternative road routing may be considered on condition that it still serves the current purpose of providing access.

The Shire of Capel indicated that the Department of Land Administration could consider an alternative route by way of a land swap such that the alternative road may be located to best suit future residential landuse while serving interim landuse needs.

By relocating Cokelup Road on the adjoining low-lying areas of Lot 2 the former 20-metre wide road reserve will be amalgamated into Lot 2 and Lot 2 will border directly onto adjoining Lots 187 and 677. This will allow for an additional 40 metres width of elevated terrain on Lot 2 becoming available for sand extraction.

The area within the current Cokelup Road Reserve setbacks will only be extracted if an agreement can be made on the road's realignment. If Cokelup Road is not realigned the standard 40-metre setback from a road will apply to extraction.

The Shire of Capel indicated that it would support the rerouting of Cokelup Road if the future residential landuse opportunities are able to be enhanced and not compromise the interim access requirements.

5.2.5 Consultations for the Draft Public Environmental Review Document

During February 2003 meetings were held with representatives of government agencies, organisations and key interest groups. The meetings were designed to give an overview of the project and the proposed environmental management. A draft copy of the PER was left for detailed review and comments. All groups approached in this round of consultations, provided comments (one via e-mail, two via telephone discussions and four via letter). Numerous comments were made and the responses provided are included in Appendix 7. The comments and responses are summarised in section 5.3.

5.3 RECORD OF SUPPORT AND RESERVATIONS OR CONCERNS RAISED THROUGH PUBLIC CONSULTATIONS

Reservations, concerns or issues that were expressed with regard to the potential impact of the proposed southern extension of the sandpit on Lot 2 were:

- **Concern:** Future relocation of Cokelup Road (Mr Ron Roberts - Landowner of adjoining Lot 186 and Messrs Payne and Shield – Landowner of adjoining Lot 677), (DoE/WRC - Bunbury), (DCLM - Bunbury).

  Response: A number of options for the extraction of sand adjacent to the western boundary of Lot 2 (next to Cokelup Road) have been considered. In discussions with the Shire of Capel it was suggested that relocation of Cokelup Road to within Lot 2 may be an acceptable option for the future residential development of Lot 2 and adjoining properties to the west. Relocating Cokelup Road would also result in the optimum use of sand resources within Lot 2 while minimising vegetation clearing.

  An application to relocate Cokelup Road will not form part of this proposal but potential for its relocation will be discussed in the proposal to gain approval to clear vegetation for the proposed sand extraction operations. Any future proposal to relocate Cokelup Road will need to conform to more detailed town planning by the Shire of Capel for future residential developments south of Calinup Road.

  The area within the current Cokelup Road reserve setbacks will only be mined if agreement can be reached for a land swap that would result in Cokelup Road being aligned in the lower portion of Lot 2 to better suit future residential landuse opportunities. Should Cokelup Road not be realigned, the standard 40-metre setback from a road will apply to extraction.

- **Concern:** Survey pegs to be in place at all times for workers to work to and from and not to be undermined or pushed out (Mr and Mrs Dillon - Landowners of adjoining Lot 167).

  Response: Sand extraction blocks will be surveyed for vegetation clearing and sand extraction areas pegged to assist the operator. In the event that survey pegs are damaged these will be re-surveyed (if necessary) and reinstated.

- **Concern:** Ensure that all noise, dust and sand migration impacts of the proposed sand extraction will be contained on Lot 2 and there will be no impact on Lot 167 (Mr and Mrs Dillon - Landowners of adjoining Lot 167).

  Response: Noise abatement and dust suppression measures will be addressed in the proposal to extract sand. The extensive setback of remnant vegetation (50 to 250 metres wide) within the eastern portion of Lot 2 will ensure that no migration of sand occurs to the east of Lot 2. The proposed sand extraction operations will commence at least 200 metres to the west and south of Lot 167 and operations will advance southwards (initially at about 100 metres per annum) thereby progressively increasing the separation distance between Lot 167 and the active areas of sand extraction. The completed areas of sand extraction will be rehabilitated progressively behind (north of) the active areas.

  Noise will be reduced by concentration of the operations below the adjoining ground surface. Dust generation will be minimised as the operations will be sheltered from the prevailing summer south-westerly winds by a ridge that forms the western boundary of Lot 2 and by extensive remnant vegetation that will be maintained around the western, southern and eastern boundaries of Lot 2.

- **Concern:** The wetlands in the area have a significant importance in the area (Mr James Smith - Landowner of adjoining Lot 3, formerly Lot 100).

  Response: There will be no adverse impact on the wetlands that are located more than 200 metres east and south of the nearest proposed sand extraction operations.

- **Concern:** Gelorup Hill is a regional landmark and its integrity should be protected (Mr James Smith - Landowner of adjoining Lot 3, formerly Lot 100), (DCLM - Bunbury), (DoE - Perth).

  Response: The proposed extraction of sand from Gelorup Hill will not reduce the level of the hilltop or adjoining ridge. Most excavation will occur within areas of current sand extraction. Slopes will be reinstated to 1:4 batters and revegetated with indigenous trees and shrubs.

  Extraction will occur on the eastern slopes of Gelorup Hill but not on the western slopes. Extraction will be undertaken to a 40-metre setback that coincides with a 58-metre contour, therefore the eastern slopes will be removed while the western slopes to the crest will remain. It is recognised that this is considered an important landscape feature and therefore the western slope and crest will remain.

  The landscape value of Gelorup Hill has been addressed in the PER in Sections 1.6, 1.8, 4.6 and 7.1.

- **Concern:** Groundwater levels and quality (DoE/WRC - Bunbury), (Conservation Council).

  Response: No oils, petrol, or lubricants will be stored on site and it is unlikely that water quality of the underlying groundwater will be affected by the sand extraction. Monitoring of groundwater levels will be undertaken to ensure that a minimum two-metre separation is maintained between the floor of the sandpit and the maximum high water table.

- **Concern:** Vegetation Evaluation and Clearing (DoE/WRC - Bunbury), (SWEC), (DoE - Perth).

  Response: The vegetation description has been improved by providing more clarity on the vegetation description and community types and likelihood of endemic taxa. Percentages for both the Southern Swan Coastal Plain and the Greater Bunbury Region have been supplied in the PER, based on the most up-to-date information available. The percentages for the Greater Bunbury Region have been used as a subset of the Swan Coastal Plain and reflect the differences in the Karrakatta Vegetation Complex - Central and South, across the Swan Coastal Plain. In addition, the PER provides details of vegetation distribution within a 15-kilometre radius of the property and the percentage that the proposed clearing constitutes within the Karrakatta vegetation complex occurring within this radius. The vegetation of the entire Swan Coastal Plain has not been mapped in further detail to allow such detail to be discussed. The clearing proposed onsite has been included as a percentage of the remaining Karrakatta Vegetation Complex – Central and South on the Swan Coastal Plain.

- **Concern:** Rehabilitation (DoE/WRC - Bunbury), (Conservation Council), (DoE - Perth).

  Response: Topsoil alone may not provide the required results. As stated in Section 1.4.3, 3.9 and now included in Section 6.4.5, where required, seedling planting will occur where topsoil alone does not result in the required rehabilitation success. It is not intended to reintroduce species that are not currently found on the site. Where possible, cleared vegetation will be used in rehabilitation. A rehabilitation and closure plan will be prepared that will address these issues. The proponent has made a commitment to rehabilitate the area. Therefore the loss of vegetation and habitat will only be a temporary one.

- **Concern:** Aerial Photograph (DoE/WRC - Bunbury), (SWEC).

  Response: A more up-to-date aerial photograph has been incorporated into the document. The area was last flown in November 2000.

- **Concern:** Future landuse (Conservation Council), (SWEC), (DCLM - Bunbury).

  Response: Figure 9 provides an indication of what may be achieved in terms of vegetation retention should subdivision be approved in the future. However, as future residential development does not form part of this proposal the rehabilitation and vegetation retention outcomes are restricted to this proposal only. In addition, the area has not been identified in the Greater Bunbury Region Scheme as an area to be set aside for conservation. However, retention of vegetation in the east and south of the property will maintain a link to adjoining vegetation.

- **Concern:** Discussion of ecological links (DoE - Perth).

  Response: The setbacks section of the PER briefly discusses the vegetation that will be retained and how that will help maintain a link between the wetlands to the east and west.

- **Concern:** Threatened species (Conservation Council), (SWEC), (DoE - Perth).

  Response: The assumptions regarding certain species likely to occur on the property are based on the characteristics of the species (i.e. home range or preferred habitat) as outlined by the Department of Conservation and Land Management, as well as database searches.

- **Concern:** Survey Techniques (SWEC), (DoE - Perth).

  Response: How's (1998) study in Bold Park indicates that trapping does not necessarily provide an accurate indication of what species occur on a site, even after a number of years of trapping. Database searches of the Western Australian Museum, Environment Australia's Environment Protection and Biodiversity Conservation and the Department of Conservation and Land Management databases were undertaken to provide information on the species known to occur in the wider area. An additional fauna survey was conducted by Bamford Consulting Ecologists in May 2003 and the results incorporated into the PER.

- **Concern:** Document Structure (SWEC).

  Response: The document is structured to meet the guidelines set for the PER. These guidelines are set by the EPA.

- **Concern:** Seen Area (DCLM).

  Response: The computer-generated views are taken from points at distances greater than five kilometres from the property, due east and in a north-east direction from the north-eastern corner of the property.

5.4 CONCLUSIONS OF THE PUBLIC CONSULTATION PROGRAMME

The outcome of the public consultation programme has shown that:

i) There is generally a high level of awareness in the local community about the existing sandpit, and recognition of the advantages of the proposed southern extension provided that environmental and social factors can be addressed and managed.

ii) There is support from the local community and the Shire of Capel.

iii) It is acknowledged that the proponent has committed to design and manage the proposed southern extension so that potentially adverse environmental and social impacts are avoided or minimised.

iv) There is considerable benefit of the continued use of the Calinup Road sandpit because it provides access to a resource via existing infrastructure which is in the community interest.

v) The proposed retention of the western slopes and crest of Gelorup Hill and the proposed rehabilitation measures are supported by all authorities, agencies, organisations and the public that were consulted.

6. BIOPHYSICAL ENVIRONMENT: IMPACTS AND MANAGEMENT

6.1 SURFACE WATER

6.1.1 Environmental Protection Authority Objective

Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance, are protected consistent with the ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

6.1.2 Impact of Proposed Extension on Surface Water

The Karrakatta sands of Lot 2 are free draining and it is unlikely that areas of cleared vegetation will be affected by localised erosion or areas of instability during high rainfall events. Previous excavations in the northern portion of Lot 2 have not been adversely affected by erosion as a result of surface water.

The ground surface of Lot 2 slopes to the east and the proposed surface after excavation maintains this slope orientation, ensuring that drainage patterns are not changed.

6.1.3 Environmental Management

Progressive mining with an advancing mining face followed closely by landform restoration and rehabilitation, ensures that at any given time only a few hectares will be actively impacted. All stormwater will be contained within the layout of the sandpit and will not drain to the east.

6.1.4 Environmental Outcome

Because of the free-draining nature of the soils, surface runoff is minimal and there are no potential impacts. No impact on the adjacent agricultural dam or regional surface water quality. Surface water hydrology will be unchanged.

6.2 WETLANDS

6.2.1 Environmental Protection Authority Objective

Maintain the integrity, functions and environmental values of wetlands.

6.2.2 Conservation Value of Wetlands

A series of wetlands are located between 150 and 250 metres east and south of Lot 2 (Figure 12), (Plate 1). These wetlands have been gazetted under the Environmental Protection (Swan

Coastal Plain Lakes) Policy (EPP lakes) and are categorised as being in the multiple-use category.

Cokelup swamp is a wetland located approximately 750 metres west of Lot 2 (Figure 12), (Plate 1). Cokelup swamp is also listed as an EPP wetland. The outer northern fringe of Cokelup swamp is categorised as multiple use, while the majority of the wetland core has been categorised as conservation. Conservation category wetlands are wetlands that support high levels of natural functions and attributes.

6.2.3 Impact of Proposed Extension on Wetlands

No natural wetlands including sumpland and palusplains occur on Lot 2 and consequently no wetlands will be directly impacted by this proposal. The free-draining soils on Lot 2 will not result in surface runoff to the east and the groundwater through-flow is to the west away from the wetlands east of Lot 2. Therefore no wetland will be indirectly impacted by the proposal.

6.2.4 Environmental Management

Excavation of sand will occur in areas outlined in Figures 6 and 7 and all stormwater occurring within the sandpit layout will be contained. Excavation will be restricted to within the property boundary of Lot 2 and will not impact the adjacent wetlands. The sand resource will be excavated to a maximum level of 20 metres AHD, which is about 2.2 metres above the groundwater table and will not impact any potential groundwater resources.

Sand extraction and landform restoration will be undertaken progressively thereby reducing any potential impact on the regional catchment.

6.2.5 Environmental Outcome

No wetlands will be mined or used for infrastructure in this proposal. The series of sumplands and palusplains to the east and the wetland to the west of Lot 2 will not be adversely impacted by the proposed extraction of sand. No impacts to wetlands will occur because free-draining soils will not result in surface runoff to the east and the groundwater through-flow is to the west away from the nearby eastern wetlands. There is a separation of 750 metres between Lot 2 and Cokelup swamp to the west. Therefore, there will be no direct or indirect impacts to the wetlands.

6.3 GROUNDWATER

6.3.1 Environmental Protection Authority Objective

Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance, are protected consistent with the ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

6.3.2 Impact of Proposed Extension on Groundwater

Potential sources of contamination of groundwater underlying Lot 2 include:

- Small crib room providing facilities for one operator.
- Use of environmentally sensitive materials such as fuels and oils.
- Activities associated with the use of environmentally sensitive materials including trucking, handling, processing and storage.

Potential impacts on groundwater flow include:

- Excavation to less than two metres above the maximum ground water level could increase evaporation and reduce ground water levels.
- Clearing of vegetation increasing recharge to groundwater resulting in elevated groundwater levels.

6.3.3 Environmental Management

Sand extraction activities do not require the storage of fuels, oils and lubricants onsite. Current refuelling of haulage trucks and light vehicles are undertaken offsite and will continue. Refuelling of equipment onsite such as the loader will be undertaken using a mobile tanker.

All routine servicing and repairs will be undertaken offsite in a properly equipped workshop. Where servicing or repairs other than routine servicing and repairs are required, it will be conducted in an environmentally sensitive manner.

Extraction will be kept to a maximum depth of 20 metres AHD, which is at least two metres above the highest known groundwater level. Regular groundwater level monitoring will be undertaken to ensure that extraction is a minimum of two metres above the highest known groundwater level. Because this is a dry mining process, there is no need for tailings storage facilities. There is also no need to intercept the water table.

Progressive mining with an advancing mining face followed closely by landform restoration and rehabilitation, ensures that at any given time only a few hectares will be actively impacted. While clearing of vegetation will increase groundwater recharge the small areas involved and the high permeability of the sands mean that the differences in groundwater levels will be small and will have little or no impact beyond the boundaries of Lot 2. Progressive rehabilitation of previously mined areas will further reduce the impact.

6.3.4 Environmental Outcome

Groundwater quality and levels on Lot 2 and adjoining areas will not be adversely affected by the proposed southern extension to sand extraction on Lot 2. Landform modifications will not affect local or regional hydrogeological regimes. Groundwater through-flow is to the west away from those wetlands located to the east of Lot 2. A 750-metre separation distance exists between Lot 2 and Cokelup swamp, the wetland to the west of Lot 2. Rural and other sand extraction activities occur between Lot 2 and Cokelup swamp.

6.4 VEGETATION AND FLORA

6.4.1 Environmental Protection Authority Objectives

- Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities.
- Protect declared rare and priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950.*
- Protect other flora species of conservation significance.

6.4.2 Conservation Value of the Vegetation

The 38 hectares of vegetation on Lot 2 is known as the Karrakatta Vegetation Complex-Central and South and is common within the region. This constitutes approximately 1.1 percent of the Karrakatta Vegetation Complex remaining within a 15-kilometre radius of Lot 2. The regional significance of vegetation on Lot 2 is low due to the known extent reserved in the area. Fifty two percent of the Karrakatta Vegetation Complex-Central and South remain within the Greater Bunbury Region Scheme area with 16 percent of this in secure tenure.

The vegetation on Lot 2 does not contain unique or unusual botanical features. Historically, Lot 2 and surrounding areas have been subject to: selective logging with remnant and regrowth vegetation now remaining; pastoral activities such as grazing; burning; and the introduction of exotic species such as stock and feral animals. Lot 2 does not contain any unusual microhabitats.

6.4.3 Impact of the Proposed Extension on Vegetation

The proposed sand extraction operations will result in the temporary loss of native vegetation covering a total area of approximately 20 hectares. This equates to the loss of about 0.14 percent of existing vegetation coverage and less than 0.6 percent of the Karrakatta Vegetation Complex occurring within a 15-kilometre radius of Lot 2. Vegetation will be cleared at a rate of between one and two hectares per annum in accordance with the typical extraction rate of one sand extraction block per annum. Each sand extraction block will be progressively rehabilitated with native vegetation, contained in the seedbank of the topsoil once extraction of the block has ceased and the final land surface has been achieved.

6.4.4 Impact on Declared Rare and Priority Flora

No gazetted rare or priority listed flora species have been recorded on Lot 2 and the area does not consist of the vegetation complexes that support the majority of rare and priority flora species recorded in the wider region. Consequently, no such plants will be affected by the proposed sand extraction operations.

6.4.5 Environmental Management

Vegetation clearing will be undertaken in stages to minimise the area of disturbance and vegetation loss at any one time. Rehabilitation will be progressive using appropriate topsoil management techniques that will increase the potential for native vegetation to re-establish from the seed source in the topsoil. Where necessary, seedlings of native trees and shrubs will be planted to supplement the establishment of vegetation from the seedbank in the topsoil. Approximately 18 hectares of vegetation will be retained within setback areas around the western, southern and eastern boundaries of Lot 2. Recruitment from these undisturbed areas is also likely to occur and will be an additional source of native vegetation establishment in the area.

Areas of vegetation that are to be cleared will be pegged or flagged according to extraction blocks shown on Figure 6. Before clearing, as much timber as possible will be salvaged or retained as brush for future rehabilitation. Topsoil will be removed to a depth of about 30 centimetres and will be stockpiled in windrows. Windrows will not be greater than two metres in height. The topsoil will be retained for use in the progressive rehabilitation of the site.

6.4.6 Environmental Outcome

The vegetation community and flora species are all common and widespread over much of the southern portion of the Swan Coastal Plain and do not have local or regionally outstanding ecological values. The Karrakatta Vegetation Complex - Central and South, which occurs on Lot 2, is well reserved within the immediate region of Lot 2. In addition, approximately 18 hectares of vegetation on Lot 2 will be retained. Consequently, the impact of the proposed southern extension of the sandpit on the vegetation complex and flora species will be negligible in a regional conservation context.

6.5 FAUNA

6.5.1 Environmental Protection Authority Objectives

- Maintain the abundance, species diversity and geographic distribution of fauna.
- Protect Specially Protected (Threatened) and Priority fauna and their habitats consistent with the provisions of the *Wildlife Conservation Act, 1950.*

6.5.2 Impact of Proposed Extension on Fauna

Progressive removal and subsequent rehabilitation of 20 hectares of habitat at a rate of between one and two hectares a year will result in temporary loss of available habitats that are common in the wider region. This habitat is well represented both locally and regionally in DCLM reserves and other remnant vegetation and the temporary loss of habitat will not have any significant or permanent impact on the future of the region.

6.5.3 Impact on Specially Protected (Threatened) and Priority Fauna

Eight priority-listed species of fauna are listed as likely to occur within 30 kilometres of Lot 2 and are gazetted under either the *Western Australian Wildlife Conservation Act, 1950* or the *Environmental Protection and Biodiversity Conservation Act, 1999.* In three fauna surveys (May 2000, June 2001 and May 2003) on Lot 2 only one species *Macropus irma*, the Brush Wallaby, listed as a Priority 4 by the Department of Conservation and Land Management, was recorded on site. This species is highly mobile and is expected to be part of a local population occurring in adjacent vegetation. With the exception of *Morelia spilota imbricata* (the South West Carpet Snake) Lot 2 is not considered to provide a potential habitat suited to the characteristics and habitats for other listed species; however some, particularly bird species, may visit the site.

Morelia spilota imbricata, the South West Carpet Snake is known to occur in Banksia woodlands, Eucalypt woodlands and grasslands of the south-west region of Western Australia such as that which occurs on Lot 2. It is therefore possible that *Morelia spilota imbricata* occurs on Lot 2. A possible Western Ring-tailed Possum (*Pseudocheirus occidentalis*) drey was observed during the fauna assessment. As only one possible drey was observed, if this species was to occur on site it is likely to be in low numbers.

The progressive nature of clearing and rehabilitation for the proposed sandpit extension is expected to minimise the impact on the species. There will only be one permanent operator on site each day that will be confined to the areas progressively cleared; there will therefore be no likely increase in encounters with humans that may endanger the snake.

6.5.4 Environmental Management

Clearing will be kept to the minimum required and will be undertaken progressively to ensure that only a small area is disturbed at any one time. Progressive clearing will provide an opportunity for fauna species, which may be present on site, to relocate to undisturbed areas retained on site or to adjacent areas. Following progressive rehabilitation of the sand extraction blocks, fauna are expected to return once vegetation has successfully re-established and has become self-sustaining.

6.5.5 Environmental Outcome

The progressive removal of 20 hectares of vegetation and temporary loss of commonly occurring habitat is expected to have no significant effect on local fauna including the priority 4 species *Macropus irma* which may occur in the area.

6.6 REHABILITATION AND CLOSURE

6.6.1 Environmental Protection Authority Objectives

- Establish stable, sustainable landforms consistent with the intended post-mining landuse and surroundings.

- Ensure proposal area and any other area affected by the proposal is rehabilitated to a standard consistent with the intended post-mining, long-term landuse.

6.6.2 Long-Term Landuse

Progressive rehabilitation of the site will occur through appropriate topsoil management and planting native species. The post-mining landform will be created to facilitate residential landuse that conforms to requirements of the Greater Bunbury Structure Plan 1995. A Subdivision Guide Plan (Figure 9, Appendix 2), approved in principle by the Shire of Capel, has been developed to demonstrate that the final sandpit contours will be suitable to allow residential developments on Lot 2 and that sequential development has been considered. Low-lying areas will be maintained with natural remnant vegetation. The ridge will still be a feature of the end landform structure. The rehabilitated landform will be created to be suitable for future development of the southern portion of Lot 2 for rural-residential blocks and for rural/special purpose land.

6.6.3 Impact of Proposed Extension on Landform and Long-Term Landuse

Sand extraction will result in an interim change in landuse, which will be progressively returned to its original use of rural, with re-establishment of native vegetation on completion of sand extraction. The eastern slope relief of Gelorup Hill and north-south ridgeline will be permanently altered, resulting in a depression along the central portions of Lot 2. This new landform will conform to engineering and town planning requirements for future potential long-term residential development.

Extraction of sand from the upper east facing slopes of Gelorup Hill may have a temporary detrimental effect on the scenic value of Gelorup Hill. The skyline will not be reduced or changed and the vegetation will be progressively re-established. Rehabilitation will alleviate impacts on factors such as visual amenity and long-term landuse.

6.6.4 Management of Rehabilitation and Closure

Procedures for the progressive rehabilitation and closure of the southern sandpit extension will be described in a rehabilitation and mine closure plan, which will be contained in the Environmental Management Plan. Removal of any rubbish and waste will be undertaken whenever practical throughout the development of the proposed southern extension. The rehabilitation of the sandpit will, wherever possible, be undertaken progressively behind the operating front.

Although it is proposed to maintain flexibility with regard to the final landuse, a default option of future subdivision has been adopted to guide the standard of rehabilitation that will be achieved.

Rehabilitation measures for the proposed southern extension are listed in Sections 6.6.4.1 to 6.6.4.4 below.

6.6.4.1 Prior to sand extraction

The topsoil (complete with remnant understorey vegetation) will be removed to about 15 centimetres depth and immediately spread onto the previously restored surfaces for completion of rehabilitation. Where this is not possible, the topsoil will be stockpiled for future rehabilitation in windrows of no more than two metres high to reduce the loss of viability to its seedbank and microbial population.

Any overburden will be removed and stockpiled separately from the topsoil.

6.6.4.2 After sand extraction

- The overburden will be spread to create the desired final landform.
- The surface will be re-contoured so that slopes are no more than 1 in 4.
- The ground surface will be left so that agricultural and other machinery can gain ready access.
- Topsoil (from existing stockpiles, or from the next sand extraction block to be extracted) will be spread to a depth of at least five centimetres.

The organic matter of the shrubs within the topsoil is expected to provide a sufficient mulch to provide physical protection against wind erosion. This will be monitored and the need for additional physical protection will be assessed. This may require the application of mulches or binding agents.

Topsoiling and vegetation establishment will be confined to the period of May to August when rainfall is reliable.

6.6.4.3 Monitoring and Maintenance

The rehabilitated areas will be monitored and maintained where deemed necessary, by way of:

- Herbicide treatment - where weeds are evident in the area.
- Fertilising - at regular intervals for a period to offset the lack of nutrients in the soil.
- Infill planting - of small areas that may fail through topsoil application alone.

6.6.4.4 Closure

Closure on completion of sand extraction at the sandpit will be as follows:

- All buildings, machinery and plant will be removed from Lot 2 on completion of sand extraction. Mine closure will be a simple procedure with final site clean up involving removal of all equipment and machinery used in the operations.
- All waste materials will be removed and disposed of in an approved waste disposal site.

6.6.5 Environmental Outcome

The post-mining landform of the sandpit after rehabilitation will be stable, vegetated with native woodland species and suitable for its current zoning of rural as well as its potential long-term zoning of residential.

The visible parts of the upper slopes of the sandpit will blend in with the rest of Gelorup Hill following rehabilitation and visual impacts will be minimal and of a temporary nature due to progressive sand extraction and rehabilitation.

7. SOCIAL SURROUNDINGS: IMPACTS AND MANAGEMENT

7.1 VISUAL AMENITY

7.1.1 Environmental Protection Authority Objective

Visual amenity of the area adjacent to the project should not be unduly affected by the proposal.

7.1.2 Visual Assessment

A visual assessment of the eastern slopes of the north-south ridgeline and Gelorup Hill was undertaken to:

- Determine the Scenic Quality of the area.
- Identify the 'Seen Area' from which the sandpit and its immediate surrounds are visible.
- Identify the Sensitivity Level of viewing locations from fore, mid and background zones.
- Study the visual impacts of the existing sand extraction operations to determine contributions of the various components of these operations to visual impact.
- Develop a management policy to avoid or minimise all potential visual impacts.

7.1.2.1 Scenic Quality

Gelorup Hill and the north-south ridgeline are visible from Bussell Highway to the west and visible from a distance to the east. The upper portion of the existing sandpit in the vicinity of Gelorup Hill is visible from a distance to the east but no part is visible from the west. This is because the sandpit and its proposed southern extension are located entirely on the eastern side of Gelorup Hill below the crest of the ridgeline.

Gelorup Hill and the ridge are considered to have high scenic quality based on landform and natural landscapes. Gelorup Hill is also considered to be a local landmark. Much of this scenic quality was impaired by earlier sand extraction operations. However, since 1998 rehabilitation works north of Calinup Road have considerably reduced these impacts. Once future rehabilitation of Gelorup Hill is done, following completion of the sand extraction operations, and indigenous trees and shrubs become re-established, this scenic quality will return.

The west-facing hillside of Gelorup Hill and the ridgeline is considered to have the highest scenic value. This scenic quality has been significantly reduced as areas north of Calinup Road have been developed as rural residential lots; south of Calinup Road large areas have been cleared for sand extraction and other rural activities.

The plain and wetlands east of Lot 2 are considered to have high scenic quality mainly when viewed from the elevated area of Gelorup Hill. This scenic quality will remain unchanged.

7.1.2.2 Seen Area

A 'Seen Area' assessment has two main components, namely:

- Sensitivity levels from viewing locations.
- Distance of viewshed from the sandpit area.

For visual assessment the viewshed is usually divided into Distance Zones, and for the proposed sandpit extension it was divided into the following three Distance Zones:

- Foreground Zone: up to 500 metres
- Midground Zone: 0.5 to five kilometres
- Background Zone: five to 10 kilometres.

The 'Seen Area' is located east of the existing sandpit and consists of rural areas and the town of Boyanup, which is about 10 kilometres south-east of Lot 2. The 'Seen Area' comprises a low-lying, undulating plain with an extensive chain of wetlands as far as the Preston River. Isolated farm homesteads are scattered throughout the area and the predominantly cleared land under pasture is used for grazing and dairy. With the exception of a series of relict dunes reaching elevations of up to 40 metres AHD approximately five kilometres east of Lot 2, the ground elevation of the entire area varies between 20 and 30 metres AHD. This is the same as the elevation of properties adjoining the eastern boundary of Lot 2.

The rural residential areas north and north-east of Lot 2 are completely screened from the sandpit due to topography and native woodland vegetation. The existing sandpit is not visible from either the Bunbury-Boyanup Road or the South Western Highway, which are located eight and 10 kilometres respectively east of Lot 2.

7.1.2.3 Simulated Views

Simulated views of the development of the proposed southern sandpit extension were prepared and compared to existing operations using 3D modelling software. A 3D surface was created from topographical survey data and the final sandpit design. An aerial photograph of the area was then placed over the 3D surface to create a realistic 3D image. This was projected from an elevated perspective viewpoint to give an accurate simulation of the sandpit appearance from selected locations. The Computer Generated Views 1 to 3 are provided at the end of this report.

No simulated views from the east are provided from actual ground levels because the extractive operations are entirely screened by vegetation in the foreground in the vicinity of Lot 2. Gelorup Hill becomes partially visible when viewed from a distance.

The photograph was modified to reflect more recent rehabilitated areas north of Calinup Road and in the area of the proposed sand extraction operations by copying the appearance of the existing sandpit slopes onto slopes that will be established in the proposed southern sandpit

extension. The new sandpit slopes were given a yellow colouring to illustrate a worst case scenario.

The detailed modelling was limited to Gelorup Hill and the ridgeline and part of the plain immediately adjacent to the sandpit. Areas further from the sandpit on the plain that appear in the foreground are less detailed than the sandpit and ridgeline.

Views 1 to 3 show the existing topography and the proposed final sandpit from the following three perspective viewpoints:

1(a), 1(b) and 1(c): greater than five kilometres due east of the sandpit viewed from an elevated perspective to show the entire extent of the southern sandpit extension.

2(a), 2(b) and 2(c): greater than five kilometres north-east of the sandpit viewed from an elevated perspective to show the entire extent of the southern sandpit extension.

3(a), 3(b) and 3(c): an aerial view from 500 metres altitude and within 500 metres distance to the north-east corner of Lot 2 to better illustrate the extent of the existing sandpit and the proposed southern extension and demonstrate the realism of the 3D model used.

7.1.2.4 Sensitivity Levels

The sensitivity level of the proposed southern sandpit extension is considered low for reasons discussed below:

- **Foreground Distance Zone (0 to 0.5 kilometre)**

The proposed southern sandpit extension will not be visible from within the 0 to 0.5 kilometre distance zone (Figure 8). This area, east of Lot 2, is zoned future rural residential north of Calinup Road and rural south of Calinup Road.

The zoned future rural residential area north of Calinup Road is completely vegetated with native woodland which will predominantly be retained should any rural residential development occur. This vegetation effectively screens out the sand extraction operations around Gelorup Hill and the proposed southern extension.

The rural area south of Calinup Road is low-lying and predominantly comprises wetland areas. The vegetation retained within the proposed setbacks along the eastern boundary of Lot 2 effectively screens out all existing and future sand extraction operations on Lot 2.

- **Midground Distance Zone (0.5 to five kilometres)**

The proposed southern sandpit extension south of Gelorup Hill will not be visible from within the 0.5 to five kilometres distance zone (Figure 8) as a result of the existing vegetation within the proposed setbacks of Lot 2.

Gelorup Hill becomes visible from distances greater than 520 metres and only the uppermost 20 metres of the east facing slopes will be visible at distances exceeding five kilometres east of Lot 2. The lower slopes, below the 38-metre AHD level, will be screened in the 0.5 to five

kilometres distance zone by the existing vegetation in the immediate foreground of Gelorup Hill.

The area within the midground zone is zoned rural and consists predominantly of low-lying plains with wetlands and woodland areas. The area is sparsely populated with occasional farmsteads and is considered to have a low sensitivity in the viewshed in terms of population and landuse.

After rehabilitation the exposed upper eastern slopes of Gelorup Hill will not be readily noticeable. Once the topsoil has been spread the yellow sand will be hidden by greyish-brown sandy topsoil. In time vegetation will establish from the seedbank stored in this topsoil and blend in with surrounding vegetation.

- **Background Distance Zone (five to 10 kilometres)**

The proposed southern sandpit extension will not be visible from within the five to 10 kilometre distance zone (Figure 8) as a result of the existing vegetation within the proposed setbacks of Lot 2. The uppermost 20 metres of Gelorup Hill extending about 200 metres north to south will be marginally visible or not noticeable within five to 10 kilometres, including from the town of Boyanup, the Bunbury-Boyanup Road and the South Western Highway. From this distance rehabilitation of the hillslopes would render these slopes almost undistinguishable from the rest of the ridgeline.

7.1.3 Impact of Proposed Southern Extension on Visual Amenity

Sand extraction has the potential to reduce the visual amenity of Gelorup Hill and the ridgeline when viewed from the east. Only the upper east facing slopes of Gelorup Hill will be visible from the east side of Gelorup Hill from distances exceeding 520 metres. The exposed sandpit slopes will be up to 200 metres wide and the height of the visible face will vary between 0 and 20 metres depending on the Seen Area from which the sandpit is viewed. These slopes will be marginally visible, if at all, from the sensitive parts of the Seen Area which are the town of Boyanup, Bunbury-Boyanup Road and the South Western Highway.

7.1.4 Management of Visual Impacts

The north-south ridgeline, upper eastern hillslopes and the crest of Gelorup Hill will be retained and the lower eastern hillslope of Lot 2 will be battered to 1:4 slopes to ensure a stable landform. Vegetation setback areas between 50 and 250 metres wide will be retained along the eastern boundary and 20 to 40 metres along the western and southern boundaries will ensure that the extracted hillslopes will not be visible from adjacent properties. The skyline as viewed from both the west and the east will remain unaffected.

Progressive clearing with sand extraction scheduled to occur in extraction blocks of one to two hectares and subsequent rehabilitation with topsoil will ensure that only minimal areas of disturbance will occur at any one time and therefore minimise the area of disturbance visible at a distance from the east.

7.1.5 Environmental Outcome

The reduction in visual amenity will be slight and temporary and will meet EPA objectives.

Gelorup Hill is the main scenic feature of the area and is considered to be a local landmark. Sand extraction has the potential to reduce the visual amenity of Gelorup Hill and the ridgeline when viewed from the east. However, careful planning of extraction and setbacks plus progressive rehabilitation mean that the impacts on visual amenity will be minimal and the skyline will remain unchanged.

Progressive clearing and subsequent rehabilitation with topsoil will ensure that only minimal areas of disturbance will occur at any one time and will, in most instances, eliminate the visual impact when viewed from 500 metres or more from the sandpit.

7.2 NOISE

7.2.1 Environmental Protection Authority Objective

Ensure that noise impacts emanating from the proposal comply with statutory requirements and acceptable standards.

7.2.2 Existing Environment

The proposed southern sandpit extension is located in a rural area, adjacent to the existing operating sandpit. The adjoining landuses south and east of Lot 2 are agricultural, being mainly cattle grazing and dairy; west of Lot 2 is mainly sand extraction; and north of Lot 2 is rural residential. The nearest residences are over 500 metres north of the proposed southern sandpit extension.

7.2.3 Relevant Standards and Legislation

Noise emissions from the proposed southern sandpit extension will be covered by the *Environmental (Noise) Regulations 1997*. These regulations specify noise limits depending on the type of premises affected at distances up to 450 metres from the premises.

In the case of the proposed southern sandpit extension, the applicable limits under Regulations 7 and 8 (Industrial and Utility Premises) are:

- Peak noise not to exceed 90 decibels noise.
- Not to exceed 80 decibels more than one percent of the time.
- Not to exceed 65 decibels more than 10 percent of the time.

In addition to the above regulations for environmental noise emissions, the sandpit is subject to workplace noise limits under the Mines Safety Inspection Act Section 9 and the Mines Safety and Inspection Regulations 1995 Part 7. These regulations require action to be taken should workers be exposed to an average noise level greater than 85 decibels (amperes) over an eight-hour day or peak noise levels of greater than 140 decibels (linear).

7.2.4 Impact of Proposed Extension on Noise

Noise associated with sand extraction activities is emitted from use of excavation equipment, a sand screener and haulage trucks. Up to 80 haulage trucks may enter and exit Lot 2 on a weekly basis. Sand extraction, screening and trucking operations have the potential to be heard from surrounding areas. The closest noise recipients of the operations are located about 500 metres north of current sand extraction areas. The southern sandpit extension will create similar noise levels to that of the existing sandpit.

7.2.5 Noise Management

The proposed operations are designed and managed to ensure that noise is not a public nuisance and that the workforce is protected against occupational noise. All machinery is fitted with appropriate mufflers. This policy will continue.

During working hours the noise emanating from the operations will be minimised by locating most of the activities on the floor of the excavations. Noise from the sand extraction operations is typically confined to the loader and screen operations.

The ridge forming the western boundary of Lot 2 effectively acts as a permanent sound barrier to the west. As the proposed finished excavation level of the sandpit is 20 metres AHD and the elevation of the eastern setback area and site boundary varies between 20 and 30 metres AHD, the sandpit operating front will be used as an effective noise barrier by locating the front of the sandpit between the operations and the eastern boundary. In addition, Lot 2 is mostly surrounded by dense vegetation with no residential buildings located within one kilometre of Lot 2 other than along its northern border.

Importantly, the hours of operation are such that noise will not be emanating from operations outside normal working hours.

7.2.6 Environmental Outcome

Noise levels will not be increased from noise generated by the existing sandpit because any development in the proposed southern extension will be offset by reductions elsewhere in the sandpit.

Noise is not considered to be a problem for the following reasons:

- Adjacent landuses have low sensitivity to noise and there will be no net increase in noise from current levels.
- The generally large distances of residences from the current sand extraction areas.
- The generally low noise levels emitted from the equipment used.
- The rehabilitation and re-establishment of vegetation in the northern portion of Lot 2.
- The retention of vegetated setbacks within Lot 2 and the presence of existing vegetation around the boundary of Lot 2.
- All regulatory noise requirements and EPA objectives for noise will be readily achieved.

7.3 PARTICULATES AND DUST

7.3.1 Environmental Protection Authority Objectives

- Ensure that particulate emissions both individually and cumulatively meet appropriate criteria and do not cause environmental or human health problems.
- Use all reasonable and practicable measures to minimise the discharge of particular wastes.

7.3.2 Existing Environment

The existing sandpit has the potential to generate dust. The southern sandpit extension is surrounded by dense native vegetation to the west, south and east and the area to the north is under rehabilitation with the re-establishment of native vegetation.

7.3.3 Relevant Standards and Legislation

The publication 'Land Development Sites and Impacts on Air Quality' by the Department of Environmental Protection, November 1996 sets out standards for control of dust from land development sites.

7.3.4 Impact of Proposed Extension on Particulates and Dust Generation

Sand extraction from the southern sandpit extension may potentially emit particulates and dust to the atmosphere from the following activities:

- Clearing of vegetation.
- Excavation of sand.
- Loading of haulage trucks.
- Screening of sand.
- Trafficking of unsealed surfaces.

7.3.5 Dust Management

The layout of the southern sandpit extension and its location within the vegetated eastern hillslopes within the sheltered lee of Gelorup Hill will minimise the potential emission of dust and particulates as a result of the prevailing south-easterlies and south-westerly winds, in particular the predominant south-westerlies.

The loading of haulage trucks and the trafficking of unsealed surfaces have been identified as activities contributing the most to generation of dust. All haulage trucks carrying a load from the operations will be covered with tarpaulins, as is currently being implemented at the existing sandpit operations, to prevent generation of dust during transport of the sand. In addition, the entire length of Calinup Road between Lot 2 and Bussell Highway has been sealed to minimise dust generation from transportation.

The progressive revegetation of mined surfaces in addition to the small areas that will be active at any one time will minimise the area susceptible to dust generation on Lot 2. Topsoil stripping will be kept to a minimum. Clearing of vegetated areas ahead of sand extraction will be kept to a minimum and rehabilitation will follow closely behind the operating front. The trees that surround the sandpit will act as a windbreak and reduce wind velocity and turbulence, thus reducing dust generation.

Sand extraction will progress southwards away from residential areas, therefore minimising the potential for extraction to have any particulate material impact.

7.3.6 Environmental Outcome

The proposed southern sandpit extension will not generate any more dust than existing sandpit operations. The potential for dust generation will reduce as sand extraction operations advance southwards into densely vegetated areas away from residences located north of Lot 2 and over 500 metres north of the proposed southern sandpit extension.

The sealing of Calinup Road between Lot 2 and Bussell Highway in March 2000 has removed the main contributing factor to dust generation from the sand extraction operations.

Dust will be managed to satisfy EPA requirements through measures developed in the Environmental Management Plan.

7.4 GREENHOUSE GASES

7.4.1 Environmental Protection Authority Objectives

- Ensure that greenhouse gas emissions both individually and cumulatively meet appropriate criteria and do not cause an environmental or human health problem.
- Use all reasonable and practicable measures to minimise the discharge of greenhouse gases.

7.4.2 Impact of Proposed Extension on Greenhouse Gas Emissions

Greenhouse gases will be emitted from vehicles used in the sand extraction and transport operations and as a result of clearing of vegetation. The proposed sand extraction on Lot 2 will continue to use one front-end loader, a screener and haulage trucks undertaking up to 80 return trips a week. Greenhouse gases will be released from vegetation clearing by burning, natural decay and soil carbon release.

The emission of greenhouse gases from the use of the proposed vehicle fleet and emission of carbon dioxide from vegetation clearing were estimated using methodology workbooks developed by the National Greenhouse Gas Inventory Committee for the National Greenhouse Gas Inventory.

It was estimated that the following emissions would occur over the proposed 20-year life of the project:

- 1,757 tonnes of carbon dioxide.
- 3.028 tonnes of carbon monoxide.
- 0.03 tonne of methane.
- 0.01 tonne of nitrous oxide.
- 6.14 tonnes of nitrogen oxides.
- 2.41 tonnes of non-methane volatile organic compounds.

The algorithms and assumptions that were used to estimate these emissions are detailed in Appendix 8. No guidelines exist to determine whether these amounts are of significance.

7.4.3 Environmental Management

The vehicle fleet and excavation and screening plant will continue to be maintained and serviced on a regular basis to ensure efficient running of equipment and optimum fuel consumption, thereby keeping emissions to a minimum. Vegetation clearing will be progressive, typically in one to two hectare blocks per annum and vegetation will be re-established on the rehabilitated landform behind the operating front. This will reduce the impacts of clearing on greenhouse gas emissions over the life of the sandpit by progressively replacing the carbon sink.

7.4.4 Environmental Outcome

The proposed southern sandpit extension will not generate any more greenhouse gas emissions from the use of vehicles, earthmoving plant and equipment than the existing sandpit operation. Vegetation clearing will result in the temporary loss in the carbon sink and in the release of carbon dioxide over a 20-year period.

The progressive rehabilitation and re-establishment of native vegetation over the sandpit area will result in full restoration in carbon sink function of the current vegetated area over a period of 40 years.

7.5 ROAD TRANSPORTATION/TRAFFIC

7.5.1 Environmental Protection Authority Objectives

- Ensure that the increase in the traffic activities resulting from the project does not adversely impact on the social surroundings.
- Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and Main Roads Western Australia (MRWA) requirements.

7.5.2 Existing Environment

Extracted sand is transported in trucks and trailers from Lot 2 via Calinup Road and the Bussell Highway to developments throughout the Bunbury-Capel-Busselton region. Up to 15 truck movements of about 54 tonnes each are conducted on a daily basis. All appropriate signage has been established under the current Extractive Industries operation and the entire length of Calinup Road between Lot 2 and Bussell Highway has been sealed.

7.5.3 Impact of Proposed Extension on Transportation and Traffic

The southern sandpit extension is a continuation of the existing sandpit operation. There is no potential for increased road traffic movements or deterioration in road quality because the traffic rate from the sandpit will remain unchanged.

7.5.4 Environmental Management

Changes to current transport activities are not proposed. Traffic movements will not increase as production levels are not planned to increase. Road maintenance will be continued in accordance with current processes. Existing signage will be maintained and the existing operating hours will continue to be observed.

7.5.5 Environmental Outcome

The extension to the south for sand extraction is not expected to increase traffic activity on the main transport routes around the facilities. Consequently, there are no potential adverse impacts on the social surroundings. Calinup Road has previously been improved and is currently being maintained to the Shire of Capel and MRWA requirements.

7.6 HERITAGE VALUES

7.6.1 Environmental Protection Authority Objectives

- Ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act, 1972.*
- Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.
- Comply with statutory requirements in relation to areas of cultural or historical significance.

7.6.2 Relevant Legislation

The *Aboriginal Heritage Act, 1972* protects and preserves any site or object that is of significance to Aboriginal people. Under section 17 of the *Aboriginal Heritage Act*, it is an offence to disturb any Aboriginal site. If a development is likely to impact a site, the consent of the Minister for Indigenous Affairs is required under Section 18 of the *Aboriginal Heritage Act, 1972.*

7.6.3 Impacts of Proposed Extension on Heritage Values

As no sites have been found in the area of the proposed southern sandpit extension on Lot 2 there is expected to be no impact.

Lot 2 is freehold land and is therefore not subject to any Native Title Claims.

7.6.4 Environmental Management

In the event that an archaeological site or a site of cultural importance to Aboriginal people is discovered in the area of the proposed southern sandpit extension, the *Aboriginal Heritage Act, 1972* will be observed and the proponent will immediately inform the Department of Indigenous Affairs.

7.6.5 Environmental Outcome

The proposed southern sandpit extension is expected to have no impact on any Aboriginal cultural or heritage sites.

Within Lot 2 there are no sites of European cultural significant and consequently the proposed extraction of sand will have no impact on European cultural heritage.

8. ENVIRONMENTAL MANAGEMENT PLAN

The proposed southern sandpit extension will form an integral part of the existing sand extraction operations. As such, an Environmental Management Plan will be developed for the sandpit.

The Environmental Management Plan will:

- Define environmental performance objectives.
- Describe resources to be used in meeting environmental objectives.
- Outline operating, monitoring and reporting procedures to achieve the objectives.
- Outline procedures for progressive rehabilitation of the sandpit throughout its operation.

Among other issues, the Environmental Management Plan will address:

- Noise management.
- Dust management.
- Vegetation clearing.
- Education of the workforce to protect native flora and fauna.
- Site rehabilitation.
- Closure (consistent with the Australian and New Zealand Minerals and Energy Council/minerals Council of Australia Strategic Framework for Mine Closure).

The Environmental Management Plan will be developed and implemented as soon as an Extractive Industries Licence is issued.

9. ENVIRONMENTAL MANAGEMENT COMMITMENTS

Environmental commitments are listed in Table 12.

Table 12
Environmental Commitments

Number	Topic	Actions	Objectives	Timing	Advice from
1	Environmental Management Plan	Development of an Environmental Management Plan for the Calinup Road Sandpit. Among other issues the EMP will address: • Noise management. • Dust management. • Vegetation clearing. • Education of the workforce to protect native flora and fauna. • Site rehabilitation. • Closure.	Provide a systematic framework with environmental performance objectives for environmental management of the sandpit.	Prior to commencement of operation	Shire of Capel. DCLM.
2	Environmental Management	Implement the Environmental Management Plan	Achieve environmental performance objectives.	During operation	Shire of Capel.
3	Visual Amenity	Minimise the visual impact of the sandpit through: 1. Rehabilitating the upper east facing sandpit slopes of Gelorup Hill which are visible at a distance from the plain by: a) Reducing the finished visible faces to a maximum 1:4 slope. b) Covering the reduced slopes with topsoil. c) Encouraging establishment of vegetation through proper topsoil handling. 2. Retaining vegetation setbacks. 3. Minimising the area of disturbance at any one time through progressive extraction followed by progressive rehabilitation.	To reduce the visual impact of the sandpit extension.	During operation	Shire of Capel.
4	Rehabilitation and closure	Develop a detailed rehabilitation and closure plan.	To progressively rehabilitate and decommission the sandpit to a standard consistent with the landuse requirements for Lot 2.	Prior to commencement of operation	Shire of Capel.
5	Rehabilitation and closure	Implement rehabilitation and closure plan.	Achieve the objectives of the closure plan.	During operation	Shire of Capel.

10. REFERENCES

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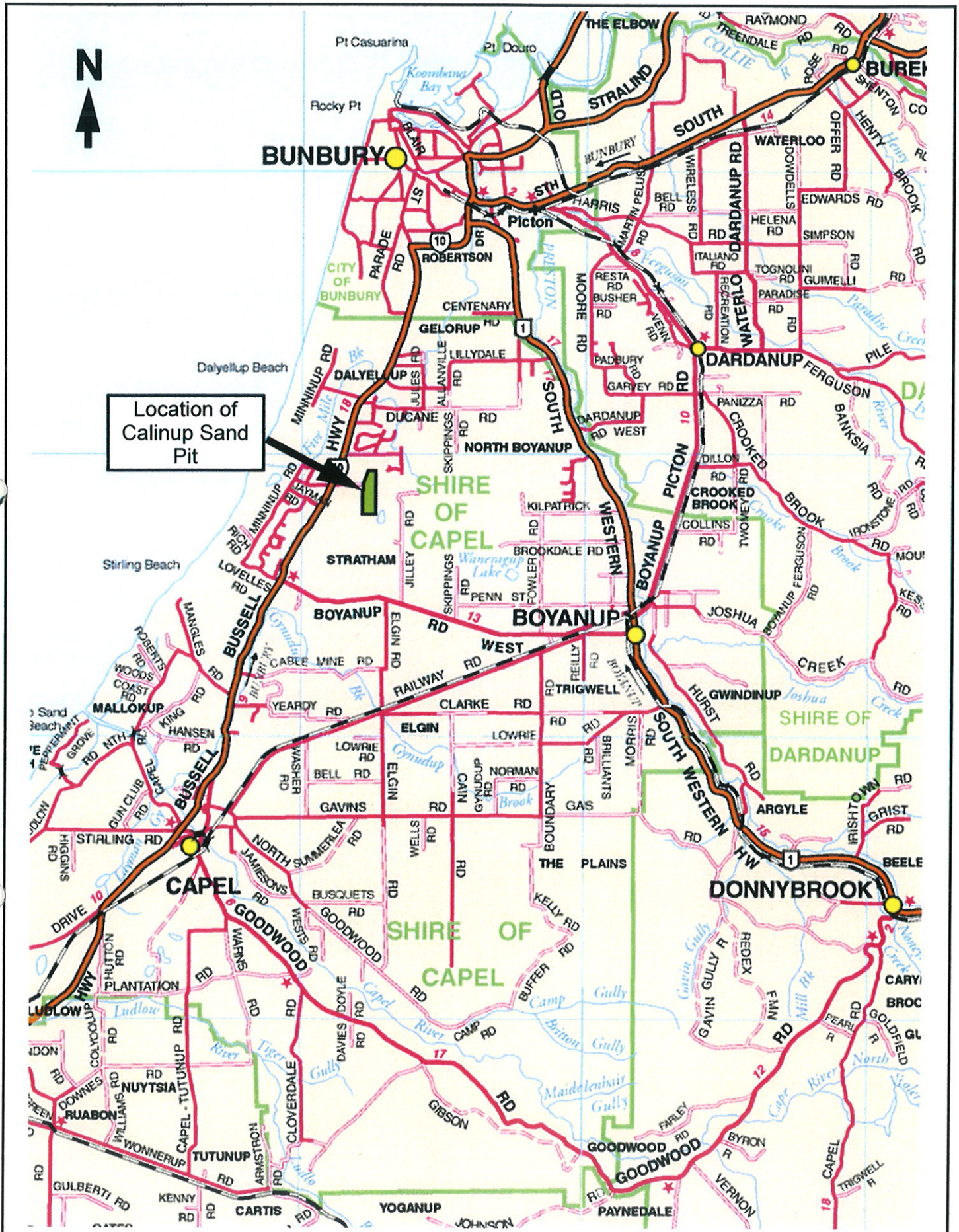
FIGURES



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Southern Extension of Lot 2
Calinup Rd Sandpit, Gelorup,
Shire of Capel

Locality Map

Figure 1

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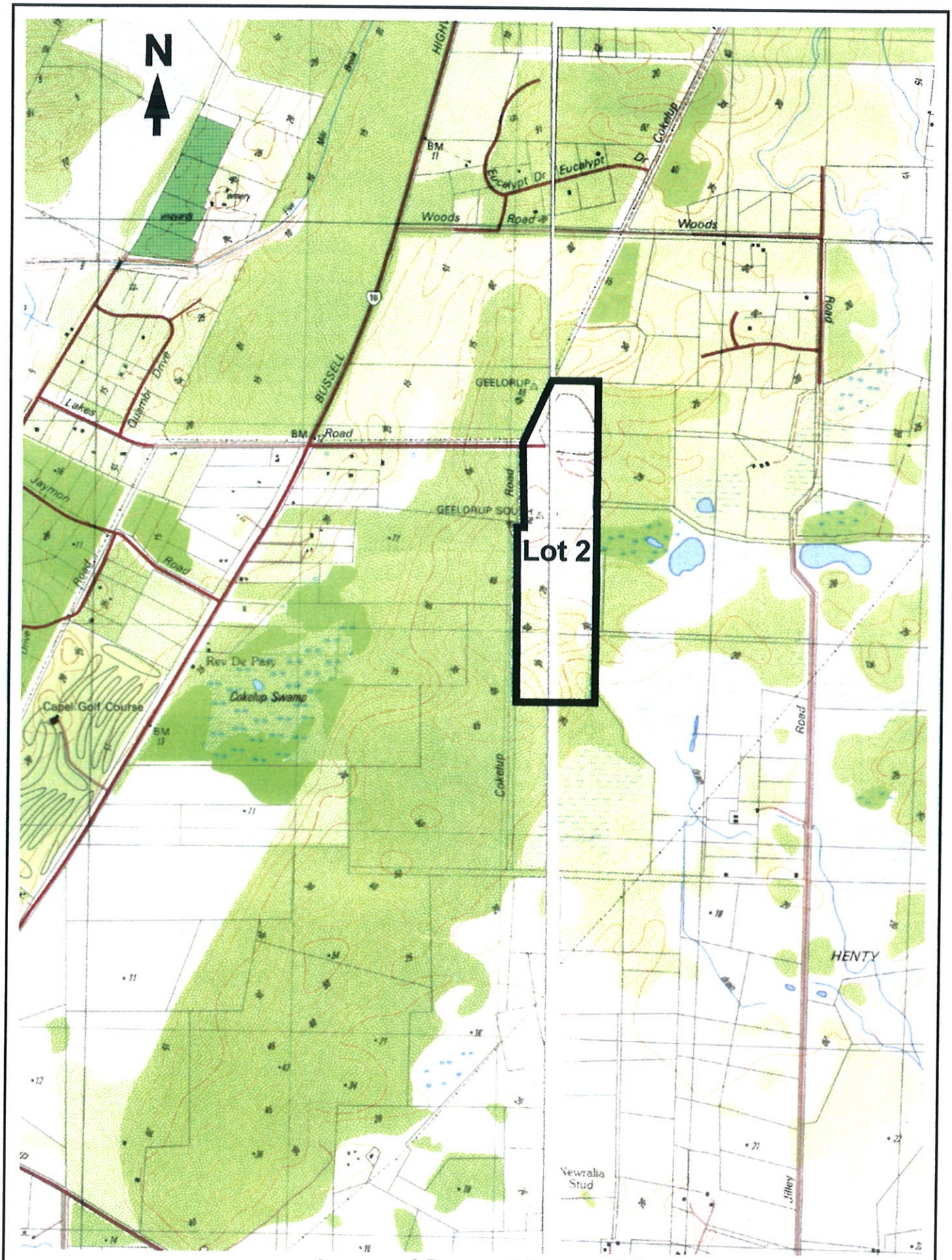

MBS ENVIRONMENTAL Environmental + Water Resource Consultants 4 Cook Street West Perth WA 6005 Telephone: +618 9226 3166 Facsimile: +618 9226 3177 e-mail: info@martinick.com.au	Pioneer Construction Materials Pty Ltd Southern Extension of Lot 2 Calinup Rd Sandpit, Gelorup, Shire of Capel	Topography of Lot 2 and Adjacent Areas Figure 2

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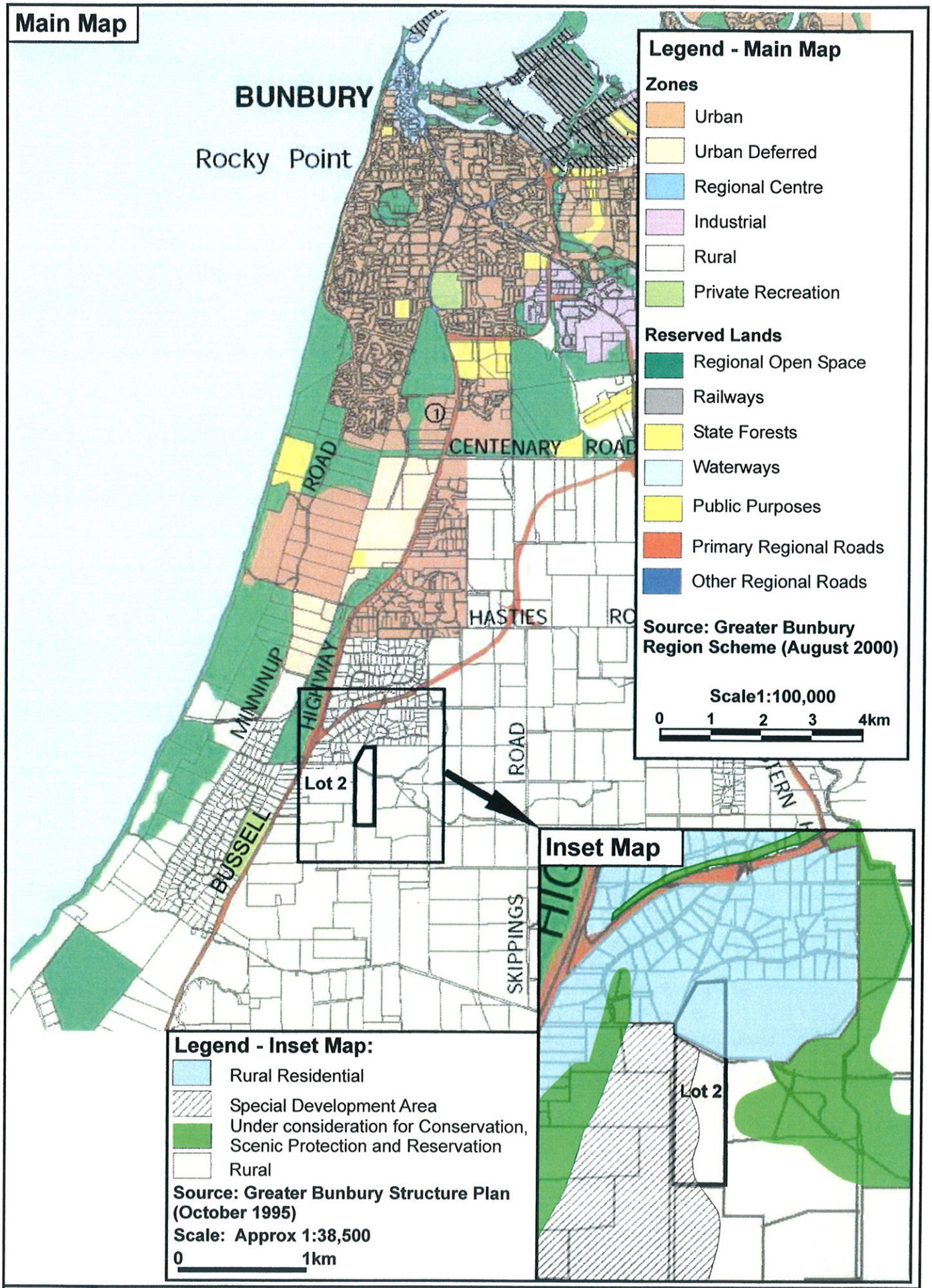

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Land Use Zoning

Figure 3

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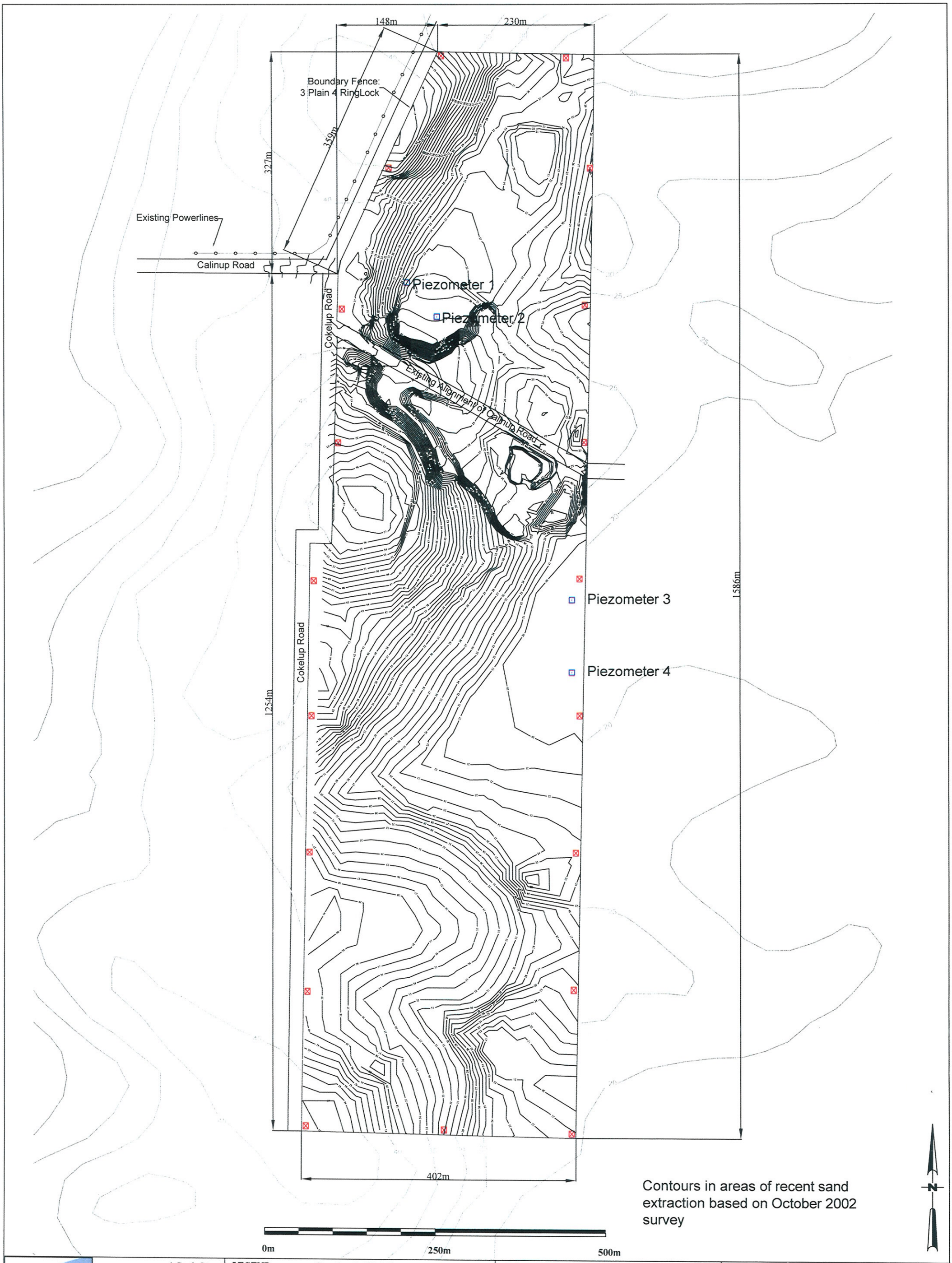

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LEGEND

Regional Contours, 5m intervals
Warning sign location
Piezometer location

Scale 1:5000

Orig. Size: A3 Date:13/08/02 Drawn by: M Dufty

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Shire of Capel

Existing Contours of Lot 2

Figure 4

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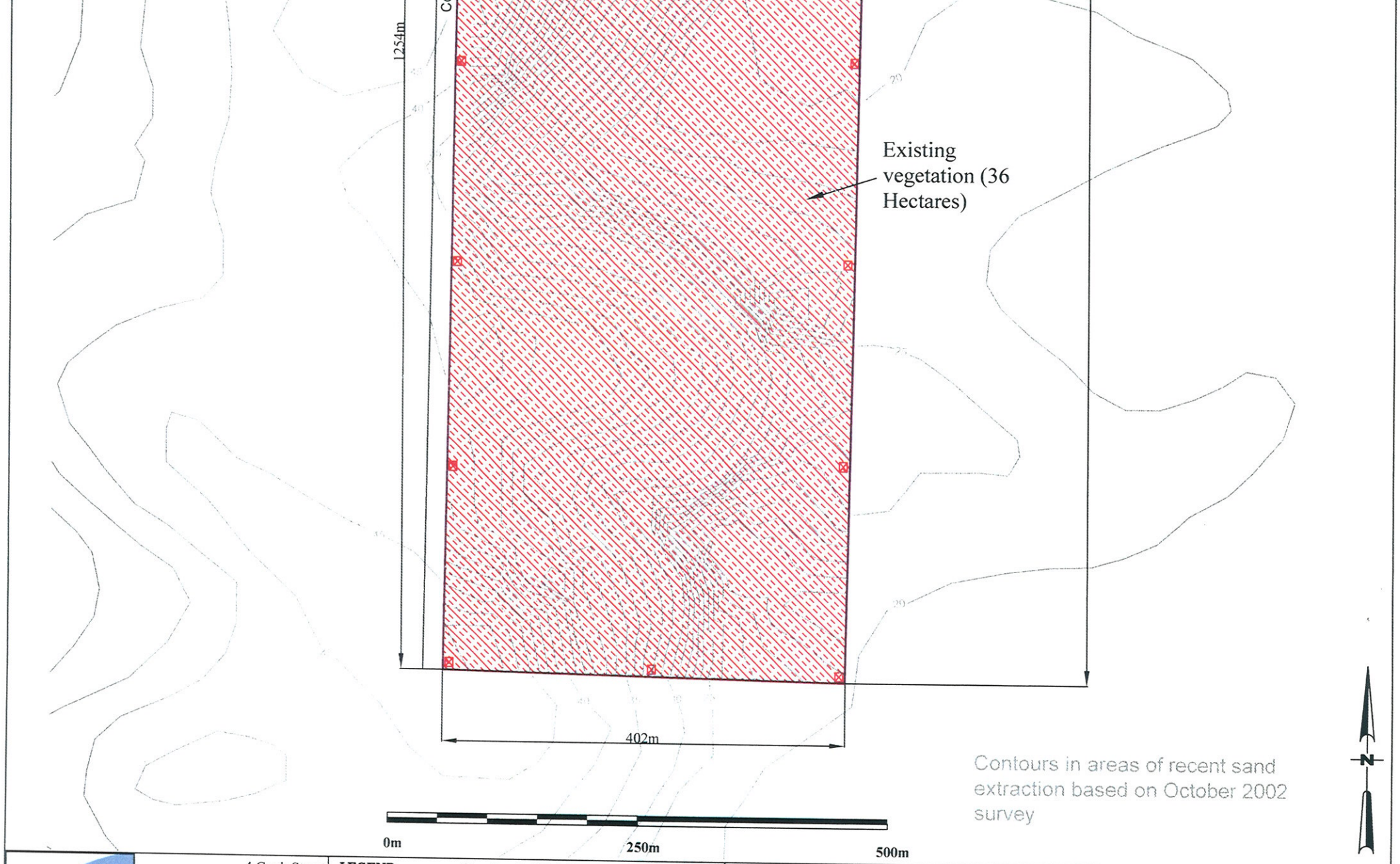

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Lot 2 Contours, 1m intervals
Regional Contours, 5m intervals
Warning sign location
Piezometer location

Scale 1:5000

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Existing Landuse Plan

Figure 5

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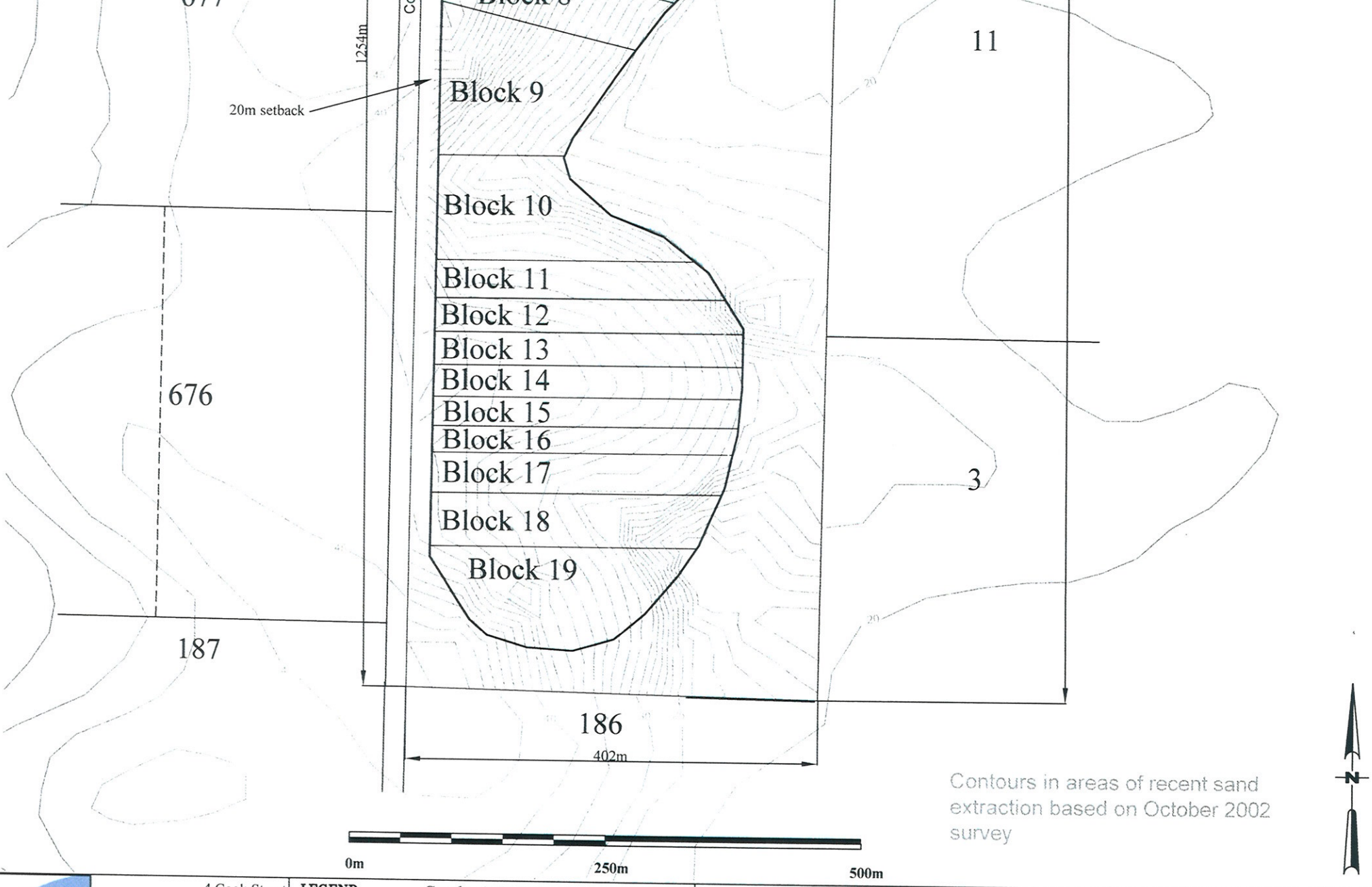

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Scale 1:5000

Lot 2 Contours, 1m intervals
Regional Contours, 5m intervals

Orig. Size: A3 Date:13/08/2003 Drawn by: M Dufty

Pioneer Construction Materials Pty Ltd
Southern Extension of Lot 2
Calinup Road Sandpit, Gelorup,
Shire of Capel

Sand Extraction Blocks

Figure 6

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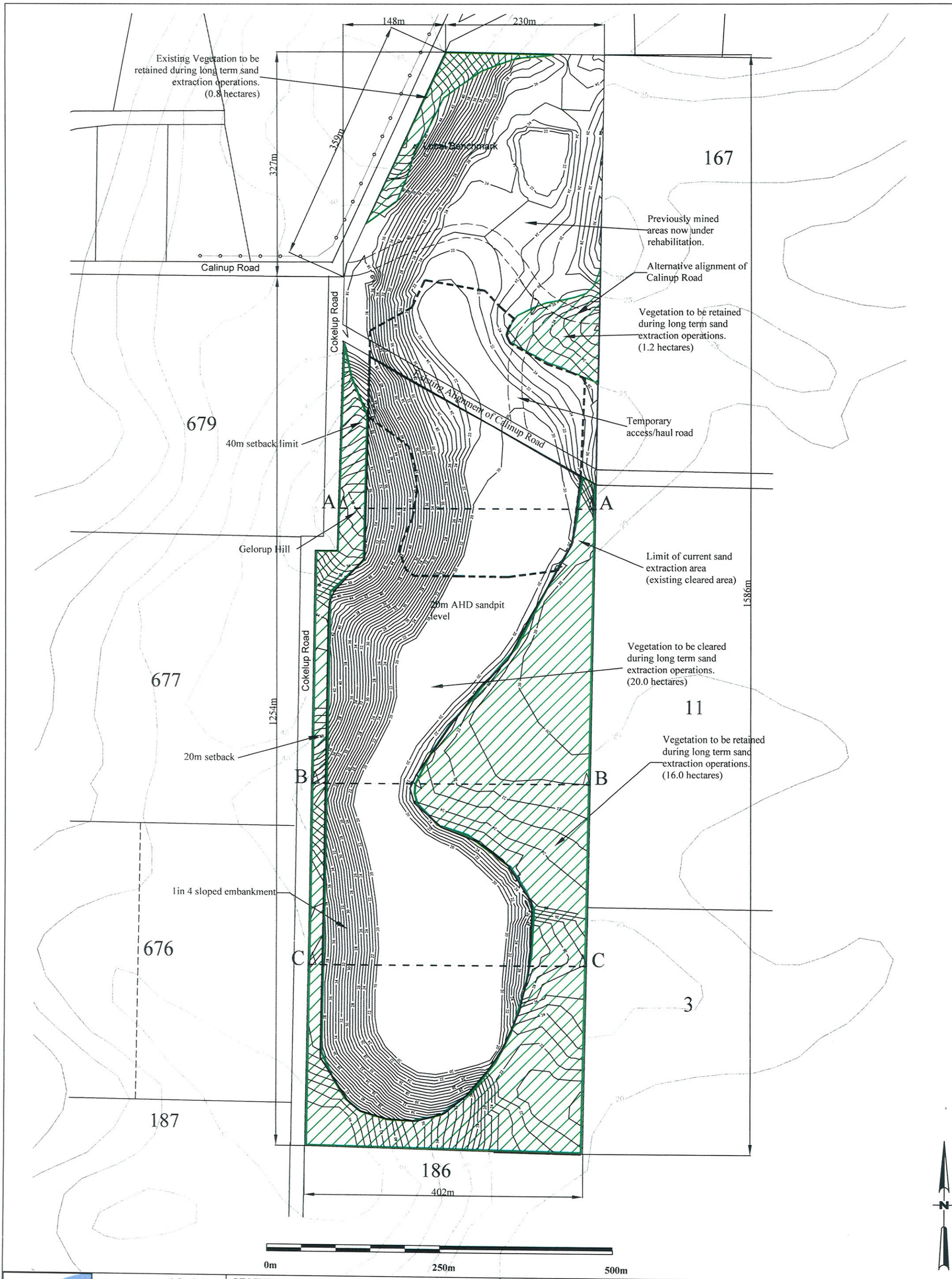

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Scale 1:5000

Lot 2 Contours, 1m intervals

Regional Contours, 5m intervals

Cross section locations (refer to Figure 8)

Orig. Size: A3 Date:13/08/2003 Drawn by: M Dufty

Pioneer Construction Materials Pty Ltd
Southern Extension of Lot 2
Calinup Road Sandpit, Gelorup,
Shire of Capel

Final Contours of Sandpit

Figure 7

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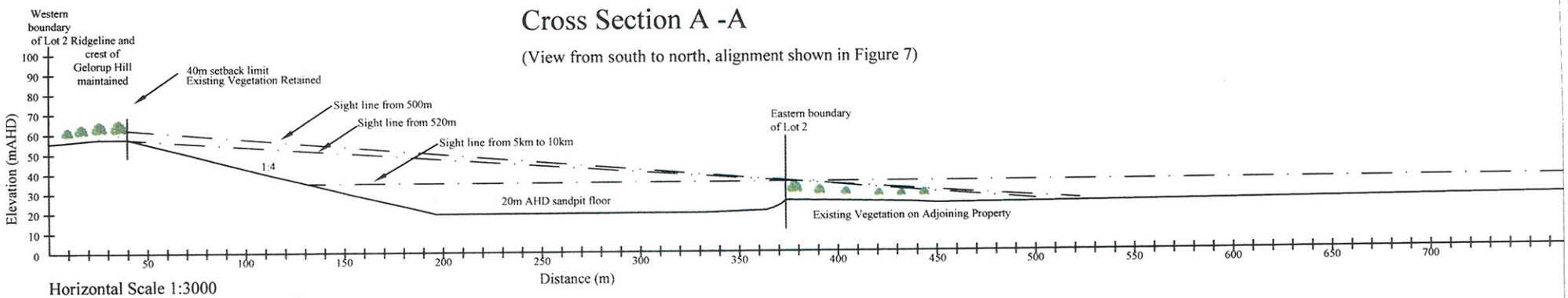
Cross Section A -A

(View from south to north, alignment shown in Figure 7)



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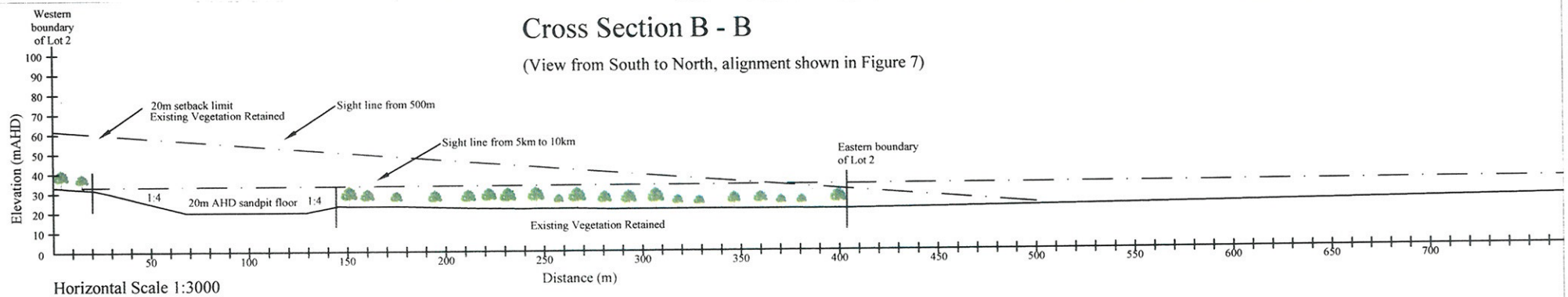
Cross Section B - B

(View from South to North, alignment shown in Figure 7)



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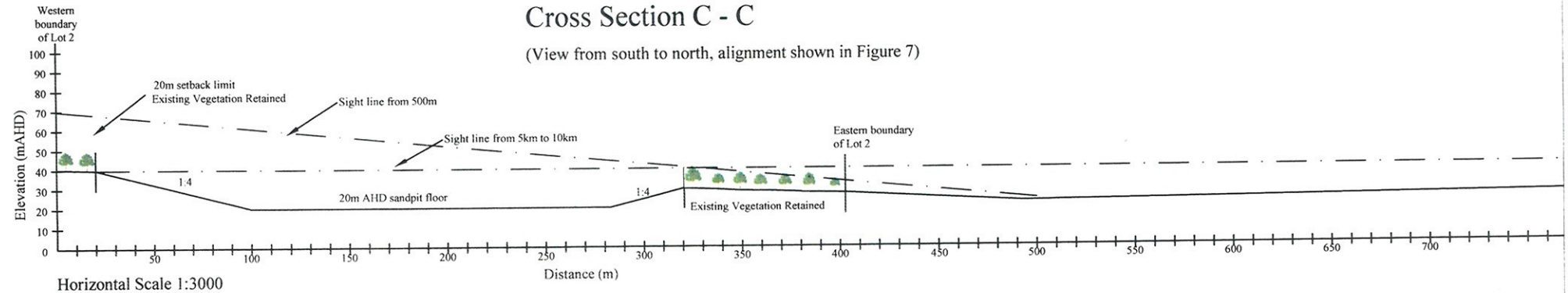
Cross Section C - C

(View from south to north, alignment shown in Figure 7)



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Southern Extension of Lot 2
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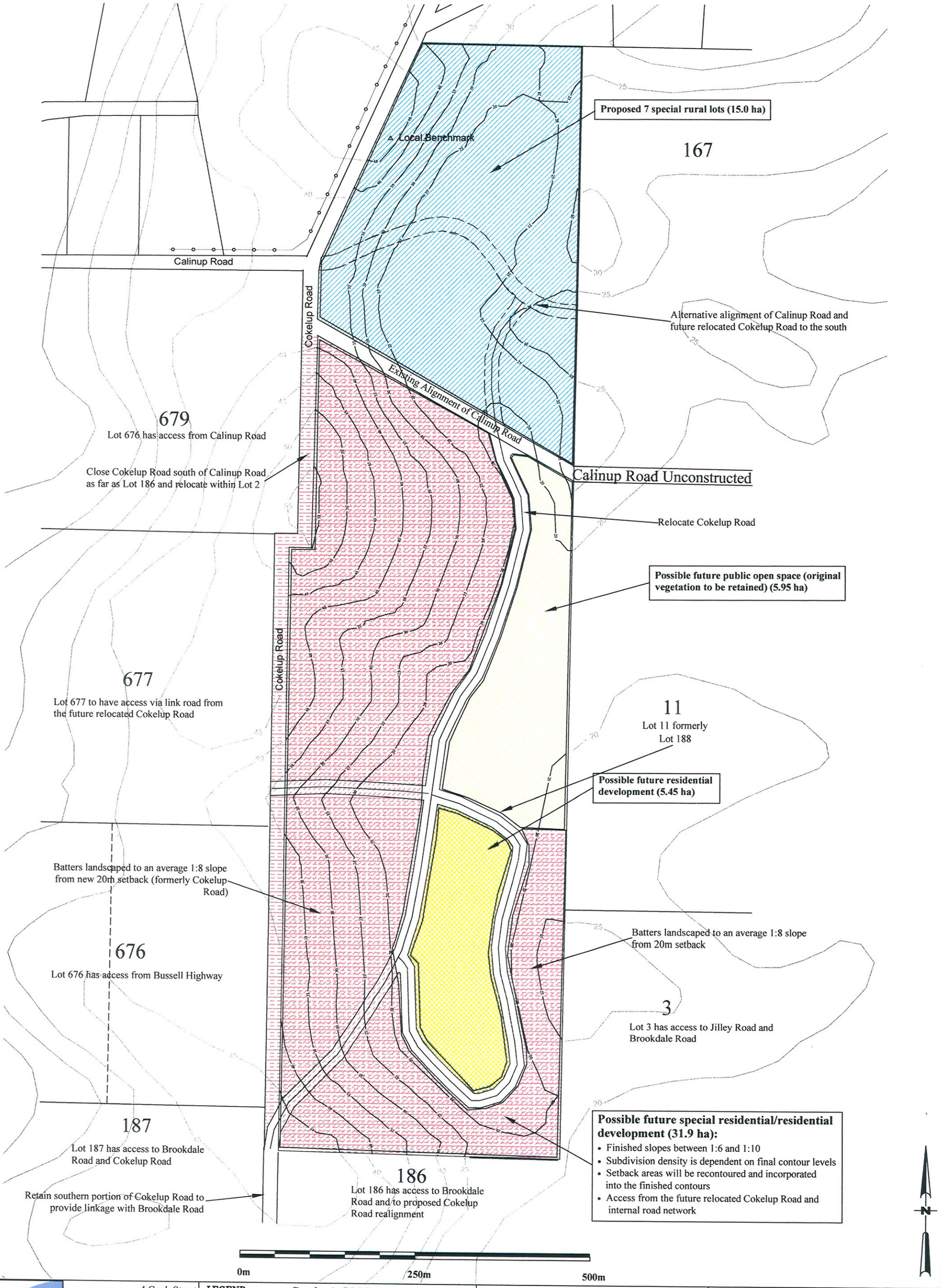
Shire of Capel

Typical Cross Sectional Views of Sandpit Showing Sightlines from the East

FIGURE 8



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Scale 1:5000

Site Contours, 5m intervals

Regional Contours, 5m intervals

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Southern Extension of Lot 2
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Shire of Capel

Subdivision Guide Plan for Long Term Residential Use

Figure 9

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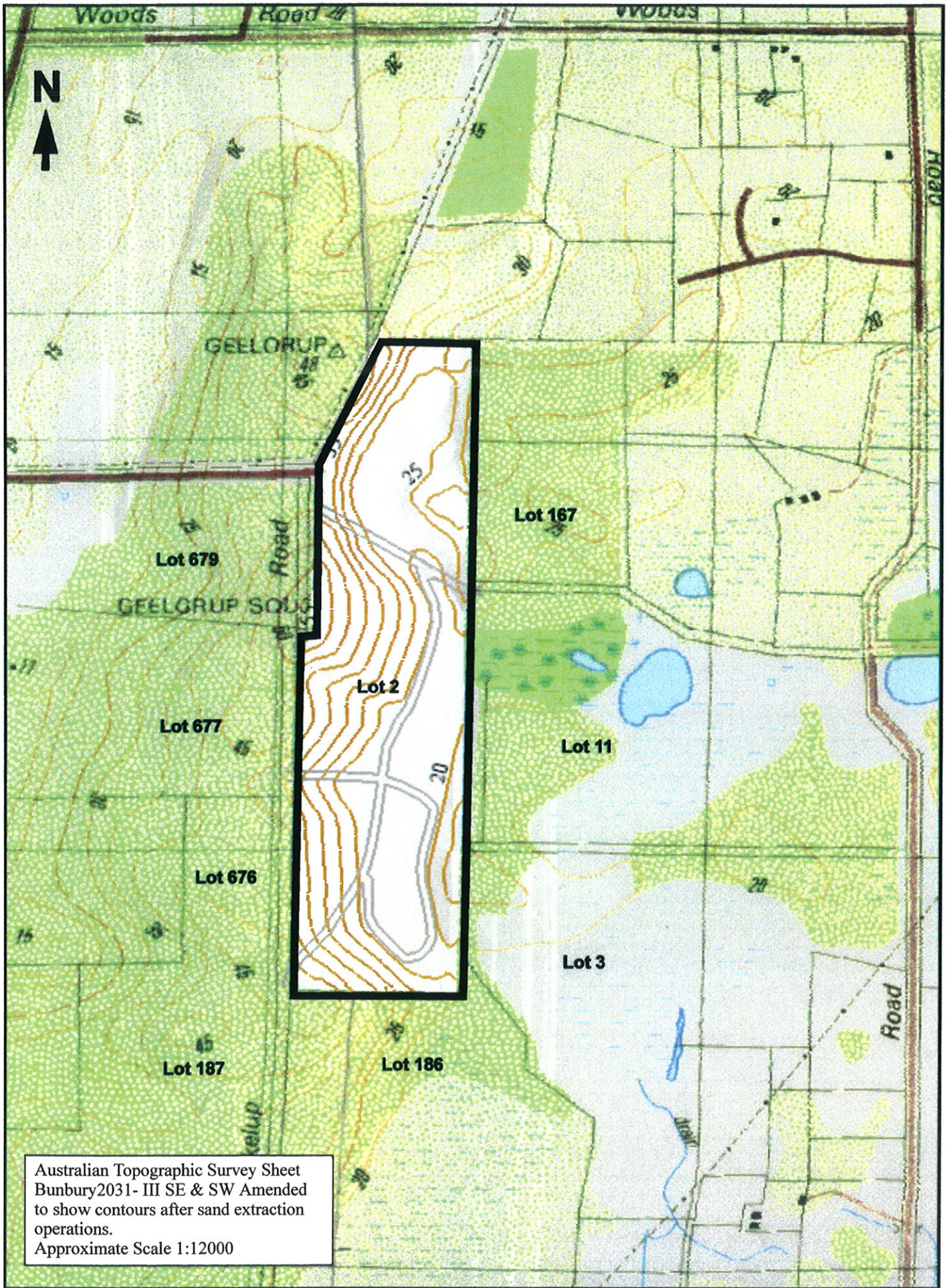

Australian Topographic Survey Sheet Bunbury2031- III SE & SW Amended to show contours after sand extraction operations.
Approximate Scale 1:12000

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Regional Contour Plan
(showing long term final contours)

Figure 10

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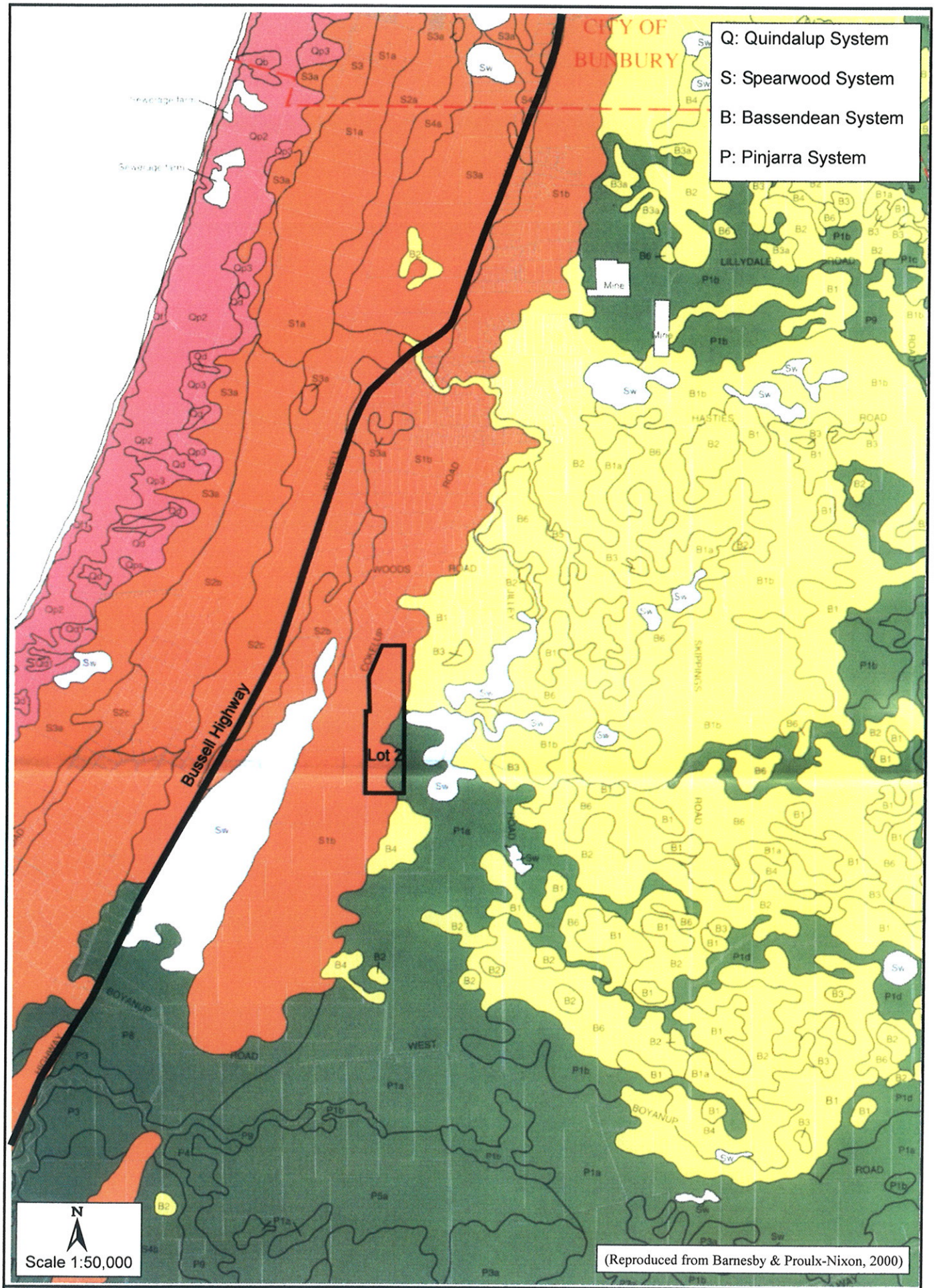

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Soil-Landscape Units of the Region

Figure 11

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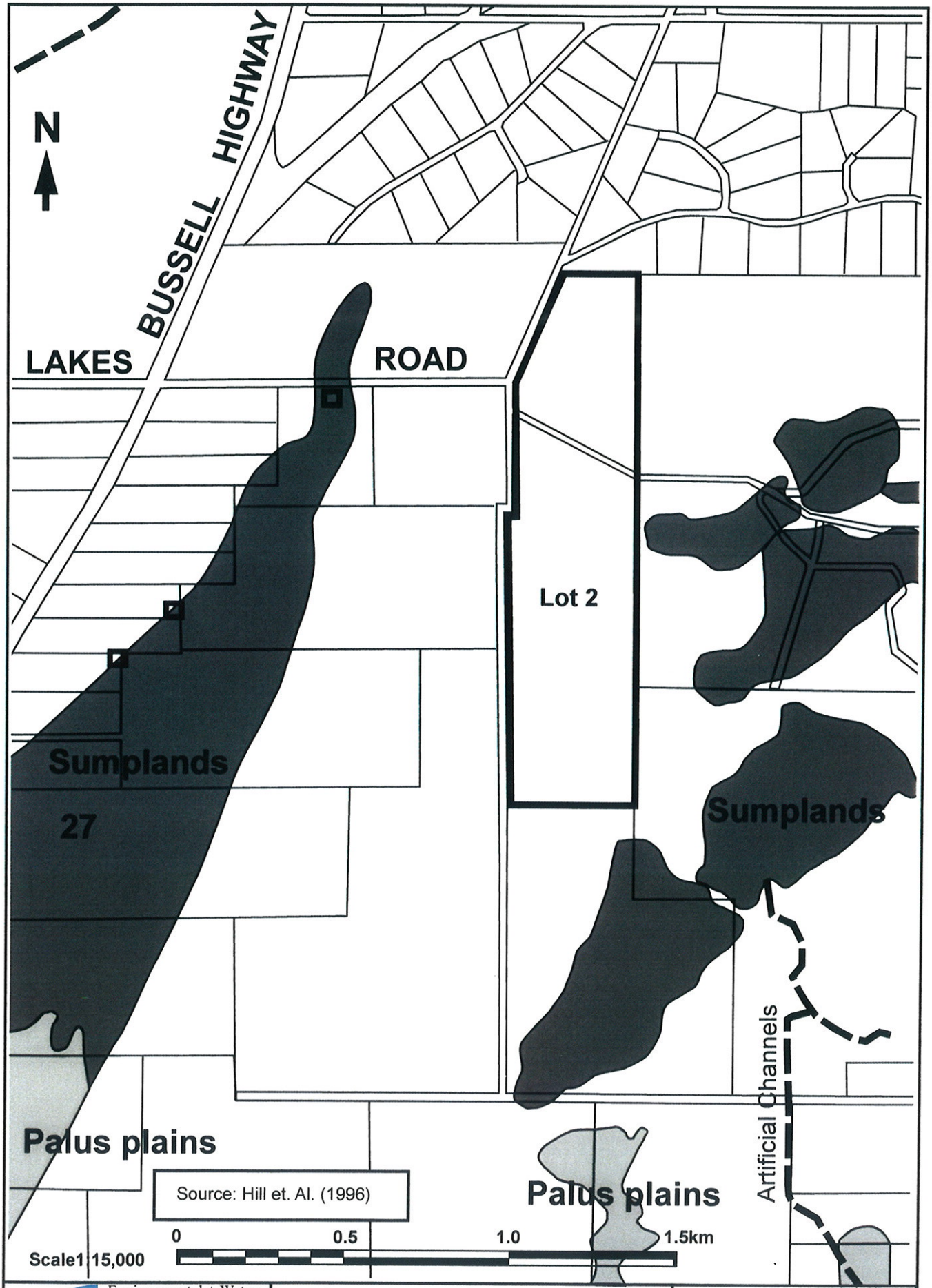

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Wetlands in the Vicinity of Lot 2

Figure 12

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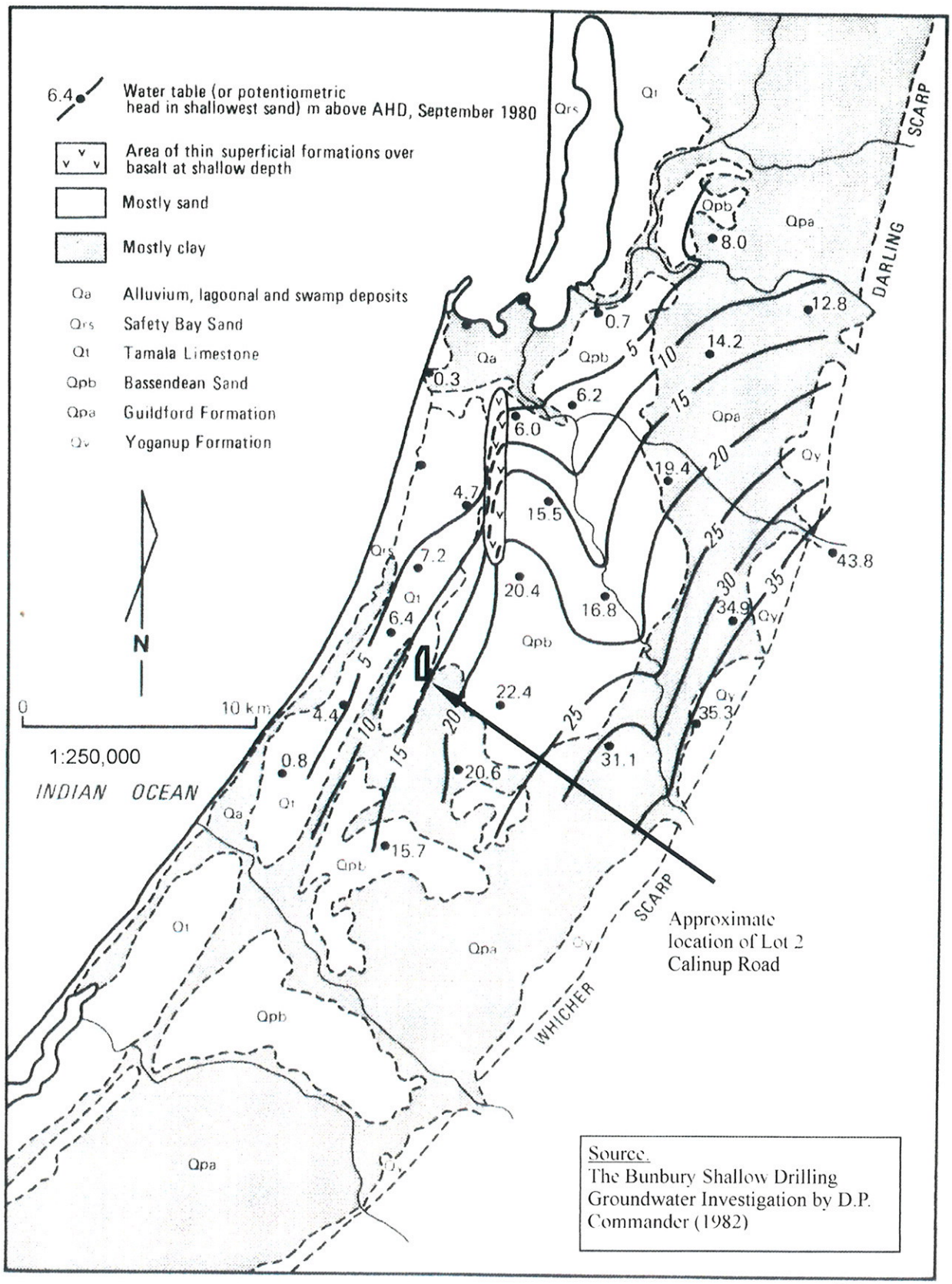

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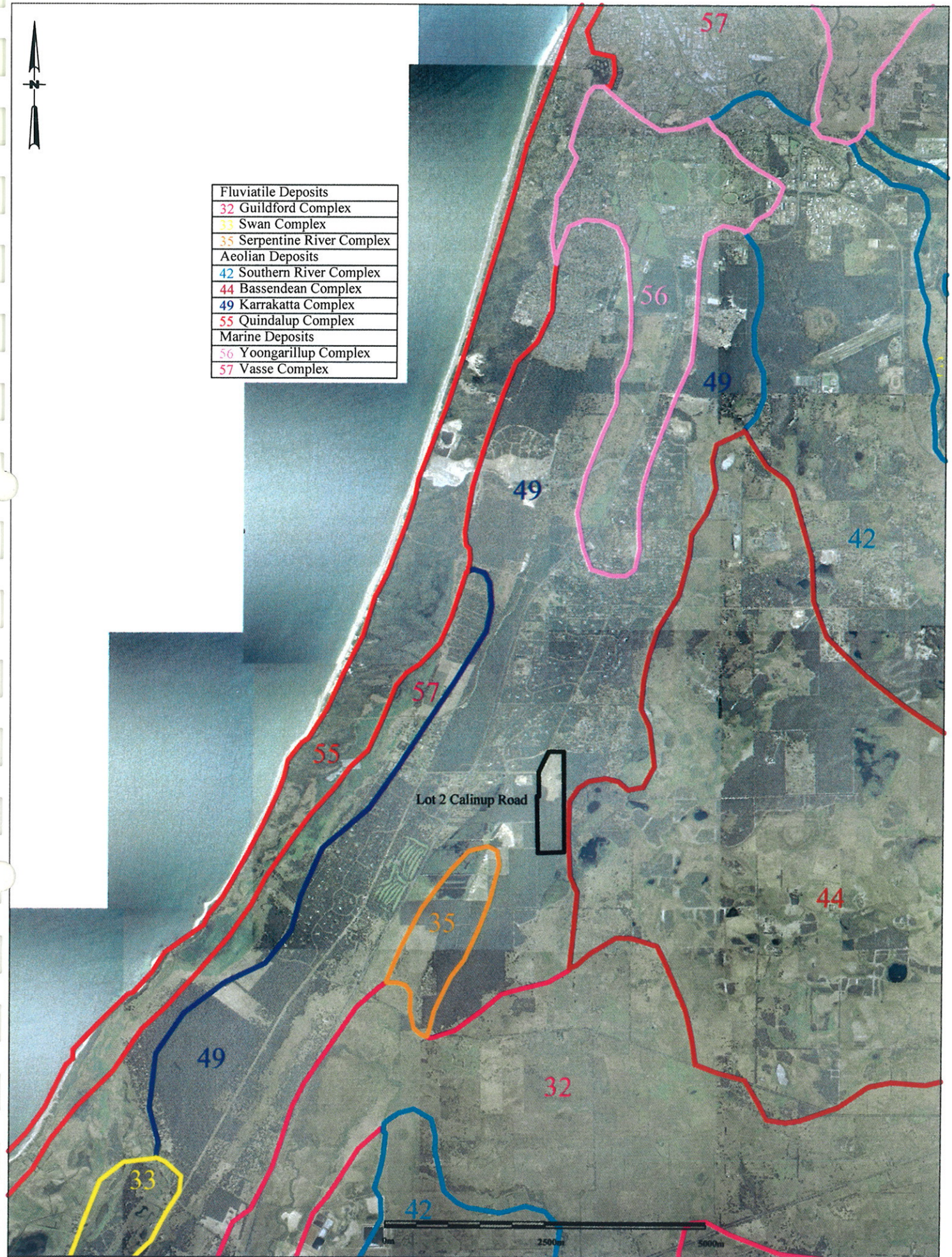
C:\projects\calinup\PER figures\F13 superficialformation.cdr 13/08/03



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LEGEND Scale 1:75,000

Photos from DOLA Panairama Collie 2001 North

Vegetation complex data from Greater Bunbury Region Scheme Environmental Review, WA Planning Commission, August 2000

Orig. Size: A4 Date:13/08/03 Drawn by: M Dufty

Pioneer Construction Materials Pty Ltd
Southern Extension of Lot 2 Calinup Road Sandpit, Gelorup, Shire of Capel

Vegetation Complexes of the Region

Figure 14

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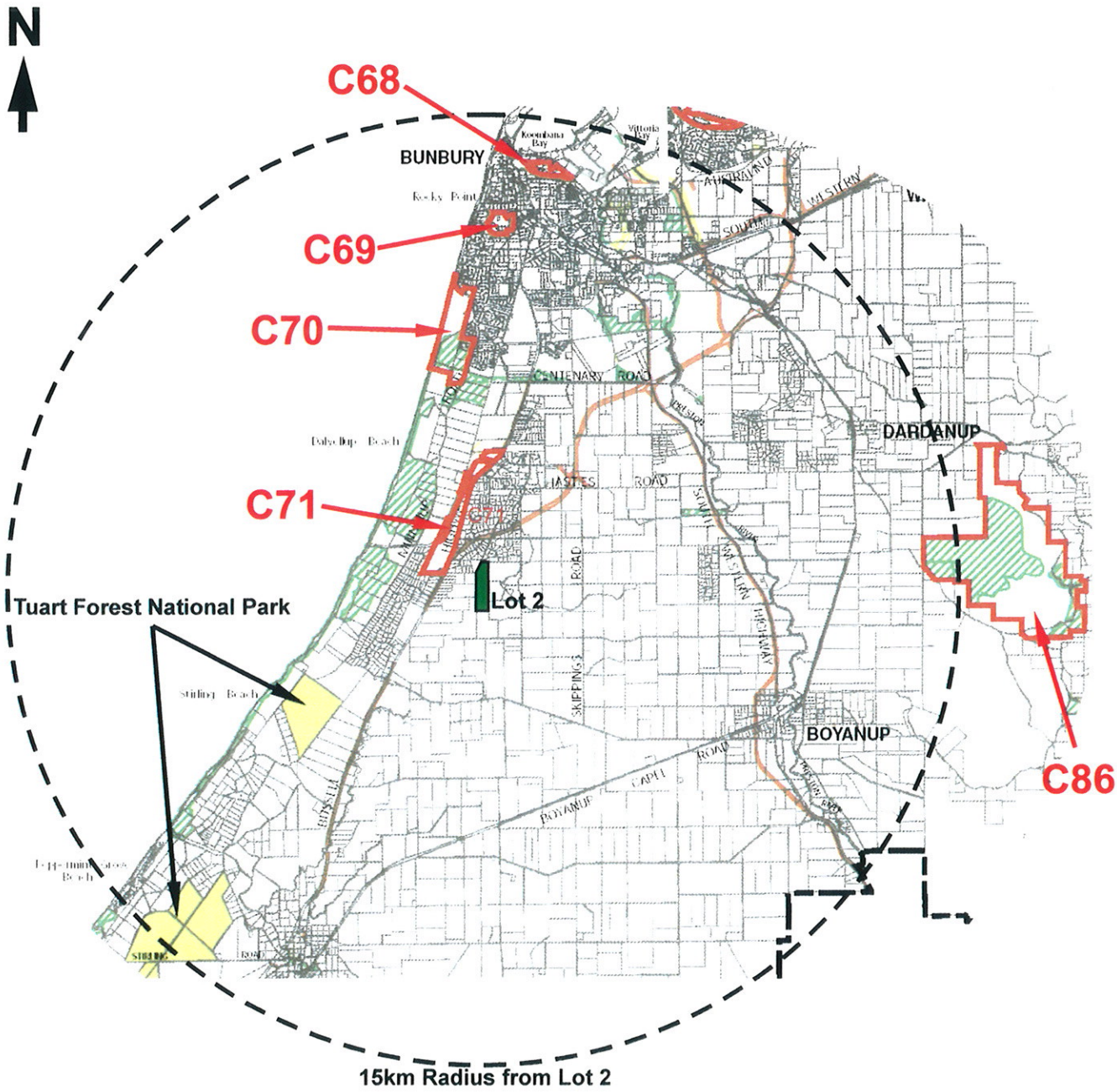

C = System 6 reserve

Source: Greater Bunbury Regional Scheme, Environmental Review (2000)

Scale1:200,000

0 5 10 15km

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Pioneer Construction Materials Pty Ltd
Southern Extension of Lot 2
Calinup Rd Sandpit, Gelorup,
Shire of Capel

Reserves Within 15 Kilometres of Lot 2

Figure 15

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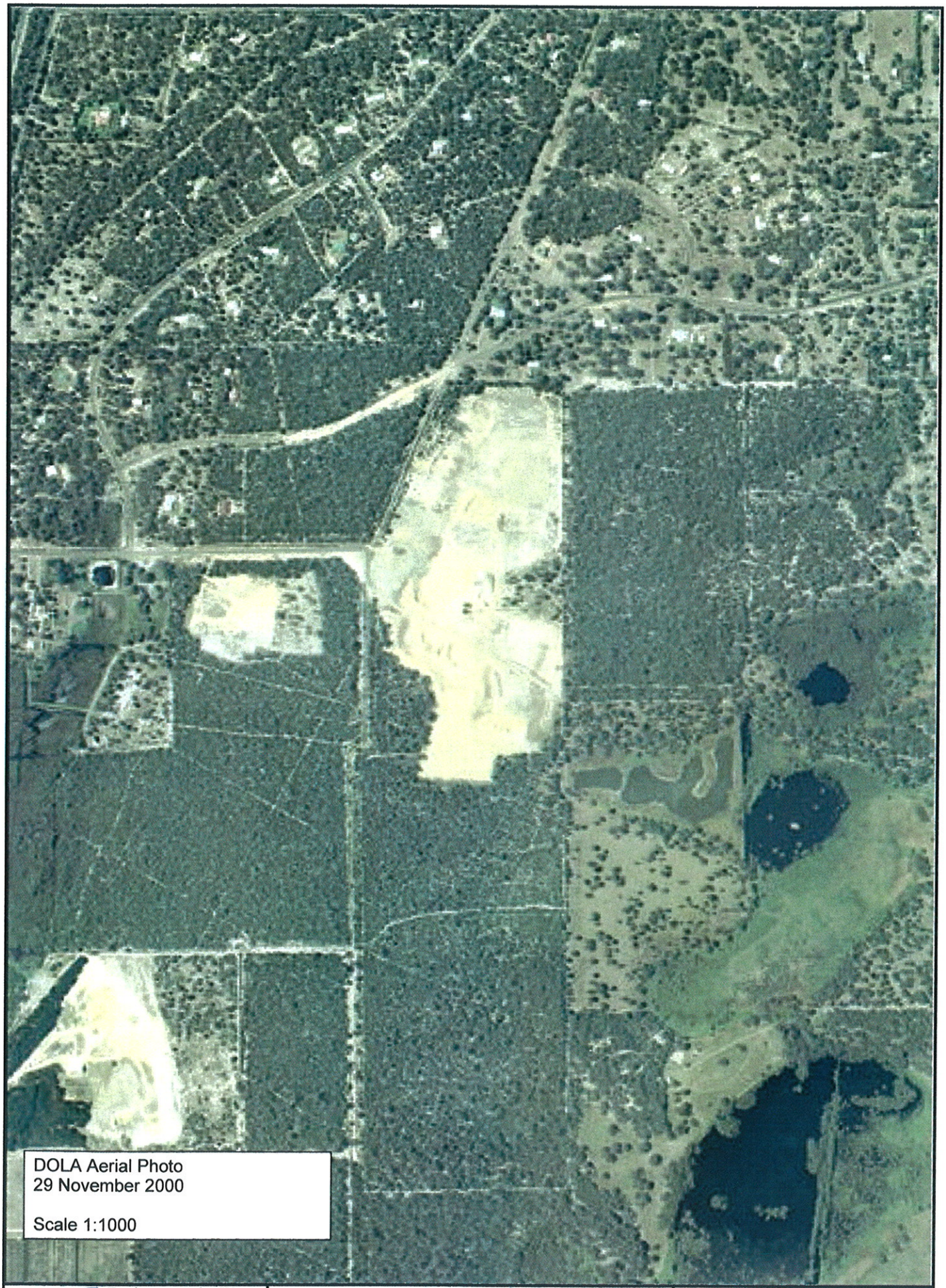
PLATES



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Southern Extension of Lot 2 Calinup Rd
Sandpit, Gelorup, Shire of Capel
August 2003

Aerial Photograph

PLATE 1

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Plates 2 and 3: Landscape Unit A: Sandy rises and hillslopes supporting mixed Eucalypt-Xylomelum woodlands over open scrub and heath

Plates 4 and 5: Landscape Unit B: Gentle Depressions supporting mixed Eucalypt-Banksia woodlands over low open thickets and shrublands

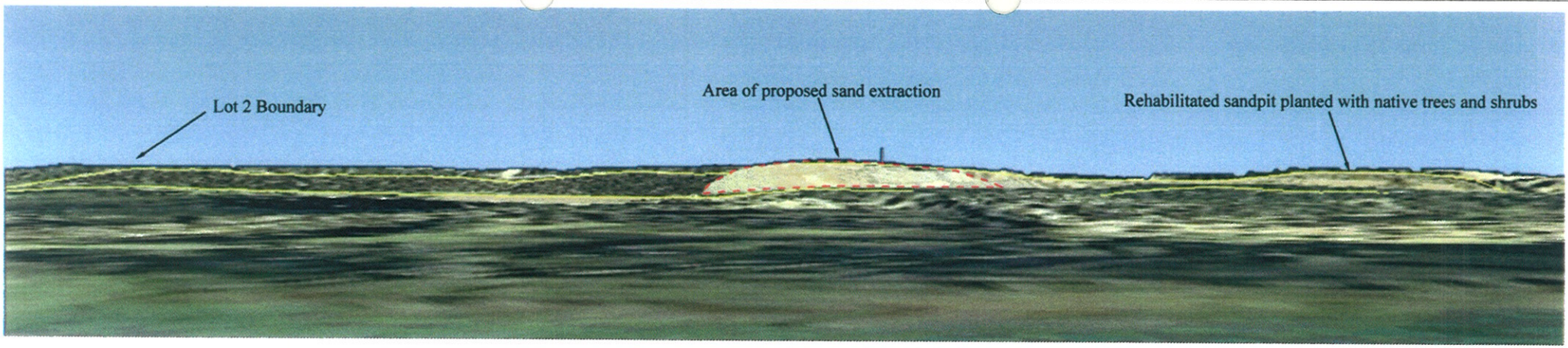
Plates 6 and 7: Landscape Unit C: Low gentle elevations supporting mixed Eucalypt-Agonis-Banksia woodlands over low open scrub

Plates 8 and 9: Landscape Unit D: Gently undulating terrain supporting Eucalypt-Banksia woodlands over mixed low open scrub

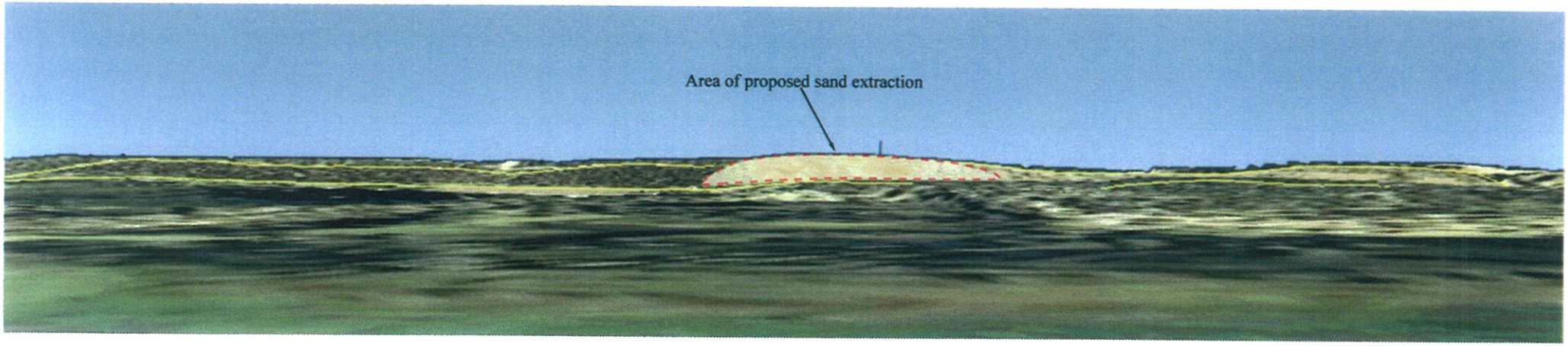
Plate 10: Landscape Unit E: Lowlying fringing dampland supporting mixed open woodlands over mixed open shrublands

COMPUTER GENERATED VIEWS

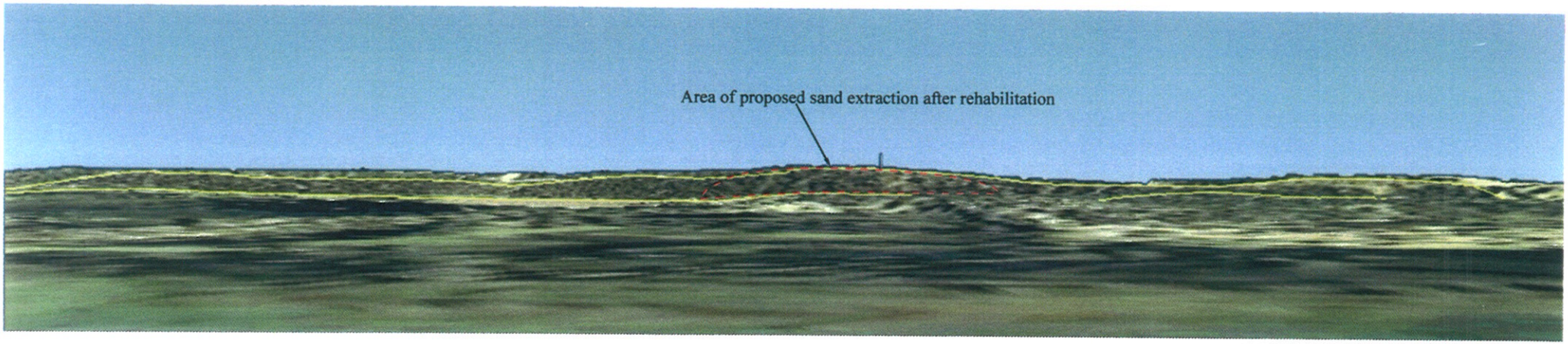
(Visual Assessment)



View 1a : View from east to west of site in current state



View 1b : View from east to west of site after sand extraction.



View 1c : View from east to west of site after sand extraction and rehabilitation

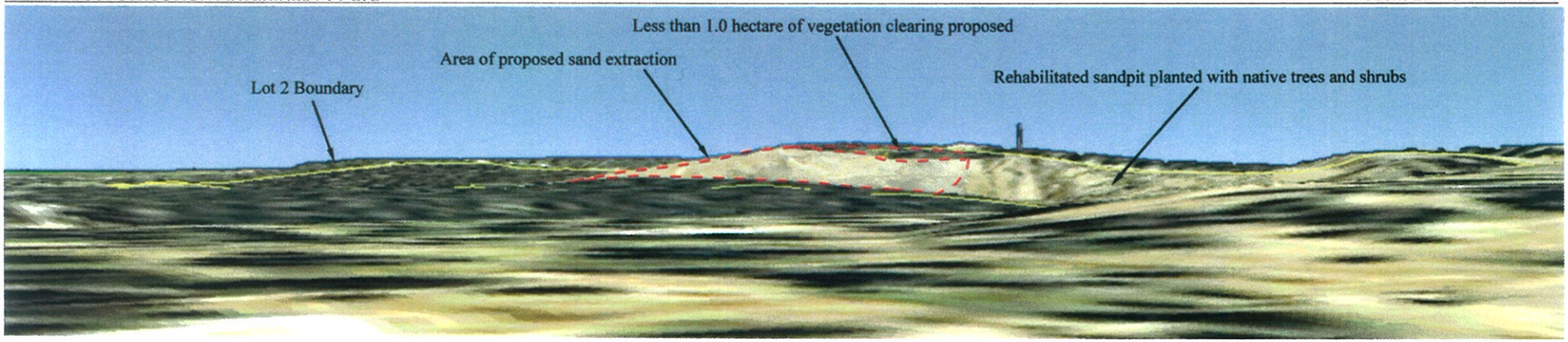


Plate 2a : View from northeast to southwest of site in current state

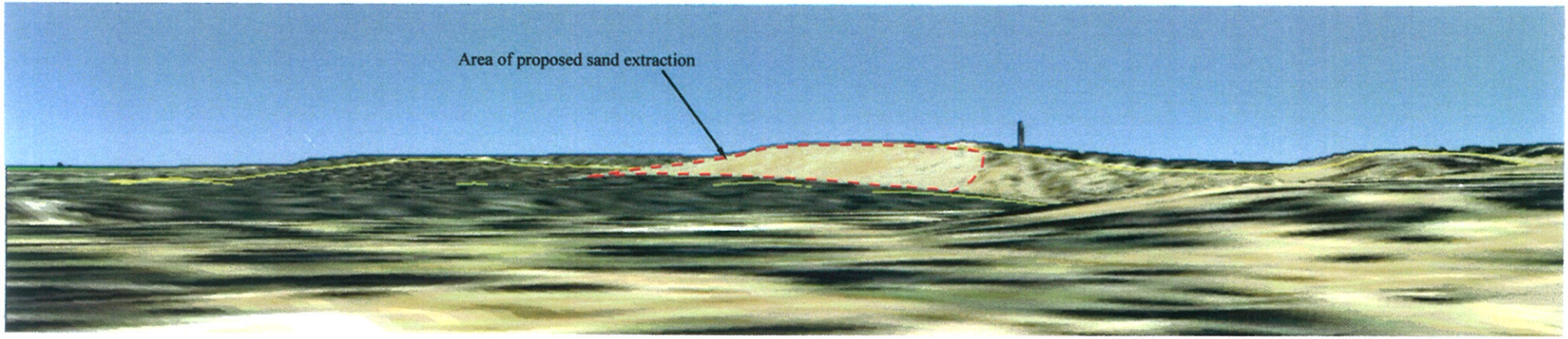


Plate 2b : View from northeast to southwest of site after sand extraction.

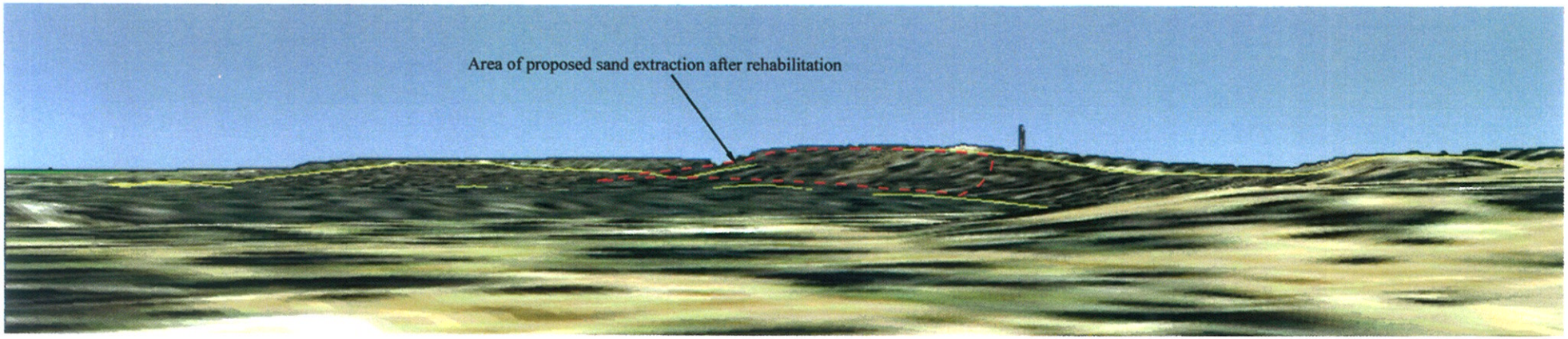
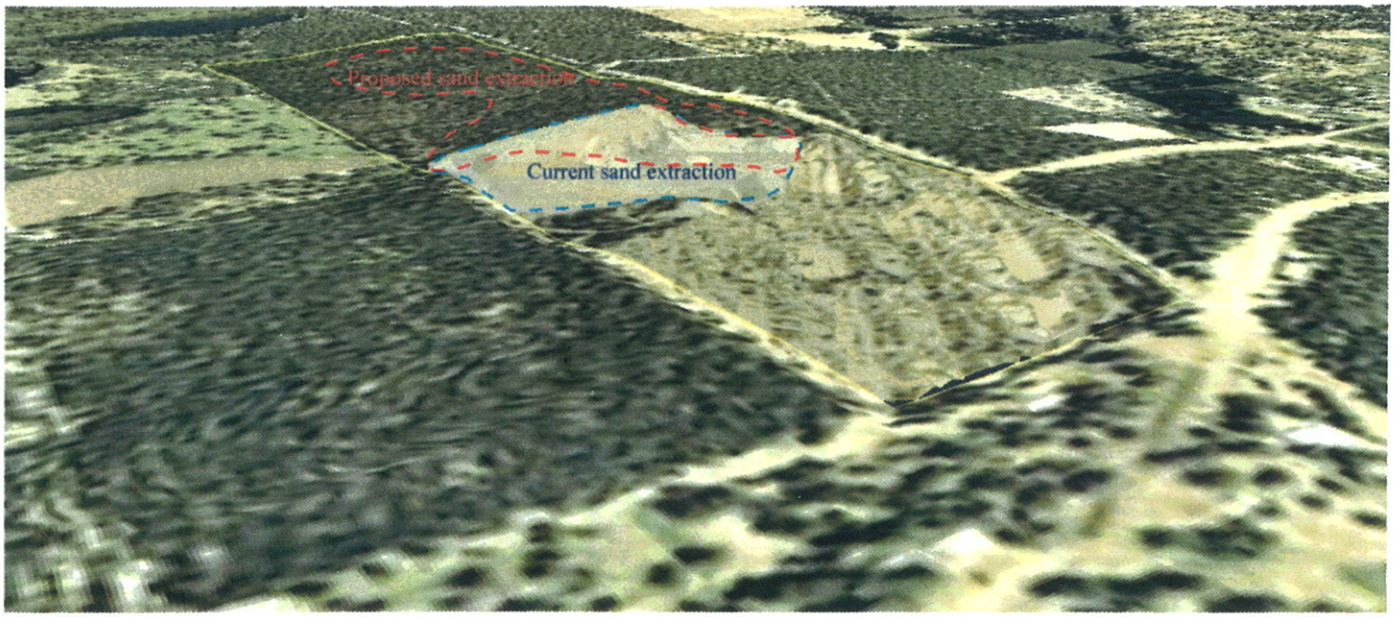
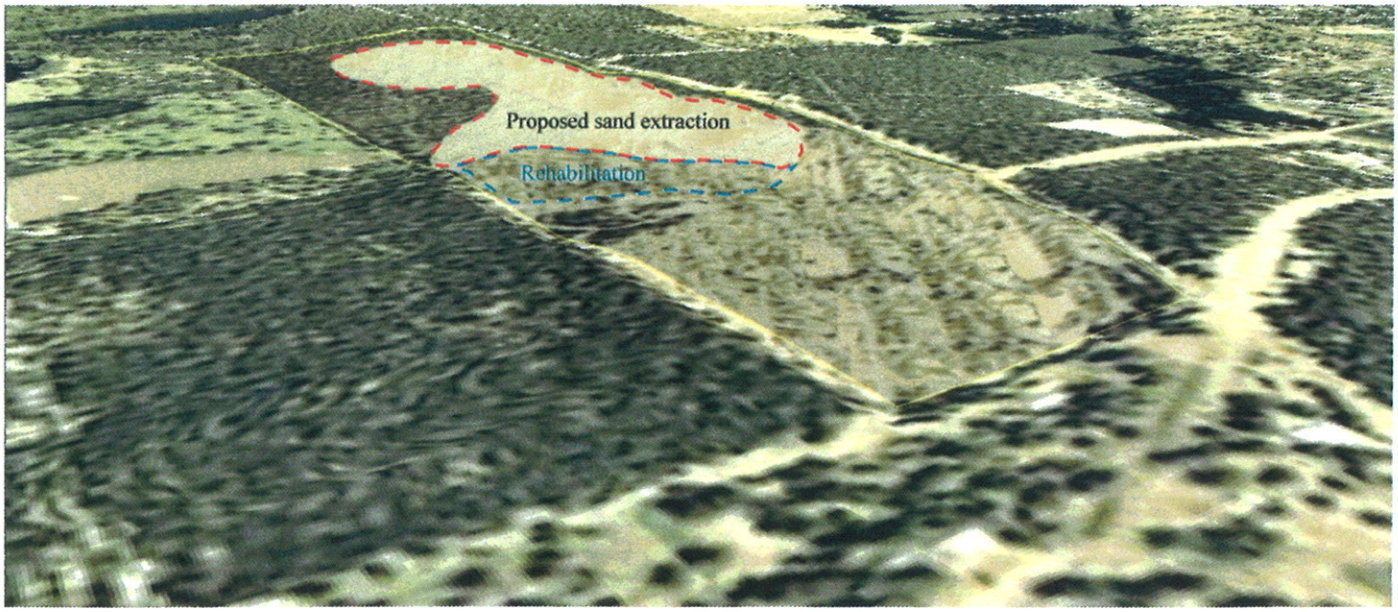


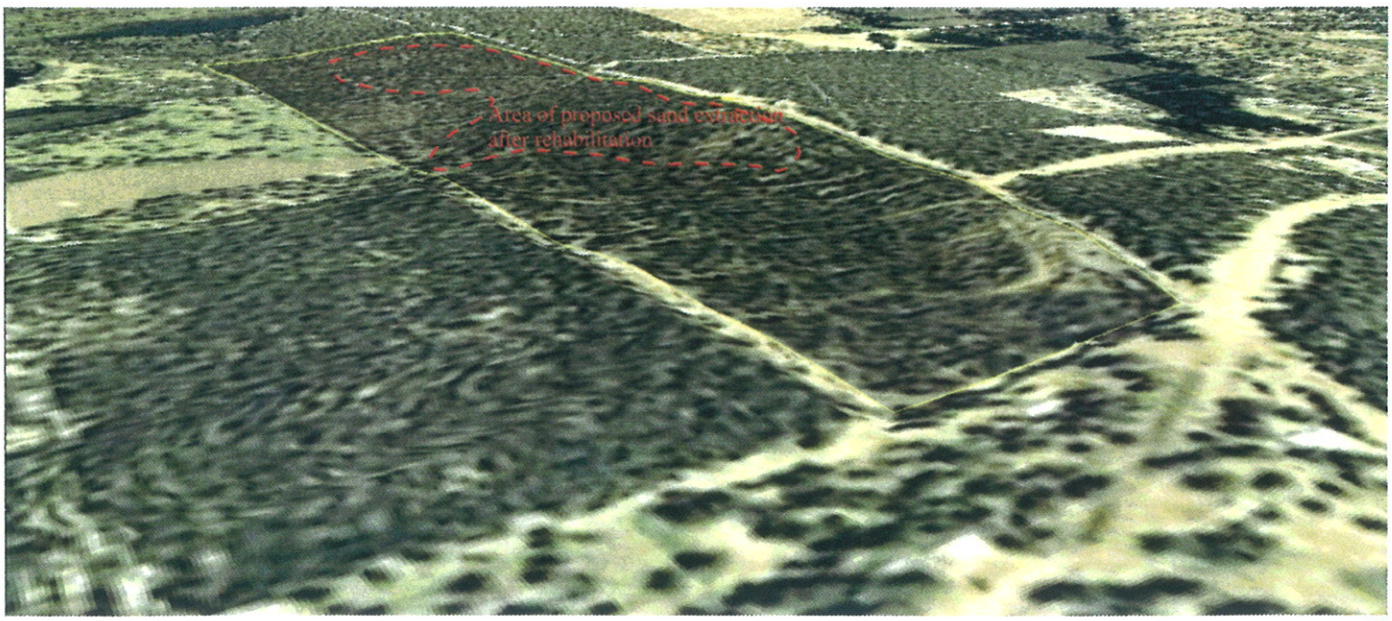
Plate 2c : View from northeast to southwest of site after sand extraction and rehabilitation



View 3a : Aerial view from northeast to southwest of site in current state



View 3b: Aerial view from northeast to southwest of site after sand extraction



View 3c: Aerial view from northeast to southwest of site after sand extraction and rehabilitation

APPENDICES

APPENDIX 1

Environmental Protection Authority's Guidelines for Public Environmental Review

Department of Environmental Protection

FACSIMILE MESSAGE

I-2152

TO: LANCE BOSCH	FAX NO: **9226 3177**
AT: MARTINICK MCNULTY	DATE: 14 DECEMBER 1999
FROM: MARK JEFFERIES PHONE: **9222 7141**	PAGES: 21
SUBJECT: CALINUP ROAD DRAFT GUIDELINES	

Lance, attached are the draft guidelines for Calinup Road. Please review and advise if there are any points that may need revision. After incorporation of comments, the Chairman will sign off as final guidelines. Generally this draft can be used as an indicator of the work required for preparation of the review document. I tried to send them to you on Email on Friday but they were returned. I will try again, and if they wont send, I will have to get you a disk copy.

Department of Environmental Protection
Westralia Square, 141 St Georges Terrace, Perth, 6000.
Facsimile: (08) 9322 1598 Telephone: (08) 9222 7000

Part A: Darft Specific Guidelines for the preparation of the Public Environmental Review

1. The proposal

Giacci Holdings Pty Ltd is proposing to extract sand from Lot 2 Calinup Rd Gelorup. The proposed sand mine is located within the Shire of Capel, approximately 12 km south Bunbury and 13 km north of Capel. The proposal location is indicated on the attached plan (see Attachment 3).

The proposal involves:

- clearing of up to 30 hectares (ha) of remnant native vegetation over the life of the mine;
- excavation and removal of the sand resource; and
- rehabilitation of the mined areas on a progressive basis.

The proponent is expected to provide the EPA with a report outlining the likely environmental impacts and proposed means of mitigating the impacts. This report will be made available for an eight week review period.

2. Environmental factors relevant to this proposal

The review document should give an assessment of each of the environmental factors identified for this proposal.

At this stage, the Environmental Protection Authority (EPA) believes the preliminary environmental factors, objectives and work required is as detailed in the table below.

These factors should be addressed within the PER document for the public to consider and make comment to the EPA. The EPA anticipates addressing these factors in its report to the Minister for the Environment.

The EPA expects the proponent to take due care in ensuring all other relevant environmental impacts which may be of interest to the public are addressed and that management is covered in the environmental review.

CONTENT	SCOPE OF WORK
INTEGRATING PROCESS	
Biodiversity	Maintain biological diversity where that represents the different plants, animals and microorganisms, the genes they contain and the ecosystems they form, at the levels of genetic diversity, species diversity and ecosystem diversity. Through studies carried out for the following environmental factors, demonstrate that biodiversity will not be compromised by this proposal.

CONTENT		SCOPE OF WORK	
Element of the Environment	**Environmental Factor**	**Preliminary Environmental Objective**	**Work required for the environmental review**
BIOPHYSICAL			
Flora	Vegetation communities	Maintain species diversity, geographic distribution and productivity of vegetation communities.	Baseline studies by appropriately trained and experienced persons under appropriate seasonal conditions to identify existing vegetation communities within the project area (defined as Heddle vegetation complex; 'Karrakatta Complex-Central and South' within 15 km of the proposal location). Map and describe the vegetation communities within the proposal location and relate these mapped communities to soil/landform types. Identify communities within the proposal location affected by dieback, weeds and past activities such as land clearing. Assessment of potential impacts (direct and indirect) on vegetation communities (local and regional, terrestrial and aquatic) as a result of sand mining and associated activities. Proposed measures to mitigate impacts.
	Declared Rare and Priority Flora	Protect Declared Rare and Priority Flora, consistent with the provisions of the Wildlife Conservation Act 1950.	Targeted search by appropriately trained and experienced persons under appropriate seasonal conditions for Declared Rare and Priority Flora likely to occur on the subject land. Analysis of likelihood of occurrence of taxa not flowering at time of survey. Proposed measures to manage impacts.
Fauna	Fauna	Maintain the abundance, species diversity and geographical distribution of fauna.	Baseline studies to identify existing fauna in the project area. Assessment of potential impacts (direct and indirect) on fauna (local and regional, terrestrial and aquatic) as a result of sand mining and associated activities. Analysis of the values of affected land as habitat for fauna. Proposed measures to manage impacts.

CONTENT		SCOPE OF WORK	
Element of the Environment	**Environmental Factor**	**Preliminary Environmental Objective**	**Work required for the environmental review**
BIOPHYSICAL CONTINUED			
	Specially Protected (Threatened) and Priority Fauna	Protect Specially Protected (Threatened) and Priority Fauna and their habitats, consistent with the provisions of the *Wildlife Conservation Act* 1950.	Targeted search by appropriately trained persons for Specially Protected (Threatened) and Priority Fauna which may occur in the project area. Analysis of the values of affected land as habitat for endangered fauna. Proposed measures to manage impacts.
Land	Landform	Establish stable, sustainable landform consistent with the intended post mining landuse and surroundings.	Assessment of potential impacts of the proposal on existing landforms. Assessment of the value of the target sand ridge (Gelorup hill) as an integral landscape feature of the local coastal environment. Define the intended post mining landform. Proposed measures to manage impacts.
	Rehabilitation	Ensure proposal area and any other area affected by the proposal, is rehabilitated to a standard consistent with the intended post mining long term land use.	Define the end landuse. Specify a rehabilitation objective. Detail of measures proposed to rehabilitate the impacted area: • including removal of infrastructure and clean-up of any contaminated areas; • weed control and management; and • the rehabilitated area should not require any on-going intervention. Develop rehabilitation performance criteria that can demonstrate attainment of the rehabilitation objective. In particular, specify structural and revegetation performance criteria for rehabilitated areas. Structural criteria should address issues such as the design of the final landform, stability of slopes and drainage. Vegetation performance criteria should be based upon the intended final vegetation community (appropriate to the intended post-mining landform and landuse). Ensure quantitative baseline vegetation survey data is available from the project area to enable development of appropriate revegetation performance criteria.

CONTENT		SCOPE OF WORK	
Element of the Environment	**Environmental Factor**	**Preliminary Environmental Objective**	**Work required for the environmental review**
BIOPHYSICAL CONTINUED			
Wetlands	Wetlands	Maintain the integrity, functions and environmental values of wetlands.	Baseline studies to identify wetlands, including sumpland and palusplain wetlands within the project area (a map should be included). Assessment of the impact of modifying the landform and the potential to modify the groundwater levels within the mined area, particularly in relation to possible impacts on wetlands adjacent to the proposed sand mine Proposed measures to manage impacts.
POLLUTION MANAGEMENT			
Air	Particulates / Dust	(i) Ensure that particulate emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or human health problem; and (ii) Use all reasonable and practicable measures to minimise the discharge of particulate wastes.	Baseline studies to identify existing sources of dust. Assessment of potential increases in dust resulting from the operation of the mine and associated activities. Assessment of potential impacts of increased dust (and sand) on the surrounding environment and the amenity of surrounding land users from the operation of the mine and associated activities. Proposed measures to manage impacts, including dust (and sand) from: • roadways and access routes; • topsoil stockpiles and bund walls; • sand extraction process and the exposed sand resource; • mud and sand tracked onto sealed roads by trucks and vehicles leaving the sand mine; and transport of sand in trucks along public roads.
	Greenhouse gases	(i) Ensure that greenhouse gas emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or human health problem; and (ii) Use all reasonable and practicable measures to minimise the discharge of greenhouse gases.	Detail source(s) and amounts of greenhouse gases released or absorbed as a result of mining or rehabilitation activities.

CONTENT		SCOPE OF WORK	
Element of the Environment	**Environmental Factor**	**Preliminary Environmental Objective**	**Work required for the environmental review**
POLLUTION MANAGEMENT CONTINUED			
Water	Groundwater quality and quantity	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).	Detail of water requirements for any on-site sand mining operations. Details of baseline monitoring of ground water quality and groundwater levels in the proposal location, licensing requirements, drainage and fate of water used in any on-site processing and mine operations. Assessment of impact from any change in groundwater quality or groundwater levels on the surrounding environment. Proposed measures to manage impacts.
	Surface water quality	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).	Detail of: • drainage and fate of water used in any on-site processing and mine operations; • Identify hydrocarbons used on site and propose measures to manage their use. • disposal of plant site waste, particularly sewage; • how surface water discharge will be managed to minimise risk of erosion and risk of dieback spread; and proposed measures to manage impacts.
Non-chemical Emissions	Noise	Ensuring that noise impacts emanating from the proposal comply with statutory requirements and acceptable standards.	Baseline studies to identify existing sources of noise. Baseline studies to identify all potentially affected residences within 2km of the mining area. A map should be included showing the precise location of all dwellings and other buildings within 2km of the proposed mining area. Assessment of: • potential increases in noise resulting from the operation of the mine and associated activities (including trucking movements); • transport heavy haulage routes; and • potential impacts of any increased noise on the amenity of surrounding land users. Proposed measures to manage impacts.

CONTENT		SCOPE OF WORK	
Element of the Environment	**Environmental Factor**	**Preliminary Environmental Objective**	**Work required for the environmental review**
SOCIAL SURROUNDINGS			
Aesthetic	Visual amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal.	Assessment of potential impacts on visual amenity of the project area and surrounds from the proposal. Proposed measures to manage impacts.
Social	Road transportation/ traffic	(i) ensure that the increase in traffic activities resulting from the project does not adversely impact on the social surroundings; and (ii) Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and MRWA requirements.	Assessment of transport heavy haulage routes.
Culture and Heritage	Indigenous and non-indigenous cultures	(i) Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972; (ii) Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area; and (iii) Comply with statutory requirements in relation to areas of cultural or historical significance.	Identify any Aboriginal cultural and heritage sites/issues of significance through archaeological and ethnographical surveys of the project area and through consultation with local Aboriginal groups and the Department of Aboriginal Affairs. Identify potential impacts on any identified sites. Proposed measures to manage impacts.

3. Availability of the environmental review

3.1 All copies for distribution free of charge

Supplied to DEP:

- Library/Information Centre 9
- EPA members 5
- Chief Executive Officer, DEP 1
- Officers of the DEP (Perth & Bunbury) 6

Distributed by the proponent to:

Government departments

- Waters and Rivers Commission 2
- Department of Conservation and Land Management 2
- Aboriginal Affairs Department 1

Local government authorities

- Shire of Capel 2

Libraries

- J S Battye Library 3
- The Environment Centre 1
- Shire of Capel Libraries 2
- City of Bunbury Public Library 2

Others

- Conservation Council of WA 1
- Capel Land Conservation District Committee 1

3.2 Available for public viewing

- Department of Environmental Protection Library, Perth;
- Department of Environmental Protection Library, Bunbury;
- Shire of Capel Libraries;
- J S Battye Library, Perth; and
- The Environment Centre, Perth.

Part B: Generic Guidelines for the preparation of an environmental review document

1. Overview

All environmental reviews have the objective of protecting the environment. Environmental impact assessment is deliberately a public process in order to obtain broad ranging advice. The review requires the proponent to describe:

- the proposal;
- receiving environment;
- potential impacts of the proposal on factors of the environment; and
- proposed management strategies to ensure those environmental factors are appropriately protected.

Throughout the assessment process it is the objective of the Environmental Protection Authority (EPA) to help the proponent to improve the proposal so the environment is protected. The DEP will coordinate, on behalf of the EPA, relevant government agencies and the public in providing advice about environmental matters during the assessment of the environmental review for this proposal.

The primary purpose of the environmental review is to provide information on the proposal within the local and regional framework to the EPA, with the aim of emphasising how the proposal may impact the relevant environmental factors and how those impacts may be mitigated and managed.

The language used in the body of the environmental review should be kept simple and concise, considering the audience includes non-technical people, and any extensive, technical detail should either be referenced or appended to the environmental review. It should be noted that the environmental review will form the legal basis of the Minister for the Environment's approval of the proposal and therefore the environmental review should include a description of all the main and ancillary components of the proposal, including options where relevant.

Information used to reach conclusions should be properly referenced, including personal communications. Such information should not be misleading or presented in a way that could be construed to mislead readers. Assessments of the significance of an impact should be soundly based rather than unsubstantiated opinion, and each assessment should lead to a discussion of the management of the environmental factor.

2. Objectives of the environmental review

The objectives of the environmental review are to:

- place this proposal in the context of the local and regional environment;
- adequately describe all components of the proposal, so that the Minister for the Environment can consider approval of a well-defined project;
- provide the basis of the proponent's environmental management program, which shows that the environmental impacts resulting from the proposal, including cumulative impact, can be acceptably managed; and

- communicate clearly with the public (including government agencies), so that the EPA can obtain informed public comment to assist in providing advice to government.

3. Environmental management

The EPA expects the proponent to develop and implement an Environmental Management System (EMS) appropriate to the proposal consistent with the principles outlined in the AS/NZS ISO 14000 series, including provisions for performance review and a commitment to continuous improvement.

The key components which should be included in environmental review documentation, depending on the scale of the proposal, are environmental management:

- policy;
- environmental management program;
- structure and responsibility (resources);
- training program;
- monitoring and measurement program;
- corrective and preventative action;
- EMS audit; and
- management review (with feedback).

Documentation on the relevant components should be proportional with the scale of the proposal and the potential environmental impacts. If appropriate, the documentation can be incorporated into a formal environmental management system and provision made for periodic performance review. Public accountability should be incorporated into the approach on environmental management.

The environmental management program (EMP) is the key document that should be appropriately defined in an environmental review document. The EMP should provide plans to manage the relevant environmental factors, define the performance objectives, outline the operational procedures and outline the monitoring and reporting procedures which would demonstrate the achievement of the objectives.

4. Format of the environmental review document

The environmental review should be provided to the DEP officer for comment. At this stage the document should have all figures produced in the final format and colours.

Following approval to release the review for public comment, the final document should also be provided to the DEP in an electronic format.

The proponent is requested to supply the project officer with an electronic copy of the environmental review document for use on Macintosh, Microsoft Word Version 6, and any scanned figures. Where possible, figures should be reproducible in a black and white format.

5. Contents of the environmental review document

The contents of the environmental review should include an executive summary, introduction and at least the following:

5.1 The proposal

- A comprehensive description of the proposal including its location (address and certificate of title details where relevant) is required.

Justification and alternatives

- justification and objectives for the proposed development;
- the legal framework, including existing zoning and environmental approvals, and decision making authorities and involved agencies; and
- consideration of alternative options.

Key characteristics

The Minister's statement will bind the proponent to implementing the proposal in accordance with any technical specifications and key characteristics[1] in the environmental review document. It is important therefore, that the level of technical detail in the environmental review, while sufficient for environmental assessment, does not bind the proponent in areas where the project is likely to change in ways that have no environmental significance.

Include a description of the components of the proposal, including the nature and extent of works proposed. This information must be summarised in the form of a table as follows:

[1] Changes to the key characteristics of the proposal following final approval, would require assessment of the change and can be treated as non-substantial and approved by the Minister, if the environmental impacts are not significant. If the change is significant, it would require assessment under section 38 or section 46. Changes to other aspects of the proposal are generally inconsequential and can be implemented without further assessment. It is prudent to consult with the Department of Environmental Protection about changes to the proposal.

Table 1: Key characteristics (example only)

Element	Description
Life of project (mine production)	< 5 yrs (continual operation)
Size of ore body	682 000 tonnes (upper limit)
Depth of mine pit	less than 30 m
Water table depth	50 m below ground surface
Area of disturbance (including access)	100 hectares
Mine operation	Only during daylight hours Only Monday to Friday
List of major components • pit • waste dump • infrastructure (water supply, roads, etc)	refer plans, specifications, charts section immediately below for details of map requirements
Ore mining rate • maximum	• 200 000 tonnes per year
Solid waste materials • maximum	• 800,000 tonnes per year
Water supply • source • maximum hourly requirement • maximum annual requirement	• XYZ borefield, ABC aquifer • 180 cubic metres • 1 000 000 cubic metres
Fuel storage capacity and quantity used	litres; litres per year

Plans, Specifications, Charts

Adequately dimensioned plans showing clearly the location and elements of the proposal which are significant from the point of view of environmental protection, should be included. The location and dimensions (for progressive stages of development, if relevant) of plant, amenities buildings, accessways, stockpile areas, dredge areas, waste product disposal and treatment areas, all dams and water storage areas, mining areas, storage areas including fuel storage, landscaped areas etc.

Only those elements of plans, specifications and charts that are significant from the point of view of environmental protection are of relevance here.

Figures that should be included are:

- a map showing the proposal in the local context - an overlay of the proposal on a base map of the main environmental constraints;
- a map showing the proposal in the regional context;
- a map showing the Calinup road sand deposit and adjacent land holdings (in black and white, so that it can be easily reproduced);
- a map showing the precise location of all dwellings and other buildings within 2km of the proposed mining area;

- a map showing identified bores within 2-3km of the supply bores for the project .

The plan/s should include contours, a north arrow, a scale bar, a legend, grid co-ordinates, the source of the data, and a title. If the data is overlaid on an aerial photo then the date of the aerial photo should be shown.

Other logistics

- timing and staging of project; and
- ownership and liability for waste during transport, disposal operations and long-term disposal (where appropriate to the proposal).

5.2 Environmental factors

The environmental review should focus on the relevant environmental factors for the proposal, and these should be agreed in consultation with the EPA and DEP and relevant public and government agencies. Preliminary environmental factors identified for the proposal are shown in Part A of these guidelines.

Further environmental factors may be identified during the preparation of the environmental review, therefore on-going consultation with the EPA, DEP and other relevant agencies is recommended. The DEP can advise the proponent on the recommended EPA objective for any new environmental factors raised. Minor matters which can be readily managed as part of normal operations for the existing operations or similar projects may be briefly described.

Items that should be discussed under each environmental factor are:

- a clear definition of the area of assessment for this factor;
- the EPA objective for this factor;
- a description of what is being affected - why this factor is relevant to the proposal;
- a description of how this factor is being affected by the proposal - the predicted extent of impact;
- a description of where this factor fits into the broader environmental / ecological context (only if relevant - this may not be applicable to all factors);
- a straightforward description or explanation of any relevant standards / regulations / policy;
- environmental evaluation - does the proposal meet the EPA's objective as defined above;
- if not, environmental management proposed to ensure the EPA's objective is met;
- predicted outcome.

The proponent should provide a summary table of the above information for all environmental factors, under the three categories of biophysical, pollution management and social surroundings:

Table 2: Environmental factors and management (example only)

Environmental Factor	EPA Objective	Existing environment	Potential impact	Environmental management	Predicted outcome
BIOPHYSICAL					
vegetation community types 3b and 20b	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation community types 3b and 20b	Reserve 34587 contains 45 ha of community type 20b and 34 ha of community type 3b	Proposal avoids all areas of community types 20b and 3b	Surrounding area will be fully rehabilitated following construction	Community types 20b and 3b will remain untouched Area surrounding will be revegetated with seed stock of 20b and 3b community types
POLLUTION MANAGEMENT					
Dust	Ensure that the dust levels generated by the proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards	Light industrial area - three other dust producing industries in close vicinity Nearest residential area is 800 metres	Proposal may generate dust on two days of each working week.	Dust Control Plan will be implemented	Dust can be managed to meet EPA's objective
SOCIAL SURROUNDINGS					
Visual amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal	Area already built-up	This proposal will contribute negligibly to the overall visual amenity of the area	Main building will be in 'forest colours' and screening trees will be planted on road	Proposal will blend well with existing visual amenity and the EPA's objective can be met

5.3 Environmental management commitments

The implementation of the key characteristics of the proposal and the consolidated environmental management commitments made by the proponent become legally enforceable under the conditions of environmental approval issued in the statement by the Minister for the Environment. All the key environmental management commitments should be consolidated in the public review document in a list (usually in an Appendix). This list is attached to the Minister's statement and becomes part of the conditions of approval.

The proponent's compliance with the consolidated environmental management commitments will be audited by the DEP, so they must be expressed in a way which enables them to be audited.

A commitment needs to contain most of the following elements to be auditable:

- who (eg. the proponent)

- will do what (eg. prepare a plan, take action)
- why (to meet an environmental objective)
- where/how (detail the action and where it applies)
- when (in which phase, eg. before construction starts)
- to what standard (recognised standard or agency to be satisfied)
- on advice from (agency to be consulted).

The proponent may make other 'commitments', which address less significant or non-environmental matters, to show an intention to good general management of the project. Such 'commitments' would not be included in the consolidated list of environmental management commitments appended to the statement.

Continuous improvement during the implementation of the consolidated commitments may necessitate changes, which can be made in updates to the environmental management plan, whilst ensuring the environmental objective is still achieved. Additional proponent commitments arising from the fulfilment of environmental conditions will be audited by the DEP.

Once the proposal is approved, changes to the consolidated commitments constitute a change to the proposal and should be referred to the EPA.

Examples of the preferred format for typical commitments are shown in the following table:

Table 3: Summary of proponent's commitments (example only)

Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement/ Compliance criteria
1.	to protect the abundance, species diversity, geographic distribution and productivity of the vegetation community types 3b and 20b	by limiting construction to a small area (10 ha) of Reserve 34587 and rehabilitating the area	XYZ Mining will [illegible] construction	[illegible]	[illegible] built; species distribution and density consistent with vegetation community types 3b and 20b
2.	to maintain the amenity of nearby land owners	by preparing and implementing a Dust Control Plan which meets EPA Dust Control criteria	XYZ Mining will [illegible] of construction phase	[illegible] dust gener[illegible] DEP; implementation: Shire	[illegible] from Shire submitted with Performance and Compliance Report.

Commitments should be written in tabular form, preferably with some specification of ways in which the commitment can be measured, or how compliance can be demonstrated.

Draft commitments which are not in a format that can be audited will not be accepted by project officers for public review documentation. Proponents will be assisted to revise inadequate commitments.

5.4 Public consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the environmental review. It should describe the activities undertaken, the dates, the groups/individuals involved and the objectives of the activities. Cross reference should be made with the description of environmental management of the factors which should clearly indicate how community concerns have been addressed. Those concerns which are dealt with outside the EPA process can be noted and referenced.

5.5 Other information

Additional detail and description of the proposal, if provided, should go in a separate section.

Attachment 1

The first page of the proponent's environmental review document must be the following invitation to make a submission, with the parts in square brackets amended to apply to each specific proposal. Its purpose is to explain what submissions are used for and to detail why and how to make a submission.

Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

[the proponent] proposes [the rezoning of land and the development of a Marina Complex in the City of Bunbury]. In accordance with the Environmental Protection Act, a [PER] has been prepared which describes this proposal and its likely effects on the environment. The [PER] is available for a public review period of [8] weeks from [**date**] closing on [**date**].

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the [PER] or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the [PER]:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable;
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the [PER];
- if you discuss different sections of the [PER], keep them distinct and separate, so there is no confusion as to which section you are considering;
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: [**date**]

Submissions should be addressed to:

The Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: [**Project Officer name**]

Attachment 2

Advertising the environmental review

The proponent is responsible for advertising the release and arranging the availability of the environmental review document in accordance with the following guidelines:

Format and content

The format and content of the advertisement should be approved by the DEP before appearing in the media. For joint State-Commonwealth assessments, the Commonwealth also has to approve the advertisement. The advertisement should be consistent with the attached example.

Note that the DEP officer's name should appear in the advertisement.

Size

The size of the advertisement should be two newspaper columns (about 10 cm) wide by about 14 cm long. Dimensions less than these would be difficult to read.

Location

The approved advertisement should, for CER's, appear in the news section of the main local newspaper and, for PER's and ERMP's, appear in the news section of the main daily paper's ("The West Australian") Saturday edition, and in the news section of the main local paper at the commencement of the public review period and again two weeks prior to the closure of the public review period.

Timing

Within the guidelines already given, it is the proponent's prerogative to set the time of release, although the DEP should be informed. The advertisement should not go out before the report is actually available, or the review period may need to be extended.

Example of the newspaper advertisement

SCM CHEMICALS LTD

Consultative Environmental Review

EXTENSION TO DALYELLUP RESIDUE DISPOSAL PROGRAM

(Public Review Period: [**date**] to [**date**])

SCM Chemicals Ltd is planning to extend the company's existing residue disposal program at Dalyellup, south of Bunbury, from March 1992 to March 1993.

A Consultative Environmental Review (CER) has been prepared by the company to examine the environmental effects associated with the proposed development, in accordance with Western Australian Government procedures. The CER describes the proposal, examines the likely environmental effects and the proposed environmental management procedures.

SCM has prepared a project summary which is available free of charge from the company's office on Old Coast Road, Australind.

Copies of the CER may be purchased for $5 from:

SCM Chemicals Ltd
Old Coast Road
AUSTRALIND WA 6230
Telephone: (08) 9467 2356

Copies of the complete Consultative Environmental Review will be available for examination at:

- Environmental Protection Authority
  Library Information Centre
  8th Floor, Westralia Square
  141 St Georges Tce
  PERTH WA 6000
- Department of Environmental Protection
  61 Victoria Street
  BUNBURY WA 6231
- City of Bunbury public libraries
- Shire of Capel libraries
- Shire of Harvey library (Australind)
- Shire of Dardanup (Eaton)

Submissions on this proposal are invited by [**closing date**]. Please address your submission to:

Chairman
Environmental Protection Authority
8th Floor, Westralia Square
38 Mounts Bay Road
PERTH WA 6000
Attention: [**Project Officer name**]

If you have any questions on how to make a submission, please ring the project officer, [**Project Officer name**], on (08) 9222 7xxx.

APPENDIX 2

Future Landuse and Town Planning Details

FUTURE LANDUSE OPTIONS FOR LOT 2 CALINUP ROAD

1. INTRODUCTION

The subject land is Lot 2 of Boyanup A.A. Lot 166 Cokelup Road Gelorup. It has an area of 58.7 hectares and has been developed for extractive industrial purposes.

2. DISTRICT FRAMEWORK

2.1 BUNBURY-WELLINGTON REGION PLAN (NOVEMBER 1995)

The Bunbury-Wellington Region Plan was approved by the Minister for Planning in 1995. The plan represents the desires and aspirations of the local community, the Western Australian Planning Commission and the six local government authorities within the region. It provides a regional framework to guide detailed planning primarily at the local authority level contained within a regional framework. The major purpose of the plan is to provide a co-ordinated approach to regional planning issues within the study area and the plan has a life span to the year 2011.

While the plan is a non-statutory document it is expected that the Western Australian Planning Commission and local planning authorities will have regard to the plan in the preparation and review of their town planning schemes. A statutory document, The Greater Bunbury Region Scheme (GBRS) has been developed in draft form and is currently progressing through the approval process. The GBRS reflects most of the factors for the City of Bunbury and Shires of Capel, Harvey and Dardanup that were raised in the Bunbury-Wellington Region Plan.

2.2 GREATER BUNBURY STRUCTURE PLAN (OCTOBER 1995)

The Greater Bunbury Structure Plan replaced the Bunbury Region Plan (1987). It reviewed that region plan and considered directions for long-term urban development and established objectives and actions for the structure plan area.

The Bunbury Region Plan identified long-term urban growth options for Bunbury to reach a population of 100,000 people. It suggested that the most suitable areas for expansion were east of Australind and south of Stratham. The Greater Bunbury Structure Plan is generally consistent with these broad concepts regarding the direction of growth.

The structure plan also identified 26 planning units within the five major surface water catchments and each of these planning units will be subject to more detailed local planning needed for the continued development of the greater Bunbury area. Lot 2 Calinup Road is located within the Beridup BU8 Planning Unit.

2.3 BERIDUP PLANNING UNIT (BU8)

The Beridup Planning Unit has a landform of flat to undulating Bassendean Dunes with local wetlands and drains and the Spearwood Dunes forming the western limit of the Bunbury

Coastal Catchment. The natural vegetation consists of Jarrah, Marri and Banksia with the swamp areas dominated by Paper Bark, Tuart Forest and Banksia Woodlands.

The main planning policy for this unit is to assess future development potential within the Special Development Area and ensure that any interim development or landuse does not prejudice that identified future use. The identified future use is as a rural-urban transition area, with amenity areas within it.

The Special Development Area is rural land identified within the Greater Bunbury urban fringe that appears to demonstrate significant potential for future development at a greater intensity and which is expected to come under increasing pressure from competing landuses.

Future development of this area may include, in the longer term, residential subdivision when the necessary services can be provided. Other uses that may be appropriate include special residential, rural-residential and tourist developments. It may also include areas of significant remnant vegetation or wetlands worthy of conservation in conjunction with that development. Most of the rural-residential lots in Greater Bunbury vary in size from 4000 square metres to five hectares.

Lot 2 is shown as a Rural-Residential area north of Calinup Road and a Special Development Area south of Calinup Road. The low-lying south-eastern corner of Lot 2 is shown as rural. The area north of Calinup Road has been included in the rounding off of the existing rural-residential area of Gelorup.

Lot 2 is located on rural land of low to moderate agricultural value and adjoins rural-residential areas.

The Greater Bunbury Structure Plan recommended that the Special Development Area should be investigated in detail, including land capability and suitable analysis, to ascertain the most appropriate long-term landuse. Furthermore, an interim use should not prejudice that identified future use.

2.4 CAPEL LANDUSE STRATEGY (APRIL 1999)

The Capel Shire Landuse Strategy was prepared using the framework and information base provided in the Bunbury-Wellington Region Plan and sets out the landuse options and development guidelines for each of the prescribed planning units. The Beridup BU8 Planning Unit covers a large area, bounded by the Bunbury Outer Ring Road on the north and the Five Mile Brook catchment to the west, south and east and includes Lot 2.

The strategy promotes the preparation of a District Structure Plan for the Planning Unit. This will address the broad landuse allocations including land requirements for future urban subdivision; identify possible opportunities for rural residential; and define areas of regional significance to be protected for conservation, agriculture and basic raw materials.

The strategy discusses the rounding off of the southern boundary of the Gelorup Special Rural Zone, which incorporates the areas of Lot 2 north of Calinup Road reserve. A number of factors are outlined that future development will need to have regard to.

The strategy does not discuss the Special Development Area south of Calinup Road on Lot 2 that is identified in the Greater Bunbury Structure Plan. The Development Criteria for the various forms of subdivisional opportunities for the Special Development Area will need to be identified in the District Structure Plan.

The strategy also recognises the potential landscape value of Gelorup Hill on Lot 2 Calinup Road and recommends that it should be protected in the event of any change of landuse or development.

3. CAPEL SHIRE TOWN PLANNING REQUIREMENTS FOR LOT 2 SOUTH OF CALINUP ROAD

Discussions were held in April 2000 between Mr Lance Boesh of Martinick Bosch Sell Pty Ltd and Mr Glen Bishop, Head Town Planner for the Shire of Capel, to ascertain the current thinking and requirements of the Shire in regard to the long term landuse of Lot 2 south of Calinup Road.

3.1 FUTURE RESIDENTIAL AREAS

The Shire of Capel recognises this area as having potential for higher density residential and thereby wishes to maximise the residential values of the elevated land within Lot 2 and the potential recreational amenity of the adjoining wetlands and lower-lying areas.

A design floor level of the sandpit at 20 metres AHD is considered by the Shire of Capel to be consistent with the future residential landuse. The finished contour of the sandpit needs to suit surrounding landforms and to have reasonable gradients for future urban landuse.

3.2 COKELUP ROAD-SOUTH OF CALINUP ROAD

Cokelup Road is approximately two kilometres long and links Calinup Road to Brookdale Road. Cokelup Road is located on the ridgeline along the western boundary of Lot 2, is approximately 1,150 metres long and provides sole access to Lot 677 and alternative access to Lots 186 and 187, which also gain access from Brookdale Road.

The Shire of Capel recognises that Cokelup Road is not a major link road and that it provides limited access. Alternative road routes may be considered on condition that they still serve the current purpose of providing access.

The Shire of Capel indicated that the Department of Land Administration could consider an alternative route by way of a land swap such that the alternative road may be located to best suit future residential landuse while serving the interim landuse needs.

By relocating Cokelup Road on the adjoining low-lying areas of Lot 2, the former 20-metre wide road reserve will be amalgamated into Lot 2 and Lot 2 will border adjoining Lots 677 and 187. This will allow for an additional 40 metres width of elevated terrain on Lot 2 becoming available for sand extraction.

The Shire of Capel indicated that it would support the re-routing of Cokelup Road if the future residential landuse opportunities are able to be enhanced while not compromising interim access requirements.

4. SUBDIVISION GUIDE PLAN

Lot 2 is located in an area recognised in the strategic planning framework as being part of a long-term development corridor. It is also in an area of landscape importance, being situated on the main ridge that separates the coastal precinct from the hinterland.

Consequently, the Shire of Capel requires the development of the sandpit to be completed in a manner consistent with this intended surrounding development. In particular the extraction of sand from the pit should not unreasonably inhibit the long-term development of the site for other purposes. This must, however, recognise that the current use of the site is primarily sand extraction.

The value of the existing extractive material within the site must be balanced with the value of the long-term final use of the property.

A Subdivision Guide Plan has therefore been developed on the basis that it provides for the maximum level of sand extraction while still ensuring sufficient suitable land is available for redevelopment. It contains approximately 37.5 hectares of land, which is developable for residential purposes.

This option has been prepared based upon the following assumptions:

- The development of the site is based upon a final surface level of the base of the sandpit of no deeper than 20 metres AHD that will give a minimum two-metre clearance to the groundwater level and will conform to similar ground levels of adjoining land east of Lot 2.
- That Gelorup Hill could be re-contoured based upon a detailed landscape assessment and landscaping plan.
- That the land south of Calinup Road is zoned for possible long-term urban development.
- The plan allows for a range of lot sizes in order to promote a mixture of housing types and styles.
- A portion of Cokelup Road between Lot 677 and the southern boundary of Lot 2 be realigned to the centre portion of Lot 2 to facilitate better road networks for future development.
- The gradient of batters within the excavated area will be battered to 1:4 to allow for revegetation. Potential low-density residential development can then occur with minor earthworks where slopes are equal to or less than 1:6.
- Minimal access points have been provided to Calinup Road so as to ensure there is no potential vehicle conflict.

The purpose of the Subdivision Guide Plan is to show in an indicative manner how it would be possible to develop the land after extraction has been completed. It recognises the long-term use of the site will be for this purpose and the final design will also reflect this.

APPENDIX 3

Muir Vegetation Classification

Muir Vegetation Classification
(Source: Muir, B (1996))

The Muir Vegetation Classification System was derived from the Bear and Webb (1974) classification with modifications based on the needs of scientists specializing in mammal, bird, reptile and amphibian studies. Consistent results have been obtained in its application, even from users with little botanical background. This classification system is based on three main components these being the biophysical environment, structural and floristic composition. Mean vegetation health and life form density classes are two assessments which describe the structural and floristic composition of vegetation. These two assessments were used to describe the vegetation of Lot 2:

Mean Vegetation Health

Mean vegetation health is estimated by using a scoring procedure based on visual assessments. Vegetation appearing to be in excellent health is given a score of 5. Vegetation which is comparatively healthy but with some yellowing is given a score of 4. If these features are more pronounced a score of 3 is given. Vegetation with very sparse foliage, yellowing and curling of leaves and considered almost dead are scored 2 and very poor or apparently freshly dead vegetation is given a score of 1. A score of 0 is given to vegetation only if it is undeniably dead.

Life Form Density Classes

The use of life form density classes by Kitchener *et al* (1982) has shown that there is a relationship, although imprecise, between the number of life form density classes and the abundance of certain passerine bird species. Kitchener's habitat variable 'total number of life form density classes; is generally considered to be the number of vegetation strata within each canopy cover class present in the sample area (i.e 2 to 10%, 10 to 30%, 30% to 70% or 70 to 100). The overall total canopy cover is generally not sufficiently variable to make this of value. However, the number of strata present is variable, so the number of strata has been taken as equivalent to the number of life form density classes. As an example, if the vegetation consists of a tall woodland over a short woodland over tall shrubs over herbaceous ground stratum, there are four strata and the rating given is 4.q

APPENDIX 4

Flora Species and Landscape Units Surveyed on Lot 2 Calinup Road

Table 4.1
Weed Species Identified on Lot 2 Calinup Road

Taxa	Life Form	Landscape Unit				
		A	B	C	D	E
Anagallis arvensis	annual grass	X				
Briza maxima	annual grass	X	X	X		X
Erhartia lengifolia	annual grass	X				
Hypochaeris glabra	annual grass					X
Lotus uliginosus	herb					X
Monadenia bracteata	herb			X		
Phytolacca octandra	shrub	X	X			X
Vulpia myuros	annual grass					X

Table 4.2
Native Flora Species Identified on Lot 2 Calinup Road

Taxa	Life Form	Landscape Unit				
		A	B	C	D	E
Acacia huegelii	shrub		X			
Acacia pulchella	shrub	X			X	X
Acacia saligna	shrub	X				
Acacia stenoptera	shrub		X			
Adenanthos meissneri	shrub		X	X		X
Agonis flexuosa	tree	X	X	X	X	X
Alyxia buxifolia	shrub	X				
Banksia attenuata	tree	X	X	X	X	X
Banksia grandis	tree		X	X	X	
Bossiaea eriocarpa	shrub	X	X	X		X
Cartonema philydroide	herb					X
Cassytha racemosa	parasite vine	X				
Clematis sp.	vine	X				
Conostephium pendulum	shrub			X		
Conostylis aculeata	shrub	X	X	X	X	X
Corymbia calophylla	tree	X	X	X	X	X
Dampiera linearis	herb	X				
Dasypogon bromeliifolius	shrub		X			
Daviesia divaricata	shrub	X	X	X	X	X
Daviesia incrassata	shrub	X				
Desmocladus fascicularis	herb	X				
Eucalyptus marginata	tree	X	X	X	X	X
Exocarpus ophyllus	shrub	X				
Gompholobium tomentosa	shrub		X	X		
Haemodorum paniculatum	lily			X		
Hardenbergia comptoniana	vine	X	X			
Hemiandra pungens	creeper		X			

Table 4.2 (continued)
Native Flora Species Identified on Lot 2 Calinup Road

Taxa	Lifeform	Landscape Unit				
		A	B	C	D	E
Hibbertia hypericoides	shrub	X	X	X	X	X
Hibbertia racemosa	shrub	X	X	X	X	
Hovea trisperma	shrub	X		X		
Hybanthus calycinus	shrub	X				
Hypolaena exsulca	sedge	X	X	X		X
Jacksonia sternbergiana	shrub	X	X			
Juncus krausii	reed	X				X
Kennedia prostrata	vine					X
Kunzea ericifolia	shrub	X	X	X	X	X
Lepidosperma squamatum	shrub	X				
Leucopogon capitellatus	shrub	X	X			
Leucopogon propinquus	shrub	X	X	X	X	X
Lomandra integra	lily	X	X			
Lyginia barbata	sedge		X	X		
Macrozamia riedlei	shrub	X	X	X	X	X
Melaleuca thymoides	shrub	X	X	X		X
Mirbelia spinosa	shrub			X		
Muehlenbeckia adpressa	shrub		X			
Nuytsia floribunda	tree					X
Orobanche minor	parasite herb					X
Patersonia occidentalis	shrub	X	X	X		
Pelargonium littorale	herb	X				
Persoonia longifolia	shrub	X	X			
Persoonia saccata	shrub		X			
Petrophile linearis	shrub		X			
Philotheca spicata	herb			X		
Phlebocarya ciliata	herb	X				
Phyllanthus calycinus	shrub	X	X	X	X	X
Platysace filiformis	shrub		X			
Podocarpus drouynianus	shrub		X			
Schoenus grandiflorus	herb	X				
Stylidium sp.	herb			X		
Thelymitra crinita	herb	X				
Thysanotus patersonii	herb	X				
Trachymene pilosa	herb	X				
Tricoryne elatior	herb					X
Sowerbaea laxiflora	shrub	X				
Waitzia suaveolens	herb	X				
Xanthorrhoea brunonis	shrub	X	X	X	X	X
Xylomelum occidentale	tree	X		X	X	X
Total N° of Native Species occurring in Landscape Unit		**44**	**35**	**28**	**16**	**24**

Landscape Unit A: Sandy rises and hillslopes supporting mixed Eucalypt-Xylomelum woodlands over open scrub and heath (Plates 2 and 3).

Landscape Unit A occurs over the main apex of the north to south aligned ridge and includes the immediate slope (Figure 16). This landscape unit consists of grey/brown surface sands over deep yellow sand and supports open woodlands of sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees to 30 metres in height over an open low woodland consisting mainly of *Xylomelum occidentale* with also *Agonis flexuosa, Banksia attenuata* being present to about 15 metres in height. These open woodlands provide a tree cover ranging from 10 to 30% and are comparatively healthy with a mean vegetation health rating of 4. Shrubs to 1.5 metres in height include *Acacia pulchella, Acacia saligna, Alyxia buxifolia, Bossiaea eriocarpa, Conostylis aculeata, Daviesia divaricata, Daviesia incrassata, Exocarpus aphyllus, Hibbertia hypericoides, Hibbertia racemosa, Hovea trisperma, Hybanthus calycinus, Jacksonia sternbergiana, Kunzea erecifolia, Lepidosperma squamatum, Leucopogon capitellatus, Leucopogon propinquus, Macrozamia riedlei, Melaleuca thymoides, Patersonia occidentalis, Pelargonium littorale, Persoonia longifolia, Phyllanthus calycinus, Sowerbaea laxiflora, Xanthorrhoea brunonis* and groundcover herb species' to 40 centimetres in height include *Dampiera linearis, Desmocladus fascicularis, Phlebocarya ciliata, Schoenus grandiflorus, Thelymitra crinita, Thysanotus patersonii, Thrachymene pilosa, Waitzia suaveolens.*

The sedge species' *Hypolaena exsulca,* vine species' *Cassytha racemosa* (parasitic), *Clematis* sp. and *Hardenbergia comptoniana*, the reed species *Juncus kraussi* and the lily species *Lomandra integra* were also present on Landscape Unit A.

Four weed species were identified and these were *Anagallis arvensis, Briza maxima, Erhartia lengifolia* and *Phtyolacca octandra.* Including these weed species a total of 48 flora species were recorded for Landscape Unit A.

This landscape unit was assessed for life form density classes which is considered to be the number of vegetation strata within each canopy cover class present in the sample area. A rating of 10 was given to this landscape unit indicating that 10 strata levels were recognised.

Landscape Unit B: Gentle Depressions supporting mixed Eucalypt-Banksia woodlands over low open thickets and shrublands (Plates 4 and 5).

Landscape Unit B occurs over the natural drainage depression of Lot 2 (Figure 16). This landscape unit consists of grey/brown surface sands over deep yellow sand and supports open woodlands of very sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees to 30 metres in height over an open low woodland consisting of *Agonis flexuosa, Banksia attenuata* and *Banksia grandis* to about 15 metres in height. These open woodlands provide a tree cover ranging from 2 to 10% and have a mean vegetation health rating of 4. Shrubs to 1.5 metres in height occasionally occur in thickets and include *Acacia huegelii, Acacia stenoptera, Adenanthos meissneri, Bossiaea eriocarpa, Conostylis aculeata, Dasypogon bromcliifolius, Daviesia divaricata, Gompholobium tomentosa, Hibbertia hypericoides, Hibbertia racemosa, Jacksonia sternbergiana, Kunzea erecifolia, Leucopogon capitellatus, Leucopogon propinquus, Macrozamia riedlei, Melaleuca thymoides, Meuhlenbeckia adpressa, Patersonia occidentalis, Persoonia longifolia, Persoonia saccata, Petrophile lincaris, Phyllanthus calycinus, Phytolacca octandra, Platysacc filifolia, Podocarpus drouynianus* and

Xanthorrhoea brunonis. The sedge species' *Hypolaena exsulca* and *Lyginia barbata*, the vine species *Hardenbergia comptoniana,* the creeper species *Hemiandra pungens* and the lily species' *Lomandra integra* were also present within Landscape Unit B.

Two weed species were identified and these were *Briza maxima* and *Phytolacca octandra.* Including these weed species a total of 37 flora species was recorded for Landscape Unit B.

This landscape unit was assessed for life form density classes. A rating of 11 was given to this landscape unit indicating that 11 strata levels were recognised.

Landscape Unit C: Low gentle elevations supporting mixed Eucalypt-Agonis-Banksia woodlands over low open scrub (Plates 6 and 7).

Landscape Unit C occurs over the low gentle elevations of Lot 2 (Figure 16). This landscape unit consists of grey/brown surface sands over deep yellow sand and supports open woodlands of very sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees to 30 metres in height over an open low woodland consisting mainly of *Agonis flexuosa* and *Banksia attenuata* with also *Banksia grandis* and *Xylomelum occidentale* being present to about 15 metres in height. These open woodlands provide a tree cover ranging from 2 to 10% and have a mean vegetation health rating of 4. Shrubs to 1.5 metres in height include *Adenanthos meissneri, Bossiaea eriocarpa, Conostephium pendulum, Conostylis aculeata, Daviesia divaricata, Gompholobium tomentosa, Hibbertia hypericoides, Hibbertia racemosa, Hovea trisperma, Kunzea erecifolia, Leucopogon propinquus, Macrozamia riedlei, Melaleuca thymoides, Mirbelia spinosa, Patersonia occidentalis, Phyllanthus calycinus and Xanthorrhoea brunonis* and groundcover herb species' to 40 centimetres in height include *Philotheca spicata* and *Stylidium* sp.

The sedge species' *Hypolaena exsulca* and *Lyginia barbata* and the lily species *Haemodorum paniculatum* were also present within Landscape Unit C.

Two weed species were identified and these were *Briza maxima* and *Monadenia bracteata.* Including these weed species a total of 30 flora species was recorded for Landscape Unit C.

This landscape unit was also assessed with respect to life form density classes. A rating of 11 was given to this landscape unit indicating that 11 strata levels were recognised.

Landscape Unit D: Gently undulating terrain supporting Eucalypt-Banksia woodlands over mixed low open scrub (Plates 8 and 9).

Landscape Unit D occurs over gently undulating terrain to the south-east boundary of Lot 2 (Figure 16). This landscape unit consists of grey/brown surface sands over deep yellow sand and supports open woodlands of very sparsely scattered *Eucalyptus marginata* and *Corymbia calophylla* trees to 30 metres in height over open low woodland mainly consisting of *Banksia attenuata* and *Banksia grandis* with also *Agonis flexuosa* and *Xylomelum occidentale* being present to about 15 metres in height. These open woodlands provide a tree cover ranging from 2 to 10% and have mean vegetation health rating of 4. Shrubs to 1.5 metres in height include *Acacia pulchella, Conostylis aculeata, Daviesia divaricata, Hibbertia hypericoides, Hibbertia racemosa, Kunzea erecifolia, Leucopogon propinquus, Macrozamia riedlei, Phyllanthus calycinus* and *Xanthorrhoea brunonis.*

No weed species were identified on this Landscape Unit. A total of 16 flora species were recorded for Landscape Unit D.

This landscape unit was also assessed with respect to life form density classes. A rating of 11 was given to this landscape unit indicating that 11 strata levels were recognised.

Landscape Unit E: Low fringing dampland supporting mixed open woodlands over mixed low open shrublands (Plate 10).

Landscape Unit E occurs over the low fringing dampland to the east of Lot 2 and is occasionally subject to inundation during very wet periods of the year. This landscape unit consists of grey/brown surface sands over deep yellow sand and supports a low open woodland of very sparsely scattered *Agonis flexuosa, Banksia attenuata, Corymbia calophylla, Eucalyptus marginata, Nuytsia floribunda* and *Xylomelum occidentale* trees to 15 metres in height. This open low woodland provides a tree cover of about 2 to 10% and has a mean vegetation health rating of 4. Shrubs to 1.5 metres include *Acacia pulchella, Adenanthos meissneri, Bossiaea eriocarpa, Conostylis aculeata, Daviesia divaricata, Hibbertia hypericoides, Kunzea erecifolia, Leucopogon propinquus, Macrozamia riedlei, Melaleuca thymoides, Phyllanthus calycinus* and *Xanthorrhoea brunonis.* The reed species *Juncus krausii*, the sedge species *Hypolaena exsulca,* the herb species' *Cartonema philydroides, Orobanche minor* (parasitic) and *Tricryne elatoir* and the vine species *Kennedia prostrata* were also present on Landscape Unit E.

Five weed species were identified on Landscape Unit E and these were *Briza maxima, Hypochaeris glabra, Lotus uliginosus, Phtyolacca octandra* and *Vulpia myuros.* Including these weed species a total of 29 flora species was recorded for Landscape Unit E.

This landscape unit was also assessed with respect to life form density classes. A rating of 10 was given to this landscape unit indicating that 10 strata levels were recognised.

APPENDIX 5

Fauna Assessment

SOUTHERN EXTENSION OF LOT 2 CALINUP ROAD, GELORUP

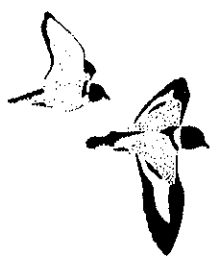
Fauna Assessment for Public Environmental Review

May 2003

Prepared for: Martinick Bosch Sell Pty Ltd.
4 Cook St,
West Perth, WA, 6005

On behalf of Pioneer Construction Materials Pty Ltd

Prepared by: M.J. & A.R. Bamford,
CONSULTING ECOLOGISTS.
23 Plover Way,
Kingsley, WA, 6026



02/06/'03

INTRODUCTION

As part of the operation of their sandpit on Lot 2, Calinup Road, Gelorup, Pioneer Construction Materials Pty Ltd is proposing to expand the excavation into the southern area of the property. As part of the expansion process, Bamford Consulting Ecologists was commissioned to conduct an assessment of the fauna values of the site. The purposes of this assessment were to:

- produce a fauna list of vertebrate species observed or predicted to occur on the site;
- identify species of conservation significance that might occur there;
- provide comments on the local and regional value of the property for fauna.

The assessment was carried out through a review of available information complemented by an inspection of the site, and this report details the findings of the assessment.

METHODS

Sources of Information

A site visit to the property was conducted on the 22nd May 2003 by Dr Mike Bamford to gather data on the habitats available within the area. During this visit, information on fauna species present, vegetation and general habitat characteristics were collected. There were also some earlier habitat and fauna observations made by Martinick Bosch Sell.

Observations made on fauna in the field were supplemented by a search of the Western Australian Museum FaunaBase and the Threatened Fauna Database managed by the Department of Conservation and Land Management. The Threatened Fauna Database includes threatened invertebrates. Bird, reptile and mammal records were also examined for a number of sites in the general region. These included records from the Capel Wetlands Centre and Capel Nature Reserve, 20km to the south, where observations have been made continuously since the mid 1980s (Doyle 2000, Bamford 1997), records from the Ludlow Tuart Forest 25km to the south, records from the Gwindinup area 15 km to the south-east and records from the Kemerton area 30km to the north (M. Bamford, unpub. data). In addition, there are several published reports on fauna in the general area, including How *et al.* (1987) and Storr and Johnstone (1988).

Observations and these supplementary sources of information were used to create lists of species expected to occur at the site. As far as possible, expected species are those that are very likely to utilise the area based upon the habitats available, and such lists exclude species that have been recorded in the general region as vagrants. Particularly among the birds, for example, vagrants can be recorded almost anywhere and the Capel Wetlands Centre species list includes a number of seabirds, while the WA Museum database includes marine mammals and reptiles that are not likely to occur on the site.

Taxonomy and nomenclature for fauna species used in this report generally follow Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals and Johnstone (2001) for birds. Alternative names, including common names recommended for national and international use by Christidis and Boles (1994) for birds, are also given.

Assessment of Conservation Significance

The conservation status of fauna species is assessed under Federal and State Acts such as the *Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999* and the *Western Australian Wildlife Conservation Act 1950.* The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994). The *WA Wildlife Conservation Act 1950* uses a set of Schedules but also classifies species using some of the IUCN categories. These categories and Schedules are described in Appendix One.

The EPBC Act also has lists of migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals). In addition, Environment Australia has supported the publication of reports on the conservation status of most vertebrate fauna species e.g. reptiles (Cogger *et al.* 1993), birds (Garnett and Crowley 2000), monotremes and marsupials (Maxwell *et al.* 1996), rodents (Lee, 1995) and bats (Duncan *et al.* 1999); while the Threatened Species and Communities Section of Environment Australia has produced a list of Threatened Australian Fauna (Environment Australia 1999), although this list is effectively a precursor to the list produced under the EPBC Act. These publications also use the IUCN categories, although those used by Cogger *et al.* (1993) differ in some respects as this report pre-dates Mace and Stuart's review (1994).

In Western Australia, the Department of Conservation and Land Management has produced a supplementary list of Priority Fauna, being species that are not considered Threatened under the WA Act but for which the Department feels there is cause for concern. Some Priority species, however, are also assigned to the IUCN Conservation Dependent category. Levels of Priority are described in Appendix One.

Fauna species included under conservation acts and/or agreements are formally recognised as of conservation significance under state or federal legislation. Species listed only as Priority by CALM, or that are included in publications such as Garnett and Crowley (2000) and Cogger *et al.* (1993) but not in State or Federal Acts, are also of recognised conservation significance. In addition, species that are at the limit of their distribution, those that have a very restricted range and those that occur in breeding colonies, such as some waterbirds, can be considered of conservation significance, although this level of significance has no legislative or published recognition and is based on interpretation of distribution information. The WA Department of Environmental Protection (2000) used this sort of interpretation to identify significant bird species in the

Perth metropolitan area as part of Perth Bushplan. On the basis of the above comments, three levels of conservation significance are recognised in this report:
Conservation Significance (CS) 1: Species listed under State or Federal Acts.
Conservation Significance (CS) 2: Species not listed under State or Federal Acts, but listed in publications on threatened fauna or as Priority species by CALM.
Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

SITE DESCRIPTION

Landscape units and vegetation types are described in some detail by Cranfield (Public Environmental Review, Appendix 4). The site is an undulating landscape of sandy soils with no wetlands present, although a degraded wetland lies on farmland immediately to the east and Cokalup Swamp lies about 1km to the south-west. The vegetation is an open woodland of Jarrah *Eucalyptus marginata* and Marri *Corymbia calophylla*, over a mid-storey of *Banksia attenuata*, Peppermint *Agonis flexuosa* and Woody Pear *Xylomelum occidentale*. The Peppermint in particular is patchily distributed. The understorey is variable in density and often low and open, but includes thickets of *Kunzea* sp. in low-lying areas.

The site lies immediately south of the existing sandpit. Farmland to the east separates the site from native vegetation, but native vegetation of similar character lies immediately to the south and west. According to land use zoning maps provided by Martinick Bosch Sell Pty Ltd, the property lies partly within a Special Development Area and between two areas of native vegetation being considered for conservation, scenic protection and reservation.

FAUNA OF THE STUDY AREA

Twenty-two fauna species were recorded during the site visit, including one mammal, 19 birds and two reptiles, although it is expected that a large number of other species also utilise the habitats present in the study area. A complete list of mammal, bird, frog and reptile species that may occur in the area is given in Tables 1 - 3. Species of conservation significance are discussed in each section, and are summarised in Table 4.

Invertebrates

The threatened fauna database managed by the Department of conservation and Land Management includes one invertebrate species, which may occur in the area, the Priority 1 scorpion-fly *Austromerope poultoni*. There is little known about the biology of this species, but it is associated with leaf-litter in forest and appears to be active after rain.

Frogs

No species of frogs were observed during the site inspection but five species are likely to occur within the area on the basis of habitats present (Table 1). At least four other frog species that occur in the region are closely associated with wetlands and would therefore not be present regularly. These are *Crinia georgiana, C. glauerti, C. insignifera* and *Geocrinia leai*. The species that are expected all breed in seasonal wetlands but the terrestrial adults can live up to several kilometres from wetlands (Bush *et al.* 1995, Bamford 1992).

None of the frog species expected to be present is of Conservation Significance at any level as all are widespread in the South-West.

The proposed development will result in loss of habitat for adult frogs. At the Capel Wetlands Centre, frogs have been found to readily use rehabilitated areas even at very early stages (Bamford in prep).

Reptiles

Only two reptile species were observed during the site inspection: the Dwarf Skink and the bobtail. A total of 33 reptile species may be present on the site, however (Table 1). This does not include several species that are closely associated with riparian vegetation around wetlands, such as the Mourning Skink *Egernia luctuosa.*

Reptile species of conservation significance are as follows:

Conservation Significance level 1.

- The South-western Carpet Python *Morelia spilota imbricata* is listed under Schedule 4 of the *WA Wildlife Conservation Act 1950* (Species protected for other reasons). Although known from the general region of the study area, it has never been personally recorded despite extensive field work in the vicinity. Its presence in the study area therefore seems unlikely.

Conservation Significance level 2.

- The Perth Lined Lerista *Lerista lineata* is listed as Rare or Insufficiently Known by Cogger *et al.* (1993) and was formerly included under the WA Wildlife Conservation Act, but recent studies have demonstrated it to be more widespread than previously thought. The study area is, however, at the southern limit of its distribution.

Conservation Significance level 3.

At least four reptile species are of Conservation Significance level 3 (see Table 1). All are close to the southern limit of their distribution in the area but most are widespread otherwise.

The proposed development will result in loss of habitat for reptiles. Reptiles have been found to colonise rehabilitated areas very poorly and open ground acts as a barrier to their dispersal (Bamford in prep).

Avifauna

Doyle (2000) lists over 150 bird species at the Capel Wetlands Centre, but the study area is likely to support only 81 species, of which 21 have been observed (Table 2). The list of expected species excludes the many waterbirds known from wetlands in the region, with the exception of species such as some ducks that nest in tree hollows in woodland close to wetlands. The list also excludes locally extinct species, such as the Emu *Dromaius novaehollandiae*. Species of conservation significance recorded or expected in the project area are as follows:

Conservation Significance level 1.

- Peregrine Falcon (Schedule 4 of the WA Wildlife Conservation Act). Individuals of this species are wide-ranging but the project area is probably within the range of a pair. The species is listed for the general area in CALM's threatened fauna database. Because of the small area involved, impacts would only be significant if there was a nest within the project area. Peregrine Falcons nest on cliffs or in large hollows/broken spouts of large trees, and there appeared to be no suitable nest sites in the project area. Occasionally, they will also use stick-nests built by other birds of prey, and there was a large stick-nest in a Marri in the south of the study area. It is not known what constructed or is currently using this nest.
- Carnaby's Black-Cockatoo (Schedule 1 (Endangered) of the WA Wildlife Conservation Act, and Endangered under the EPBC Act). Although not observed during the site inspection, it is likely to be a regular non-breeding visitor to the area and is listed in CALM's threatened fauna database for the general region. This species feeds on the seeds of eucalypts, banksias, dryandras and hakeas, so there is suitable foraging habitat on the site.
- Baudin's Black-Cockatoo (Schedule 1 (Vulnerable) of the WA Wildlife Conservation Act, and Vulnerable under the EPBC Act). Although not observed during the site inspection, it is likely to be a regular non-breeding visitor to the area and is listed in CALM's threatened fauna database for the general region. It feeds largely on the seeds of eucalypts.

Conservation Significance level 2.

- Barking Owl (south-west population listed as Priority 2 by CALM and is of the southern race, *N. c. connivens*, listed as Near Threatened by Garnett and Crowley 2000). The Barking Owl has not been recorded at the Capel Wetlands Centre but is listed for the general region in CALM's threatened fauna database. It nests in large tree hollows. There did not appear to be any suitable nests sites but the species may visit the project area occasionally.
- Masked Owl (listed as Priority 4 by CALM and as Near Threatened by Garnett and Crowley 2000). As with the Barking Owl, the Masked Owl may occur in the general region of the project area in low numbers, and it is included in CALM's threatened fauna database. It also nests in large tree hollows. There is some anecdotal evidence to suggest that it favours the open tall woodland of Tuart.

Conservation Significance level 3

Many of the birds recorded or expected are woodland species that are currently recognised as being in decline (Robinson and Traill 1996), with some listed as significant in the Perth area (Department of Environmental Protection 2000). However, those listed as of Conservation Significance level 3 (Table 2) are only those that have declined on the coastal plain between Perth and Busselton. Of particular note is the Western Yellow Robin, which is considered to be extinct in the Perth area and for which there are very few records south of Perth. Two pairs were observed during the May 2003 site inspection, and the species has also been observed at Gwindinup and Kemerton (Bamford unpub. data). It appears that this species persists in remnant native vegetation in the Bunbury region in what may be an isolated, relictual population.

Impacts upon birds will result from loss and fragmentation of habitat. The study area is part of a larger area of native vegetation and lies between areas being considered for reservation. Because of their mobile nature, birds may currently move through the study area, so the loss of habitat may affect this movement. Rehabilitation can provide alternative habitat for birds that will allow movement through the area.

No trees containing exceptionally large nest hollows, such as might be used by ducks, the Peregrine Falcon, Barking Owl or Masked Owl, were observed, although such hollows can sometimes be concealed. There were, however, many trees with small hollows suitable for parrots and small species such as pardalotes. As noted above, there was also one large stick-nest in the south of the study area that might be suitable for use by the Peregrine Falcon, although it is more likely to be used by one of the more common birds of prey, such as the Whistling Kite.

Mammals

The only mammal observed during the site inspection was the Western Grey Kangaroo, but a possible drey of the Western Ring-tailed Possum was also observed. A total of 25 mammal species may use the site (Table 3). This does not include regionally extinct species such as the Tammar *Macropus eugenii* and the Woylie *Bettongia penicillata*. Species of conservation significance that are expected in the project area are as follows:

Conservation Significance level 1

- Chuditch (Schedule 1 (Vulnerable) of the WA Wildlife Conservation Act and Vulnerable under the EPBC Act). Chuditch were found to be common at Gwindinup (Bamford unpub. data) and have been reported at Kemerton and Ludlow, so it is likely that the study area is at least regularly visited by the species. It may even be within the territories of several animals. If the species is present, the animals will rely upon hollows for shelter, especially amongst fallen timber.

- Western Ring-tailed Possum (Schedule 1 (Vulnerable) of the WA Wildlife Conservation Act and Vulnerable under the EPBC Act). Locally common in the Bunbury to Busselton region, particularly where Peppermint Trees form a continuous canopy. Although Peppermints were present in the mid-storey of the study area, they did not form a continuous canopy and only a single, probable drey was located. This suggests that Ring-tailed Possums are present only at a low density, and possibly as visitors rather than residents. While the presence/absence of dreys is not always directly correlated with the presence and abundance of the species, in previous surveys in the general region, it has been found that dreys occur at 2-3 times the density of Ring-tailed Possums (M. Bamford unpub. data).

Conservation Significance level 2

- Brush-tailed Phascogale (Listed as Priority 3 by CALM). Very likely to be present in the study area, particularly where tree and understorey density are high.
- Brush Wallaby (Listed as Priority 4 by CALM). Very likely to be present in the study area. Bamford and Bamford (2002) recorded densities of *ca.* 1 wallaby/ha in banksia woodland north of Perth and found individuals to be sedentary. Animals in the study area are therefore likely to be part of a local population that occurs through native vegetation lying to the east and west.
- Quenda (Listed as Priority 4 (conservation dependent) by CALM). Locally common in the region, some evidence of Quendas (diggings) was found in the study area. The habitat was not especially favourable for the species, however, with the understorey generally being too sparse, so these diggings may have been made by individuals passing through the study area while travelling between more favourable sites.
- False Pipistrelle (Listed as Priority 4 by CALM). This species is infrequently recorded but is known from the Kemerton area in Marri/banksia woodland (Bamford unpub. data), so may be present in the study area. As with other small, insectivorous bats in the region, it shelters under loose bark and in tree hollows.

Conservation Significance level 3.

With the exception of most bat species, the majority of native mammals that are not of either Conservation Significance level 1 or 2 can be considered to be of Conservation Significance level 3 (Table 3). This is because of widespread declines in the abundance of most species in the South-West. Species such as the honey Possum are highly mobile and have to move through the landscape in search of seasonal nectar sources.

As with birds, impacts of the development upon mammals will result from loss and fragmentation of habitat. The study area is part of a larger area of native vegetation and lies between areas being considered for reservation. Many mammals occur at low population densities and are very mobile, so the loss of habitat may affect this movement. Rehabilitation can provide alternative habitat for mammals that will allow movement through the area, but many species require hollows and fallen timber for shelter. Such features are not generally available in rehabilitated landscapes.

CONCLUSIONS

The study area is expected to support a rich vertebrate fauna including a number of species of conservation significance (discussed above and summarised in Table 4). The proposed sandpit expansion will adversely impact upon the fauna, including these significant species, through habitat loss, but the impact may extend beyond the boundaries of the study area for some species. This is because for some birds and mammals, the study area is part of a much larger area of native vegetation and lies between two regions that are being considered for reservation. The sandpit expansion may reduce linkage between these large areas and therefore could compromise local populations of some significant species. The most likely species to be present that would be affected in this way would include:
Conservation Significance level 1: The Chuditch.
Conservation Significance level 2: The Brush-tailed Phascogale, Quenda and Brush Wallaby.
Conservation Significance level 3: The Western Yellow Robin, Golden Whistler, Gilbert's Dunnart, Western Pygmy Possum and Honey Possum.

Habitat loss and the reduction of linkage can be managed through adequate rehabilitation after sand extraction. Note that the importance of habitat in the study area will depend upon regional conservation planning. If areas to the east and west are reserved for conservation, the area of habitat in the study area will be of little significance in a local context, since large areas will be protected nearby. However, the role of the study area in providing linkage between these areas will be great. Conversely, if nearby areas are not reserved for conservation, the area of habitat in the study area may be of local significance but its role in providing linkage will be reduced.

TABLE ONE. Frog and reptile species expected to occur in the study area. The source refers to where the record of each species is from as follows:

1. Capel Wetlands Centre (Bamford 1997);
2. Gwindinup (Bamford unpub. data);
3. Ludlow (Bamford unpub. data);
4. Kemerton (Bamford unpub. data);
5. WA Museum database.

Conservation significance refers to the levels described in Methods.

Species		Source	Conservation Significance
FROGS			
Myobatrachidae (ground frogs)			
Moaning Frog	*Heleioporus eyrei*	1, 2, 3, 4, 5	
Pobblebonk	*Limnodynastes dorsalis*	1, 2, 3, 4, 5	
Guenther's Toadlet	*Pseudophryne guentheri*	1, 4, 5	
Hylidae (tree frogs)			
Slender Tree Frog	*Litoria adelaidensis*	1, 4, 5	
Motorbike Frog	*Litoria moorei*	4, 5	
REPTILES			
Chelidae (side-neck tortoises)			
South-West Long-necked Tortoise	*Chelodina oblonga*	1, 3, 4, 5	
Gekkonidae (geckoes)			
Marbled Gecko	*Chrstinus (Phyllodactylus) marmoratus*	1, 3, 5	
Pygopodidae (legless-lizards)			
Sandplain Worm-Lizard	*Aprasia repens*	1, 5	
Burton's Legless-Lizard	*Lialis burtonis*	1, 4, 5	
Common Scaleyfoot	*Pygopus lepidopodus*	5	
Agamidae (dragon lizards)			
Bearded Dragon	*Pogona minor*	1, 2, 4, 5	
Varanidae (monitors or goannas)			
Gould's Sand Goanna	*Varanus gouldii*	1, 3, 4, 5	
Rosenberg's Goanna	*Varanus rosenbergi*	1, 4	
Scincidae (skink lizards)			
	Acritoscincus (Bassiana) trilineatum	1, 4, 5	
Fence Skink	*Cryptoblepharus plagiocephalus*	1, 2, 3, 4, 5	
	Ctenotus australis	4, 5	
	Ctenotus fallens	5	
	Ctenotus impar	1, 2, 4, 5	
	Ctenotus labillardieri	2, 4, 5	
King's Skink	*Egernia kingii*	1, 5	
Salmon-bellied Skink	*Egernia napoleonis*	1, 2, 4, 5	
	Glaphyromorphus gracilipes	5	
Three-toed Skink	*Hemiergis peronii*	1, 2, 3, 5	
	Lerista elegans	1, 3, 4, 5	
	Lerista lineata	5	CS3

Table 1 (cont.).

Species		Comments	
Dwarf Skink	*Menetia greyii*	1, 2, 3, 4, 5	
	Morethia lineoocellata	1, 2, 3, 4, 5	
Bobtail	*Tiliqua rugosa*	1, 2, 3, 4, 5	
Typhlopidae (blind snakes)			
Southern Blind Snake	*Ramphotyphlops australis*	1, 2, 3, 4, 5	
Boidae (pythons)			
South-West Carpet Python	*Morelia spilota imbricata*	5	CS1
Elapidae (front-fanged snakes)			
Crowned Snake	*Drysdalia (Notechis) coronata*	5	
Bardick	*Echiopsis (Notechis) curtus*	5	
Black-naped Snake	*Neelaps bimaculata*	5	
Tiger Snake	*Notechis scutatus*	1, 2, 4, 5	
Dugite	*Pseudonaja affinis*	1, 4, 5	
Jan's Bandy-bandy	*Simoselaps bertholdi*	4, 5	
Gould's Snake	*Parasuta (Rhinoplocephalus) gouldii*	5	
	Parasuta (Rhinoplocephalus) nigriceps	5	
	Number of frog species expected:	5	
	Number of reptile species expected:	33	

TABLE TWO. Bird species expected to occur in the study area, including those observed during the site inspection in May 2003 (*) or in earlier studies (+). The list of species expected to occur in the study area is after Doyle (2000) for the Capel Wetlands Centre, where bird records have been maintained on a weekly basis since 1988. Conservation significance refers to the levels described in Methods. [Int.] indicates introduced species.

Species		May 2003	Conservation Significance
Anatidae (ducks, geese and swans)			
Australian Shelduck	*Tadorna tadornoides*		
Pacific Black Duck	*Anas superciliosus*		
Grey Teal	*Anas gibberifrons*		
Australian Wood Duck	*Chenonetta jubata*		
Ardeidae (herons and egrets)			
White-faced Heron	*Egretta novaehollandiae*		
Accipitridae (kites, hawks and eagles)			
Square-tailed Kite	*Lophoictinia isura*		
Black-shouldered Kite	*Elanus axillaris*		
Whistling Kite	*Haliastur sphenurus*		
Brown Goshawk	*Accipiter fasciatus*		
Collared Sparrowhawk	*Accipiter cirrhocephalus*		
Wedge-tailed Eagle	*Aquila audax*		
Little Eagle	*Hieraaetus morphnoides*		
Falconidae (falcons)			
Peregrine Falcon	*Falco peregrinus*		CS1
Australian Hobby	*Falco longipennis*		
Brown Falcon	*Falco berigora*		
Nankeen Kestrel	*Falco cenchroides*		
Turnicidae (button-quails)			
Painted Button-quail	*Turnix varia*		
Columbidae (pigeons and doves)			
Laughing Turtle-Dove	*Streptopelia senegalensis* [Int.]		
Common Bronzewing	*Phaps chalcoptera*	*	
Crested Pigeon	*Ocyphaps lophotes*		
Cacatuidae (cockatoos)			
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*		CS1
Baudin's Black-Cockatoo	*Calyptorhynchus baudinii*		CS1
Galah	*Cacatua roseicapilla*		
Psittacidae (lorikeets and parrots)			
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*		
Regent Parrot	*Polytelis anthopeplus*		
Red-capped Parrot	*Purpureicephalus spurius*	*	
Western Rosella	*Platycercus icterotis*		
Australian Ringneck	*Barnardius zonarius*	*	
Elegant Parrot	*Neophema elegans*		

Table 2 (cont.)

Species		May 2003	Conservation Significance
Cuculidae (cuckoos)			
Pallid Cuckoo	*Cuculus pallidus*		
Fan-tailed Cuckoo	*Cuculus pyrrhophanus*		
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*		
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*		
Strigidae (hawk-owls)			
Barking Owl (south-west sub-species)	*Ninox connivens connivens*		CS2
Southern Boobook Owl	*Ninox novaeseelandiae*	+	
Tytonidae (barn owls)			
Masked Owl (southern sub-species)	*Tyto novaehollandiae novaehollandiae*		CS2
Barn Owl	*Tyto alba*		
Podargidae (frogmouths)			
Tawny Frogmouth	*Podargus strigoides*		
Halcyonidae (forest kingfishers)			
Laughing Kookaburra	*Dacelo novaeguineae* [Int.]	+	
Sacred Kingfisher	*Todiramphus sanctus*		
Meropidae (bee-eaters)			
Rainbow Bee-eater	*Merops ornatus*		CS1
Maluridae (fairy-wrens)			
Splendid Fairy-wren	*Malurus splendens*	*	
Pardalotidae (pardalotes)			
Spotted Pardalote	*Pardalotus punctatus*	*	CS3
Striated Pardalote	*Pardalotus striatus*		
White-browed Scrubwren	*Sericornis frontalis*	*	
Weebill	*Smicrornis brevirostris*		
Western Gerygone	*Gerygone fusca*	*	+
Inland Thornbill	*Acanthiza apicalis*	*	
Western Thornbill	*Acanthiza inornata*		
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		
Meliphagidae (honeyeaters)			
Red Wattlebird	*Anthochaera carunculata*		
Western Wattlebird	*Anthochaera lunullata*		
White-naped Honeyeater	*Melithreptus lunatus*	*	
Brown Honeyeater	*Lichmera indistincta*		
New Holland Honeyeater	*Phylidonyris novaehollandiae*		
White-cheeked Honeyeater	*Phylidonyris nigra*		
Tawny-crowned Honeyeater	*Phylidonyris melanops*		
Western Spinebill	*Acanthorhynchus superciliosus*		

Table 2 (cont.)

Species		May 2003	Conservation Significance
Petroicidae (Australian robins)			
Scarlet Robin	*Petroica multicolour*	*	
Western Yellow Robin	*Eopsaltria griseogularis*	*	CS3
Neosittidae (sittellas)			
Varied Sittella	*Daphoenositta chrysoptera*		
Pachycephalidae (whistlers)			
Golden Whistler	*Pachycephala pectoralis*	*	CS3
Rufous Whistler	*Pachycephala rufiventris*	*	
Grey Shrike-thrush	*Colluricincla harmonica*	*	
Dicruridae (flycatchers)			
Magpie-lark	*Grallina cyanoleuca*	+	
Restless Flycatcher	*Myiagra inquieta*		CS3
Grey Fantail	*Rhipidura fuliginosa*	*	
Willie Wagtail	*Rhipidura leucophrys*		
Campephagidae (cuckoo-shrikes)			
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		
White-winged Triller	*Lalage sueurii*		
Artamidae (woodswallows)			
Black-faced Woodswallow	*Artamus cinereus*		
Dusky Woodswallow	*Artamus cyanopterus*		
Grey Butcherbird	*Cracticus torquatus*		
Australian Magpie	*Gymnorhina tibicen*	*	
Grey Currawong	*Strepera versicolor*		
Corvidae (ravens and crows)			
Australian Raven	*Corvus coronoides*	*	
Motacillidae (pipits and true wagtails)			
Richard's Pipit	*Anthus novaeseelandiae*		
Hirundinidae (swallows)			
Welcome Swallow	*Hirundo neoxena*	*	
Tree Martin	*Hirundo nigricans*		
Sylviidae (old world warblers)			
Rufous Songlark	*Cincloramphus mathewsi*		
Zosteropidae (white-eyes)			
Silvereye	*Zosterops lateralis*	+	
Number of bird species expected (observed):		81 (21)	

TABLE THREE. Mammal species expected to occur in the study area. The source refers to where the regional record of each species is from as follows:

1. Capel Wetlands Centre (Bamford 1997);
2. Gwindinup (Bamford unpub. data);
3. Ludlow (Bamford unpub. data);
4. Kemerton (Bamford unpub. data);
5. WA Museum database.

Conservation significance refers to the levels described in Methods.
[Int.] indicates introduced species.

Species		Source	Conservation Significance
Tachyglossidae (echidnas)			
Echidna	*Tachyglossus aculeatus*	1, 2, 4	
Dasyuridae			
Chuditch	*Dasyurus geoffroii*	2, 3, 4, 5	CS1
Brush-tailed Phascogale	*Phascogale tapoatafa*	2, 3, 5	CS2
Gilbert's Dunnart	*Sminthopsis gilberti*	2, 5	CS3
Peramelidae (bandicoots)			
Quenda (Southern Brown Bandicoot)	*Isoodon obesulus*	1, 2, 3, 4, 5	CS2
Phalangeridae (possums)			
Brush-tailed Possum	*Trichosurus vulpecula*	1, 2, 3, 4, 5	
Pseudocheiridae (ring-tailed possums)			
Western Ring-tailed Possum	*Pseudocheirus occidentalis*	1, 2, 3, 5	CS1
Burramyidae (pygmy possums)			
Western Pygmy Possum	*Cercartetus concinnus*	2, 3, 5	CS3
Tarsipedidae (honey possum)			
Honey Possum	*Tarsipes rostratus*	2, 4, 5	CS3
Macropodidae (kangaroos and wallabies)			
Western Grey Kangaroo	*Macropus fuliginosus*	1, 2, 3, 4, 5	
Brush or Black-gloved Wallaby	*Macropus irma*	1, 2, 4	CS2
Mollosidae (mastiff bats)			
White-striped Bat	*Nyctinomus australis*	1, 2, 3, 4	
Vespertilionidae (vesper bats)			
Gould's Wattled Bat	*Chalinolobus gouldii*	4, 5	
Chocolate Wattled Bat	*Chalinolobus morio*	5	
	Vespedalus (Eptesicus) regulus	4, 5	
	Falsistrellus mackenziei	4, 5	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	5	
Gould's Long-eared Bat	*Nyctophilus gouldii*	3, 5	
Greater Long-eared Bat	*Nyctophilus timoriensis*	3, 5	

Table 3 (cont.)

Species		Source	Conservation Significance
Muridae (rats and mice)			
House Mouse	*Mus musculus* [Int.]	1, 2, 3, 4, 5	
Moodit or Southern Bush Rat	*Rattus fuscipes*	5	CS3
Black Rat	*Rattus rattus* [Int.]	3, 4, 5	
Leporidae (rabbits and hares)			
Rabbit	*Oryctolagus cuniculus* [Int.]	1, 2, 3, 4	
Canidae (foxes and dogs)			
European Red Fox	*Vulpes vulpes* [Int.]	1, 2, 3, 4, 5	
Felidae (cats)			
Feral Cat	*Felis catus* [Int.]	1, 2, 3, 4, 5	
	Number of species expected:	25	

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Robinson, D. and Traill, B. (1996) Conserving woodland birds in the wheat and sheep belts of Southern Australia. RAOU Conservation Statement No. 10. Royal Australasian Ornithologists Union, Melbourne.

APPENDIX 1 - Categories used in the assessment of conservation status.

Environmental Protection and Biodiversity Conservation Act and the **WA Wildlife Conservation Act** (categories from IUCN, based on review by Mace and Stuart (1994)).

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently Known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

WA Department of Conservation and Land Management Priority species (species not listed under the Conservation Act, but for which there is some concern).

Priority 1. Taxa with few, poorly known populations on threatened lands.

Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring.

APPENDIX 6

Archaeological Survey of Lot 2 and Correspondence with the Department of Indigenous Affairs

ARCHAEOLOGICAL SURVEY FOR PROPOSED SANDPIT ON LOT 2 CALINUP ROAD, GELORUP

NOVEMBER 2000

Prepared for

GIACCI HOLDINGS PTY LTD

By

MARTINICK MCNULTY PTY LTD

4 Cook Street
West Perth WA 6005
Australia

Telephone: (618) 9226 3166
Facsimile: (618) 9226 3177
Email: info@martinick.com.au

Martinick McNulty Pty Ltd

ENVIRONMENTAL + WATER RESOURCE CONSULTANTS

TABLE OF CONTENTS

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1 EXECUTIVE SUMMARY

Giacci Holdings Pty Ltd propose to continue to extract sand from about 21 hectares of open Jarrah-Marri regrowth forest located in the southern portion of Lot 2 Calinup Road, Gelorup. Lot 2 is approximately 12 kilometres south of Bunbury.

An archaeological survey was undertaken in May 2000 by archaeologist, Mr Darren Cooper of Martinick McNulty Pty Ltd to determine the presence of archaeological sites of Aboriginal importance.

No archaeological sites were found within the Project Area and no such sites have been registered with the Aboriginal Affairs Department for Lot 2. In the event that artefacts are exposed during ongoing excavation of sand, the proponent will report these to the Aboriginal Affairs Department in accordance with Sections 15, 17 and 18 of the *Aboriginal Heritage Act 1972 (as amended)*.

2 OBJECTIVES

The objectives of the archaeological survey were to:

- Search for archaeological sites within the Project Area.
- Record any sites and assess their archaeological significance.
- Develop recommendations for the management of such sites if they were found.

3 INTRODUCTION

Giacci Holdings Pty Ltd propose to continue to extract sand from about 21 hectares of Jarrah-Marri forest in the southern portion of Lot 2 Calinup Road, Gelorup and are required by the Environmental Protection Authority to prepare a Public Environmental Review for this expansion of their current operations. Sand reserves in the northern portion of Lot 2 have been extracted since 1978 and much of this area is being rehabilitated.

A review of Lot 2, proposed extension of sand quarrying and a description of the archaeological survey are given in the following sections.

3.1 LOCATION

Lot 2 Calinup Road is located 12 kilometres south of Bunbury and is accessed via Calinup Road which turns off Bussell Highway (Figure 1).

3.2 EXISTING ENVIRONMENT

Lot 2 Calinup Road is 58.7 hectares in area (Figure 2), of which approximately 7 hectares have been cleared for current sand extraction (Plate 1) and 14 hectares have been rehabilitated following previous sand extraction. The remaining 38 hectares are located in the southern portion of Lot 2, and they support mixed Jarrah-Marri regrowth forest with Peppermint and Banksia trees scattered throughout. These 38 hectares were searched for archaeological material.

The terrain of the southern portion of Lot 2 comprises an east facing inland dune with moderately steep to gently undulating slopes. The western boundary of Lot 2 is bounded by a north–south ridge varying in elevation from 35 to 58 metres Australian Height Datum and the eastern boundary adjoins the coastal plain with wetlands. These wetlands are outside of Lot 2 and will not be impacted by the proposed extension of the current sand extraction. There is no surface water within Lot 2.

A prominent hill, Gelorup Hill with an elevation of 58.8 metres Australian Height Datum, is located within the northwestern corner of the survey area (Figure 2). The top of Gelorup Hill will not be affected by the proposed sand extraction.

3.3 LAND OWNERSHIP

Lot 2 Calinup Road is freehold land and is therefore not subject to Native Title claims.

3.4 PROPOSAL TO EXTRACT SAND

The proposed extension of the existing sand extraction will necessitate the clearing of about 21 hectares of native forest. Clearing will be undertaken in excavation blocks, each less than 3 hectares in extent over a period of about 12 to 15 years. The excavation blocks will be rehabilitated progressively and the restored landform will be landscaped for potential future residential use.

4 ARCHAEOLOGICAL SURVEY

4.1 PREVIOUS RESEARCH

On 31 March 2000 a 2 kilometres square area surrounding Lot 2 was searched on the Register of Sites of the Heritage and Culture Division of the Aboriginal Affairs Department. This search determined that in 1978 archaeological Site 4881 was registered about 750 metres to the north of Lot 2 (Appendix A). Site 4881 consists of several quartz flakes on yellow sand near a soccer field to the east of Bussell Highway. No diagram or sketch was provided in the Register to accurately relocate this site.

4.2 METHOD

On 17 May 2000 Mr Darren Cooper (Archaeologist) and Ms Jenny Lazorov (Environmental Scientist) of Martinick McNulty Pty Ltd extensively traversed the Project Area, searching the ground for artefactual material as follows:

- Gelorup Hill and adjacent exposed east facing sand face: traverses at about 15 metre intervals.
- Valley areas and depressions south of Gelorup Hill: traverses at about 25 metre intervals.
- Lowlying areas of Lot 2 in the vicinity of the wetlands east of Lot 2: traverses at about 15 metre intervals.
- Systematic east-west transects at about 40 metre intervals.
- Traverse of property boundaries.

Much of the understorey has been cleared and grazed, and surface visibility ranged from 50% to 80%, depending on the coverage of leaf litter.

4.3 RESULTS

No archaeological sites were found within the Project Area. Three isolated quartz artefacts were located on exposed sand adjacent to Gelorup Hill. These were not considered to be of any significant value and by definition they did not constitute an archaeological site.

No other artefacts were found .

5 CONCLUSION AND MANAGEMENT

No direct management of Aboriginal archaeological sites is required for the proposed extension of the existing sand extraction on Lot 2.

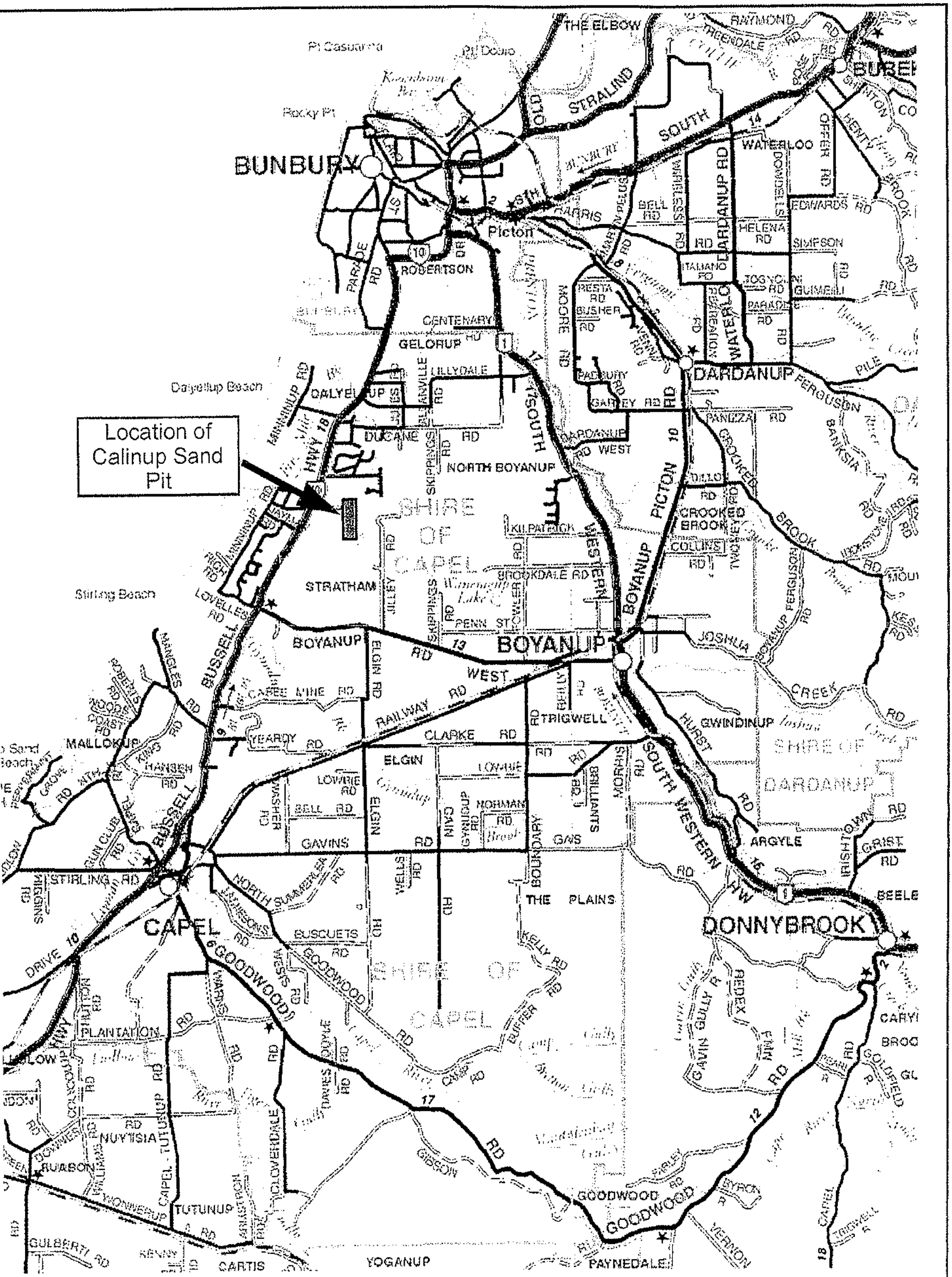
In the event that artefacts are exposed while extracting sand, the operator will immediately cease work within the vicinity of the find and report to Giacci's Operations Director. A suitably qualified person will assess the significance of the artefacts and this will be reported to the Department of Aboriginal Affairs.

6 STUDY TEAM

The following participated in this study:

Dr Wolf Martinick:	Review of report
Mr Darren Cooper (Archaeologist):	Archaeological survey, report preparation
Mr Lance Bosch:	Study co-ordinator, report preparation
Ms Jenny Lazorov:	Search of Register of Sites of the Aboriginal Affairs Department, reporting preparation and collation

FIGURES



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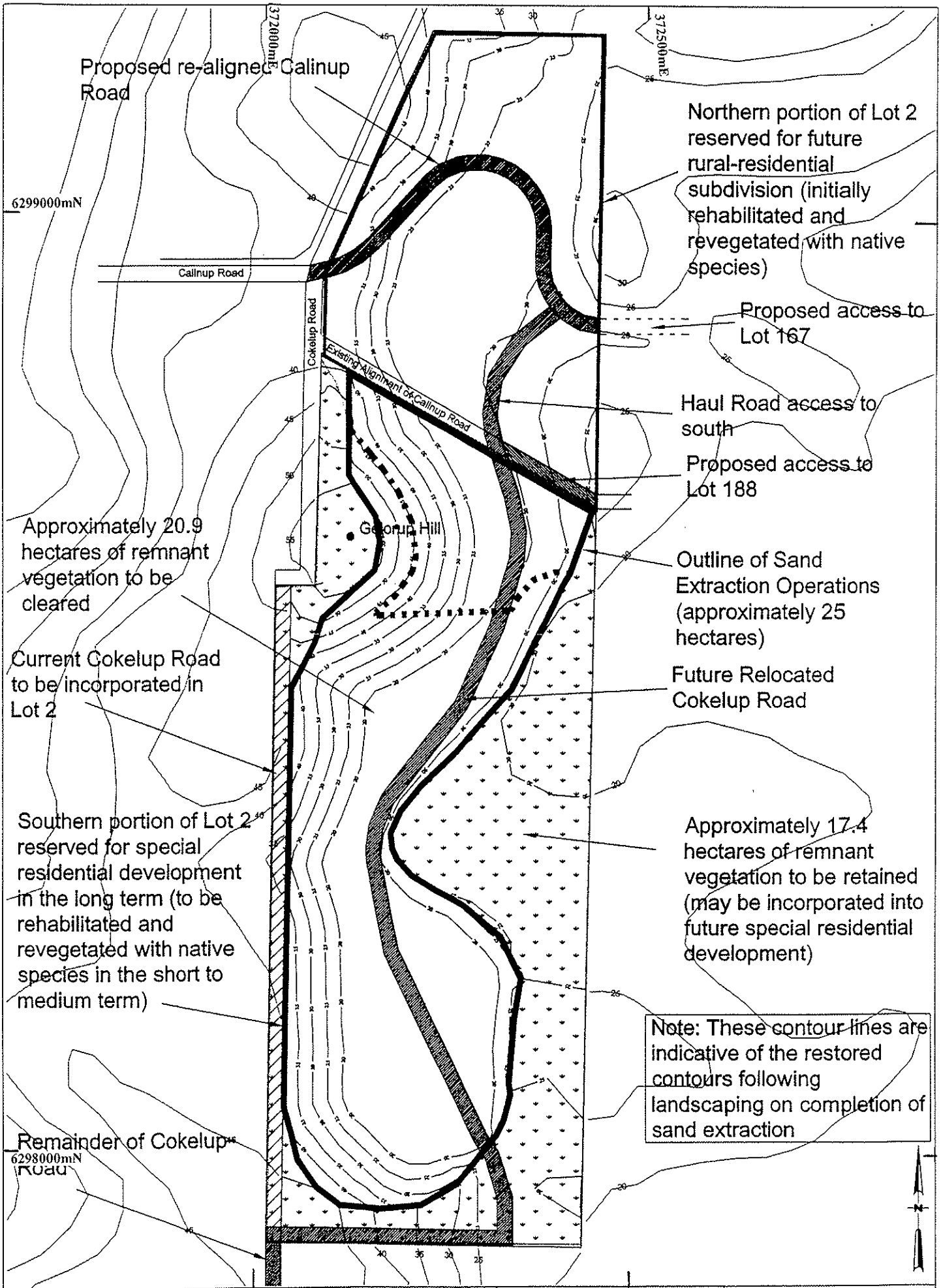
Giacci Bros
Calinup
Sandpit
November 1998

Locality Map

FIGURE 1



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Environmental + Water Resource Consultants

LEGEND

Existing remnant vegetation to be retained

Existing remnant vegetation to be cleared

Scale 1:6500

0m 100m 200m

Drawn by: M. Duffy | Date: 10/11/2000 | Paper Size: A4

GIACCI HOLDINGS Pty Ltd

Lot 2 Calinup Road

Project Area showing Contours and Operational Areas of the Sand Pit

Figure 2

calinupfigure8nov.dwg

PLATES

DOLA Aerial Photo 7 October 1996
Amended to show most recent sand extraction operations.

Scale 1:1000

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Giacci Holdings Pty Ltd
Calinup Road Sandpit
January 1999

AERIAL PHOTOGRAPH

PLATE 1

APPENDIX A

Results from the search of the Register of Sites – 31 March 2000

ABORIGINAL AFFAIRS DEPARTMENT

Register of Aboriginal Sites

RPGSR V1.55

Reference No: AU-RPGSR 8714#

Selection Criteria

Coordinates: Easting: 372000 Northing: 6301000
Easting: 372000 Northing: 6299000
Easting: 373000 Northing: 6299000
Easting: 373000 Northing: 6301000

Legend

Status
I Interim Register
P Permanent Register
S Stored Data

Access
C Closed
O Open
V Vulnerable

Restriction
F Female Access Only
M Male Access Only
N No Gender Restrictions

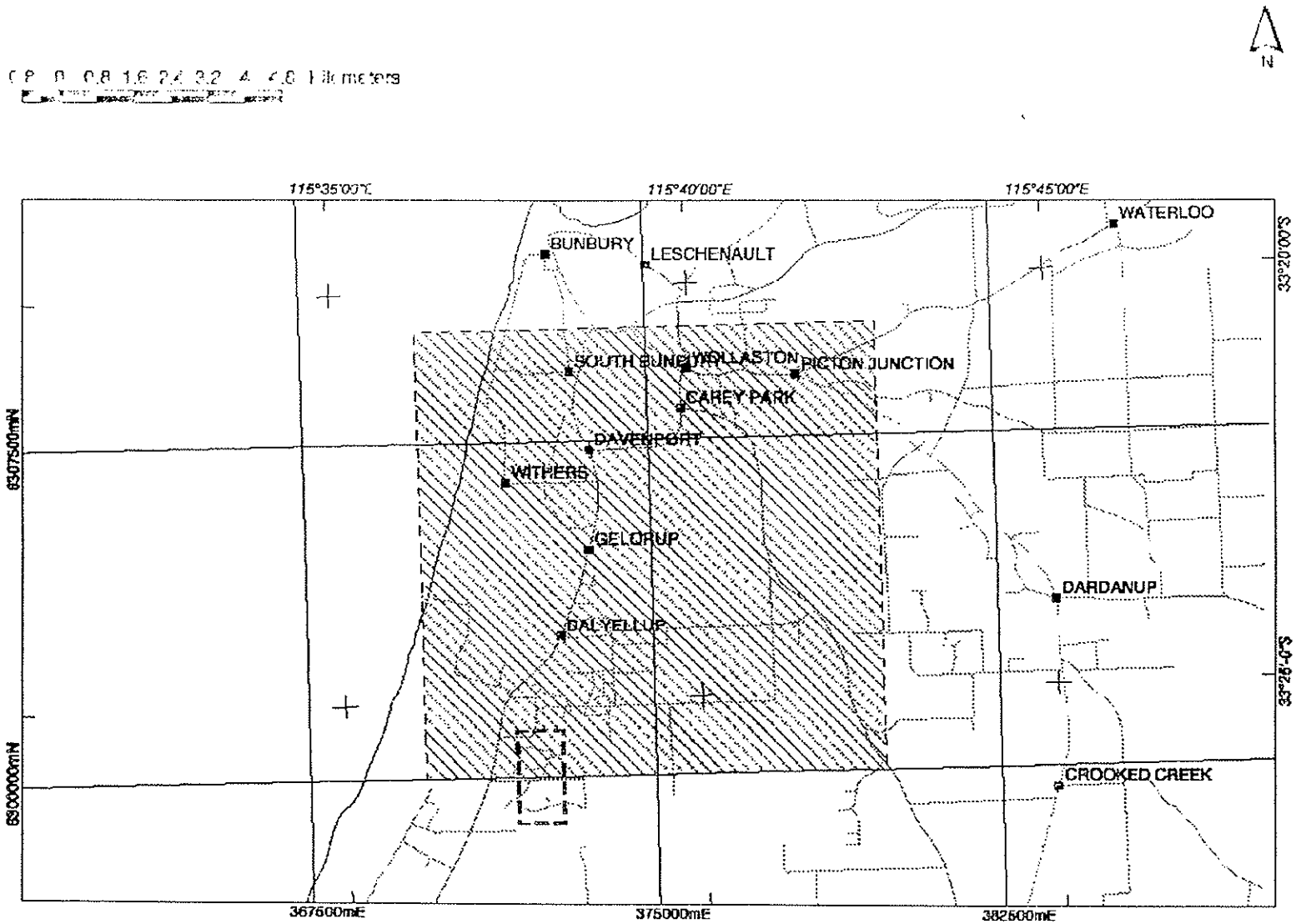
Reliability
R Reliable
U Unreliable

Site Types
C Ceremonial
RP Repository / cache
S Man-Made Structure
T Modified Tree
E Engraving
ART Artefact
HIST Historical
M Mythological
BUR Skeletal material/Burial
F Fish Trap
P Painting
Q Quarry
MD Midden / Scatter
G Grinding patches / grooves

Coordinates(Latitude / Easting & Longitude / Northing) are indicative locations and may not necessarily represent the true centre of sites, especially if access to specific site information is tagged as "Closed" or "Vulnerable". The metric grid on the attached maps is for a specific AMG zone, and does not cater for AMG coordinates for a different AMG zone.

Site Id	Status	Access	Restriction	Latitude/ Easting	Longitude/ Northing	Reliability	Site Type	Site Name	Informants	Site No
4881	I	O	N	33°23'13"S	115°39'22"E	U	ART	No Sites Found within selected [illegible]RY 24		S01764
		AMG Zone	50	375000 mE	6305000 mN					

Site Search Map

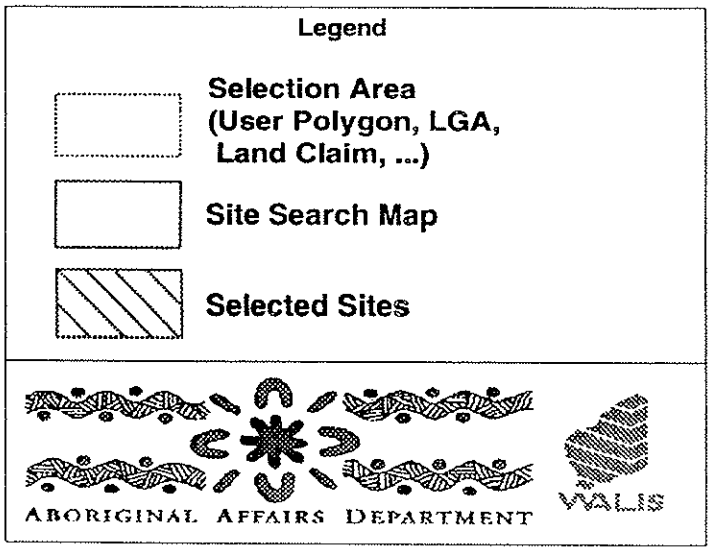


WESTERN AUSTRALIA

Aboriginal Sites Register

Site Search Overview Map

Sites [illegible] to the Register [illegible], or are on the Register and no longer exist. The [illegible] Aboriginal whether they are known to the [illegible] Aboriginal Cultural Material Committee is required to identify any additional sites that may exist.



ABORIGINAL AFFAIRS DEPARTMENT

ALBANY BROOME GERALDTON KALGOORLIE MIDLAND PORT HEDLAND PERTH

ENQUIRIES: Peter Randolph (08) 9235 8100

OUR REF: 97/1022-06 I:\dms\open\pjr\pjr14401.doc

YOUR REF: W:\GIACC\GiaCAL\letfax2000\is0112let.doc

Mr Lance Bosch
Martinick McNulty Pty Ltd
4 Cook Street
WEST PERTH WA 6005

Dear Mr Bosch

Archaeological survey for Lot 2 Calinup Road, Gelorup, Shire of Capel

Thank you for the copy of the report entitled *Archaeological Survey for Proposed Sandpit on Lot 2 Calinup Road, Gelorup.*

The report has now been forwarded to the Aboriginal Affairs Department for accessioning.

Yours sincerely

Peter Randolph
SENIOR POLICY OFFICER - ABORIGINAL HERITAGE & CULTURE
11/01/01

1ST FLOOR 197 ST GEORGES TERRACE, PERTH, WESTERN AUSTRALIA 6000
PO BOX [illegible]0, CLOISTERS SQUARE, PERTH, WESTERN AUSTRALIA 6850 TELEPHONE (08) 9235 8000 FACSIMILE (08) 9235 8088

APPENDIX 7

Public Consultation Details

Lot 166 Calinup Road
Resident Contact List

Name	Address	Contact No.	Method of Consultation	Property	Comments
Helen Wood and John O'Sullivan *	35 Brockway Drive, Gelorup 6232	9795 5711			
Benti Wright *	Lot 4 Brockway Drive, Gelorup 6232	9795 6620			
Esme and Geoff Child *	Lot 27 Manea Drive, Gelorup 6232	9795 7369			
Colin Morton *	Lot 46 Bussell Highway	0417 992 298			Letter returned to sender
Karen and Kim Danis *	21 Brockway Drive, Gelorup 6232	9795 9270			
Tony Pannett *	Lot 26 Manea Drive, Gelorup 6232	9795 5726			
Les Goodfield *	Lot 213 Marri Place, Gelorup 6232	9795 7791			
Alan Saunders *	Lot 201 Marri Place, Gelorup 6232	9795 6564			
Peter Kerr *	Lot 7 Brockway Drive, Gelorup 6232	9795 5285			
Don Scott	RMB 145, Boyanup 6237	9727 2241 (?)			
SK and LS Barnes	120 Mangles Street, Bunbury 6230	9721 6776			

* *Attended residents meeting in March 1999*

Martinick McNulty Pty Ltd

Name	Address	Contact No.	Method of Consultation	Property	Comments
Paul and Tanya Farnsworth +	Lot 33 Manea Drive, Gelorup 6232	9795 6313 (h) 9721 9599 (w) 9791 3312 (f)	Letter Meeting (15/11/00)		• Has no objections. • Positive feedback from residents to Giacci sealing Calinup Road ie dust and noise. • Request that road boundary fencing be reinstated following drainage channels being constructed when Calinup Road sealed.
CJ and Shirley* Penniment	Lot 34 Manea Drive, Gelorup 6232	9795 8876			
Carbone Bros	PO Box 61, Brunswick Junction 6224	9726 1178			
PJ and F Giadresco	Lot 1 Calinup Road, Gelorup 6232	9795 9609			
Diab Engineering	PO Box 92, Capel 6271	?			
DPM Contractors	PO Box 1319, Bunbury 6231	9791 1811			
BW and KD Barker	2 Norma Place, Mandurah 6210	9581 4109			
RE Roberts (Ron)	RMB 118, Stratham 6237	9727 2291	Letter Phone (17/11/00) Meeting (21/11/00)	Lot 186	• Objects to relocation of Cokelup Road as removes direct route to Bunbury for say future sand extraction from Lot 186 and other southern properties, relocated road may be problem if residential development. • Supports sand extraction proposal. • Considers environmental impact not to be of significance.
KS and EN Roberts	RMB -----, Boyanup 6237	9727 2276 (?)			
CA Hudson and IW Jesen	10 Bromley Place, Kingsley 6026	-			

* *Attended residents meeting in March 1999*

\+ *Tanya Farnsworth – representative for residents*

Name	Address	Contact No.	Method of Consultation	Property	Comments
SJ and SM Clemons	6 Miller Street, Bunbury 6230	9721 2157			
Peter and Cheryl Dillon *	167 Woods Road, Gelorup 6230	9795 7070	Letter Phone (20/11/00) Meeting (21/11/00)	Lot 167	Refer to letter.
SJ Hovard and TE Turner	Lot 206 Manea Drive, Gelorup 6232	9795 5696			
TK and KM Smith	PO Box 1083, Bunbury 6231	9795 5124 or 9721 5042			
FK and MJ Jones *	Lot 208 Manea Drive, Gelorup 6232	9795 5893			
PF and CM Liedermoy	PO Box 36, Gelorup 6230	9795 9313			
BJ and WA Roby	37 Wyllie Cres, Busselton 6280	9752 4894 0417 951 213			
TW and BJ Fortescue	35 Eulalia Street, Bunbury 6230	9721 7980			
Jim Smith	PO Box 23 Gelorup 6230	9767 1303	Phone (22/11/00) Letter	Lot 100	**Phone call discussion**: Happy with proposal subject to no development further east. Support the relocation of Calinup as this may assist in future access to Bunbury especially during wet season when roads east become flooded. Possible alternatives to travelling south. Refer to letter.
P and LJ Stott	PO Box 5111, Bunbury 6231	9795 4372 or 9731 8346			

* *Attended residents meeting in March 1999*

Martinick McNulty Pty Ltd
ACN 009 079 309

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23 January 2001

Ms Tanya Farnsworth
Lot 33 Manea Drive
GELORUP WA 6232

Dear Tanya

Re: Proposed Long Term Sand Extraction on Lot 2 Calinup Road

Thank you for your review of the residents information letter (prior to issue) and for meeting with me on 15 November 2000 to discuss the long term extraction of sand from Lot 2 Calinup Road.

Your interest in the proposal and understanding of the issues and your views and suggestions as representative for the residents is appreciated. It is pleasing to hear that you have received positive responses from the residents in respect of the sand extraction operations of Giacci Holdings Pty Ltd and especially in respect of the absence of noise and dust from trucks using Calinup Road which Giacci Holdings Pty Ltd sealed in March 2000.

I have requested Giacci Holdings Pty Ltd to attend to the undercutting of road boundary fencing which was associated with the construction of drainage channels at the time of sealing Calinup Road. The road embankments and fencing will be reinstated by Giacci Holdings Pty Ltd.

I confirm that you do not have any objections to the proposed long term extraction of sand on Lot 2 by Giacci Holdings Pty Ltd.

Should you have any queries please contact me.

Yours faithfully,
Martinick McNulty Pty Ltd

Lance Bosch
Director – Project Management

cc. Giacci Holdings Pty Ltd: Attention: Messrs Mario and Peter Giacci

R.M.B. 118
STRATHAM
6237
17/11/00.

Martinick & McNulty.
ATTN. LANCE BOSCH.

Re Giacci Sand Mine Proposal.

Sir,

With regards to the proposed part closure of Cakelup Rd. I must object on the grounds that Cakelup Rd gives direct access to land holders to the south of Lot 2 from Bunbury. If in the future heavy haulage vehicles had to use the realigned Calinup Rd it would mean travelling through residential areas which would be undesirable especially as rejoining Cakelup Rd would mean ascending a very steep hill which would cause a lot of noise problems.

I have no objections to their mining proposal or E.P.A. objections but I object strongly to part closing Cakelup Rd.

R E Davies.

Martinick McNulty Pty Ltd
ACN 009 079 306

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West Perth WA 6005
Australia

Telephone: (618) 9226 3166
Facsimile: (618) 9226 3177
Email: info@martinick.com.au

23 January 2001

Mr Ron Roberts
RMB 118
STRATHAM WA 6237

Dear Ron

Re: Proposed Long Term Sand Extraction on Lot 2 Calinup Road

Thank you for your letter of 17 November 2000 and meeting with me on 21 November 2000 to discuss the long term extraction of sand from Lot 2 Calinup Road. Your objection and concerns to the relocation of Cokelup Road are noted.

A number of options for the extraction of sand adjacent to the western boundary of Lot 2 (ie. next to Cokelup Road) have been considered. In discussions with the Shire of Capel it was suggested that the relocation of Cokelup Road to within Lot 2 may be an acceptable option for the future residential development of Lot 2 and adjoining properties. Relocating Cokelup Road would also result in the optimum use of sand resources within Lot 2 while minimising vegetation clearing.

An application to relocate Cokelup Road will not form part of this proposal but the potential for its relocation will be discussed in the proposal in order to get approval to clear vegetation for the proposed sand extraction operations. Any future proposal to relocate Cokelup Road will need to conform with more detailed townplanning by the Shire of Capel for future residential developments south of Calinup Road at which time your concerns and suggestions will be considered.

Thank you for your support of the sand extraction proposal and Environmental Protection Authority objectives.

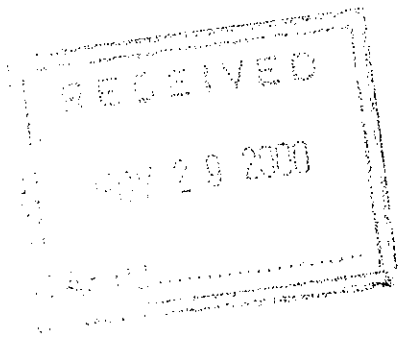
Should you have any queries please contact me.

Yours faithfully,
Martinick McNulty Pty Ltd

Lance Bosch
Director – Project Management

cc. Giacci Holdings Pty Ltd: Attention: Messrs Mario and Peter Giacci
Shire of Capel: Attention: Messrs Glen Bishop and Ian Cocker

29 November, 2000.



Martinick McNulty,
4 Cook St,
West Perth. W.A. 6005.

Dear Mr. Bosch,

I am writing to you on behalf of my husband and I and hope you take this as a submission to Giacci Holdings Pty. Ltd proposal to extend sand extraction operations on Lot 2 Calinup Road.

As residents on our land at Lot 167 for over 34 years, we have seen the project grow from its infancy. It has not always been easy living on the boundary of an operation like this, but it has been something we've dealt with. However we feel that over the years, as the operation has expanded, more and more problems have arissen and never dealt with satisfactorily.

For instance due to mining operations in these early years there was no buffer zone to our fence line, sand extraction has happened to the base of the fence itself, resulting in either
a) sand collapsing in parts, underming the fence (since rectified) or
b) large amounts of yellow sand being windblown onto our property.

This compounded with the lack of "progressive revegetation" that was supposed to occur on a regular basis over the years has only been addressed in a small way in recent time. We feel that the rehabilitated hillsides, where mining has been completed, the slopes have not been reinstated to the required 1:4. We would suggest that it is far steeper than that. I also am concerned that no topsoil has been saved or stockpiled so as to redistribute over the mined area. This leaves a stark yellow sand on the surface, with little or no nutritional value to the regenerated plants.

There have also been problems regarding the fact that Lot 2 is not satisfactorily fenced. This has led to motorcyclists having easy access to the pit, where they are free to ruin much of the revegetation work, which only undoes the good work that goes on. There have been instances where fences have been cut so as motorcyclists can access our property.

As you can see, Giaccis' past record in the sand mining business hasn't been very impressive and it would not be easy to convince us it will change unless strict guidelines and a written agreement is entered into with the Capel Shire.

Points to be addressed-
1) Control of hours of operations; sand migration; noise; revegetation; buffers; fencing.

2) At Giacciss' expense a Conformant Report to be signed by a licenced surveyor and lodged with council for approval every 6 mths.
3) Survey pegs to be in place at all times for workers to work to and from and not to be undermined or pushed out.
4) Giacci to ensure/guarantee that all of the noise, dust and sand migration impacts of the proposed sand extraction will be contained on Lot 2 and there will be no impact on Lot 167.
5) Eastern boundary of Lot 2 (where it adjoins Lot 167) to be revegetated to provide a visual, dust and noise buffer.
6) Giacci to be fully responsible for the relocation and full construction of Calinup Road.
7) Proposed sand extraction to not interfere with the current use of the site - natural bushland and not to interfere with the proposed use of the site - special rural subdivision. This will mean that Giacci needs to provide a buffer on Lot 2 between the sand extraction area and Lot 167. A buffer to the sand extraction should not need to be provided for on Lot 167.

Lastly but not least we definitely don't want Cokelup Road to be relocated closer to our boundary.

Hopefully all our comments and wishes will be met if the licence is extended.

Yours sincerely,

P.& C.A. Dillon.
Lot 167 Jilley Rd,
Gelorup. 6230.

c.c. Shire of Capel.
E.P.A.

Martinick McNulty Pty Ltd
ACN 009 079 305

Environmental + Water Resource Consultants

4 Cook Street
West Perth WA 6005
Australia

Telephone: (618) 9226 3166
Facsimile: (618) 9226 3177
Email: info@martinick.com.au

9 January 2001

Mr P and Mrs C. A. Dillon
Lot 167 Jilley Road
GELORUP WA 6230

Dear Mr and Mrs Dillon

Re: Proposed Long Term Sand Extraction on Lot 2 Calinup Road

Thank you for meeting with me on the 21 November 2000 to discuss the long term extraction of sand from Lot 2 Calinup Road and for your letter of 29 November 2000.

The issues that you have raised have all been identified in the information letter issued by Martinick McNulty to yourself and other residents nearby to Lot 2. These issues will be considered in the proposal to extract sand from the southern portion of Lot 2.

1. Historical problems (associated with the extraction of sand north of Calinup Road)

Paragraphs 3, 4 and 5 of your letter refer to a number of issues associated with past sand extraction operations north of Calinup Road. These include the absence of buffer zones (setback) adjacent to your property boundary, undermining of fence (since rectified), windblown sand, lack of revegetation, steepness of slopes, stockpiling and redistribution of topsoil over reinstated areas and access by motorcyclists to the sandpit.

Giacci have extracted sand since 1978 from the northern portion of Lot 2 which adjoins your property (Lot 167) along the northeastern boundary of Lot 2. Much of the problems which you experienced during these earlier years of operations may be attributed to the absence of extractive conditions and guidelines. A major factor to the lack of progressive revegetation has been the short term nature of the Extractive Industries Licence which has limited forward planning of sand extraction operations within the context of a longer term plan for the entire site. An area of 4.5 hectares within the northern portion of Lot 2 was reinstated and revegetated during 2000 and the remainder will be completed during 2001. Windblown sand due to the absence of a vegetated buffer (in the past) will be reduced and will eventually stop as the vegetation re-establishes.

The batters of slopes under recent and current Extractive Industries Licences require a maximum of 1:4 batters and Giacci will conform to these requirements.

In respect of fencing of Lot 2 and the illegal access via breaks created in the fence by motorcyclists these breaks will be repaired. Giacci is presently seeking legal advice on ways to

address this problem and appropriate measures will be implemented to prevent illegal entry onto Lot 2.

2. Agreements and guidelines for sand extraction operations

The Public Environmental Review process will assess the proposal on the basis of the potential environmental and social impacts of vegetation clearing and sand extraction and conditions will be imposed by the Department of Environmental Protection to manage any adverse environmental impacts which may result from such activities.

3. Specific points raised in your letter

The proposal to extract sand south of Lot 2 will address the points raised in your letter as follows:

Point 1: ***Control of hours of operation, sand migration, noise, revegetation, buffers, fencing***

- Hours of operation – Refer to Item 3.5 of the information letter.
- Sand migration - The minimum setback from adjoining boundaries is 20 metres and adjacent to the eastern boundary a significant area (80 and 250 metres wide) of remnant vegetation will be retained. These measures will effectively mitigate against the migration of sand to the properties east of Lot 2. Refer to Item 3.1b (setback from adjoining boundaries), Item 3.2 (vegetation clearing) and Item 4.4 of the information letter.
- Noise – Refer to Item 4.3 of the information letter.
- Revegetation – Refer to Item 3.3 of the information letter.
- Buffers (setbacks) – Refer to Item 3.1b and the response to sand migration in this letter.
- Fencing – Fencing will be maintained around the boundary of Lot 2. The condition of the fence will be monitored routinely for breaks and repaired.

Point 2: ***At Giacci's expense a Conformant Report to be signed by a licenced surveyor and lodged with council for approval every 6 months***

An annual management report is submitted by Giacci to the Shire of Capel in November of each year. This report includes a contour survey by a licenced surveyor of the areas of sand extraction operations which have occurred since the previous annual report.

Point 3: ***Survey pegs to be in place at all times for workers to work to and from and not be undermined or pushed out***

Sand extraction blocks will be surveyed for vegetation clearing and sand extraction areas pegged to assist the operator. In the event that survey pegs are damaged these will be re-surveyed (if necessary) and reinstated.

Point 4: ***Giacci to ensure/guarantee that all of the noise, dust and sand migration impacts of the proposed sand extraction will be contained on Lot 2 and there will be no impact on Lot 167***

Noise abatement and dust suppression measures will be addressed in the proposal to extract sand (refer to Items 4.3 and 4.4 of the information letter). The extensive buffer of remnant vegetation (80 to 250 metres wide) within the eastern portion of Lot 2 will ensure that no migration of sand occurs to the east of Lot 2. The proposed sand extraction operations will commence at least 200 metres to the south of Lot 167 and operations will advance southwards (at approximately 100 metres per annum) thereby progressively increasing the separation distance between Lot 167 and the active areas of sand extraction. The completed areas of sand extraction will be rehabilitated progressively behind (north of) the active areas.

Point 5: ***Eastern boundary of Lot 2 (where it adjoins Lot 167) to be revegetated to provide a visual, dust and noise buffer***

Revegetation of the areas north of Calinup Road will be completed in accordance with the current Extractive Industries Licence and is not included in the proposal to extract sand south of Calinup Road. The vegetation adjacent to Lot 167 will be inspected and infill planting (where necessary) of native species will be undertaken during 2001.

Point 6: ***Giacci to be fully responsible for the relocation and full construction of Calinup Road***

Giacci will relocate and construct the re-aligned Calinup Road to the same limestone gravel standard as the existing Calinup Road.

Point 7: ***Proposed sand extraction to not interfere with the current use of the site – natural bushland and to not interfere with the proposed use of the site – special rural subdivision. This will mean that Giacci needs to provide a buffer on Lot 2 between the sand extraction area and Lot 167. A buffer to the sand extraction should not need to be provided for on Lot 167***

The proposed sand extraction operations will have a minimum separation distance of 200 metres south of the southernmost limit of Lot 167. This separation distance will increase at approximately 100 metres per annum as operations advance south such that a separation distance in excess of 500 metres will be achieved within 4 years of operation.

Noise will be buffered by concentration of the operations below the ground surface. Dust generation will be minimised as the operations will be sheltered from the prevailing summer southwesterly winds by the ridge which forms the western boundary of Lot 2 and by the extensive remnant vegetation which will be maintained around the western, southern and eastern boundaries of Lot 2.

4. Relocation of Cokelup Road

A number of options for the extraction of sand adjacent to the western boundary of Lot 2 have been considered. In discussions with the Shire of Capel it was suggested that the relocation of Cokelup Road to within Lot 2 may be an acceptable option for the future residential development of Lot 2 and adjoining properties. Relocating Cokelup Road would also result in the optimum use of sand resources within Lot 2 while minimising vegetation clearing.

An application to relocate Cokelup Road will not form part of this proposal but the potential for its relocation will be discussed in the proposal in order to get approval to clear vegetation for the proposed sand extraction operations. A future proposal to relocate Cokelup Road will need to conform with more detailed townplanning by the Shire of Capel for future residential developments south of Calinup Road.

Thank you for your comments and your concerns and suggestions will be considered in formalising the design, operation and management of the sandpit.

Should you have any queries please contact me.

Yours faithfully,
Martinick McNulty Pty Ltd

Lance Bosch
Director – Project Management

cc. Giacci Holdings Limited: Attention: Messrs Mario and Peter Giacci

I-2647

A C N 053 762 504
TRADE WINDS INTERNATIONAL PTY LTD
PO BOX 23
GELORUP
WA 6230

TO:	FROM:
Lance Bosch	James R Smith
COMPANY:	DATE:
Martinick McNulty Pty Ltd	06-12-00
FAX NUMBER:	TOTAL NO. OF PAGES INCLUDING COVER:
08- 9226 3177	1
CC. Capel Shire	

RE:Proposed Long Term Sand Extraction on Lot 2 Calinup Road.

Dear Sir,

With reference to your letter dated 6th November 2000 and our subsequent telephone conversation I would like to bring to you attention several reservations.

Since our conversation I have been to look at the Gracel Operation and have spoken to various people.

I have made the following observations:-

1 That sand has been extracted from outside the permitted area- encroaching on the eastern fence line.
2 Sand has been extracted in some areas to way below the stipulated slope.
3 The attempt at rehabilitation already carried out leaves much to be desired.

In light of the above I have serious concerns that the requirements of this new Sand Extraction license, if issued, will not be adhered to. I am not one to stand in the way of progress as long as it is carried out within the stipulated parameters of the license and with consideration of whom may be affected and consultations with them.

The wetlands in the area have a significant importance in the area. Both to the Flora and Fauna as well as being of great natural beauty in their own right. So any operations carried out should have absolutely no impact on these areas.

Plans have reached an advanced stage now for the building of a house on our property at 100 Jilley Road Gelorup. A shed has already been approved by the shire and has been erected. The positioning of the house has been discussed with the relevant authorities the septic system has already been installed ready for the house. The position of this site is approximately 350 meters from the western boundary of 100 Jilley road which forms a common border with lot 2. It is our concern that the sand extraction may be within the minimum distance required as a buffer between the extraction and any residences. Being so close there is concern for the possibility of noise and dust being a nuisance .An acoustic test should be considered and investigations into the dust problem should be done.

Gelorup Hill is a regional Landmark and its integrity should be protected. It should not be left as an "ex sand mining site" to be seen as it is now from some distance away. The area is paticulary picturesque and unique within the areas of flat Dairy farms.

Signed

For and on behalf of
Trade Winds International Pty Ltd

Martinick McNulty Pty Ltd
ACN 009 079 305

Environmental + Water Resource Consultants

4 Cook Street
West Perth WA 6005
Australia

Telephone: (618) 9226 3166
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Email: info@martinick.com.au

23 January 2001

Tradewinds International Pty Ltd
PO Box 23
GELORUP WA 6230

Attention: Mr James Smith

Dear Jim

Re: Proposed Long Term Sand Extraction on Lot 2 Calinup Road

Thank you for your telephone call on the 22 November 2000 to discuss the long term extraction of sand from Lot 2 Calinup Road and for your facsimile of 6 December 2000.

The issues that you have raised have all been identified in the information letter issued by Martinick McNulty to yourself and other residents nearby to Lot 2. These issues will be considered in the proposal to extract sand from the southern portion of Lot 2.

1. Observations in respect of the Existing Sandpit

The three observations referred to in your letter:

1. *That sand has been extracted from outside the permitted area – encroaching on the eastern fence line.*
2. *Sand has been extracted in some areas to way below the stipulated slope.*
3. *The attempt at rehabilitation already carried out leaves much to be desired.*

These observations relate to the extraction of sand north of Calinup Road and around Gelorup Hill.

Giacci Holdings Pty Ltd have been extracting sand from the northern portion of Lot 2 since 1978. During the earlier years of operation there was an absence of extractive conditions or guidelines and consequently vegetation clearing limits, setbacks and batters of slopes were not defined. More recently the conditions of the Extractive Industries Licence have defined setback, batter of slopes and rehabilitation procedures. The issues you have raised are a result of the earlier sand extraction operations prior to the enforcement of the more recent Extractive Industries Licence conditions.

Another problem has been the short term nature of the Extractive Industries Licence's which have limited forward planning of the sand extraction operations within the context of a longer

term plan for the entire site. This has resulted in the inability to finalise the landforms of the completed areas for long term landuses or to revegetate progressively.

Furthermore under a previous Extractive Industries Licence much of the site was revegetated with bluegums (as a timber plantation landuse) and subsequently the Shire of Capel has requested as a condition of the current Extractive Industries Licence for the entire site to be revegetated with indigenous shrubs and trees. An area of 4.5 hectares within the northern portion of Lot 2 was reinstated and revegetated during 2000 and the remainder will be completed during 2001.

2. Concerns in respect of proposed sand extraction operations

The Public Environmental Review process will assess the proposal on the basis of the potential environmental and social impacts of vegetation clearing and sand extraction and conditions will be imposed by the Department of Environmental Protection to manage any adverse environmental impacts which may result from such activities.

This process includes consulting with affected landowners and stakeholders. Giacci Holdings Pty Ltd will accept the outcome of the Public Environmental Review process and will adhere to the licence conditions that will be established through this process.

3. Wetlands

There will be no adverse impact on the wetlands which are located more than 200 metres east and south of the nearest proposed sand extraction operations. Refer to Item 4.2 of the information letter.

4. Impact on nearby residence on Lot 100

A minimum separation distance of 350 metres will exist between your future residence and the eastern limit of the proposed sand extraction operations and for the most part sand extraction operations will occur between 450 and 600 metres west of your residence. Sand extraction will commence in the north and proceed southwards within Lot 2 such that extraction is programmed to occur west of your residence during the later stages of operation of the sandpit. Sand extraction will occur in maximum 3 hectare excavation blocks over a one to two year period and thereafter the area will be rehabilitated and revegetated during the following wet season.

Noise will be buffered by concentration of the operations below the ground surface. Dust generation will be minimised as the operations will be sheltered from the prevailing summer southwesterly winds by the ridge which forms the western boundary of Lot 2 and by the extensive remnant vegetation which will be maintained around the western, southern and eastern boundaries of Lot 2.

The investigation of the potential impacts of noise and dust caused by the proposed sand extraction operations is a requirement of the Public Environmental Review.

5. Gelorup Hill

The proposed extraction of sand from Gelorup Hill will not reduce the level of the hilltop or adjoining ridge. Most of the excavation will occur within areas of current sand extraction. Slopes will be reinstated to 1:4 batters and revegetated with indigenous trees and shrubs. Refer to Items 3.1(c) and 4.6 of the information letter.

Thank you for your comments and your concerns and suggestions will be considered in formalising the design, operation and management of the sandpit.

Should you have any queries please contact me.

Yours faithfully,
Martinick McNulty Pty Ltd

Lance Bosch
Director – Project Management

cc. Giacci Holdings Pty Ltd: Attention: Messrs Mario and Peter Giacci

Martinick McNulty Pty Ltd
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6 November 2000

To the Residents
Adjoining Lot 2 Calinup Road

Dear Resident

Re: Proposed Long Term Sand Extraction on Lot 2 Calinup Road

Giacci Holdings Pty Ltd is the owner of Lot 2 Calinup Road and is currently licenced to extract sand from the existing cleared areas within the northern portion of Lot 2 and east of Gelorup Hill.

In 1999, Giacci Holdings Pty Ltd applied to the Shire of Capel for an Extractive Industries Licence to extract sand from the southern portion of Lot 2. This application was referred to the Environmental Protection Authority which nominated in November 1999 the preparation of a Public Environmental Review to assess the potential environmental and social impacts of vegetation clearing and sand extraction and to design operations which will minimise and manage any adverse environmental impacts which may result from such operations.

The Public Environmental Review documentation is being prepared by Martinick McNulty in accordance with guidelines set by the Environmental Protection Authority. The following list of issues were identified by the Environmental Protection Authority:

Issue	Proposed Management/Action
The impact of vegetation clearing	Less than 55 % of the existing vegetation on Lot 2 will be cleared. The vegetation is regrowth forest which is common and well represented within the region.
The impact on flora and fauna	Studies by Martinick McNulty have found no declared rare or priority listed flora and the vegetation contains habitats which are common and unlikely to support rare or endangered fauna species.
Finished landform	The area north of Calinup Road Reserve will be restored for rural residential subdivision and the areas south will be restored to allow for potential future residential development. Gelorup Hill will be retained as a regional landmark.
Rehabilitation	Extracted areas will be reinstated with stable slopes and native trees and shrubs will be re-established. Rehabilitation will be undertaken progressively during the life of the operations.
Wetlands	There will be no impact on the wetlands east and south of Lot 2.
Pollution management including dust and noise	These issues are addressed in the design and management of the operations.
Visual amenity	With restoration and the re-establishment of vegetation on the northern portion of Lot 2 and Gelorup Hill and as future sand extraction areas are rehabilitated progressively the operations of Lot 2 will become increasingly less visible from the surroundings.

These factors are addressed in the Public Environmental Review of the proposed extraction of sand from Lot 2.

During a public meeting in March 1999 in the Gelorup Community Centre members of the public raised the following list of issues:

Issue	Proposed Management/Action
Dust and noise from Calinup Road	Giacci sealed Calinup Road in March 2000.
Hours of operation	Giacci to comply with the licenced hours of operation.
Potential impact of land clearing and sand extraction on community and nature	The proposed area of sand extraction has been amended to reduce the area of vegetation clearing from the original 30 hectares to 20.9 hectares thereby retaining a significant portion of remnant vegetation (17.4 hectares) on Lot 2. The potential environmental impact of vegetation clearing on vegetation communities and on flora and fauna is minimal.
Effect on water table	The proposed depth of sand extraction has been reduced to the 20 metre Australian Height Datum level which conforms with the adjoining ground levels and is more than 2 metres above the groundwater table.
Windblown sand onto northern adjoining property	Giacci planted native seedlings along the northeastern property boundary and over the restored areas north of Calinup Road Reserve.
Long term Landuse	A guide plan was prepared for the proposed re-alignment of Calinup Road and future special rural subdivision of the northern portion of Lot 2. Once Council has approved this guide plan then a subdivision application will be lodged with the Western Australian Planning Commission for approval.
Access to Calinup Public Road east of Lot 2	Access will be provided.
General noise from operations	The proposed operations will be managed to ensure that noise is not a public nuisance.
General safety	Warning signs will be displayed on boundary fencing and the entry gate locked outside of operating hours. The face of the working front will be sloped to 1 in 1 bank batters.

Attached to this letter you will find a summary of Giacci Holdings Pty Ltd's current proposal and a plan showing the restored contours of Lot 2 following completion of the proposed sand extraction operations. Please take this opportunity to study the proposal and provide us with your comments by the 22 November 2000. Your comments will be considered in the project proposal.

Should you wish to discuss this proposal or record a potential concern, issue or recommendation you may contact Lance Bosch of Martinick McNulty Pty Ltd on (08) 9226 3166. Written responses are welcomed.

Yours faithfully,
Martinick McNulty Pty Ltd

Lance Bosch

Director – Project Management

SUMMARY OF PROPOSED EXTRACTION OF SAND ON LOT 2 CALINUP ROAD, GELORUP

1. Introduction

Since 1978 Giacci Holdings Pty Ltd have been actively engaged in commercial sand extraction from Lot 2 Calinup Road. The sand is of a high quality and consequently Lot 2 is an important source of sand for concrete production and supplies infrastructure developments throughout the Shire of Capel and adjoining Bunbury-Busselton regions.

Sand extraction operations north of the Calinup Road Reserve are nearing completion and this area will be rehabilitated for future landuse as rural residential. Giacci Holdings Pty Ltd propose to continue to extract sand from the southern portion of Lot 2. This will require the clearing of remnant vegetation south of Gelorup Hill. The Environmental Protection Authority will formally assess this proposal as a Public Environmental Review.

Details of the proposed sand extraction operations and the restored landform of Lot 2 are shown in Figure 1 (attached).

2. Location

Lot 2 Calinup Road is a private property which is situated in the Shire of Capel about 1 kilometre to the east of Bussell Highway, about 12 kilometres south of Bunbury and 13 kilometres to the north of the town of Capel. Access to Lot 2 is via Calinup Road off Bussell Highway.

3. Proposed Sand Extraction Operations

It is proposed to extract approximately 2.2 million bank cubic metres of sand from 25 hectares (of which approximately 4 hectares is already cleared of vegetation) over a period of 12 years at an annual rate of about 180,000 bank cubic metres. Sand will be extracted to a maximum depth of 20 metres Australian Height Datum which conforms with the ground levels of similar landforms of the adjoining eastern properties. It is proposed that sand extraction will continue from east of Gelorup Hill and move progressively southwards in yearly excavation blocks, each less than 3 hectares in extent. Embankments will be reinstated to 1:4 (14°) slopes and the restored landform will be landscaped for potential future residential use.

3.1 Layout and Setback Limits

a) Relocation of a section of Cokelup Road

Subject to town planning approval, it is proposed to relocate a section of Cokelup Road Reserve from the western boundary to within Lot 2. By relocating Cokelup Road the following will be achieved:

- Improved road network for potential future residential development of Lot 2 and adjoining properties.
- Minimise remnant vegetation clearing while maximising sand resources located in the hillsides.

Access to properties currently served by Cokelup Road will still be gained (where required) from the relocated Cokelup Road.

b) Setback from Adjoining Boundaries

Excavation will be limited to a 20 metre setback from the western property boundary and a 40 metre setback from the southern boundary. Giacci propose to maintain remnant vegetation within the eastern portion of Lot 2, thus excavation will vary between 80 metres and 250 metres from the eastern boundary.

c) In the Vicinity of Gelorup Hill

Giacci propose to maintain the crest of the Gelorup Hill intact to preserve the aesthetic values. Sand will be excavated from the eastern and southern hillsides of Gelorup Hill, and will be limited to between 40 and 70 metres from the western boundary.

3.2 Vegetation Clearing

Giacci proposes to progressively clear only 20.9 hectares of the 38.4 hectares of remnant vegetation on Lot 2, or about 54%, for sand extraction purposes. The remnant vegetation which will be retained exceeds the 20% which is recommended by the Department of Agriculture Western Australia and the Department of Environmental Protection to be retained when clearing vegetation.

Vegetation will be retained around the crest of Gelorup Hill and along the ridge forming the western boundary of Lot 2. A significant area of remnant vegetation will be retained within the eastern and southern portions of Lot 2.

Prior to clearing vegetation, all commercial timber will be salvaged.

3.3 Rehabilitation

Rehabilitation will be progressive and take place immediately behind the excavation front of each individual excavation block. Rehabilitation will consist of terrain re-shaping and the re-establishment of native vegetation, particularly trees. The topsoil from the excavation area will be saved and re-spread over surfaces of restored landforms to allow for the establishment of native species from the seedbank in the topsoil. If possible the stripped topsoil from a new excavation block will be spread immediately onto restored surfaces to avoid double handling and avoid stockpiling. Where necessary, seedlings of native trees and shrubs will be planted to supplement the establishment of vegetation from the seedbank in the topsoil.

3.4 Access and Haulage

Sand will be transported from the site in a truck and trailer combination capable of carrying loads of up to 54 tonnes. On average, 15 truck movements are expected per day but this may fluctuate with demand. Most of the sand will be transported to the Bunbury-Capel-Busselton regions via Calinup Road and Bussell Highway. All road signage warning motorists of trucking associated with the sand operations are already installed for the existing operations.

Access within Lot 2 will be via a re-aligned Calinup Road Reserve within the northern portion of Lot 2 and southwards along a future relocated Cokelup Road to the southern portion of Lot 2. Tracks within Lot 2 will be established on a needs basis to meet operational requirements and they will be upgraded as necessary.

3.5 Hours of Operation

Working hours within the sandpit area will be confined to the hours of 7.00 am to 6.00 pm Monday to Friday, and 7.00 am to 12.00 noon Saturday, excluding public holidays. These are the same hours as the existing operations.

4. Environmental Considerations

4.1 Flora and Fauna

Much of the remnant vegetation is regrowth forest and does not support any declared rare or priority listed flora. Cleared areas will be rehabilitated after sand extraction and native vegetation species re-established from the seedbank contained in the topsoil.

The remnant vegetation contains habitats which are common in the region and it does not contain unique or endangered fauna. Consequently, it is unlikely that the vegetation supports any rare or endangered fauna species.

4.2 Surface Water and Drainage

Lot 2 is underlain by free draining sand and does not support any natural drainage systems or wetlands. There is no surface water runoff or erosion. Consequently the proposed sand extraction operations will have no impact on the existing drainage systems of surface water bodies located east of Lot 2.

The proposed operations will finish more than 2 metres above the groundwater level within the southern portion of Lot 2 and should have no adverse impacts on the quality and quantity of the groundwater of Lot 2 or within the adjoining area.

4.3 Noise Abatement Measures

The proposed operations will be managed to ensure that noise is not a public nuisance. Operations will be minimised by locating most of the activities on the floor of the excavations, which for the most part will be surrounded by dense vegetation.

4.4 Dust Suppression

Calinup Road was sealed between Bussell Highway and Lot 2 in March 2000 as part of a commitment by Giacci Holdings Pty Ltd to undertake future sand extraction operations on Lot 2. The sealing of Calinup Road has eliminated the dust problems associated with trucking along this road.

Sand extraction of the northern portion of Lot 2 is nearing completion and landscaping and re-establishment of vegetation with native species will be completed by June 2001. Over time this vegetation will act as a windbreak and reduce wind velocities and turbulence, thus reducing dust generation.

Clearing of vegetated areas ahead of sand extraction will be kept to a minimum and rehabilitation will follow closely behind the excavation front. The nearest sand excavation will be more than 500 metres from any of the existing residences located north of Lot 2 and this separation distance will increase as the operations progress south within Lot 2.

4.5 General Visual Impact Management

Lot 2 is not readily visible from the surrounding areas due to its position in the landscape and the presence of trees on and adjacent to Lot 2. With restoration and revegetation of the northern portion of Lot 2 and Gelorup Hill, and as it is proposed to rehabilitate future sand extraction areas progressively the operations of Lot 2 will become less visible from the surroundings.

4.6 Visual Impact on Gelorup Hill

A landscape assessment using computer imagery modelling has demonstrated that the extraction of sand from the eastern slopes of Gelorup Hill will have no significant long term visual impact on Gelorup Hill because the proposed sand extraction will not affect or lower the crest of the hill or the ridge on which it is located. The hill will remain as a prominent feature in the region.

5. Long Term Landuse of Lot 2

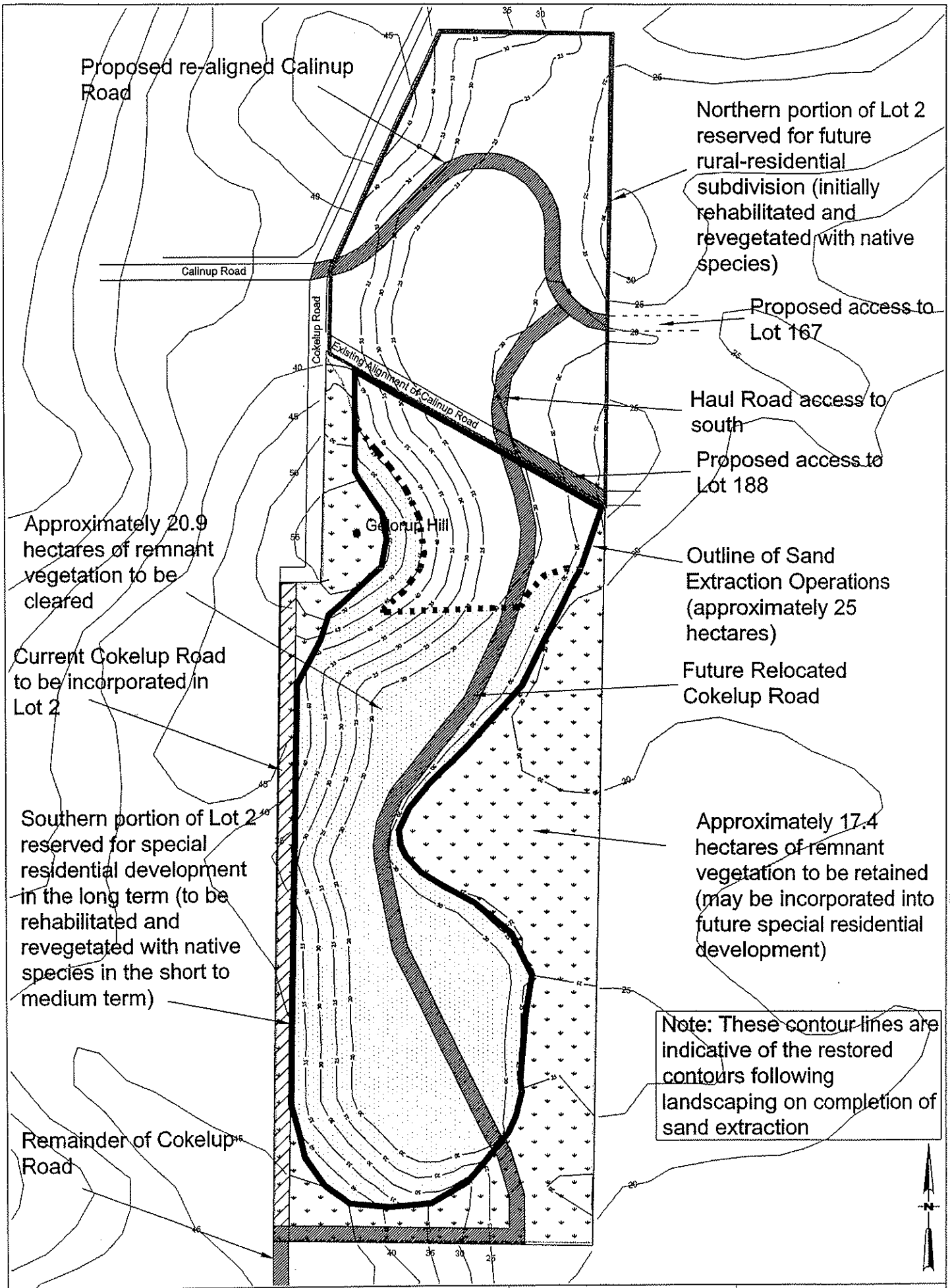
The Greater Bunbury Structure Plan (1995) has identified long term landuses for the continued development of the greater Bunbury area. Lot 2 is shown as a rural residential area north of the existing Calinup Road Reserve and a special development area south of Calinup Road. The lowlying southeastern portion of Lot 2 is shown as rural.

Sand extraction operations have been designed to conform with these town planning initiatives as follows:

- North of existing Calinup Road Reserve – town planning approvals are presently being sought by Giacci Holdings Pty Ltd to re-align Calinup Road and create seven rural residential lots.
- South of the existing Calinup Road Reserve – on completion of the proposed sand extraction operations the restored landform will suit future residential development as identified in the Greater Bunbury Structure Plan for special development areas.
- The lowlying areas adjacent to the southeastern portion of Lot 2 will be maintained with existing remnant vegetation.

For further information please contact:

Mr Lance Bosch of Martinick McNulty Pty Ltd (Environmental Consultants for Giacci Holdings Pty Ltd)
Telephone: (08) 9226 3166 **Facsimile: (08) 9226 3177**



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Environmental + Water Resource Consultants

LEGEND

Existing remnant vegetation to be retained

Existing remnant vegetation to be cleared

0m 100m 200m Scale 1:6500

Drawn by: M. Dufty | Date: 10/11/2000 | Paper Size: A4

GIACCI HOLDINGS Pty Ltd

Lot 2 Calinup Road

Sand Extraction Operations South of Calinup Road and Long Term Land-Use

FIGURE 1

calinupfigure8nov.dwg

Lot 166 Calinup Road
Resident Contact List

Name	Address	Contact No.
Helen Wood and John O'Sullivan *	35 Brockway Drive, Gelorup 6232	9795 5711
Benti Wright *	Lot 4 Brockway Drive, Gelorup 6232	9795 6620
Esme and Geoff Child *	Lot 27 Manea Drive, Gelorup 6232	9795 7369
Colin Morton *	Lot 46 Bussell Highway	0417 992 298
Karen and Kim Danis *	21 Brockway Drive, Gelorup 6232	9795 9270
Tony Pannett *	Lot 26 Manea Drive, Gelorup 6232	9795 5726
Les Goodfield *	Lot 213 Marri Place, Gelorup 6232	9795 7791
Alan Saunders *	Lot 201 Marri Place, Gelorup 6232	9795 6564
Peter Kerr *	Lot 7 Brockway Drive, Gelorup 6232	9795 5285
Don Scott	RMB 145, Boyanup 6237	9727 2241 (?)
SK and LS Barnes	120 Mangles Street, Bunbury 6230	9721 6776
Paul and Tanya Farnsworth +	Lot 33 Manea Drive, Gelorup 6232	9795 6313 (h) 9721 9599 (w) 9791 3312 (f)
CJ and Shirley Penniment*	Lot 34 Manea Drive, Gelorup 6232	9795 8876
Carbone Bros	PO Box 61, Brunswick Junction 6224	9726 1178
PJ and F Giadresco	Lot 1 Calinup Road, Gelorup 6232	9795 9609
Diab Engineering	PO Box 92, Capel 6271	?
DPM Contractors	PO Box 1319, Bunbury 6231	9791 1811
BW and KD Barker	2 Norma Place, Mandurah 6210	9581 4109
RE Roberts (Ron)	RMB 118, Stratham 6237	9727 2291 (?)
KS and EN Roberts	RMB Boyanup 6237	9727 2276 (?)
CA Hudson and IW Jesen	10 Bromley Place, Kingsley 6026	-
SJ and SM Clemons	6 Miller Street, Bunbury 6230	9721 2157
Peter and Cheryl Dillon *	167 Woods Road, Gelorup 6230	9795 7070
SJ Hovard and TE Turner	Lot 206 Manea Drive, Gelorup 6232	9795 5696
TK and KM Smith	PO Box 1083, Bunbury 6231	9795 5124 or 9721 5042 (?)
FK and MJ Jones *	Lot 208 Manea Drive, Gelorup 6232	9795 5893 (?)
PF and CM Liedermoy	PO Box 36, Gelorup 6230	9795 9313
BJ and WA Roby	37 Wyllie Cres, Busselton 6280	9752 4894 0417 951 213
TW and BJ Fortescue	35 Eulalia Street, Bunbury 6230	9721 7980
Jim Smith	PO Box 23 Gelorup 6230	9767 1303 (?)
P and LJ Stott	PO Box 5111, Bunbury 6231	9795 4372 or 9731 8346 (?)

* *Attended residents meeting in March 1999*

\+ *Tanya Farnsworth – representative for residents*

2 February 1998

To Whom It May Concern:

In the interest of the community we would like to address some major concerns we have in regards to the Giacci Holdings Pty Ltd Sandpit situated on Calinup Road, Gelorup.

Firstly the amount of dust that is kicked up by trucks travelling along Calinup Road.

Calinup Road is only sealed as far as Brockway. The rest of the road is a dirt/gravel road.

The Shire of Capel has stipulated that water supplies to houses must be supplied from rainwater tanks. The dust that is being thrown into the air from these trucks is polluting our tanks. Furthermore we are unable to collect rainwater from the roofs of our houses without washing even more dust into our tanks. This is a health risk.

It is virtually impossible to hang clothes on our clotheslines without having them covered in dust. Many residents have now had to go to the inconvenience of being only able to hang out their washing on Sundays.

Due to the pollution caused by these trucks and the fact that Giacci Holdings Pty Ltd do not even make attempts to wet the road down, we feel that Calinup Road should be a sealed road in order to keep the amount of dust from these trucks to a minimum.

We have been led to believe by the Shire of Capel that operation hours for this site are 6:00am till 6:00pm Monday to Saturday excluding Public Holidays. This being the case Giacci Holdings Pty Ltd is operating outside these hours. We have had trucks entering and leaving this site from 5:00am 9:00pm and trucks have been known to operate on Sundays.

In the newspaper the South Western Times on Thursday January 28 1999, there were 2 public notices printed in regards to the Giacci Holdings Pty Ltd sandpit.

The first notice was for a "Notice of Intention to Clear". This is a notice of intention to clear approximately 30 hectares of Jarrah/Marri forrest vegetation for the purpose of sand extraction.

The second notice was for a "Notice of Application for an Extractive Industries Licence" for the continued excavation of the Giacci Holdings Pty Ltd sandpit.

We are concerned at the impact this will have not only on our community but also on the degradation of land and the effect it will have on wildlife within the area.

Since this is a vast amount of land to be cleared we believe that an environmental impact study should be carried out including the effects that this will have on the water table. We would like be advised on the outcome of this study.

As this facility is being managed without regard to the welfare of the community we oppose the continued operation of this facility and we oppose any expansion in regards to this sandpit unless it can be assured that Calinup Road will be completely sealed and operation hours will be kept to a minimum.

Your written response to this matter would be greatly appreciated.

Kirsty Stratford

From: Rachel Siewert [rachel.siewert@conservationwa.asn.au]
Sent: Tuesday, 18 February 2003 10:56 PM
To: kstratford@martinick.com.au
Subject: RE: Meeting on 10th February

Hi Kirsty,

sorry to take so long to get back to you with our comments on your draft - time pressure is my only excuse

Julie has asked that I pass on the following brief comments.

Public Environment Review Southern Extension of Lot 2 Calinup Rd Sandpit

Pg 2 - Rehabilitation

We believe it should be stated that seeds be collected and grown from vegetation on site and also maintained for at least 3 years or until established to a reasonable size (self sustainable).

Seed banks in topsoil or mulch can not be relied on for diversity as many of our seed need animal dispersion and consumption or other methods to grow, this is especially true for the hard to grow species. Also changing the contour of the block will change the preferred conditions for some species to grow. Plants known to exist in this soil type that have been lost to previous activity like logging should be reintroduced to the block preferrable collected from closest vegetation of original type to the area.

Maybe the area can be set aside as building parcels in conjunction with council so that revegetated site is able to regenerate and time is not spent revegetating areas that are going to be cleared for housing at a later date. Future fire control tracks would also need to be created and maintained.

We are concerned that mining within 2.2mtr of the water table could cause problems from contamination in future especially as the Yarragadee is connected all under Southern WA.

Pg 42 - threatened species (Haliaeetus leucogaster) white bellied Sea Eagle likely to occur or likely to use habitat within project area. (Eagles prefer these sheltered dues as nesting and feeding sites where they can glide on the winds also between ocean/lakes)

gards

Rachel

-----Original Message-----
From: Kirsty Stratford [mailto:kstratford@martinick.com.au]
Sent: Friday, 24 January 2003 12:23 PM
To: Rachel Siewert (E-mail)
Cc: "Lance Bosch"@mail.conservationwa.asn.au
Subject: Meeting on 10th February
Importance: High

Rachel

As discussed on the phone earlier this morning please find below information regarding the proposed Southern Extension of Lot 2 Calinup Road Sandpit and associated meeting.

Lot 2 Calinup Road is located approximately 12 kilometres south of Bunbury and 13 kilometres north of Capel. Sand extraction has occurred at Lot 2 since 1978. It is proposed to extend the sand pit to the south. This will involve clearing 20 hectares of vegetation. The proposal was deemed to require formal assessment via the PER process by the EPA.

A draft PER document has now been prepared. We would like to meet with you to provide an overview of the proposal and a copy of the draft PER for your comments.

I confirm that Both Lance Bosch and I can meet with you at 10am on Monday the 10th February at your offices in West Perth.

Should you wish to discuss this prior to our meeting please do not hesitate to contact me on 9226 3166.

Regards Kirsty

Kirsty Stratford
Senior Environmental Scientist
Martinick Bosch Sell Pty Ltd
ph: 08 9226 3166
fax: 08 9226 3177

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18 July 2003

Conservation Council of Western Australia
2 Delhi Street
WEST PERTH WA 6005

Attention: Ms Rachel Siewert

Dear Rachel

Re: Draft No. 2 - Public Environmental Review - Southern Extension of Lot 2, Calinup Road, Sandpit

Thank you for taking the time to review the above referenced document. Responses to comments received by government agencies, organisations and key interest groups have now been formulated and, where appropriate, incorporated into the PER. Please find below a response to your comments on the document.

1. We believe it should be stated that seed be collected and grown from vegetation on site and also be maintained for at least three years or until established to a reasonable size (self sustainable).

Response:
A rehabilitation and closure plan will be prepared that will address these issues. The opportunity for seed collection will be investigated and requirements for vegetation maintenance will be addressed in the rehabilitation and closure plan.

2. Seedbanks in topsoil or mulch cannot be relied on for diversity as many of our seed needs animal dispersion and consumption or other methods to grow, this is especially true for the hard-to-grow species. Also, changing the contour of the block will change the preferred conditions for some species to grow. Plants known to exist in this soil type that have been lost to previous activity like logging should be reintroduced to the block, preferrably collected from closest vegetation of original type to the area.

Reponse:
Topsoil alone may not provide the required vegetation re-establishment results. As stated in sections 1.4.3 and 3.9 and now included in section 6.4.5, where required seedling planting will occur where topsoil alone does not result in the required rehabilitation success. It is not intended to reintroduce species that are not currently found on the site.

3. Maybe the area can be set aside as building parcels in conjunction with council so that re-vegetated site is able to regenerate and time is not spent re-vegetating areas that are going to be cleared for housing at a later date. Future fire control tracks would also need to be created and maintained.

Response:
The Subdivision Guide Plan (Figure 9) provides an indication of what may be achieved in terms of vegetation retention should subdivision be approved in the future. Finished landforms following sand extraction will endeavour at all times to achieve landforms suited to residential development, which would therefore reduce the likelihood of major earthworks and vegetation clearing in the future. However, as future residential development does not form part of this proposal, the rehabilitation cannot be dealt with strategically through the current process.

4. We are concerned that mining within 2.2 metres of the water table could cause problems from contamination in future, especially as the Yarragadee is connected all under Southern WA.

Response:
The Water and Rivers Commission requires that no mining occur within two metres of the water table. Monitoring groundwater levels on site will be done on a regular basis, as stated in Sections 1.8 and 6.3.3 of the document. As stated in sections 3.8.3, 3.8.4 and 6.3, no oils, petrol or lubricants will be stored on site. It is thus considered unlikely that contamination of the water table will occur. Lot 2 Calinup Road is underlain by a superficial aquifer (of stock water quality) and is separated from the Yarragadee aquifer by at least 18 metres depth.

5. Threatened species, *Haliaeetus leucogaster,* White Bellied Sea Eagle likely to occur or likely to use habitat within project area. (Eagles prefer these sheltered dues as nesting and feeding sites where they can glide on the winds also between ocean/lakes).

Response:
The fauna assessment undertaken in May 2003 showed no evidence that the While Bellied Sea Eagle uses the property. As the adjacent wetlands are relatively small and degraded, they are considered unlikely to be used by the White Bellied Sea Eagle. The fauna assessment of the site undertaken by Bamford Consulting Ecologists in May 2003 did not record this species as likely to occur on the site.

Should you wish to discuss any of these issues please do not hesitate to contact either Lance Bosch or myself on (08) 9226 3166.

Yours sincerely
Martinick Bosch Sell Pty Ltd

Kirsty Stratford
Senior Environmental Scientist

Cc: Department of Environment, Attention: - Mr Andrew Mack

GARY NIXON BARRISTER & SOLICITOR
your local legal professional

Our ref: GN:B037

26 February, 2003

Martinick Bosch Sell Pty Ltd

By facsimile only: 9226 3177

Attention: Mr Lance Bosch

Dear Sirs

D PAYNE and I SHIELD – SUBMISSION – PROPOSED SOUTHERN EXTENSION OF SANDPIT ON LOT 2 CALINUP ROAD

We refer to our Mr Gary Nixon's telephone discussion with Mr Bosch on 14 February 2003 concerning this matter. We confirm we represent Messrs David Payne and Ian Shield who own lot 677 Cokalup Road Gelorup and have asked us to make this submission on their behalf.

Our clients do not oppose the proposal by Giacci Holdings Pty Ltd to extract sand, clear vegetation and rehabilitate lot 2, provided those activities do not lead to the relocation of Cokalup Road or interfere with the use of that road by the owners and occupiers of the land abutting it to its west. Our clients are concerned any relocation of the road or loss of the full frontage of their lot to the road will diminish the value of that lot and the potential for them to economically subdivide it.

Please send your response to this letter and all future correspondence including a copy of the Public Environmental Review documentation when it is completed to our clients (care of PO Box 92 Capel 6271) rather than us. That way they will be able to decide to what extent if any they seek our further assistance. Please also include a copy of this letter or acknowledgement of our clients' concerns in the PER documentation.

Yours faithfully

GARY NIXON

This facsimile contains **1** pages including this page.

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7 April 2003

Messrs David Payne and Ian Shield
PO Box 92
CAPEL WA 6271

Dear Sirs

Re: Proposed Southern Extension of Sandpit on Lot 2 Calinup Road

I refer to my discussion of 14 February 2003 with Mr Gary Nixon of Gary Nixon Barrister & Solicitor and to a letter of 26 February 2003 from Gary Nixon Barrister & Solicitor in regard to the PER submission for the proposed southern extension of the sandpit on Lot 2 Calinup Road. I acknowledge that you do not oppose the proposal by Giacci to extract sand, clear vegetation and rehabilitate Lot 2, provided those activities do not lead to the relocation of Cokelup Road or interfere with the use of that road by the owners and occupiers of the land abutting it to its west. Your concerns to the possible future relocation of Cokelup Road are noted.

A number of options for the extraction of sand adjacent to the western boundary of Lot 2 (ie. next to Cokelup Road) have been considered. In discussions with the Shire of Capel it was suggested that the relocation of Cokelup Road to within Lot 2 may be an acceptable option for the future residential development of Lot 2 and adjoining properties. Relocating Cokelup Road would also result in the optimum use of sand resources within Lot 2 while minimising vegetation clearing.

An application to relocate Cokelup Road will not form part of this proposal but the potential for its relocation will be discussed in the proposal in order to get approval to clear vegetation within Lot 2 for the proposed sand extraction operations. Any future proposal to relocate Cokelup Road will need to conform with more detailed townplanning by the Shire of Capel for future residential developments south of Calinup Road at which time your concerns and suggestions will be considered.

Thank you for your response and interest in the proposed sandpit extension. All responses and correspondence in the above regard will be incorporated into the PER documentation, a copy of which will be issued to yourselves.

Should you have any queries please contact me.

Yours sincerely
Martinick Bosch Sell Pty Ltd

Lance Bosch

Department of Environmental Protection
Water and Rivers Commission
Amalgamating to form the Department of
Environment, Water and Catchment Protection

Your ref:
Our ref: SWB1300
Enquiries: Henry Sieradzki
Direct tel: (08)9721 0666

Martinick, Bosch, Sell Pty Ltd
4 Cook St
West Perth WA 6005

Attention: Kirsty Stratford

Re: Draft N° 2 – Public Environmental Review
Southern Extension of Lot 2 Calinup Rd, Sandpit

I refer to the above document provided to the Commission for comment. Our meeting on the 4 February 2003 was a good opportunity to discuss and expand on some of the issues raised with the proposal.

The following comments are provided from our meeting and further review of the document: -

S1.4.2 Vegetation Clearing

Is this statement strictly correct? The DEP guidance relates to each vegetation type within a 15-kilometre radius of the proposal, not just in relation to the amount of clearing on the property.

S3.2.1 Extractive Industries By-Laws and Requirements

Finished slopes of embankments throughout the rest of the PER refer to maximum batter angles of 1:4. Reference to *vary from 1:3 to 1:4* is inconsistent. I recommend that to maintain consistency you only refer to 1:4.

S4.5.2 Groundwater Levels

To maintain a minimum of 2-metre clearance between the likely future maximum water table and the proposed final surface level continued monitoring of groundwater levels is required. These levels should be compared to final surface levels as the project progresses.

S5.2.4 Meeting with Shire of Capel

iii) – Needs to be made explicit that additional sand resources would only be available if the Shire agrees to the land swap AND it fits in with the mining program.

S6.3.1 Groundwater – EPA Objective

WA uses the ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

S6.6.4 Management of Rehabilitation and Mine Closure

Commitment to or commitments to consider mulching of non-forest produce vegetation for use in rehabilitation rather than burning.

South West Region
35-39 McCombe Road, Bunbury, Western Australia 6230
PO Box 261, Bunbury, Western Australia 6231
Telephone (08) 9726 4111 Facsimile (08) 9726 4100
www.environ.wa.gov.au www.wrc.wa.gov.au

The aerial photograph indicates it was flown in 1996. Is there a more recent aerial photograph available?

Any enquires relating to this matter should be referred to David Bills (DEP) or Henry Sieradzki (WRC) on telephone (08) 9726 4111.

Yours sincerely

Henry Sieradzki
Regulation and Licensing
South West Region
24 February 2003

MARTINICK BOSCH SELL PTY LTD
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Email: info@martinick.com.au

18 July 2003

Water and Rivers Commission
PO Box 261
BUNBURY WA 6231

Attention: Mr Henry Sieradzki

Dear Henry

Re: Draft No. 2 - Public Environmental Review -Southern Extension of Lot 2, Calinup Road, Sandpit

Thank you for taking the time to review the above-referenced document. Responses to comments received by government agencies, organisations and key interest groups have now been formulated and, where appropriate, incorporated into the PER. Please find below a response to your comments on the document.

S1.4.2 Vegetation Clearing
Is this statement correct? The DEP guidance relates to each vegetation type within a 15-kilometre radius of the proposal, not just in relation to the amount of clearing on the property.

Response:
The statement "The remnant vegetation that will be retained exceeds the 20% recommended by the Department of Agriculture Western Australia and the 30% recommended by the Department of Environmental Protection to be retained when clearing vegetation" is a summary. This is expanded in the main text of the report in Section 4.6.2, where vegetation within a 15-kilometre radius is discussed.

S3.2.1 Extractive Industries By-Laws and Requirements
Finished slopes of embankments throughout the rest of the PER refer to maximum batter angles of 1:4. Reference to *vary from 1:3 to 1:4* is inconsistent. I recommend that to maintain consistency you only refer to 1:4.

Response:
The By-laws do allow 1:3 slopes, however, it is not proposed to have finished slopes steeper than 1:4. The document has been amended to state that 1:4 slopes will be established.

S4.5.2 Groundwater Levels
To maintain a minimum of two-metre clearance between the likely future maximum water table and the proposed final surface level, continued monitoring of groundwater levels is required. These levels should be compared to final surface levels as the project progresses.

Response:
The proponent will undertake regular monitoring to maintain a minimum separation of two metres. This has been incorporated into Sections 1.8 and 6.3.3 of the document.

S5.2.4 Meeting with Shire of Capel
iii) - Needs to be made explicit that additional sand resources would only be available if the shire agrees to the land swap AND it fits in with the mining program.

Response:
The area within the current Cokelup Road reserve setbacks will be mined if an agreement can be reached for a land swap. This would result in Cokelup Road being relocated in the lower portion of Lot 2 to better suit future residential landuse opportunities. Should Cokelup Road not be relocated, the standard 40-metre setback from a road will apply to extraction.

The proposal is to extract sand to within 20 metres of the eastern boundary of Cokelup Road reserve. This will be achieved either by:

- *Relocating Cokelup Road into the lower portion of Lot 2 and maintaining a 40-metre setback, or*
- *Gaining permission to reduce the extractive setback from the eastern Cokelup Road reserve boundary from 40 metres to 20 metres.*

S6.3.1 Groundwater - EPA Objective
WA uses the ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

Response:
The EPA guidelines for preparation of the PER state that groundwater and surface water quality must be maintained and protected under the draft WA Guidelines for Fresh and Marine Waters (EPA 1993). However, references to the guidelines in the document have been updated to the new ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 on advice from the DEP.

S6.6.4 Management of Rehabilitation and Mine Closure
Commitment to or commitments to consider mulching of non-forest produce vegetation for use in rehabilitation rather than burning.

Response:
Section 6.4.5 states that prior to clearing, as much timber as possible will be salvaged or retained as brush for future rehabilitation. The following comment has now been placed in section 3.4 of the document: "where possible, cleared vegetation will be mulched to minimise the requirement for burning".

General Comment
The aerial photograph indicates it was flown in 1996. Is there a more recent aerial photograph available?

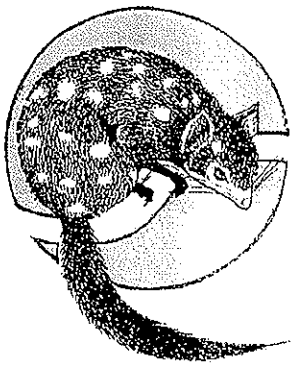
Response:
The most up-to-date aerial photography (flown November 2000) has been acquired from DOLA and will be incorporated into the document.

Should you wish to discuss any of these issues please do not hesitate to contact either Lance Bosch or myself on (08) 9226 3166.

Yours sincerely
Martinick Bosch Sell Pty Ltd

Kirsty Stratford
Senior Environmental Scientist

cc: Department of Environment, Attention: - Mr David Bills
Department of Environment, Attention: - Mr Andrew Mack



SOUTH WEST ENVIRONMENT CENTRE (INC)

'Lotteries House' 101 Victoria Street, BUNBURY WA 6230
PO Box 693, BUNBURY WA 6231 ABN: 38 024 987 507

Phone: 9791 3210 - Fax: 9791 3333
Email: swec@bigpond.com - **Website:** www.users.bigpond.com/swec/

28th February 2003

Martinick, Bosch, Sell
4 Cook Street
WEST PERTH WA 6005

Attention: Lance Bosch, Kirsty Stratford

Re: Draft Public Environmental Review, Southern Extension of Lot 2, Calinup Road Sandpit

Further to our meeting in Bunbury on 4th February 2003, a review of the above document has now been completed.
Although the review will not be produced in full here, as you became aware at our meeting, there were a number of simple but important shortfalls in the document that at a glance were immediately obvious and only served to highlight the urgent priority there is to conserve the bushland of the Swan Coastal Plain.
One of those factors, the outdated aerial photographs (1996), although easily updated, presented an overall misleading picture of the ongoing loss of remnant vegetation in the greater Bunbury Region, as well as demonstrating that the preparation of the PER in this respect had been less than rigorous.
Upon closer perusal, the document also revealed a raft of assumptions and alarming conclusions that disappointingly appear to have been reached more in favour of the proponent than in the spirit of a PER.
The interpretation of desktop data is presented in a misleading fashion. While it is true that 52% of the Karrakatta Vegetation Complex - Central and South may occur in the Greater Bunbury Region, only 30% remains in the southern Swan Coastal Plain. It is also noted, within the document (4.6.1) that the Karrakatta Vegetation Complex - Central and South varies from north to south according to rainfall. Therefore, the argument (1.6.1) that 52% of the Karrakatta Vegetation Complex - Central and South still occurs in the Greater Bunbury Region (and is common) is poor, since the vegetation throughout this vegetation complex varies considerably, catering for a large range of fauna and flora.
The quality of surveying within the document is not of scientific standard and does not adequately attempt to sample for target species. For example, the fauna surveying (4.7.2) stated that only searches were conducted for fauna. There was no mention of trapping for fauna, which is a standard method for sampling vertebrate and invertebrate fauna. Consequently, only nine species were recorded.
The document appears to reflect a throw away attitude where (4.7.3) it is stated "if the Chuditch does occur in lot 2 it is expected only to be in low numbers". If, with regard to specially protected and threatened and priority fauna, the Chuditch did occur in lot 2 then there would be no mining of sand.

The review of the document, apart from specifying numerous examples of laxity in PER standards, highlighted the omission of understanding of the urgency of the need to protect the remnant bushland of the Swan Coastal Plain.
Overall the draft PER failed to acknowledge the big picture vision for bushland and biodiversity in the Greater Bunbury Region. Although it might be argued that this is only 21 hectares to be lost, it is another contribution to "the death by a thousand cuts" of the native bush environment.
I appreciate the time that you may have spent on the document but it is neither acceptable in its preparation nor in its intent to cause the further loss of native bushland on the Swan Coastal plain.
I attach an appendix that may be of interest to the proponent.

Yours faithfully

Brendan Kelly

BRENDAN KELLY
CONVENOR

APPENDIX

The Government has announced its intention to extend existing tax concessions to landholders who enter into conservation covenants with accredited covenanting programs managed by state and local governments. The proposal is reported in a joint media release, dated 20 February 2003, issued by the Minister for the Environment and Heritage, Dr David Kemp, and the Minister for Revenue and Assistant Treasurer, Senator Helen Coonan. The media release is available on the Assistant Treasurer's website at http://assistant.treasurer.gov.au.

The text of the media release is reproduced below.

TAX INCENTIVES FOR CONSERVATION EXTENDED
Landholders interested in managing and conserving their land will now be entitled to tax incentives when entering into voluntary conservation agreements with government agencies.
The Minister for the Environment and Heritage, Dr David Kemp, and the Minister for Revenue and Assistant Treasurer, Senator Helen Coonan, announced the incentive today.
Dr Kemp said the change extends already existing tax incentives and provides financial benefits to landowners who help conserve Australia's environment through entering perpetual conservation covenants.
A conservation covenant is a voluntary agreement entered into between a landowner and an authorised body, such as the Trust for Nature, which sets out

actions to manage and conserve native vegetation.
Previously, tax incentives were not available for conservation covenants entered into with state or local government agencies.
"The incentive was designed to encourage a significantly larger number of people to enter into conservation covenants," Dr Kemp said.
"Conservation covenants are becoming increasingly popular with over 2,000 covenants covering nearly 1 million hectares of land already entered into or currently in the process of negotiation."
Minister for Revenue and Assistant Treasurer Senator Helen Coonan said the change will apply to covenants entered into on or after 1 July 2002.
"We've already removed many of the disincentives to donate land to conservation in order to protect our important environmental sites," Senator Coonan said.
"Today's announcement extends tax incentives to people entering conservation covenants with government agencies, such as state departments of parks and wildlife, where they had previously only applied if entered into with deductible gift recipients.
"It allows people to claim an income tax deduction for any decrease in land value as a result of entering into a qualifying conservation covenant provided the landowner receives no payment for entering into it.
"Capital gains tax provisions continue to apply as if it was a sale or gift of land.
"Land holders play a vitally important role on behalf of all Australians in the conservation of the nation's unique native vegetation and their individual activities deserve to be rewarded."
Qualifying conservation covenants must be approved by, or through a program approved by, the Commonwealth Minister for the Environment and Heritage.
A conservation covenant is registered on a property's land title, formalising the commitment by landholders to put in place conservation activities such as fencing off rare plants, seed collecting and tree planting.
For further information on the Government's conservation initiatives, visit www.ea.gov.au or refer to the attached fact sheet.

Media contacts:
Peter Poggioli (Dr Kemp) - 02 6277 7640 or 0412 970 063
Amanda Kennedy (Senator Coonan) - 02 6277 7360 or 0438 690 305

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18 July 2003

South West Environment Centre
PO Box 693
BUNBURY WA 6231

Attention: Mr Brendan Kelly

Dear Brendan

Re: Draft No. 2 - Public Environmental Review - Southern Extension of Lot 2, Calinup Road, Sandpit

Thank you for taking the time to review the above referenced document. Responses to comments received from government agencies, organisations and key interest groups have now been formulated and, where appropriate, incorporated into the PER. Please find below a response to your comments on the document.

Aerial Photography and Extent of Vegetation
The outdated aerial photographs (1996), although easily updated, presented an overall misleading picture of the ongoing loss of remnant vegetation in the greater Bunbury Region, as well as demonstrating that the preparation of the PER in this respect has been less than rigorous.

Response:
The most up-to-date aerial photography (flown in November 2000) has been acquired from DOLA and incorporated into the document.

The extent of vegetation as shown in Plate 1 (Aerial Photograph) and Figure 16 (Landscape Units) is no different to the 1996 photography, other than some additional clearing associated with sand extraction on adjoining Lot 679.

Within the broader region, as shown in Figure 14 (Vegetation Complexes of the Region), there has been further clearing of the Karrakatta Vegetation Complex associated with the Dallyellup Residential Developed about four kilometres northwest of Lot 2.

Extent of Karrakatta Vegetation Complex
While it is true that 52 per cent of the Karrakatta Vegetation Complex - Central and South may occur in the Greater Bunbury Region, only 30 per cent remains in the southern Swan Coastal Plain. It is also noted, within the document (4.6.1) that the Karrakatta Vegetation Complex - Central and South varies from north to south according to rainfall. Therefore, the argument (1.6.1) that 52 per cent of the Karrakatta Vegetation Complex - Central and South

still occurs in the Greater Bunbury Region (and is common) is poor, since the vegetation throughout this vegetation complex varies considerably and caters for a large range of fauna and flora.

Response:
Percentages for both the Southern Swan Coastal Plain and the Greater Bunbury Region have been included in the document based on the most up-to-date information available (EPA documentation, August 2002). Figures for the Greater Bunbury Region have been used as a subset of the Swan Coastal Plain and reflect the differences in the Karrakatta Vegetation Complex- Central and South, across the Swan Coastal Plain. In addition, the PER provides details of the vegetation distribution within a 15-kilometre radius of the property and the percentage that the proposed clearing constitutes within the Karrakatta vegetation complex within this 15-kilometres radius. The vegetation within this area has more similar values with the vegetation described for the Greater Bunbury Region (52 per cent remaining) than that of the Swan Coastal Plain, of which only 30 per cent remains.

Fauna Surveys
The quality of surveying within the document is not of scientific standard and does not adequately attempt to sample target species. For example, the fauna surveying (4.7.2) stated that only searches were conducted for fauna. There was no mention of trapping for fauna, which is a standard method for sampling vertebrate and invertebrate fauna. Consequently, only nine species were recorded.

Response:
How's (1998) study in Bold Park indicates that trapping does not necessarily provide an accurate indication of what species occur on a site, even after a number of years of trapping. Hence database searches of the Deapartment of Conservation and Land Management, the Western Australian Museum and Environment Australia's Environment Protection and Biodiversity Conservation databases were undertaken to provide information on the species known to occur in the wider area or likely to occur in the area. A second fauna assessment of the site by Mike Bamford has subsequently been undertaken in May 2003 and the results incorporated into the document.

The survey found:

- *Common habitats.*
- *Previously well documented and researched within the region.*
- *22 species of fauna were recorded, one mammal, 19 birds and 2 reptiles.*

Specially Protected and Threatened and Priority Fauna
The document appears to reflect a 'throw-away' attitude where (4.7.3) it is stated "if the Chuditch does occur in Lot 2 it is expected only to be in low numbers". If, with regard to specially protected and threatened and priority fauna, the Chuditch did occur in Lot 2 then there would be no mining of sand.

Response:
The assumption that if the Chuditch occurred on site it would be in low numbers is based on the characteristics of the species (such as home ranges) as outlined by the Department of Conservation and Land Management. The Chuditch has not been recorded on Lot 2 and the Bamford survey (May 2003) suggests that the area may be within the territories of several animals and may be visited by the species.

The PER clarifies that clearing will be progressive, thus providing an opportunity for fauna species to move into either the 18 hectares that will not be cleared or into adjacent vegetated areas.

PER Standards
The review of the document, apart from specifying numerous examples of laxity in PER standards, highlighted the omission of understanding of the urgency of the need to protect the remnant bushland of the Swan Coastal Plain.

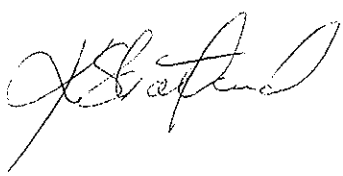
Response:
The document is structured to meet the Environmental Protection Authority (EPA) guidelines set for the PER.

Loss of Native Bushland
Overall the draft PER failed to acknowledge the 'big picture' vision for bushland and biodiversity in the Greater Bunbury Region. Although it might be argued that only 21 hectares is to be lost, it is another contribution to 'the death by a thousand cuts' of the native bush environment. I appreciate the time you may have spent on the document but it is neither acceptable in its preparation nor in its intent to cause the further loss of native bushland on the Swan Coastal plain.

Response:
The PER addresses in appropriate detail the environmental factors and potential impacts that the sand extraction operation and proposed extension will have on the environment and suggests management and mitigation measures. The PER also recognises that Lot 2 has a high potential for residential development in the future. The proposal to extract sand from Lot 2 prior to residential development is considered desirable and responsible because it avoids sterilisation of a diminishing resource within the Greater Bunbury Region. It also reduces the need to clear native vegetation in other areas located further away, which are less likely to be developed in the future. The EPA receives information on all projects in the area and therefore has access to data that enables them to assess such cumulative impacts. The PER process is for the proponent to demonstrate how the proposal can be managed in an environmentally appropriate manner. The issues to be addressed in the PER are set by the EPA. The Greater Bunbury Region Scheme has not identified Lot 2 as an area to be set aside for conservation.

Should you wish to discuss any of these issues please do not hesitate to contact either Lance Bosch or myself on (08) 9226 3166.

Yours sincerely
Martinick Bosch Sell Pty Ltd



Kirsty Stratford
Senior Environmental Scientist

Cc: Department of Environment, Attention: - Mr Andrew Mack

Kirsty Stratford

From: Watson, Andrew [awatson@agric.wa.gov.au]
Sent: Tuesday, 18 March 2003 3:41 PM
To: 'Stratford Kirsty'
Subject: Calinup road Sand pit PER

Kirsty

Further to our recent meeting regarding this proposal, I advise that I have reviewed the draft PER document and conclude that it does not raise issues of concern to the Commissioner of Soil and Land Conservation.

Regards
Andrew

Shire of Capel

OUR REF: EC.6.4.8A
ENQ: Mr Bishop

Kirsty Stratford
Senior Environmental Scientist
Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005

Dear Ms Stratford

RE: PUBLIC ENVIRONMENTAL REVIEW (DRAFT 1) – SOUTHERN EXTENSION OF LOT CALINUP ROAD SANDPIT

I refer to your letter dated 27 November 2002 and the draft review document.

Shire staff have spent some time on considering the draft and have noted some comments that need to be clarified. However as the Shire has now been made aware of an impending change of ownership it is intended that no further consideration of the matter will take place until the future ownership and consequent intentions for the land are resolved.

Yours faithfully

G.E. BISHOP
MANAGER PLANNING AND DEVELOPMENT SERVICES

19 March 2003

RECEIVED
MAR 20 2003
Ans'd

Environmental Protection Authority

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PO Box K822, Perth, Western Australia 6842
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Mr Wolf Martinick
MBS Environmental Pty Ltd
4 Cook Street
WEST PERTH WA 6005

Your Ref
Our Ref 770/99; 185691
Enquiries Andrew Mack (9222 7078)
E-mail: andrew.mack@environ.wa.gov.au

Dear Mr Martinick

PUBLIC ENVIRONMENTAL REVIEW (DRAFT NO.1) – SOUTHERN EXTENSION OF LOT 2 CALINUP ROAD SANDPIT FLORA AND FAUNA IMPLICATIONS

The draft Public Environmental Review (PER) document provided to the Environmental Protection Authority (EPA) Service Unit on 27 November 2002 for comment has now been reviewed by officers from the Ecological Systems Branch with respect to the implications of the proposal for flora and fauna. Comments provided by these officers are attached.

Issues are ordered under the numbered sections in the Public Environmental Review (PER). Overall, the draft PER is lacking in detail and rigour and fails to address the natural values of the area in a regional context. Substantial upgrading of the flora, vegetation and fauna sections of the report is required before it can be recommended for release.

Should you wish to discuss this matter further, please contact Mr Andrew Mack of the EPA Service Unit on 9222 7078 in the first instance.

Yours sincerely

for K J Taylor
DIRECTOR
ENVIRONMENTAL IMPACT ASSESSMENT DIVISION

Monday, 31 March 2003

Enc.

CC. Peter Giacci
Giacci Holdings Pty Ltd
South Western Highway
PICTON JUNCTION WA 6229

4.6 VEGETATION AND FLORA

4.6.1 Regional Vegetation Description

This section is somewhat confusing as illustrated by the following. The report correctly describes Lot 2 as being from the Karrakatta Central and South complex after Heddle *et al.* (1980). However the description given of the complex refers to Beard (1990) who may describe the vegetation of the Karrakatta Sands but he does not refer to complexes. The report has confused the two studies. Some confusion is also evident in reference to the 1994 Gibson *et al.* study. The best available data (DEP 1996, see Table 1) on floristic groups in the area describes two floristic community types from the area of Lot 2. Floristic community types 21a and 21c, which are generally found on Bassendean Dunes, have been identified by this work. The report on Lot 2 correctly infers that floristic community type 21a is expected to occur in the area but describes it as being typical of Spearwood Dunes. The Gibson *et al.* study is also referenced in respect to endemic taxa indicating that the Gibson *et al.* study identifies endemic taxa only from the 'heavy clay and iron enriched' soils of the Plain. This is incorrect, reference is made to the highest incidence of endemic taxa being on the 'heavy clay and iron enriched' soils, not all of the taxa.

Table 1: Floristic Community Types (identified in Gibson *et al.*, 1994, and in the System 6 and Part 1 Update DEP, 1996)

Key
Column 1: Floristic Community Type Codes (Gibson *et al.* (1994)
Column 2: General Description of Floristic Community Types
Descriptions are based on generalised information from all plots in the group. Structural units are categorised into forest, woodlands, shrublands, sedgelands and herblands after Gibson *et al.* (1994).
Column 3: Plots located in immediate vicinity of the study area
Column 4: Average Species Richness per Floristic Community Type
Average species richness per 10m x 10m plot, less those species only occurring in a single plot (single records). Some community types can have a high proportion of single records and these estimates of average species richness are underestimates in some cases.

Supergroup 3 - Uplands, centred on Bassendean Dunes

21a	Central *Banksia attenuata - Eucalyptus marginata* woodlands	gelor02 (west of the Lot 2 from SYS6ENV2 dataset)	52.0
21c	Low lying *Banksia attenuata* woodlands or shrublands	dillo01 (east of Lot from SYS6ENV2dataset)	38.5

4.6.2 Regional Vegetation Coverage

This section begins with reference to the Environmental Protection Authority (2002), *A Strategy for the EPA to Identify Regionally Significant Natural Areas in its Consideration of the Greater Bunbury Region Scheme Portion of the Swan Coastal Plain.* However the treatment of this PER does not adequately address the following three regional issues raised in EPA (2002):

(i) Representation of ecological communities ie

For the Greater Bunbury Region (except for lands identified in the 'GBR Constrained Area' in Map 2 and described below) this means the objective is to seek to:

- retain at least 30% of the pre-clearing extent of the ecological communities in the GBR, where >30% of an ecological community remains on the Swan Coastal Plain
- preferentially locate developments in cleared areas, where 30% or <30% of the pre-clearing extent of the ecological community remains on the Swan Coastal Plain.

Lot 2 is not in the constrained area and is on the Karrakatta Central and South complex which is currently cleared to 30% on the Swan Coastal Plain. That is further clearing is inconsistent with this objective.

(ii) Specific reference to the Gelorup Hill (bold underlined in quote below)

- *Undulating Spearwood Dunes*

  The most southern of the massive limestone ridges associated with the Spearwood Dunes occurs in Yalgorup National Park, north of the GBR. The Spearwood Dunes of the GBR are characterised by low relief generally forming extensive flats to the west and bounded to the east by dunes of slightly higher relief that merge into the Bassendean Sands. **The higher eastern dunes are found from Myalup to Gelorup, south of Gelorup only the low dunes remain.** The Spearwood Dunes are vegetated with *Banksia* woodlands and some of the most intact Tuart woodlands on the Plain.

  Previously identified areas (see Map 2)

  System 6: Part C56 – McLarty Management Priority Area, C54 -Yalgorup National Park, C57 - Myalup Management Priority Area and C61 – Lake Preston (Crampton Nature Reserve); C63 – Myalup Swamp and Mialla Lagoon, C71 - Dalyellup Reserves

  System 1: part 1.1.2 - Tuart Forest Reserve (extend beyond GBR)

(iii) Specific reference to the 'regionally significant sequences of ecological communities' or regional ecological linkages of which the Lot 2 is part (bold underlined in quote below).

- *Regionally significant sequences of ecological communities within and between the major landform elements*

  Two types of linked (or potentially linked) sequences of communities can be distinguished.

  Vegetated sequences

  Four predominantly vegetated sequences are evident, being: Riverdale Road Transect; Kemerton Buffer Link; Ocean to Preston River Park and the Dalyellup/Gelorup/Preston River/Plateau Link. It should be appreciated that these sequences have significant north/south components.

  Previously identified areas (see Map 2)

  Riverdale Road Transect: C57 - Myalup MP Area;

  Kemerton Buffer Link: C63 – Mialla Lagoon

  Ocean to Preston River Park: C70 - The Maidens, **Manea Park**

  Dalyellup/Gelorup/Preston River/Plateau: C71, C 86 - Dardanup Management Priority Area.

  River Corridors

  The Brunswick, Collie, Wellesley, **Preston** and Capel Rivers (and their tributaries) of the GBR form natural corridors between the coast and the Darling/Blackwood Plateaus, these are heavily cleared but significant natural areas are associated with each of these

  Previously identified areas (see Map 2)

  System 6: C67 - Brunswick, Collie and Wellesley Rivers

4.6.2.1 Reserves and Department of Conservation and Land Management Estate
See point (iii) above which places Lot 2 in relation to C71 and C 86 as part of a regional ecological linkage. The other reserves are all associated with Quindalup Dunes, outside the regional ecological linkage of which Lot 2 is part.

4.6.3 Vegetation and Flora of Lot 2
The flora survey is just adequate (see Appendix 3 of the report) in describing a diversity of species for a diversity of vegetation units on Lot 2. However, the information is limited in its ability to be compared with other information on the Plain as it used 'unbounded transects of 30m', "health ratings' and "Life form density classes'. These are not standard sampling procedures and/or terminology for the Plain and they are not described to aid in doing a comparison. In addition there is no indication of the time spent on the survey or what information was gained in February and what in October (a much more suitable time for survey on the SCP). As a consequence the specific values of Lot 2 are not adequately related to other Spearwood Dune areas either locally or broadly on the Plain.

4.6.4 Rare and Priority Listed Flora
This section is somewhat limited; it should be expanded to consider flora generally and consider significant flora, not just ' Rare and Priority Listed Flora'. Other priority species possible in the area are: *Jacksonia sparsa* and *Lasiopetalum membranaceum.*

4.6.7 Evaluation of Vegetation on Lot 2
As outlined above this is limited by the form of the information collected. To place Lot 2 regionally according to its natural values, this section needs to consider the following:

- Gelorup Hill
    - variation in the vegetation from north to south, condition vegetation, adjacent vegetation (especially the conservation category wetland – Cokelup Swamp to the west) and EPP lakes to east
    - regional values of Gelorup Hill;
- specific values of Lot 2 in Dalyellup/Gelorup/Preston River/Plateau Ecological Linkage; and
- representation of Karrakatta Central and South complex on the Swan Coastal Plain.

4.7 FAUNA

4.7.1 Regional Fauna
This section is inadequate to assess the regional significance of the site for fauna. Significant regional references including

How, R.A., Dell, J. and Humphreys, W.F. (1987). The ground vertebrate fauna of coastal areas between Busselton and Albany, Western Australia. *Records Western Australian Museum* 13: 553-574.

Storr, G.M. and Johnstone, R.E. (1988). Birds of the Swan Coastal Plain. *Records of the Western Australian Museum* Suppl. No. 28.

have not been included and there is no assessment of the species likely to occur in the habitats of the site.

4.7.2 Fauna Survey

No specialised survey was conducted to determine the fauna present on the site. The 6 bird species, 1 native mammal and 1 reptile species recorded are unlikely to be a true indication of the vertebrate fauna present. The habitats present on the site and depicted in Plates 2-10 are likely to have many more species than indicated in the limited survey described.

4.7.3 Specially Protected (Threatened) and Priority Fauna

There has not been an adequate survey to determine the likely presence of these species. Some of the information presented especially that on Chuditch and Western Ringtail Possum gives no references or data source.

Despite the heading of this section there is no consideration of Priority fauna. For example, Appendix 5 includes 9 Priority species (e.g. Quenda, Western Brush Wallaby, Western False Pipistrelle, Brush-tailed Phascogale, Water Rat, Black Bittern, Little Bittern, Forest Red-tailed Black Cockatoo, Masked Owl, that are not considered in this section.

Appendix 5

The standard of the species lists included here is extremely poor.

The list of mammals includes 5 families and 7 species of marine mammals. These have no relevance in an assessment of a terrestrial site. The list fails to include any of the small dasyurid mammals.

The list of amphibians and reptiles includes duplication of at least 6 species under different names. The list also includes sea snakes which have no relevance in an assessment of a terrestrial site.

The list of birds includes duplication of at least 3 species under different names and includes an eastern Australian species (Pied Currawong)

The alphabetical sequence of family names in all the groups included in this appendix is confusing. This list should follow accepted taxonomic sequences and the nomenclature should follow current usage, e,g. the current Western Australian Museum checklist of State vertebrate species.

Conclusions on Fauna Assessment

The sections in the draft PER detailing fauna assessment are inadequate and not of a sufficient standard for acceptance as a public document. The fauna survey does not

adequately address the assessment guidelines presented in the Draft Specific Guidelines for the Preparation of the Public Environmental Review. The baseline survey is inadequate to identify the existing fauna in the study area and is inadequate to determine the effects of the proposal on the fauna.

REFERENCES

Department of Environmental Protection 1996 System 6 and part System 1 Update Program. Unpublished bushland plot and area records and analysis.

Environmental Protection Authority 2002 *A Strategy for the EPA to Identify Regionally Significant Natural Areas in its Consideration of the Greater Bunbury Region Scheme Portion of the Swan Coastal Plain.* Unpublished report September 2002.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H., and Lyons, M.N. 1994 *A Floristic Survey of the Southern Swan Coastal Plain.* Unpublished report for the Australian Heritage Commission, prepared by the Department of Conservation and Land Management and the Conservation Council of W.A. (Inc.).

Government of Western Australia 1998a *Perth's Bushplan Vol. 1.* Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia 1998b *Perth's Bushplan Vol. 2A, B and C.* Department of Environmental Protection, Perth, Western Australia.

How, R.A., Dell, J. and Humphreys, W.F. 1987. The ground vertebrate fauna of coastal areas between Busselton and Albany, Western Australia. *Records Western Australian Museum* 13: 553-574.

Storr, G.M. and Johnstone, R.E. 1988. Birds of the Swan Coastal Plain. *Records of the Western Australian Museum* Suppl. No. 28.

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18 July 2003

Department of Environment
Level 9 Westralia Square
141 St Georges Terrace
PERTH WA 6000

Attention: Mr Andrew Mack

Dear Andrew

Re: PER -Southern Extension of Lot 2 Calinup Road Sandpit, Flora and Fauna Implications

Please find attached a copy of our response to the Flora and Fauna comments provided by the Department of Environmental Protection in a letter dated 31 March 2003 on the draft Calinup PER. Our response is based on issues discussed during our meeting on 7 April 2003. The PER document is expected to be finalised within the next month and will be forwarded to you at that stage for approval to advertise.

Should you have any queries regarding our responses please do not hesitate to contact either Lance Bosch or myself on (08) 9226 3166.

Yours sincerely
Martinick Bosch Sell Pty Ltd

Kirsty Stratford
Senior Environmental Officer

Issues discussed at Meeting with DEP on 7/4/2003 regarding the Draft Calinup Road PER submitted on 27/11/2002.

Each comment from the DEP's letter dated 31/3/2003 was discussed as follows and with the following outcomes:

4.6.1 Regional Vegetation Description
DEP comments that there is confusion regarding a number of reports referred to in this section. These have now been rectified by:

a) Inserting a description of Karrakatta Complex - Central and South.

b) Changing Paragraph 3 to read "Beard (1990) recognised that the vegetation of the Karrakatta sands (rather than Karrakatta vegetation)..."

c) Changing reference to Community Type 21a to state that Community Group 21a is centred on, but not exclusive to, Bassendean Dunes. There are also significant occurrences on the Pinjarra Plain and the Spearwood Dune Systems. Gibson et al (1994) shows that Community Type 21a is common to the Bassendean Central and South Vegetation Complex, as well as the Karrakatta Central and South Vegetation Complex.

d) Change statement by adding "the highest incidence" of endemic taxa to the Swan Coastal Plain occur on the heavy clay and iron enriched soils of the footslopes on the eastern edge of the plain.

NOTE: Both the DEP library and Ms Bridgett Hyde-Griffith of the DEP were contacted regarding the document DEP 1996 "System 6 and Part System 1 Update Program". Unpublished bushland plot and area records and analysis, which was referred to in the DEP Letter of 31/03/2003. This document was not available and hence has not been referred to in the PER document.

4.6.2 Regional Vegetation Coverage
The DEP refers to the document "A Strategy for the EPA to Identify Regionally Significant Natural Areas in its Consideration of the Greater Bunbury Region Scheme Portion of the Swan Coastal Plain" and states that the PER does not adequately address regional issues.

The status of this document was discussed along with the intent of comments made in a DEP Letter of 31/03/2003 with regard to the document. The following items were discussed as being adequate to address these comments.

The DEP commented on the percentage of vegetation to remain on the property and within the vegetation complex and how it correlates to the EPA objective to retain 30 per cent and to establish developments within cleared areas.

a) The following statement has been added to Section 4.6.2 after paragraph 1. "14,729 hectares of the Karrakatta Vegetation Complex - Central and South remains on the Swan Coastal Plain. This proposal requires the clearing of 20 hectares. This equates to 0.14 per cent of the remaining Karrakatta Vegetation Complex - Central and South."

b) Highlight that the proponent has made a commitment to rehabilitate the area. The loss of Karrakatta Vegetation Complex - Central and South is therefore a temporary one, as stated in sections 1.4.3, 1.7, 1.8, 3.9, 6.4, 6.5 6.6, 8 and 9 of the PER. That is, will return to 30 per cent.

c) Highlight Section 2.7 of the PER (Justification and Purpose). This section of the PER states that the resource available per hectare of clearing results in a productive sandpit and minimises the need to clear extensive areas of vegetation. The idea that the development should occur in an area already cleared is not feasible in this instance because extraction needs to occur in areas where the resource exists and is of appropriate quality.

DEP states that the value of Gelorup Hill needs to be included in the PER.

a) The landscape value of Gelorup Hill has been mentioned in sections 1.6.5, 1.8, 4.6.7 and 4.6.8, and the management and mitigation of impacts addressed in section 7.1. A reference to these sections will be made in the regional vegetation section.

DEP states that regional ecological links need to be discussed in the PER.

a) The setbacks section of the PER briefly discusses the vegetation that will be retained and how this will help maintain a link between the wetlands to the east and west (through vegetation being retained on the eastern portion and the southern portion of the property). This will be highlighted in the vegetation sections.

4.6.2.1 Reserves and Department of Conservation and Land Management Estate
DEP suggests that ecological links should also be mentioned in this section.

a) The PER briefly discusses the vegetation that will be retained and how this will help maintain a link between the wetlands to the east (through vegetation being retained on the eastern portion and the southern portion of the property) and to the west. This has been mentioned in the setbacks section of the PER. It will also be referred to in the reserves section.

4.6.3 Vegetation and Flora of Lot 2
DEP questions the methodology used and the time spent on each survey.

a) Mark Jeffries of the DEP initially advised that the method used (the Muir method) was recommended because this was the approach used for the Kemerton Study. Section 4.6.3.1 will be updated to reflect what was undertaken in each survey.

4.6.4 Rare and Priority Listed Flora
DEP suggests that this section should cover flora generally, not just rare and priority flora. Also suggests two other species likely to occur.

a) General flora issues will be covered in the Vegetation and Flora section (4.6.3). *Podocarpus drouynianus* occurs on site near its most northern limit. This has been discussed in section 4.6.7 but will also be incorporated into the section on rare and priority flora. The two species suggested by the DEP will be included in the rare and priority flora section, although it will be noted that these were not listed as a result of database searches.

4.6.7 Evaluation of Vegetation on Lot 2
The DEP has suggested that this section needs to incorporate more regional information, including Cokelup swamp and wetlands to the east as well as Gelorup Hill, and refer to the Karrakatta Vegetation Complex.

a) This section has been updated to include more information on the clearing and condition of adjoining land, the condition of surrounding EPP wetlands and Gelorup Hill. As discussed at our meeting on 7 April 2003, some of this information is not available due to the adjoining properties being privately owned.

4.7.1 Regional Fauna

DEP suggests that more information is required to assess regional significance.

a) Additional database searches were conducted in May 2003. Observations made on fauna in the field were supplemented by bird, reptile and mammal records from a number of sites in the general region. These include records from the Capel Wetlands Centre and Capel Nature Reserve, Ludlow Tuart Forest, Gwindinup and from the Kemerton area. In addition, several published reports on fauna in the general area, including How et al (1987) and Storr and Johnstone (1985), were used as references.

4.7.2 Fauna Survey

DEP suggests that the survey conducted is of limited value.

a) A fauna survey was undertaken by Mike Bamford of Bamford Consulting Ecologists in May 2003. The findings from this survey have been incorporated into the PER document.

4.7.3 Specially Protected (Threatened) and Priority Fauna

DEP suggests that there has not been adequate consideration of priority fauna.

a) An assessment of priority fauna was included in the fauna assessment conducted in May 2003. The results have been incorporated into the PER document.

Appendix 5

DEP suggests that the species list is extremely poor.

a) A revised species list based on the outcomes of the fauna survey and assessment conducted in May 2003 has been developed.

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18 July 2003

Department of Conservation and Land Management
Corner Dodson & South West Highway
BUNBURY WA 6005

Attention: Mr Peter Hanley

Dear Peter

Re: Draft No. 2 - Public Environmental Review - Southern Extension of Lot 2, Calinup Road, Sandpit

Thank you for taking the time to review the above referenced document. Responses to comments received from government agencies, organisations and key interest groups have now been formulated and, where appropriate, incorporated into the PER. Please find below a response to your comments on the document.

Visual/Landscape Assessment
1. Further clarification regarding the seen areas and from what point the seen area is taken is required in the Landscape analysis section (ie what are the viewing points).

Response:
The seen area is described in section 7.1 and computer-generated views are also provided. The seen area is analysed from a line taken from the north-eastern corner and a line due east of the property. Three distance zones are discussed:

- *Foreground (0-500m)*
- *Midground (0.5 - 5km)*
- *Background (5-10km)*

The computer-generated views are taken from points at distances greater than five kilometres from the property in a due east direction and in a northeast direction from the north-eastern corner of the property. Specific locations are not provided.

Future Residential Subdivision and Vegetation Retention
2. No subdivision plan provided in his copy of the report. No statement of what vegetation will be left after subdivision.

Response:
Figure 9 shows a diagrammatic representation of potential long-term use. It indicates that a large portion of the vegetation retained during the sand mining proposal may also be retained

during any potential future residential development that may take place on the property. While future landuse options are provided in Appendix 2, a subdivision plan is not incorporated because this proposal only covers sand extraction. Any future residential development will be submitted for assessment as a separate project.

A Subdivision Guide Plan (Figure 9) has been prepared in consultation with town planning consultant TME and the Shire of Capel. The Subdivision Guide Plan has been prepared to demonstrate to the local council that sequential use of the land has been considered, not to gain approval for subdivision through this current process.

Gelorup Hill
Stating that Gelorup Hill will remain is an error as the contour plan for extraction appears to go into the crown of the hill, therefore the hill will be removed. This landscape feature is important to the community and should be retained - therefore excavation in the vicinity of Gelorup Hill should be reduced.

Response:
The batter of the eastern slopes will typically increase from 1-in-8 to 1-in-4 gradient and will be reinstated to a stable, vegetated landform. It is recognised that Gelorup Hill is considered an important landscape feature and therefore extraction will occur only on the eastern slopes.

Should residential development occur in the future, it is shown in Appendix 2 and Figure 9 that Gelorup Hill may be developed by creating a landform with gentler slopes. This would involve earthworks on the upper eastern slopes and crest of Gelorup Hill. Any future residential development involving Gelorup Hill would be the subject of a separate proposal and assessment.

Cokelup Road
The document assumes that Cokelup Road reserve will be closed and realigned but does not provide a clear indication of what setback limits will be retained and how extraction will be managed if this does not occur.

Response:
Section 3.2 provides the setbacks for the proposed extractive operation. The area within the current Cokelup Road reserve setbacks will be mined if agreement can be reached for a land swap. This would result in Cokelup Road being relocated in the lower portion of Lot 2 to better suit future residential landuse opportunities. Should Cokelup Road not be relocated, the standard 40-metre setback from a road will apply to extraction.

The proposal is to extract sand to within 20 metres of the eastern boundary of Cokelup Road reserve. This will be achieved either by:

- *Relocating Cokelup Road into the lower portion of Lot 2 and maintaining a 40-metre setback, or*
- *Gaining permission to reduce the extractive setback from the eastern Cokelup Road reserve boundary from 40 metres to 20 metres.*

Vegetation Corridor
No real mention of investigating potential to retain an east-west corridor of vegetation to link into the wetlands to the east of the property.

Response:
The wetlands to the east of the property have been modified to varying degrees and vegetation around them has been cleared extensively. Substantial vegetation will be retained along the eastern and southern boundaries of the property, maintaining a link between the wetlands and the vegetation to the south and west of the property.

The setbacks section of the PER briefly discusses the vegetation that will be retained and how this will help maintain a link between the wetlands to the east and west (through vegetation being retained on the eastern portion and the southern portion of the property). This will be referred to in the reserves section.

Should you wish to discuss any of these issues please do not hesitate to contact either Lance Bosch or myself on (08) 9226 3166.

Yours sincerely
Martinick Bosch Sell Pty Ltd

Kirsty Stratford
Senior Environmental Scientist

Cc: Department of Environment, Attention: - Mr Andrew Mack

APPENDIX 8

Estimated Greenhouse Gas Emissions

ESTIMATED GREENHOUSE GAS EMISSIONS FROM THE PROPOSED CLEARING OF VEGETATION, EXTRACTION OF SAND AND PROGRESSIVE REHABILITATION OF LOT 2 CALINUP RD, GELORUP

1. BACKGROUND

Greenhouse gases are gases that contribute to the increase in surface temperature of the earth and include carbon monoxide, water vapour, methane, nitrous oxide and ozone (Department of Environmental Protection, 1998). Global greenhouse gas concentrations have been increasing as a result of worldwide human activities and have caused the global climate to change. As part of Australia's reporting obligations under the United Nations Framework Convention on Climate Change and also under the National Greenhouse Strategy, a National Greenhouse Gas Inventory Committee was established to oversee the development of inventory methods and compilation of inventories (NGGIC, 1998a).

Using the methods developed by the National Greenhouse Gas Inventory Committee it was possible to estimate the emission of greenhouse gases from the clearing of vegetation and the use of mobile equipment for the proposed sand extraction operations at Lot 2 Calinup Road, Gelorup.

The following two methodology workbooks were used to estimate greenhouse gas emissions recommended by the Department of Environment:

- Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks, Landuse Change and Forestry, *Workbook for Carbon Dioxide from the Biosphere.* National Greenhouse Gas Inventory Committee, Workbook 4.2 with Supplements 1998, Canberra.
- Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks, Energy, *Workbook for Fuel Combustion Activities (Stationary Sources),* National Greenhouse Gas Inventory Committee. Workbook 1.1 with Supplements 1998, Canberra.

The following sections describe the methodologies that were used to estimate greenhouse gas emissions.

2. CARBON DIOXIDE EMISSIONS FROM VEGETATION CLEARING

2.1 INTRODUCTION

The *Workbook for Carbon Dioxide from the Biosphere 4.2* focuses on the emissions and removals of carbon dioxide (CO_2) as a result of human activities. The activity which has particular significance to Australia and is applicable to the proposed sand extraction on Lot 2 is the clearing of native vegetation. Although the methodology described in this workbook

utilises the most recent information, there still remains large uncertainties in estimation methods (NGGIC, 1998a).

The rate of release of carbon after forest clearing can be evaluated by allocating the amount of carbon released into three distinct carbon pools that have different release rates for CO_2. These carbon pools are (NGGIC, 1998a):

- Immediate release of carbon from onsite and offsite burning of cleared vegetation.
- Delayed release of carbon from onsite decay-averaging the effects over 10 years up to and including the year of clearing.
- Long-term release of soil carbon-averaging effects over 20 years up to and including the year of clearing.

Fundamental assumptions of the methodology given by the National Greenhouse Gas Inventory Committee include:

- *The flux (number of molecules moving) of CO_2 to (or from) the atmosphere is equal to the decrease (or increase) in the carbon stocks (number of atoms of carbon) in existing biomass and soils.*
- *Changes in carbon stocks can be estimated by first establishing rates of change in landuse and then applying simple assumptions about biological response to a given landuse change.*

Prior to estimating the three carbon pools and CO_2 release rates the following items need to be determined and taken into consideration:

- The forest class that best represents the native vegetation occurring on Lot 2 Calinup Road as specified by the methodology.
- Clearing and rehabilitation schedule for Lot 2 Calinup Road.
- Aboveground biomass on Lot 2 Calinup Road before and after clearing.

2.2 CLASSIFICATION OF FOREST CLASS

The methodology specifies three different forest classes, which are derived from the Australian Surveying and Land Information Group (AUSLIG) (1990). AUSLIG identified four foliage cover classes and three growth form classes for all forests and woodlands in Australia from digitised data following the Carnahan (1976) method of vegetation classification which is based on height and growth form of plants. For the Greenhouse Gas Inventory, AUSLIG nominated three forest and woodland classes to represent the Carnahan forest categories as shown in Table 1.

Table 1
Forest and Woodland Classes nominated by AUSLIG (1990)

AUSLIG Forest Class	Carnahan Forest Category	Growth Form	Foliage cover class
Tropical and temperate closed forest			
	Closed forest	Medium hight, 10-30m	>70% cover
	Low closed forest	Low height, <10m	>70% cover
	Tall open forest	Tall height, >30m	30-70% cover
Open forest			
	Open forest	Medium height, 10-30m	30-70% cover
	Low open forest	Low height, <10m	30-70% cover
Woodland and scrub			
	Woodland	Medium height, 10-30m	10-30% cover
	Low woodland	Low hight, <10m	10-30% cover

Vegetation on Lot 2 is considered to be *woodland and scrub* type forest class having 10-30 percent foliage cover. The *woodland and scrub* category is described by AUSLIG as being suitable for grazing and having no timber value except collection of fuel wood. The vegetation survey of Lot 2 undertaken in February 1999 indicates that much of the vegetation on Lot 2 consists of open woodlands having a tree cover of 2-10 percent with only one Landscape Unit having a tree cover of 10-30 percent. For this reason the *woodland and scrub* category is considered to best represent the vegetation on Lot 2 Calinup Road.

2.3 CLEARING SCHEDULE FOR LOT 2 CALINUP ROAD

Approximately 20 hectares of native vegetation is to be cleared on Lot 2 Calinup Road. This area will be cleared in two-hectare working blocks over a period of approximately 10 years. Prior to clearing, as much timber as possible will be salvaged and some shrubbery will be mulched for rehabilitation purposes. This will reduce the amount of vegetation that requires burning and the consequent release of CO_2 to the atmosphere.

For the purposes of estimating carbon fluxes from vegetation clearing, the following assumptions are made:

- 35 percent of vegetation will be salvaged.
- 10 percent of vegetation will be mulched or kept as brush for rehabilitation purposes.
- 55 percent of vegetation will be burnt onsite.
- No vegetation will be burnt offsite.

2.4 ESTIMATING ABOVEGROUND BIOMASS BEFORE AND AFTER CLEARING

2.4.1 Aboveground Biomass before Clearing

To estimate the fluxes of carbon from vegetation clearing it is necessary to first estimate the amount of carbon present in the existing aboveground biomass. The estimated values of aboveground biomass as given in Workbook 4.2 are:

Table 2
Aboveground Biomass Carbon in Three Forest Classes – National Averages for 1990

Forest Class i	Forest Biomass before clearing B_{bi} (t dm/ha)	Carbon Content C_b (t C/t dm)	Biomass Carbon $B_{bi}C_b$ (t C/ha)
Tropical and temperate closed forest	226	0.5	113
Open forest	80	0.5	40
Woodland and scrub	42	0.5	21

Considering that 35 percent of vegetation from Lot 2 will be salvaged, the forest biomass before clearing (B_{bi}) would be reduced by 35 percent. Therefore, woodland and scrub vegetation for Lot 2 will have a reduced forest biomass (B_{bi}) from 42 to 27.3 tonnes dry matter per hectare that will be subject to CO_2 release.

For Lot 2 Calinup Road the following parameters are applicable:

- Forest biomass before clearing (B_{bi}): 27.3 tonnes dry matter per hectare (t dm/ha)
- Carbon Content (C_b): 0.5 tonnes of carbon per tonne of dry matter (t C/t dm)
- Biomass Carbon ($B_{bi}C_b$): 13.65 tonnes of carbon per hectare (t C/ha)

2.4.2 Aboveground Biomass After Clearing

If there is regrowth of woody vegetation following burning, regrowth has been assumed to be linear with return to the original biomass, B_{bi}, after 25 years (NGGIC, 1998a). It is assumed that the growth of planted seedlings and seeds following rehabilitation of working blocks will be similar to the rate of regrowth of vegetation following burning. It is assumed that biomass increases at a rate of four percent of its original biomass per year (NGGIC, 1998a). The natural regrowth of forest following burning is considered to take up much less CO_2 than already established seedlings that will be planted for rehabilitation. Consequently, the use of the suggested rate of biomass increase will result in an underestimate of CO_2 uptake.

Taking into consideration that vegetation clearing will be undertaken in two-hectare blocks together with progressive rehabilitation, it is estimated that aboveground biomass carbon after clearing, for the life of the project will be as follows:

Table 3
Estimation of Total Aboveground Biomass After Clearing

Year of Project	Amount of Vegetation Cleared (ha)		Aboveground Biomass			Remaining Average Aboveground Biomass (t/C)	
	Annually	Cumulative	Removed (t C)	Regrown (t C)	Net Annual Gain (+) Net Annual Loss (-) (t C)	Per hectare	Over 20 hectares
0	0	0	0	0	0	13.65*	273.00
1	1	1	13.65	0	13.65	12.29	245.80
2	1	2	13.65	0.55	13.10	12.31	246.20
3	1	3	13.65	1.09	12.56	11.68	233.60
4	1	4	13.65	1.64	12.01	11.08	221.60
5	1	5	13.65	2.18	11.47	10.51	210.20
6	1	6	13.65	2.73	10.92	9.96	199.20
7	1	7	13.62	3.28	10.37	9.45	189.00
8	1	8	13.65	3.82	9.83	8.95	179.00
9	1	9	13.65	4.37	9.28	8.49	169.80
10	1	10	13.65	4.91	8.74	8.05	161.00
11	1	11	13.65	5.46	8.19	7.64	152.80
12	1	12	13.65	6.01	7.64	7.26	145.20
13	1	13	13.65	6.55	7.10	6.91	138.20
14	1	14	13.65	7.10	6.55	6.58	131.60
15	1	15	13.65	7.64	6.01	6.28	125.60
16	1	16	13.65	8.19	5.46	6.01	120.20
17	1	17	13.65	8.74	4.91	5.76	115.20
18	1	18	13.65	9.28	4.37	5.54	110.80
19	1	19	13.65	9.83	3.82	5.35	107.00
20	1	20	13.65	10.37	3.28	5.19	103.80
21	0	20	0	10.92	10.92	5.73	114.60

** Tonnes of biomass carbon (B_hC_h) per hectare before clearing*

The aboveground biomass produced from regrowth for Lot 2 varies for each year and for this reason it is difficult to estimate an annual rate. Consequently, the value of total aboveground biomass from regrowth for the life of the project is calculated below rather than an annual rate as described in the workbook.

Total aboveground biomass from regrowth following the rehabilitation of Block 20 (F_{Ri}) is 114.60 tonnes of carbon. The mass of CO_2 taken up from regrowth (J_R) can be calculated using the molecular weight of CO_2 (44 $gmol^{-1}$) to the atomic weight of carbon (12 $gmol^{-1}$):

Lot 2 Calinup Road

J_R = 114.60 x 44/12

= 420.20 t CO_2

From the progressive rehabilitation of all 20 working blocks the regrowth of native vegetation on each block will result in the total uptake of 420.20 tonnes of carbon dioxide for the life of the project.

2.5 CARBON DIOXIDE EMISSIONS FROM BURNING

To determine the net amount of CO_2 released by burning of cleared aboveground biomass (after taking into account the growth of the subsequent cover) the proportion of the affected biomass burnt onsite, $\mathbf{b_n}$, is estimated to be 0.9 and offsite, $\mathbf{b_f}$ as 0 because all of the vegetation that is to be burnt will be burnt onsite. Approximately 10 percent of the vegetation will be stockpiled for future rehabilitation purposes and will not be burnt.

The following assumptions apply to the estimation of CO_2 emissions from burning:

- *Where vegetation is cleared all burning occurs within the year of clearing.*
- *Cleared biomass will remain onsite.*
- *A fraction of the material burned onsite is assumed to remain as charcoal undergoing no further release.*
- *The remaining amount of biomass (1-(b_n + b_f)) that is not burnt is assumed to decay at a uniform rate over 10 years.*

The flux of carbon associated with burning *onsite* (F_{Bni} (t C/yr)) for the forest class, i, can be estimated using the following algorithm:

$$\mathbf{F_{Bni} = A'_{li} B_{bi} C_b b_n e}$$

The flux of carbon associated with burning *offsite* (F_{Bfi} (t C/yr)) for the vegetation class, i, can be estimated using the following algorithm:

$$\mathbf{F_{Bfi} = A'_{li} B_{bi} C_b b_f}$$

Where

$\mathbf{A'_{li}}$ (ha/yr) is the annual rate of clearing in a year for the woodland and scrub forest class, i.
$\mathbf{B_{bi}}$ (t dm/ha) is the aboveground biomass per unit area for the forest class, before clearing.
$\mathbf{C_b}$ is the carbon content of the biomass before clearing (dimensionless).
$\mathbf{b_n}$ proportion of affected biomass burnt onsite (estimated as 0.9).
$\mathbf{b_f}$ proportion of affected biomass burnt offsite (estimated as 0).
$\boldsymbol{e}$ is the combustion efficiency and is equivalent to the proportion of carbon converted to CO_2 (dimensionless). The IPCC (1995) default figure of 0.9 is used in this case.

Lot 2 Calinup Road

$F_{Bni} = A'_{li} B_{bi} C_b b_n e$

$= 1 \times 27.3 \times 0.5 \times 0.9 \times 0.9$

$= 11.05$ t C/yr

The flux of carbon to the atmosphere associated with burning vegetation of a 2 hectare working block *onsite* for Lot 2 (excluding regrowth) is 11.05 t C/yr.

$F_{Bfi} = A'_{li} B_{bi} C_b b_f$

= 1 x 27.3 x 0.5 x 0

= 0 t C/yr

No vegetation will be burnt offsite, therefore the flux of carbon to the atmosphere associated with burning offsite for Lot 2 is 0 t C/yr.

The total carbon release (F_{Bi} (t C/yr)) from burning for the forest class is the sum of carbon released from burning *onsite* and *offsite*:

$$\mathbf{F_{Bi} = F_{Bni} + F_{Bfi}}$$

The mass of CO_2 emitted by burning (J_B) can be calculated using the molecular weight of CO_2 (44 $gmol^{-1}$) to the atomic weight of carbon (12 $gmol^{-1}$):

$$\mathbf{J_B = F_{Bi} \times 44/12}$$

Lot 2 Calinup Road:

$F_{Bi} = F_{Bni} + F_{Bfi}$

= 11.05 + 0

= 11.05 t C/yr

For Lot 2 a net flux of carbon to the atmosphere of 22.11 t/yr is produced based on a clearing rate of two hectares per year and salvaging of timber prior to clearing.

$J_B = F_{Bi} \times 44/12$

= 11.05 x 44/12

= 40.54 t CO_2/yr

A total of 40.54 tonnes CO_2/yr is emitted to the atmosphere from the clearing and burning of 1 hectares of native vegetation taking into account vegetation that is salvaged and retained for rehabilitation purposes. For the life of the project, 810.8 tonnes CO_2 will be emitted from clearing 20 hectares of vegetation.

2.6 CARBON DIOXIDE DELAYED EMISSION FROM DECAY

The aboveground biomass which remains onsite and is not burnt onsite or offsite will oxidize over a period of 10 years (IPCC 1993/4c). Of the aboveground biomass the proportion which remains to decay (B_{Di}) for Lot 2 is 1 minus the portion of total vegetation that is to be burnt onsite (0.55), minus the portion of total vegetation that is to be burnt offsite (0) and minus the portion of total vegetation that is to be salvaged (0.35). This value is equal to 0.1 and represents the vegetation that will be mulched or kept as brush for rehabilitation purposes.

The net aboveground carbon in biomass is multiplied by this proportion and by the 10-year annual average area of land cleared to give the average quantity of carbon released by decay. The algorithm for carbon flux after decay (t/C/yr) is:

$$F_{Di} = A'_{10i}\, B_{Di}\, B_{bi}\, C_b$$

Where
A'_{10i} (ha/yr) is the average annual rate of clearing including the inventory year for the forest class, i.
B_{Di} is the proportion of the aboveground biomass which will decay over a period of 20 years.
B_{bi} (t dm/ha) is the aboveground biomass per unit area, before clearing, for the forest class.
C_b (dimensionless) is the carbon content of the biomass before clearing.

Lot 2 Calinup Road:

$F_{Di} = A'_{10i}\, B_{Di}\, B_{bi}\, C_b$

$= 1 \times 0.1 \times 27.3 \times 0.5$

$= 1.365$ t C/yr

Approximately 1.365 tonnes of carbon is emitted to the atmosphere per year due to the natural decay of vegetation that will be mulched or kept as brush for progressive rehabilitation.

The quantity of CO_2 released by decay J_{Di} (t C/yr) is:

$$J_{Di} = F_{Di} \times 44/12$$

Lot 2 Calinup Road:

$J_{Di} = F_{Di} \times 44/12$

$= 1.365 \times 3.67$

$=$ **5.00 t CO_2/yr**

Approximately 5.00 tonnes of CO_2 will be released from the natural decay of vegetation that will be mulched or used as brush for rehabilitation purposes. For the life of the project, 100 tonnes CO_2 will be emitted to the atmosphere from natural decay.

2.7 CARBON DIOXIDE DELAYED EMISSIONS FROM SOIL CARBON RELEASE

2.7.1 Soil Carbon Estimates

To calculate the emission of CO_2 from the soil the amount of carbon in the soil before and after clearing needs to be estimated.

2.7.1.1 Soil carbon before clearing

The total belowground carbon content before clearing is S_{TC} (t C/ha) is calculated as follows:

$$S_{TC} = S_{bi} + R_{bi}$$

Where
S_{bi} (t C/ha) is the soil carbon content (excluding roots) in forest class, i.
R_{bi} (t C/ha) is the root carbon content in forest class, i.
Estimates of the soil carbon contents (S_{bi}) for the three forest classes nominated by AUSLIG (1990) are given in Table 4.

Table 4
Typical Carbon Quantities in Soils (Excluding Roots) of Three Forest Classes

Forest Class i	Carbon in soils S_{bi} (t C/ha)
Tropical and temperate closed forest	120
Open forest	85
Woodland and scrub	70

Source: Dalal and Mayer (1986); Lefroy et al 1993

The root carbon content of a forest class (R_{bi}) is calculated by the multiplication of the root to shoot ratio of mature trees which is given a value of 0.25, the IPCC value of 0.5 for carbon content in roots and the aboveground biomass (B_{bi}) for the forest class as given in Table 2. In this estimation of root carbon, B_{bi} is 42 t dm/ha because the roots of trees that are salvaged remain in the soil and are not removed. This calculation is shown below.

Lot 2 Calinup Road:

$S_{TC} = S_{bi} + R_{bi}$

$= 70 + (0.25 \times 0.5 \times 42)$

$= 70 + 5.25$

$= 75.25$ t C/ha

Approximately 75.25 tonnes of carbon (including roots) per hectare is stored within the soil before clearing.

2.7.1.2 Soil carbon after clearing

To calculate the soil carbon content the following components of soil carbon need to be taken into consideration:

- Loss of soil carbon (excluding roots) from clearing.
- Natural root decay.

- Root regrowth from the re-establishment of vegetation.

The content of carbon (excluding roots) in soil after clearing of vegetation is based on the assumptions that:

- *30 percent of soil carbon is lost upon clearing.*
- *Soil carbon release after clearing is linear over a 20 year period (IPCC, 1995).*

The algorithm, which is used to estimate soil carbon after clearing, is (NGGIC, 1998a):

$$S_a = 0.7\ S_{bi}$$

S_a is defined as the soil carbon content (excluding roots) after clearing that will reach a 'steady state' after 20 years (t C/ha). The calculation for Lot 2 is shown below.

Lot 2 Calinup Road:

$S_a = 0.7\ S_b$

$= 0.7 \times 70$

$= 49$ t C/ha

Following clearing, the soil carbon content of Lot 2 will be approximately 49 tonnes of carbon per hectare after 20 years.

Root decay and regrowth will influence the amount of carbon that is contained in the soil after clearing. Taking these factors into consideration the following assumption is made:

- *The decay time for large roots is 10 years (IPCC, 1995) and carbon will be released during this time.*

To calculate the loss of carbon from root decay (R_{Di} (t C/yr)) the following algorithm is used:

$$R_{Di} = A'_{10i}\ B_{BDi}\ S_{TC}$$

Where
A'_{10i} (ha/yr) is the average annual rate of clearing over the decade up to and including the inventory year for the forest class, i.
B_{BDi} (t C/ ha) is the proportion of the belowground biomass which will decay over a period of 10 years.
S_{TC} (t dm/ha) is the belowground carbon content per unit area, before clearing, for the forest class, i.

Lot 2 Calinup Road

$R_{Di} = A'_{10i} B_{BDi} S_{TC}$

$= 1 \times (1 - (S_b/S_{TC})) \times 75.25$

$= 1 \times (1-(70/75.25)) \times 75.25$

$= 1 \times 0.069 \times 75.25$

$= 5.19$ t C/yr

Approximately 5.19 tonnes of carbon will be removed due to root decay for each year of the project where one hectare is cleared.

To estimate the root carbon content from regrowth (R_{ai} (t C/yr)) the following algorithm is used:

$$\mathbf{R_{ai} = R_{ri} \times B_{ai} \times C_{ai}}$$

Where
$\mathbf{R_{ri}}$ is the root to shoot ratio of regrowth vegetation (IPCC default value of 0.25).
$\mathbf{B_{ai}}$ (t dm/ha) is the aboveground biomass per unit area from regrowth.
$\mathbf{C_{ai}}$ is the carbon content of the biomass after regrowth (IPCC default value of 0.5).

The aboveground biomass after clearing of Lot 2 will vary for each year of the project due to the progressive rehabilitation of working blocks as shown in Table 3. Consequently, root regrowth, a function of the aboveground biomass, will also vary from year to year for the life of the project (Table 5). The difference between R_{Di} and R_{ai} will give the total root carbon after clearing and this will also vary from year to year.

Table 5
Root Regrowth and Total Root Carbon After Clearing

Year of Project	Aboveground Biomass from Regrowth (t dm/ha)*	Root Regrowth (R_{ai} (t C))		Root Decay (R_{Di} (t C))		Root Carbon (t C) Net Gain (+) Net Loss (-)	
		Per year	Cumulative	Per year	Cumulative	Per year	Cumulative
1	0	0^{+}	0	5.19	5.19	5.19	5.19
2	1.09	0.14	0.14	5.19	10.38	5.05	10.25
3	2.18	0.27	0.41	5.19	15.58	4.92	15.16
4	3.28	0.41	0.82	5.19	20.77	4.78	19.94
5	4.37	0.55	1.37	5.19	25.96	4.64	24.59
6	5.46	0.68	2.05	5.19	31.15	4.51	29.09
7	6.55	0.82	2.87	5.19	36.35	4.37	33.47
8	7.64	0.96	3.82	5.19	41.54	4.23	37.70
9	8.74	1.09	4.91	5.19	46.73	4.10	41.80
10	9.83	1.23	6.14	5.19	51.92	3.96	45.76
11	10.92	1.37	7.51	5.19	57.11	3.83	49.58
12	12.01	1.50	9.01	5.19	62.31	3.69	53.27
13	13.10	1.64	10.65	5.19	67.50	3.55	56.83
14	14.20	1.77	12.42	5.19	72.69	3.42	60.24
15	15.29	1.91	14.33	5.19	77.88	3.28	63.52
16	16.38	2.05	16.38	5.19	83.08	3.14	66.66
17	17.47	2.18	18.56	5.19	88.27	3.01	69.67
18	18.56	2.32	20.88	5.19	93.46	2.87	72.54
19	19.66	2.46	23.34	5.19	98.65	2.73	75.27
20	20.75	2.59	25.94	5.19	103.85	2.60	77.87
21	21.84	2.73	28.67	5.19	109.04	2.46	80.33
Mean						**3.83**	**N/A**

* *Including biomass form the regrowth of vegetation. To convert to (t C/ha) multiply by 0.5.*
$^{+}$ *Regrowth will not occur until year 2 when rehabilitation will commence.*

2.7.2 Soil Carbon Release

For calculating the annual carbon flux from soil (FS_i (t C/yr)) associated with the loss of soil carbon from decay and also taking into consideration the regrowth of roots the following algorithm is used:

$$F_{Si} = A'_{20i} (S_{bi}-S_{ai}) + A'_{10i} (R_{bi}-R_{ai})$$

Where

A'_{20i} and A'_{10i} (ha/yr) are the average annual rate of clearing of land area in that forest class over the IPCC (1995) default time span of 20 years for soil carbon decay and 10 years for root decay.

S_{bi} (t C/ha) is the soil carbon content (excluding roots) of that forest before the change.

S_{ai} (t C/ha) is the soil carbon content (excluding roots) that it will reach in the 'steady state' ie 20 years after the change.

A'_{tri} (ha/yr) is the average annual rate of clearing of land area in the forest class, i over the IPCC default time of 10 years.

R_{bi} (t C/ha) is the root carbon content of the forest class, i before the change in landuse.

R_{ai} (t C/ha) is the root carbon content of regrowth vegetation of the forest class, i.

Lot 2 Calinup Road:

$F_{Si} = A'_{20i} (S_{bi}-S_{ai}) + A'_{tri} (R_{bi}-R_{ai})$

$= 1 \times (70-49) + 2 \times (5.25-R_{ai})$

The root carbon content of regrowth varies from year to year as calculated in Table 5. As a result the annual carbon flux from soil (F_{si}) will also vary as follows:

Year 1 = 26.25	Year 7 = 23.38	Year 13 = 15.60	Year 19 = 2.91
Year 2 = 26.11	Year 8 = 22.42	Year 14 = 13.82	Year 20 = 0.31
Year 3= 25.84	Year 9 = 21.34	Year 15 = 11.91	Year 21 = -2.41
Year 4 = 25.43	Year 10 = 20.11	Year 16 = 9.87	Total = 341.04
Year 5 = 24.88	Year 11 = 18.74	Year 17 = 7.68	
Year 6 =24.20	Year 12 = 17.24	Year 18 = 5.36	

Over the life of the project and the rehabilitation of all 20 blocks (by year 21), a net value of approximately 341.04 tonnes of carbon will be removed from the soil through carbon decay.

The quantity of CO_2 released from the soil J_{Si} (t CO_2) is:

$$\mathbf{J_{Si} = F'_{Si} \times 44/12}$$

Lot 2 Calinup Road:

$J_{Si} = F_{Si} \times 44/12$

$= 341.04 \times 44/12$

$= \mathbf{1250.48\ t\ CO_2}$

A total of 1250.48 t CO_2 will be removed from the soil and to the atmosphere for the life of the project from the decay of soil carbon and root carbon.

2.8 TOTAL CARBON DIOXIDE EMISSIONS

Total CO_2 released from clearing of vegetation for the life of the project (J (t CO_2)) is calculated by the following sum:

$$\mathbf{J = J_B + J_D + J_S - J_R}$$

Where
$\mathbf{J_B}$ (t CO_2) is the total flux for the life of the project due to burning onsite and offsite.

J_D (t CO_2) is the total flux for the life of the project due to decay of carbon.
J_S (t CO_2) is the total flux for the life of the project due to release from soils.
J_R (t CO_2) is the total flux for the life of the project due to regrowth of forest.

Lot 2 Calinup Road:

$J = J_B + J_D + J_S - J_R$
$= 810.8 + 1008 + 1250.48 - 420.2$
$= 2160 - 420$
$=$ **1740 t CO_2**

For the entire life of the project, 1740 tonnes of carbon dioxide will be emitted from the removal of 20 hectares of vegetation and the rehabilitation of all the working blocks. Averaged over the 20 years of the project this is equivalent to an annual emission of 87 tonnes of carbon dioxide.

3. GREENHOUSE GAS EMISSIONS FROM THE EXTRACTION OF SAND

3.1 INTRODUCTION

Greenhouse gases are emitted from fuel used in mobile equipment such as tractors and earthmoving equipment. The combustion process in engines of mobile equipment produces mainly carbon dioxide with small quantities of methane, nitrous oxide, oxides of nitrogen, carbon monoxide and non methane volatile organic compounds (NGGIC, 1998b). It is anticipated that for the proposed sand extraction at Lot 2 Calinup Road, one loader will be used to excavate sand and to load haul trucks on a working schedule of 80 trucks per week and one screener will be used to remove large debris from excavated sand. The operation of the loader, haul trucks and the screener on Lot 2 Calinup Road will emit greenhouse gases.

The *Workbook for Fuel Combustion Activities 1.1* provides a methodology that follows the guidelines of the Intergovernmental Panel on Climate Change (IPCC, 1995), which assumes that:

- *All carbon emitted to the atmosphere during the combustion of fuel is in the form of carbon dioxide (CO_2).*
- *Emitted quantities of other carbon containing direct and indirect greenhouse gases are small relative to the quantity of CO_2.*

As a result CO_2 emissions are estimated separately from other greenhouse gases and will involve the following steps (IPCC, 1995):

- Estimate consumption of fuel in material (mass/volume) units.
- Convert to standard energy units (TJ).
- Multiply by carbon emission factor (t C/TJ) for fuel.

- Subtract quantity of carbon stored.
- Correct for incomplete combustion of carbon, by multiplying by an oxidation factor.
- Convert emission calculated as carbon to full molecular weight of CO_2.

For all other greenhouse gases the main calculation steps are:

- Estimate consumption of fuel type from activity in standard energy units (PJ).
- Multiply by technology weighted emission factor (Gg/PJ) for fuel type used in activity.

3.2 GREENHOUSE GASES EMITTED FROM THE OPERATION OF A LOADER

3.2.1 Carbon Dioxide Emissions

The amount of CO_2 emitted ($TOTAL_{ijc}$(t CO_2/yr)) from the combustion of fuel type, j, by a loader, i, is calculated by the following algorithm:

$$\mathbf{TOTAL_{ijc} = (F_{ij} \times E_{jc} \times P_{ij} / 100) - S_{ij} \times 44/12}$$

Where
$\mathbf{F_{ij}}$ is the amount of fuel type, j, combusted by the loader (PJ).
$\mathbf{E_{jc}}$ is the CO_2 emission factor for fuel type, j (t CO_2/PJ).
$\mathbf{P_{ij}}$ is the oxidation factor of fuel type, j (%).
$\mathbf{S_{ij}}$ is the amount of carbon sourced from fuel type, j, which is stored for the use of the loader (t).
44/12 conversion factor from C to CO_2 using the molecular weight of CO_2 (44 $gmol^{-1}$) and the atomic weight of carbon (12 $gmol^{-1}$):

Each of these parameters is determined as shown in Table 6.

Table 6
Parameters used to Calculate Carbon Dioxide Emissions from the Use of Fuel by a Loader

Parameter	Value	Source
F_{ij}	0.00336 PJ	The amount of diesel used by a loader for 7 days is approximately 1672L (as directly measured) where 1L of diesel contains 38.6 MJ (Bush et al, 1993). Therefore annually the loader is expected to use 3356.91GJ (or 0.00336 PJ)*.
E_{jc}	69.7 t CO_2/PJ	Emission factor for automotive diesel oil (ADO). Table 4; Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998).
P_{ij}	99%	Oxidation factor for oil. Table 5; Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998). IPCC (1995) default value.
S_{ij}	0 t	No storage occurs.

* *G = giga, 10^9*
P = peta, 10^{15}

Lot 2 Calinup Road:

$TOTAL_{ijc} = [(F_{ij} \times E_{jc} \times P_{ij} / 100) - S_{ij}] \times 44/12$

$= [(0.00336 \times 69.7 \times 99 / 100) - 0] \times 44/12$

$= 0.232 \times 44/12$

$= 0.849$ t CO_2/yr

Approximately 0.849 tonnes CO_2/yr is emitted from the combustion of diesel by the use of a loader to excavate sand at Lot 2 Calinup Road.

3.2.2 Other Greenhouse Gas Emissions

To estimate the emission (g/yr) of non-CO_2 greenhouse gases, k, from the combustion of fuel type, j, by the loader, i, the following algorithm is used:

$$\mathbf{TOTAL_{ijk} = A_{ij} \times E_{ijk}}$$

Where
$\mathbf{A_{ij}}$ is the amount of kilometers travelled by the loader, i (km/yr).
$\mathbf{E_{ijk}}$ is the emission factor (g/km) for greenhouse gas k from fuel type, j.

The amount of kilometres travelled by the loader on an annual basis is 18,928 kilometres. Emission factors for non-CO_2 greenhouse gases (Table 7) were derived from the Workbook for Transport 3.1 due to the lack of specific emission factors for earthmoving equipment in the Workbook for Fuel Combustion Activities. This workbook also did not include correction factors for emission factors to account for the presence of emission control technology as was done in the Workbook for Transport 3.1 (NGGIC, 1998).

Table 7
Weighted emission factors for non-CO_2 greenhouse gases

Greenhouse Gas	Emission Factor	Source
CH_4	0.070 g/km	Emission factors for heavy truck using automotive diesel oil (ADO). Table A.5; Workbook for Transport 3.1 (NGGIC, 1998).
N_20	0.025 g/km	
NO_x	15.290 g/km	
CO	7.860 g/km	
NMVOC	2.780 g/km	

Lot 2 Calinup Road:

$TOTAL_{ijk} = A_{ij} \times E_{ijk}$

$TOTAL_{ijCH4}$ $= 18928$ km/yr x 0.07 g CH_4/km $= 1.325$ kg CH_4/yr

$TOTAL_{ijN2O}$	= 18928 km/yr x 0.025 g N_20/km	= 0.473 kg N_20/yr
$TOTAL_{ijNOx}$	= 18928 km/yr x 15.29 g $N0_x$/km	= 289.409 kg $N0_x$/yr
$TOTAL_{ijCO}$	= 18928 km/yr x 7.86 g C0/km	= 148.774 kg C0/yr
$TOTAL_{ijNMVOC}$	= 18928 km/yr x 2.78 g NMVOC/km	= 52.620 kg NMVOC/yr

3.3 GREENHOUSE GASES EMITTED FROM HAUL TRUCKS

3.3.1 Carbon Dioxide Emissions

The amount of CO_2 emitted ($TOTAL_{ijc}$(t CO_2/yr)) from the combustion of fuel by haul trucks travelling *within* Lot 2 is calculated using the algorithm given in Section 3.2.1.

The parameters used in the algorithm are shown in Table 8 and the calculation is given below.

Table 8
Parameters used to Calculate Carbon Dioxide Emissions from the Use of Fuel by Haul Trucks

Parameter	Value	Source
F_{ij}	0.00000351 PJ*	Each haul truck is expected to travel a maximum of 1.9 km from entering and existing Lot 2. The amount of diesel used travelling this distance is approximately 1.108 L (as directly measured) where 1L of diesel contains 38.6 MJ (Bush *et al*, 1993). Given 82 trucks are expected to use Lot 2 per week (a total of 155.8 km/week) approximately 3508 MJ of fuel will be used per year.
E_{jc}	69.7 t CO_2/PJ	Emission factor for automotive diesel oil (ADO). Table 4; Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998).
P_{ij}	99%	Oxidation factor for oil. Table 5; Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998). IPCC (1995) default value.
S_{ij}	0 t	No storage occurs.

* G = giga, 10^9
P = peta, 10^{15}

Lot 2 Calinup Road:

$TOTAL_{ijc} = (F_{ij} \times E_{jc} \times P_{ij} / 100) - S_{ij} \times 44/12$

$= (0.00000351 \times 69.7 \times 99 / 100) - 0 \times 44/12$

= 0.000887 t CO_2/yr

Approximately 0.887 kg CO_2/yr is emitted from the combustion of diesel by the use of haul trucks on Lot 2 Calinup Road.

3.3.2 Other Greenhouse Gas Emissions

To estimate the emission (g/yr) of non-CO_2 greenhouse gases from the combustion of fuel the algorithm given in Section 3.2.2 is used.

The amount of kilometres travelled by the loader on an annual basis is 155.8. Emission factors used in the algorithm for non-CO_2 greenhouse gases (Table 9) were derived from the Workbook for Transport 3.1 due to the lack of specific emission factors for earthmoving equipment in the Workbook for Fuel Combustion Activities. The Workbook for Fuel Combustion Activities also did not include correction factors for emission factors to account for the presence of emission control technology as was done in the Workbook for Transport 3.1 (NGGIC, 1998).

Table 9
Weighted emission factors for non-CO_2 greenhouse gases

Greenhouse Gas	Emission Factor	Source
CH_4	0.070 g/km	Emission factors for heavy truck using automotive diesel oil (ADO). Table A.5; Workbook for Transport 3.1 (NGGIC, 1998).
N_20	0.025 g/km	
NO_x	15.290 g/km	
CO	7.860 g/km	
NMVOC	2.780 g/km	

The calculations of non-CO_2 greenhouse gas emissions from haul trucks for Lot 2 is shown below:

Lot 2 Calinup Road:

$TOTAL_{ijk}$ = A_{ij} x E_{ijk}

$TOTAL_{ijCH4}$ = 155.8 x 0.07 g CH_4/km = **0.0109 kg CH_4/yr**

$TOTAL_{ijN2O}$ = 155.8 x 0.025 g N_2O/km = **0.00390 kg N_2O/yr**

$TOTAL_{ijNOx}$ = 155.8 x 15.29 g NO_x/km = **2.382 kg NO_x/yr**

$TOTAL_{ijCO}$ = 155.8 x 7.86 g CO/km = **1.225 kg CO/yr**

$TOTAL_{ijNMVOC}$ = 155.8 x 2.78 g NMVOC/km= **67.480 kg NMVOC/yr**

3.4 GREENHOUSE GASES EMITTED FROM THE SCREENER

3.4.1 Carbon Dioxide Emissions

The amount of CO_2 emitted ($TOTAL_{ijc}$ (t CO_2/yr) from the combustion of fuel type, j, by the use of a screener, i, is calculated by the following algorithm:

$$\mathbf{TOTAL_{ijc} = (F_{ij} \times E_{jc} \times P_{ij} / 100) - S_{ij} \times 44/12}$$

Where
$\mathbf{F_{ij}}$ is the amount of fuel type, j, combusted by the screener (PJ).
$\mathbf{E_{jc}}$ is the CO_2 emission factor for fuel type, j (t CO_2/PJ).
$\mathbf{P_{ij}}$ is the oxidation factor of fuel type, j (%).
$\mathbf{S_{ij}}$ is the amount of carbon sourced from fuel type, j, which is stored for the use of the screener (t).
44/12 conversion factor from C to CO_2 using the molecular weight of CO_2 (44 $gmol^{-1}$) and the atomic weight of carbon (12 $gmol^{-1}$):

All of these parameters are determined as shown in Table 10.

Table 10
Parameters used to Calculate Carbon Dioxide Emissions from the Use of Fuel by a Screener

Parameter	Value	Source
F_{ij}	0.0001 PJ	The amount of diesel used by a screener for 7 days is approximately 50L (as directly measured) where 1L of diesel contains 38.6 MJ (Bush et al, 1993). Therefore annually the loader is expected to use 100360 MJ (or 100.36 GJ)*.
E_{jc}	69.7 t CO_2/PJ	Emission factor for industrial diesel fuel (IDF). Table 4; Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998).
P_{ij}	99%	Oxidation factor for oil (petroleum products). Table 5; Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998). IPCC (1995) default value.
S_{ij}	0 t	No storage occurs.

* *G = giga, 10^9*
P = peta, 10^{15}

Lot 2 Calinup Road:

$TOTAL_{ijc} = (F_{ij} \times E_{jc} \times P_{ij} / 100) - S_{ij} \times 44/12$

$= [(0.000100 \times 69.7 \times 99/100) - 0] \times 44/12$

$= 0.00693 \times 44/12$

$= 0.0254$ t CO_2/yr

Approximately 0.0254 tonnes CO_2/yr is emitted from the combustion of fuel by the screener.

3.4.2 Other Greenhouse Gas Emissions

To estimate the emission (g/yr) of non-CO_2 greenhouse gases, k, from the combustion of fuel type, j, by, i, the following algorithm is used:

$$\mathbf{TOTAL_{ijk} = F_{ij} \times E_{ijk}}$$

Where
F_{ij} is the amount of fuel type, j, combusted by the screener (PJ).
E_{ijk} is the emission factor (Mg/PJ) for greenhouse gas k from fuel type, j.

The amount of fuel combusted on an annual basis is 0.0001 PJ (Table 10). Emission factors for non-CO_2 greenhouse gases (Table 11) that are emitted from fuel combustion were derived from Workbook for Fuel Combustion Activities 1.1 (NGGIC, 1998). This workbook does not provide specific emission factors for screeners but does specify emission factors for 'miscellaneous' equipment types under general activities. These emission factors are given in Table 11 and were used to estimate non-CO_2 greenhouse gas emissions from the use of the screener.

Table 11
Weighted emission factors for non-CO_2 greenhouse gases

Greenhouse Gas	Emission Factor	Source
CH_4	1.3 Mg/PJ	Emission factors for general activities heavy truck using oil (petroleum products) to operate miscellaneous equipment. Table 6; Workbook for Fuel Combustion Activities (NGGIC, 1998).
N_20	0.6 Mg/PJ	
NO_x	154 Mg/PJ	
CO	14 Mg/PJ	
NMVOC	3.2 Mg/PJ	

Lot 2 Calinup Road:

$TOTAL_{ijk} = F_{ij} \times E_{ijk}$

$TOTAL_{ijCH4}$ = 0.0001 x 1.3 Mg CH_4/ PJ /yr = **0.13 g CH_4/yr**

$TOTAL_{ijN2O}$ = 0.0001 x 0.6 Mg N_2O/ PJ /yr = **0.06 g N_2O/yr**

$TOTAL_{ijNOx}$ = 0.0001x 154 Mg NO_x/ PJ /yr = **15.4 g NO_x/yr**

$TOTAL_{ijCO}$ = 0.0001 x 14 Mg CO/ PJ /yr = **1.4 g CO/yr**

$TOTAL_{ijNMVOC}$ = 0.0001 x 3.2 Mg NMVOC/ PJ /yr = **0.32 g NMVOC/yr**

3.5 TOTAL GREENHOUSE GAS EMISSIONS FROM THE OPERATION OF A LOADER, HAUL TRUCKS AND A SCREENER TO EXTRACT SAND FROM LOT 2 CALINUP ROAD

The total greenhouse gas emissions expected to be released to the atmosphere from the use of a loader, haul trucks and a screener are shown in Table 12.

Table 12
Total Greenhouse Emissions from the Operation of a Loader, Haul Trucks and a Screener

Greenhouse Gas	Quantity emitted (kg/yr)
Carbon dioxide (CO_2)	875.29
Carbon monoxide (CO)	151.40
Methane (CH_4)	1.466
Nitrous Oxide (N_2O)	0.537
Nitrogen Oxides (NO_x)	307.19
Non-methane volatile organic compound (NMVOC)	120.42

4. CONCLUSION

Following the methodologies developed by the National Greenhouse Gas Inventory Committee for the estimation of greenhouse gas emissions from clearing of vegetation and the use of earthmoving equipment, it is estimated that for the proposed 20-year life of the sand extraction operations on Lot 2 Calinup Road a total of:

- 1,757.51 tonnes of carbon dioxide will be released to the atmosphere.
- 3.028 tonnes of carbon monoxide will be released to the atmosphere.
- 0.029 tonne of methane will be released to the atmosphere.
- 0.011 tonne of nitrous oxide will be released to the atmosphere.
- 6.14 tonnes of nitrogen oxides will be released to the atmosphere.
- 2.41 tonnes of non-methane volatile organic compounds will be released to the atmosphere.

The Environment Protection and Biodiversity Conservation Act 1999 includes provision to include a trigger threshold for carbon dioxide emissions that will require projects to be assessed formally under the Act if the threshold is exceeded. This threshold is 1.5 million tonnes.

Within the Environment Protection and Biodiversity Conservation Act 1999 there are no thresholds specified for non-carbon dioxide emissions.

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