ORDINARY COUNCIL AGENDA

DEVELOPMENT SERVICES (ITEM 9.1.5 ONLY) ATTACHMENTS

WEDNESDAY, 17 OCTOBER 2012

Locality Plan

Lot 6 Wandena Road

Lower Chittering

RENEWAL OF EXTRACTIVE INDUSTRY

EXCAVATION and REHABILITATION MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

June 2012

BORAL BRICKS

RENEWAL OF EXTRACTIVE INDUSTRY

EXCAVATION and REHABILITATION MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

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SUMMARY

Boral Bricks Western Australia Pty Ltd seeks renewal of Planning Consent of the Extractive Industries Licence for the removal of clay and shale from Lot 6 Wandena Road, Muchea.

Clay has been excavated from this part of Muchea for many years and from this site for 5 years, because of the uniqueness of the resource and proximity to the Metropolitan area.

The Muchea area is the only known location where the formation outcrops onto the surface and even here it is restricted to low ridges which are all that remain following extensive erosion. The closest sedimentary kaolin resources are 100 km away in the Bolgart area.

This pit forms an important component of the Boral Bricks clay resources to continue blend clays to produce a full range of brick products.

A vegetation study was completed by Landform Research and shows that the site is covered by pasture with a small area of scattered *Eucalyptus calophylla - Eucalyptus wandoo - Eucalyptus accedens* Remnant Woodland that has scattered trees over pasture, degraded and grazing.

The useable clay reserve occupies an area of about 45 hectares and extends to an average depth of 20 metres of which approximately 15 metres will be excavated. However the depth of overburden will currently restrict the taking of the resource to about 25 hectares in the south and east of the deposit. Overlying the clay is 200 mm of topsoil and up to 5 metres of overburden. Excavation will continue to be progressive with land being closed and rehabilitated as new ground is opened. At this stage there is insufficient ground open for rehabilitation to commence.

Some of the overburden is gravel and this also provides a resource that has been used on site locally for roadmaking.

The surrounding land use continues to be broad acre grazing and cropping with the WAMIA livestock facility to the west with increasing small rural living lots to the east. The Shire of Chittering landfill site occupies an old clay pit 150 metres to the north east. Clay excavations are present to the south of Muchea East Road and to the north along Wandena Road.

The closest dwelling, from aerial photography and site observation, dwelling on the eastern side of Wandena Road which is 150 metres from the boundary of later stages of excavation. Other dwellings are over 600 metres from the proposed excavation.

The site is zoned Agriculture Resource under the Shire of Chittering Town Planning Scheme. The zoning has objectives that provide for the maintenance of productive grazing land, protection of the landscape values and continued extraction of the basic raw materials. The proposed excavation has been designed to comply with these objectives.

The site is listed as a Priority Clay Resource in the Statement of Planning Policy No 2.4, Basic Raw Materials Policy. Statement of Planning Policy No

2.4 is strong in its recommendations for the protection of basic raw materials, and that planning decisions should not be taken that will impeded the use of the resource.

Other Statement of Planning Policies are also relevant. Statement of Planning Policy No 2.5, Agricultural and Rural Land Use Planning makes provision for the extraction of basic raw materials. SPP 2.5 in Point 9 states that "The location of rural residential and rural small holdings should avoid unacceptable impacts on, or sterilisation of natural primary resources including prospective areas for mineralisation and basic raw materials ....."

There are no proposed changes to the methods of excavation or the rates of excavation.

Up to 100 000 m^3 clay is anticipated to be removed each year, but in recent times the amount of clay has not reached this volume because of the downturn in the housing market. The amount of material extracted will depend on the nature of the local and export brick markets and public demand for particular colours of bricks.

Transport is to Wandena Roadand then along Wandena Road to Great Northern Highway.

Perimeter fences are in place and locked gates are maintained.

The site is internally draining and draining to a sediment trapping dam that acts as a water source for dust suppression.

End use of the site is proposed to be pasture with a farm dam. Boral Bricks has, over the years, worked closely with the Chittering Landcare Group to restore 23 hectares of pasture along two watercourses to the north and south of the proposed excavation, to native vegetation and trees. This revegetation was completed on land previously held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA. It is anticipated that this association will continue.

Wherever possible rehabilitation will be continued as areas are completed to ensure that the amount of ground that is open at any one time is minimised. However this will be restricted because of the need to maintain a large open area to enable access to the base of the pit.

The operations have been designed to continue to minimise visual impact, noise and dust impacts.

APPROVAL SOUGHT

Boral Bricks is applying for Planning Approval and an Extractive Industries Licence for a period of 20 years.

PROJECT SUMMARY

ASPECT	PROPOSAL CHARACTERISTIC
EXCAVATION	
Total area of excavation	• 45 ha available of which about 40 ha will be excavated. • Currently there is approximately 3.2 ha of pit
Resource extraction	• Up to 100 000 tonnes clay per year.
Operational time	• Intermittent and restricted to campaigns • Excavation up to 90 days per year. • Transport may occur on other days as well.
Life of project	• > 20 years
Area cleared per year	• A few clumps of Eucalypts to be cleared. • Clearing Permit CPS 2928/1 in place. • Approximately 1 hectare of ground is required annually.
Area mined per year	1 – 1.5 hectare
Dewatering requirements	• Minor. • Water collecting in the pit is used for dust suppression. • Any water to be released will pass through a neutralising basin contained limestone.
Maximum depth of excavations	• 20 metres
Native vegetation to be cleared	• A few clumps of Eucalypts to be cleared. • Clearing Permit CPS 2928/1 in place.
PROCESSING	
Resources	• Not required on site
Water requirements	• Minimal to 10 000 kL per year
Water supply source	• Supplied from sump and sediment settlement dam.
INFRASTRUCTURE	
Total area of plant and stock	• Located within or adjacent to excavated area.
Area of settling ponds	• 2 ha
Fuel storage	• Mobile refuelling with no onsite storage.
TRANSPORT	
Truck movements	• Variable but approximately 5 – 10 per hour on 90 days per year.
Access	• Wandena Road to Muchea East Road and the Great Northern Highway
WORKFORCE	
Construction	• Renewal – already in operation.
Operation	• 2 – 4 persons
Hours of operation	• Hours of operation, will continue to be 6.00 am to 6.00 pm Monday to Friday inclusive, excluding public holidays and 7.30 am to 12.00 pm Saturday.

PROJECT MANAGEMENT SUMMARY

Factor	Summary	Reference
Mining Operations	Excavation methods are an open pit up to 20 plus metres deep. There are no proposed changes to the excavation methods or volumes taken.	5.0 Mining Operations See also Project Summary above.
Biodiversity Management Flora	The site is cleared pasture land with scattered clumps of trees. Clearing Permit CPS 2928/1 is in place.	3.1 Vegetation and Flora 6.1 Biodiversity Management Appendices 1 and 4
Dieback - Plant Pathogens	There is unlikely to be any impact and low risk of introducing plant diseases. A Dieback Management Plan is included.	6.1.5 Dieback Management Plan
Weeds	There is unlikely to be any impact and low risk of introducing new weed species. Included with normal farm management. A Weed Management Plan is included.	6.1.6 Weed Management Plan
Water Management	The main risk to surface and groundwater is from fuel spills. A Fuel Management Plan is proposed. An acid sulphate risk assessment has been completed and a management plan is in place.	6.2 Water Management Appendix 3
Fuel and Maintenance	Fuel is to be brought to the site by mobile tanker. A mobile service truck maintains vehicles. A Refuelling and Maintenance Management Plan is included.	6.2.8 Refuelling and Maintenance
Visual Management	The site is set back from dwellings, and generally protected by vegetation and landform.	6.3.1 Visual Management
Noise	See above for buffer distances. Noise management procedures are proposed for all parts of the operations	6.3.2 Noise Management
Dust	Dust is managed for Health and Safety under the *Mines Safety and Inspection Act 1994.* Dust management procedures are used for all aspects of the operations to protect both the staff and environment. A Dust Management Plan is included.	6.3.3 Dust Management Plan Appendix 5.
Fire	Fire is seen as a low risk in quarries such as this, but could include fire in the surrounding vegetation or plant and equipment. Fire management procedures are addressed in Boral Bricks Safety Management Plans which are used for all sites and are implemented at this site. These plans include emergency procedures, muster areas, training and contingencies. A Fire Management Plan has been prepared.	6.3.4 Fire Management Appendix 6
Mine Closure	All equipment will be removed from site at the completion of activities and the disturbed land created into a form compatible with the surrounding areas.	7.0 Mine Closure Plan
Mine Closure - Rehabilitation	Rehabilitation will be a return to parkland pasture. A Mine Rehabilitation Plan has been developed.	7.0 Mine Closure Plan

CONTENTS

APPENDICES

1.0 BACKGROUND INFORMATION

1.1 Background

Boral Bricks Western Australia Pty Ltd (formerly Boral Bricks) seeks renewal of Planning Consent and an Extractive Industries Licence for the removal of sedimentary shales and clay from Lot 6, Muchea. In the text Boral Bricks Western Australia Pty Ltd is referred to as Boral Bricks.

1.2 Location

The site lies on a rural property that is part of the WAMIA livestock holding facility on the north western corner of Wandena and Muchea East Roads Muchea.

The site is accessed along from Wandena Road.

1.3 Land Ownership and Agreements

Lot 6 is owned by Boral Bricks.

The landowner contact is;

Boral Bricks
102 Great Northern Highway, Middle Swan, WA, 6056.

Lot Description

Lot	Lot 6
Volume	2631
Folio	794
Plan	49665

1.4 Proponent

The proponent is Boral Bricks Company Pty Ltd. Boral Bricks, the largest clay brick manufacturer in the Perth Metropolitan area, is a subsidiary of Boral Building Products Pty Ltd.

Boral Bricks clay brick and paver manufacturing facilities at the Middle Swan works have an annual capacity of 400,000,000 units. Approximately 90 % of the brick products produced are consumed in the local market with the balance being exported to Asia, New Zealand and the Middle East.

1.5 Requested Approval

Approval is sought to continue to remove clay from the existing pits and adjoining identified resource over a period of 20 plus years to enable staged extraction and satisfy long term community needs for bricks.

1.6 Resource Description

Clay has been excavated from this part of Muchea for many years because of the uniqueness of the resource and proximity to the Metropolitan area. The Muchea area is the only known location where the formation outcrops onto the surface and even here it is restricted to low ridges which are all that remain following extensive erosion. The closest sedimentary kaolin resources available to Boral Bricks are 100 km away in the Bolgart area. Similar geological units occur at Blue Plains Road but are held by another resource company.

The clay is part of a sedimentary sequence of slightly varying kaolin clays and shales. The clays are left as remnant ridges following erosion and weathering. With the local changes to the landform and elevation, different beds of clay are present in different localities.

This, combined with horizontal variations in the clay quality, means that the useable clay is intermittent in outcrop and restricted by the depth of overburden and changes in grainsize and composition. These changes lead to composition changes in the clay, changes in plasticity and behaviour when fired. Therefore a range of clays are available from the Muchea area. These clays are normally blended together or with clays from other areas to increase the use of the resource and to provide as wide a range of clay products as possible.

Boral Brick has two small pits currently totalling 3.2 hectares open on site. They also extract clay from the same geological formation to the south and north but some of these clay types are nearing completion.

The clay resource is a white to cream kaolinite clay of sedimentary origin. It has been drilled, and the useable clay reserve found to occupy an area of about 45 hectares to an average depth of 20 metres of which approximately 15 metres will be excavated. However the depth of overburden will currently restrict the taking of the resource to about 25 hectares from the south and east of the deposit. Overlying the clay is 200 mm of topsoil and up to 5 metres of overburden.

Some of the overburden is gravel and this also provides a resource that is be used on site for roadmaking.

It is likely that at some time in the future, as resources are used up and equipment becomes even more efficient, the areas of deeper overburden will be taken and so those areas remain as "Future Reserves".

Clay types vary from hard shale/mudstone to more plastic kaolin with 4 grades of mudstone recognised for brick making. During excavation the various clay types are worked separately to prevent contamination and ensure consistent material for blending with other clays.

Blending from stockpiles is a normal part of production.

1.7 Resource Protection

The Chamber of Commerce and Industry noted the need to protect Basic Raw Materials prior to sterilisation by encroaching development in its comprehensive research of the Basic Raw Materials of Perth and the Outer Metropolitan Area, 2008, and also listed the area as a clay resource area.

Currently the Departments of Mines and Petroleum and Planning are remapping and assessing the future needs of basic raw materials and are updating the mapping of State Planning Policy 2.4.

A number of other documents provide information on the importance of the clay resources and the issues that apply to construction materials in terms of protection and use.

Research on the clay resources and the issues involved can be found in the following;

- Abeysinghe P B, 2002, *Bentonite, Attapulgite and Common Clays in Western Australia*, Geological Survey of Western Australia, Mineral Resources Bulletin 20.
- Western Australian Planning Commission*, Statement of Planning Policy 2.4, Basic Raw Materials.*
- Chamber of Commerce and Industry, 1995 and 1996, *Managing the Basic Raw Materials of Perth and the Outer Metropolitan Region*, Parts 1 and 2.
- Chamber of Commerce and Industry, 2008, *Basic Raw Materials Access and Availability*, 1996 - 2008.
- Gozzard J R, 1987, *Information on Industrial Minerals - Coastal Plain between Lancelin and Fremantle,* Geological Survey of Western Australia record 1978/11.
- Gozzard, 2007, *Geology and Landforms of the Perth Region*, Geological Survey of Western Australia.

1.8 Project Objectives

The operation is a valuable source of white firing clay suitable for bricks, that has operated since 2007. This application is to renew the existing facilities.

The objectives can be summarised as:

- Provide a long term supply of white firing kaolin clay for local and export brick making.
- Extract the restricted sedimentary shale type kaolin clays prior to sterilisation by potential long term encroaching development.
- Provide resources for blending with other clays to enable Boral Bricks to produce the wide range of brick types demanded by consumers.

- Excavate clay from the lot adjoining a Priority Clay Resource area in line with Statement of Planning Policy 2.4, Basic Raw Materials.

- Excavate clay from locations close to the Middle Swan site which will assist in keeping prices lower for the consumer.

- Comply with *Statement of Planning Policy No 2.5, Agricultural and Rural Land Use Planning*, which states that basic raw materials should be taken prior to sterilisation of the area by development.

1.9 Site Plans

Site plans are shown in the attached Figures.

2.0 PHYSICAL ENVIRONMENT

2.1 Geology and Geomorphology

The clay resource occurs on the eastern edge of the Perth Basin, as a series of low ridges located on the Gingin Scarp. It lies on a rounded hill rising to 150 metres in elevation. A creek line runs west to the south of the deposit.

The site is underlain by Mesozoic sediments, predominantly clays of Cretaceous age commonly ascribed to the Leederville Formation and sometimes the Osborne Formation, although the lithological description better fits with the Osborne Formation which overlies the Leederville Formation.

The sediments are horizontally bedded shallow water marine shales that are white where oxidised but below the proposed excavation can be dark grey, organic and slightly pyritic at depth below the water table. The shales can carry some salt.

Shallow laterite soils cap the sequence, formed during prolonged weathering in seasonally wet and dry conditions which persisted for some time during the late Tertiary Period. The laterite material, which is generally gravelly, is considered as overburden.

Acid Sulfate

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

However the interest has been over reactive and conditions and risk applied in many areas where there is no geological risk or evidence of acid sulfate.

For acid sulfate conditions to be present the soils and rocks must be under reducing conditions, or have been under reducing conditions. The type of oxidation minerals present can be used to provide a highly definitive method of identifying materials at risk.

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

On site the shale beds are clay and silt, horizontally bedded and white in colour. At depth, below the water table, they turn into grey carbonaceous claystone and siltstones that can carry pyrite. Above the carbonaceous beds the sediments consist of oxidised clays and silts of some 10 to 30 metres thickness.

Testing is normally only required if “at risk” materials are to be disturbed.

As there are grey carbonaceous shales at depth below the excavations an acid sulphate investigation was commissioned by Boral Brick from Parsons Brinkerhoff. That study found some evidence of acid sulphate below the base of the pit and as a result Parsons Brinkerhoff prepared an Acid Sulfate

Management Plan which has been used during the excavations on site. Acid sulfate is discussed in more detail in 6.2.5 Acid Sulfate Risk.

2.2 Regolith and Soils

The soils which form the overburden are loamy gravels and gravelly sands, grading to gravelly loams and clay with depth. During excavation the soils and subsoils, and overburden are stored in separate in bunds for later use in rehabilitaiton of the land surface.

The reconstructed soils, at the completion of excavation, will be a blend of gravel and loam rich materials to form manufactured gravelly loam and loam soils.

2.3 Climate

The climate of the area is classified as Mediterranean, with dry hot Summers and cool wet Winters.

Climatic data is recorded at Bullsbrook, 9 km to the south. Precipitation is 688 mm per annum, of which 90% falls in the months April to October inclusive. At Swan Research Station evaporation exceeds rainfall in all but the four wettest months, and the situation at Bullsbrook can be expected to be similar.

Average maximum temperatures at Bullsbrook reach 33.3 degrees Celsius for the hottest months, January and February, but fall to 17.6 degrees Celsius in July. Average minima for the coldest month August, is 8.2 degrees Celsius.

The climate data for Bullsbrook is shown in Appendix 2, and shows that the predominant summer winds are from the east at 9.00 am and from the south west at 3.00 pm

2.4 Hydrology

One watercourse runs east – west along the southern edge of the site. This has been rehabilitated and fenced as part of a landcare project.

The Leederville Formation of sands and shales underlies the site. These are generally horizontally bedded aquicludes separated by thin more permeable beds. The recharge area is in the east close to the site. The aquifer then runs within the more permeable beds under the site to the west.

There may be some leakage of surface water to deeper aquifers but this is less likely because the shale beds are likely to act as an aquiclude.

Elevation of the aquifers is variable and generally at elevations below 60 metres AHD. Water within the aquifer is normally confined and artesian in nature. For example a small bore into the Leederville Formation, on the north eastern corner of M1327, is artesian and flowing at the surface. Davidson W A, 1995, Hydrogeology and Groundwater Resources of the Perth Region Western Australia, Department of Industry and Resources, Bulletin 142.

Water quality of the Leederville Formation is generally less than 1000 mg/L, and often contains dissolved iron. (Department of Environment).

Superficial and surficial aquifers are shallow surface aquifers that form in surface sands and sediments. On this site, these normally form in the surface sand or more permeable areas where the water runs along the top of the less permeable shale or more permeable interbeds to emerge as seepages along the base of slopes and adjacent to the water course, for example to the south of the clay resource. Drilling has revealed a small seepage to the south east of the resource which appears to flow from a more permeable bed at approximately 12 metres depth to the surface. Water quality on 11 May 2005 was 4 235 mg/L salt and a pH of 6.3.

Parsons Brinckerhoff 2006 found the groundwater elevation to be 116 – 117 metres AHD on the ridge, dropping to 97 metres AHD in the lower elecvvations in the south which is below the base of the clay excavations. The dam sits in the lowest elevation and does nto have any water seepage into it, and is therefore above the groundwater elevation at that point.

Surface water occurs along the water course to the south of the resource area. The water course in the south has elevated salinity and has been restored as part of a local landcare project.

A sediment and water trapping basin has been constructed in the south west of the operations. This collects the surface water from disturbed land on site. The water storage is used for wetting down and dust suppression. When excess water is present it is pumped to a small treatment basin to the east which is lined with limestone to ensure any acidity in the water is neutralised and then released to the creekine in the south. Boral Bricks regularly test the water and in particular the water released to the watercourse.

Further discussons of water quality protection are listed in 6.2.2 Water Quality.

Water in the current operational pits of Boral Bricks is normally moderate in salinity and little different to surface water in the drainage line at the south of the resource next to Muchea East Road. During excavation salt washes from the clays as they are exposed. The clays normally become more saline with depth, however the salinity is limited by Boral Bricks not excavating clay which is too saline because the salinity affects the processing equipment.

For comparison two dams in the active pit south of Muchea East Road had water quality of 3 960 mg/L salt and pH 6.2 on 11 May 2005. Both dams were being used by a number of water birds at the time.

See 6.2.3, Groundwater Protection and Water Use.

3.0 BIOLOGICAL ENVIRONMENT

3.1 Vegetation and Flora

The vegetation on all of Lots 5 and 6 assessed by Lindsay Stephens of Landform Research on 20 August 2004, to check all the areas that might be impacted on by the proposed developments of the WAMIA Livestock facility and the clay excavations. On 1 November 2004 additional flora surveys were

conducted of the remaining areas, which were to be excluded from development, and to recheck some of the other areas of remnant vegetation within the central southern portions of the site.

At the time both EPBC and DEC databases were searched for Threatened and Priority taxa and communities. All species on that list were checked to ensure familiarity. See Appendix 1.

The excavation area is cleared with scattered areas of parkland pasture that are largely excluded from the resource area.

The woodland remnants are *Eucalyptus (Corymbia) calophylla - Eucalyptus wandoo - Eucalyptus accedens* Remnant Woodland which occupy the laterite ridges. These have deeper overburden and at this stage are largely excluded from the earlier resource areas.

In the woodland remnants the understorey is almost totally replaced by pasture, but occasional plants such as *Hakea lissocarpha*, *Desmocladus fasciculatus*, *Dryandra bipinnatifida, Phyllanthus calycinus* and *Dryandra lindleyana* var *melliculata (Banksia dallanneyi* var *mellicula)* occur.

Eucalyptus accedens is added to the community on the higher more clayey slopes in the east where *Eucalyptus calophylla* drops out of the community. *Eucalyptus marginata* subsp *thalassica* is also present to the west outside the clay resource areas, particularly where the soil becomes more sandy.

A vegetation study is included as Appendix 1. It should be noted that the vegetation study covers the whole of Lots 5 and 6. Based on a site inspection in May 2012, no changes to the vegetation ahead of excavation have occurred since 2004.

3.2 Fauna

The excavation area is covered by pasture and parkland pasture. The vegetation will still contain some fauna which will utilise the site. It is proposed to clear the resource areas gradually, which will assist in fauna being able to relocate. In addition there has already been extensive revegetation as part of the landcare activities along the southern creek line. Excavated areas will be rehabilitated to parkland pasture.

3.3 Wetlands

There are no wetlands on the resource area.

A wet soil area is located within a natural drainage swale along the northern side of Muchea East Road on the southern edge of Lot 6. These soils are permanently wet, saline and the area has expanded and developed as a result of land clearing which occurred during the original opening of the local area to agricultural production.

Boral Bricks has worked with the local Landcare Group over a number of years and has rehabilitated and replanted the area of moist soils of the drainage lines both north and south of the resource.

The area now consists of rehabilitation on saline soils planted to local trees and shrubs, which serves as a wetland. A separation of 100 metres lies between the operations and the rehabilitation. This revegetation was completed on land previously held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA.

3.4 Stygofauna and Troglofauna

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

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

Voids do not occur in the elevated natural soils or shales on this site.

The location is in the wrong geological environment for caves or cavities. Therefore there is no risk of troglofauna or ground fauna that live in crevices occurring on the excavation site or within the resource.

The resource areas are gently sloping parkland pasture and cropped land and therefore do not have potential for short range terrestrial fauna.

4.0 SOCIAL ENVIRONMENT

4.1 Planning Issues

4.1.1 Alternative Resources

Why not use other materials?

Clays suitable for brick making do not occur widely. In this case there is a shortage of white firing clay locally and in the near Perth Area generally.

4.1.2 The Site and Land Zonings

- **Current Land Use and Land Zonings**

The excavation lies on parkland pasture owned by Midland Brick Company Pty Ltd.

The WAMIA site lies to the west of the clay excavation area.

The surrounding local land use continues to be broad acre grazing and cropping to the west with increasing small rural living lots in subdivisions to the east.

The Shire of Chittering landfill site occupies an old clay pit 150 metres to the north east.

Clay excavations are present to the south of Muchea East Road and to the north east along Wandena Road. Figure 2.

The closest dwelling, from aerial photography and site observation, remains a dwelling on the eastern side of Wandena Road which is 150 metres from the boundary of Boral Bricks. Other dwellings are over 600 m from the excavation.

The site is zoned Agriculture Resource under the Shire of Chittering Town Planning Scheme. The zoning has objectives that provide for the maintenance of productive grazing land, protection of the landscape values and continued extraction of the basic raw materials. The proposed excavation has been designed to comply with these objectives.

The State Gravel Supply Policy, 1998, also recognises the need to ensure that sources of gravel are available for construction and road making.

Statement of Planning Policies are also required to be considered under the Local Authority Town Planning Schemes.

- **SPP 2.4 – Basic Raw Materials**

The site lies within a Priority Resource Area for clay extraction, of Statement of Planning Policy No 2.4 Basic Raw Materials, (SPP 2.4), Western Australian Planning Commission. (2002 update).

SPP 2.4 supports the principle that basic raw materials should be taken before they become sterilised by development, and that they should be protected for future use. It provides guidelines to local government to recognise the importance of not permitting conflicting landuses to impinge on the operation of clay extraction.

Currently the basic raw materials are being reviewed by the Department of Mines and Petroleum and the Department of Planning. Those reviews will be used to update the databases of SPP 2.4.

State Planning Policy 2.4 is currently being upgraded by the Department of Planning, Department of Mines and Petroleum, and the clay resources identified on this site will be added to the updated databases and maps.

- **SPP 2.5 – Agricultural and Rural Land Use Planning**

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

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

SPP 2 Environmental and Natural Resources Policy

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

Part of Section 5.7 states;

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

Planning strategies, schemes and decision making should:

ii. Identify and protect important basic raw materials and provide for their extraction and use in accordance with Statement of Planning Policy No 10 (2.5); Basic Raw Materials.

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

- **End Use**

It is planned to return the excavated areas to a farm dam with slopes covered by pasture. As there will be material removed from site, and the overburden is not very thick, there will be less material available for rehabilitation and a void will be left. The void will contain a dam with sloping pasture back up to natural land surface. The southern slope will be left steeper to match the contours in that area.

The land surface will be contoured to be compatible with the existing landform of the area and be reformed as a gently undulating surface. The end use will be pasture and could be a buffer to the WAMIA livestock facility.

4.1.3 Surrounding Landuses and Buffers

- **Separation to Dwellings**

The closest dwelling remains the dwelling in Wandena Road at a distance of 250 metres from the eastern internal edge of the pit and stockpiles along Wandena Road.. Other dwellings are 600 metres to the south east and 800 metres to the east from the proposed excavation.

Great Northern Highway lies at a distance of 1.4 km from the eastern face of the quarry, with scattered trees of parkland pasture occurring on the intervening ground between the highway and the excavation, which should assist in minimising visual impact.

Excavation is worked from inside out on the floor of the pit between 5 and 15 metres below natural ground level. The recommended 20 metre buffer zones are retained along the perimeter boundaries of the site, to the north, west and south, with a road buffer of 40 metres along Wandena Road.

Where possible the buffer vegetation is retained to minimise the visual impact.

A number of Government Policies relate to buffer distances and the protection of basic raw materials. *Statement of Planning Policy No 4.1, State Industrial Buffer Policy*, (draft July 2004) discusses the need to consider adjoining land uses when locating buffers but does not prescribe set buffers for operations such as this.

EPA guidance "Separation Distances between Industrial and Sensitive Land Uses", June 2005 lists the generic buffers for sand and limestone pits as 300 - 500 metres depending on the extent of processing. There is no generic guide for clay extraction. In many ways the extraction of clay is similar to sand or between sand and limestone. There is no onsite crushing of the clay, which is excavated and either loaded directly onto trucks or stockpiled for later transport.

A generic buffer relates to the distance at which there are unlikely to be any problems without some further investigations and does not mean that smaller buffers are not acceptable. *EPA Guidance for the Assessment of Environmental Factors No 3* June 2005 provides for a case by case separation, based on the potential impacts.

Based on the nature of the clay a generic buffer of 300 – 500 metres is appropriate. The Guidance states that for quarries other than hard rock, where crushing, milling and grinding occur, a site by site buffer is appropriate.

The issue of appropriate buffers is a matter of the distance and protection measures to prevent impact on adjoining land users. This applies mainly to noise, dust and visual impact, all of which are treated separately. Therefore excavation has been designed in a manner to minimise potential impacts on the dwelling to the east.

In the past five years the operations and the dwellings have co-existed. IN the past 5 years there has not been any complaint from the owners of the dwelling.

The clay excavations are well buffered by the large face to the east and will continue to progreses west away from the area that has been excavated during the past five years.

With excavation lower in the landscape, and moving further away from the closest dwelling, the potential impacts should continue to reduce over time.

A 40 metre buffer is retained along the road perimeter boundaries along Wandena Road and a 20 metre buffer will be retained along boundaries to other lots.

Detailed studies have been completed for these operations and based on the separation distances in which potential impacts can be managed on excavation of the same types of resource by Boral Bricks the buffers in place are appropriate.

4.2 Community Consultation

The Excavation Management Plan will be circulated to Government Departments and Authorities by the Shire of Chittering.

4.3 Heritage

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

The site has been grazed, cultivated and farmed for many years. Therefore disturbance of the soils has been a regular occurrence over the years.

Aboriginal Heritage - Applicable Legislation / Policies
Aboriginal Heritage Act 1972-1980
Commitments to Safety Management
• Should any evidence of early aboriginal occupation be uncovered, development will be stopped pending an assessment by a recognised consultant. • If the site is confirmed as a site under the provisions of Section 15 of the Aboriginal Heritage Act 1972-1980 and Amendments operations will cease pending relevant negotiations.

4.4 Compliance and other Legislation

A number of State and Local Government authorities are responsible for overseeing the safety and management of quarries in the area. Other authorities have an interest in the proposal but may not hold any responsibility.

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

Shire of Chittering

- Issues Planning Consent under the Town Planning Scheme.
- Defines land zonings and strategies in conjunction with the Western Australian Planning Commission through the Town Planning Scheme.
- Issues Extractive Industry Licences for quarries.
- Has an interest in transport along local roads.
- Controls the measures used to prevent bush fires.
- Issues approvals for transport. Vehicle owners to apply to MRWA (Main Roads) for permits to utilise oversize vehicles on specific roads.

Department of Mines and Petroleum

- Controls the safety and methods of excavation through the *Mines Safety and Inspection Act 1994 and Regulations 1995.*
- Covers the health and safety of workers.
- Identifies and maps basic raw materials.

Department of Environment and Conservation

- May provide advice on aspects of environmental impact and management.
- Issues licences for crushing and screening plants. (not used on this site).
- Issues clearing permits under the *Environmental Protection Act 1986.*
- Oversees the *Environmental Protection (Noise) Regulations 1997*.

Western Australian Planning Commission

- Prepares Statements of Planning Policy.
- Defines land zonings and strategies in conjunction with the local authority.
- Responsible for strategic planning.
- Responsible of State Planning Policies such as SPP 2.4 Basic Raw Materials.

Main Roads Department

- Has an interest in the transport routes.

Department of Water

- Has published guidelines for water quality management for extractive industries.
- Licenses bores and oversees water use.
- Has control over the management of ground and surface water in the area, including water catchments.

Department of Indigenous Affairs

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

5.0 MINING OPERATIONS

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

Boral Bricks is highly experienced in this type of quarrying and has an excellent record in the excavation of basic raw materials.

Excavation will be conducted to the:-

- *Mines Safety and Inspection Act 1994 and Regulations 1995.*

5.1 Project Summary

ASPECT	PROPOSAL CHARACTERISTIC
EXCAVATION	
Total area of excavation	• 45 ha available of which about 40 ha will be excavated. • Currently there is approximately 3.2 ha of pit
Resource extraction	• Up to 100 000 tonnes clay per year.
Operational time	• Intermittent and restricted to campaigns • Excavation up to 90 days per year. • Transport may occur on other days as well.
Life of project	• > 20 years
Area cleared per year	• A few clumps of Eucalypts to be cleared. • Clearing Permit CPS 2928/1 in place. • Approximately 1 hectare of ground is required annually.
Area mined per year	1 – 1.5 hectare
Dewatering requirements	• Minor. • Water collecting in the pit is used for dust suppression. • Any water to be released will pass through a neutralising basin contained limestone.
Maximum depth of excavations	• 20 metres
Native vegetation to be cleared	• A few clumps of Eucalypts to be cleared. • Clearing Permit CPS 2928/1 in place.
PROCESSING	
Resources	• Not required on site
Water requirements	• Minimal to 10 000 kL per year
Water supply source	• Supplied from sump and sediment settlement dam.
INFRASTRUCTURE	
Total area of plant and stock	• Located within or adjacent to excavated area.
Area of settling ponds	• 2 ha
Fuel storage	• Mobile refuelling with no onsite storage.
TRANSPORT	
Truck movements	• Variable but approximately 5 – 10 per hour on 90 days per year.
Access	• Wandena Road to Muchea East Road and the Great Northern Highway
WORKFORCE	
Construction	• Renewal – already in operation.

Operation	• 2 – 4 persons
Hours of operation	• Hours of operation, will continue to be 6.00 am to 6.00 pm Monday to Friday inclusive, excluding public holidays and 7.30 am to 12.00 pm Saturday.

5.2 Extraction and Processing of the Resource

5.2.1 Excavation

Excavation is conducted to the:-

- *Mines Safety and Inspection Act and Regulations*.

As part of the excavation commitments and procedures there are a number of management plans in place to control the various safety and environmental procedures.

A 40 metre buffer is retained along the road perimeter boundaries along Wandena Road and a 20 metre buffer will be retained along boundaries to other lots.

Excavation Methods

The excavation methods will be the same as those used in existing Boral Bricks pits in the Muchea area.

The gravel and clay resources are being progressively extracted in a sequence starting with the separate removal of topsoil and overburden, the extraction of clay, and finally the restoration of the land surface. Any Gravel is used for internal road construction.

There are no proposed changes to the methods or rates of excavation.

1. The resource will continue to be excavated in stages/cells across the excavation area on an intermittent basis using the same methods.

2. Where required by the the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, a Clearing Permit will be obtained. CPS 2928/1 is in place for the current pit.

3. Any trees are the cleared in accordance with that Clearing Permits.

4. Topsoil is removed by scraping from the resource and pushing to the perimeter to form a small bund of topsoil for later use in rehabilitation. Where possible it is transferred directly to an area being rehabilitated. If no suitable rehabilitation area is available topsoil is stockpiled in windrows of 1.0 to 2.0 metres high for later use around the perimeter The location of the dumps will change as excavation proceeds, but generally these will be perimeter dumps.

5. A low bund and/or drain will be located upslope to divert stormwater around the active pit towards the settlement dam.

6. Overburden, which accounts for 2 to 5 metres, is then scraped from the surface and transferred directly to an area being rehabilitated. If a rehabilitation area is not available, such as in the early stages of excavation, the overburden is stored in perimeter bunds to assist with screening of the operations.

7. The overburden will be used at the completion of excavation to cover the excavated surface.

8. Up to this stage the overburden has been used to create screening bunds along Wandena Road; just inside the boundary of Lot 6. A large overburden dump is also located along the western edge of the proposed excavation to improve visual and other management in that direction.

9. Where gravel forms part of the overburden, the gravel is recovered and used for local roads and construction. Excess gravel is stockpiled for later use.

10. Over time material in existing dumps and windrows will be used and new dumps created as excavation moves in a staged progression.

11. Exacavation is conducted as an inside out operation where possible, commencing in the south western corner so that the sediment trapping dam can be created as the first part of the excavation.

12. Vehicles normally work on the floor of the excavation and work towards the edges of the excavation as much as possible.

13. As the resource contains several grades of clay, benches are used to enable the various clays to be separated. Each grade of clay is then stored in separate stockpiles. The location of stockpiles is shown in Figure 3 and will change from time to time as the excavations progress.

14. The depth of the excavation depends on the quality of the resource, which changes with depth. Whilst the resource extends to depths of 20 metres currently a depth of 15 metres is used on the peak of the ridge.

15. To ensure a continuous supply of clay throughout the year, clay is excavated in the drier months and stockpiled for use during the wetter months when excavation is more difficult. Stockpiles are required because there is insufficient space to store all clay resources at the Middle Swan site.

16. The excavation is undertaken by a combination of mobile plant depending on the nature of the resource as it changes and the progressive alterations to the staging and design of the pit. In some parts the safest option will be to use an excavator whereas in other locations scrapers may be the most efficient.

17. Scrapers are also used to remove overburden or transport clay to the stockpiles because they are very efficient, but the pit configuration does not always permit this.

18. Bulldozers are sometimes used to push clay and clear or reform the land surface.

19. Blending and the recovery of clay from the stockpiles will be completed using a rubber tyred loader or excavator loading directly into road trucks for transport to the factory.

20. Reforming of the landform will normally be carried out using a bulldozer, but a scraper or excavator may also be used to push the topsoil and overburden.

21. To efficiently create stockpiles a small dump truck is used to move the clay from the face to the stockpiles. Overburden that requires translocation is also moved in the dump truck.

22. Water collecting on the excavated area is retained within the pit area or directed to sediment settlement dams on the pit floor and the south western corner of the operations. The south western dam is used as a water supply source.

23. Small bunds, contour and other drains are used to direct water to the sumps and storage areas and prevent runoff from the disturbed areas.

24. These facilities are sufficiently large to retain all water from 1 : 100 storm events as shown in other Boral Bricks Company Pty Ltd pits in the area.

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

Details of Visual Management are shown in 6.3.1 Visual Management, Water Management is discussed in 6.2.2 Protrection of Water Quality and Rehabilitation Methods are listed under 7.0 Pit Closure Plan.

5.2.2 Stockpiles and Processing

1. The location of stockpiles is determined by the need to provide maximum screening. The methods to be used to minimise visual impact are addressed in 6.3.1 Visual Management. 5 include:

    - location of the site behind the already established landcare buffer along Muchea East Road.
    - the planting of perimeter trees,
    - creation of perimeter bunds,
    - placing and sizing stockpiles to minimise visual impact,

- creating overburden screening bunds that have been temporarily seeded with pasture species
- planting additional tree belts some of which will be removed in the later stages of excavation
- in later phases of the excavation creating stockpiles on the floor of the excavation.

2. Currently the stockpiles are located in the south and south west of the site.

3. Clay is recovered from the stockpiles using rubber tyred loaders loading directly to road trucks. On site processing is not required.

4. Stockpiles of resource can result in a significant amount of material being required to be stored.

5. The maximum quantity of clay stored in the stockpiles normally represents 6 month's supply from the pit.

5.2.3 Final Contours

The land surface will be contoured to match the existing landform of the area.

The elevation will be formed into a self draining landform that drains to a dam to be located on the southern portion of the resource area.

The depth of the dam will be some 10 metres and the water holding area will be made steeper, however a safe and stable batter slope will be established to maximise the volume but at the same time minimise the surface area to reduce evaporation effects.

Experience has shown that dams of this type, in completed clay pits, can be constructed in a manner whereby they will not overflow. This is done by calculating the runoff from the created catchment and ensuring that it is contained within the depression.

On completion, the land surface is to be graded down to the dam in the base of the void. The slopes will be made as gentle as possible but because of a lack of overburden will need to be 1 : 3 and even 1 : 2 vertical to horizontal, in the south near the ridge. The existing land surface near the ridge is already steep at 1 : 2, and the reformed land surface will be designed to most closely match those slopes.

The Concept Final Contours are shown in the attached plan. They show the land elevation ranging from 90 to 150 metres AHD with the water level in the proposed dam filling to an elevation of about 95 metres AHD. These elevations are consistent with the pre-mined surface.

5.3 Staging and Timing

There is approximately 45 hectares of resource on site. However because of variations in the clay resource, and the increasing depth of overburden to the north west, the current proposed excavation area is approximately 25 hectares.

It is likely that at some time in the future, as resources are used up and equipment becomes even more efficient, the areas of deeper overburden will be taken and so those areas remain as "Future Reserves".

The is anticipated to have a life of 20 plus years depending on market demands for the products.

There will be no planned changes to the current extraction rates that could be up to 100 000 m^3 annually.

In recent years the volume has been less than this because of the economic and construction downturn.

The amount of material extracted will depend on the nature of the local and export brick markets and public demand for particular colours of bricks.

The total volume of clay extracted from the Muchea area is not proposed to change, but rather the sources of the clay will include the proposed pit, in addition to continued extraction from the existing pits in the area.

Excavation is proposed to be staged according to the Staging Plan shown in Figure 3 and the Existing Contour Plan. The south western corner will be completed and the eastern pit will progress west and north.

Wherever possible rehabilitation will be continued as areas are completed to ensure that the amount of ground that is open at any one time is minimised.

5.4 Hours of Operation

Hours of operation will continue to be the same as those applying to the Extractive Industries Licence.

The hours approved in the existing Licence issued by the Shire of Chittering are 6.00 am to 6.00 pm Monday to Friday inclusive, excluding public holidays and 7.30 am to 12.00 pm Saturday.

The flexibility of a six day week operation is seen as necessary to maintain efficiency, because not all parts of the site can be excavated at all times of the year.

Restricting hours will not change the total number of trucks on the road, but will merely concentrate more trucks into a limited time, making the operation less efficient in terms of machinery usage and therefore increasing costs.

Although clay will be transported throughout the year, excavation will be discontinuous, and dependant on the need for particular clay types, and to avoid very wet conditions. It is more efficient to excavate material for a period of weeks to produce on-site stockpiles from which clay can be transported in the intervening time, as this maximises the use of mobile plant. There will also be times when there is no activity on site because stock piles at the Middle Swan works site are being utilised.

5.5 Machinery and Equipment

The operation will use modern equipment tt is regularly serviced.

All operational equipment will be serviced onsite by mobile service vehicles.

Proposed Equipment	Comment
Site office and/or containers	A transportable site office is installed on the western portion of the operations. Figure 6.
Toilet system	A serviced portable toilet system is used during excavation campaigns. Figure 6.
Bulldozer	A D11R Bulldozer or similar will be used to reform the landscape and open various stages of the pit.
Excavator	Used to extract clay and load to haul and road trucks. Figure 6.
Loader	Used to recover clay from stockpiles and load road trucks. Figure 6.
Portable crushing plant	Not required
Screening plant	Not required
Blasting	Blasting is not used.
Water tanker	A water tanker is available on site during excavation and transport operations to provide for dust suppression. Figure 6.
Rockbreaker	A rockbreaker is not used for normal excavation.
Loader	A Cat 966/972 or similar Loader will be used for loading and handling products
Fuel Storage	Fuel is not proposed to be stored on site. Vehicles are refuelled from dedicated fuel supply and maintenance trucks. Figure 6.
Maintenance	Boral Bricks has mobile maintenance truck based facilities that access the site as required.
Weighbridge	A weighbridge is not proposed.

5.6 Access and Transport

Excavation will continue to be discontinuous. It is more efficient to excavate material for a period of weeks to produce on site stockpiles from which clay will be transported in the intervening time, as this maximises the use of bulldozers and other equipment. There will also be times when there is no excavation activity on site because stock piles at the Middle Swan works site are being utilised. The excavation methods are described in 5.2 Extraction and Processing of the Resource.

Trucks exit directly to Wandena Road and then to Great Northern Highway And then south along Great Northern Highway towards the Middle Swan Works.

The number of truck movements will vary throughout the year depending on whether clay is being transported or not. During the transport of clay, it is estimated that between 5 and 10 laden trucks will leave the site per hour, depending on the type of truck and trailer combination used. At other times there may be no clay transported for several weeks. This represents a continuation of the transport methods used in the past and involves no anticipated overall increase.

The site adjoins the WAMIA livestock holding facility which exits directly to Muchea East Road.

Warning signs for trucks are used at the entrance onto Wandena Road. Figure 6.

5.7 Workforce

The workforce will continue to vary, depending on the level of operation and market demands, but usually 2 - 4 persons can be expected to be working on site when the site is operating.

5.8 Water Use

Water is to be mainly used for dust suppression.

Water from the water storage dam in the south western corner pit will continue to be used for dust suppression in the same manner as other local clay pits.

Potable water is to be brought to the site as needed.

5.9 Safety

Boral Bricks is committed to maintaining a safe working environment.

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

Boral Bricks have in place Safety Management Plans and a site specific Emergency Response Plan to cover operational procedures, which include workforce induction and training to ensure that all employees involved are made aware of the environmental and safety implications associated with all stages of the mining activities.

Where applicable Safe Operating Procedure Sheets are prepared and made available for hazards. Workers and staff on all sites are trained in the use of the procedures and all employees provided with site induction and training as necessary prior to commencing work on the site.

Radio contact is available for all vehicles, and the site is within mobile phone range.

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

A key aspect of site safety is the provision of fencing and signage.

Excavation Safety - Applicable Legislation / Policies
• *Mines Safety and Inspection Act 1994 and Regulations 1995.*
Commitments to Safety Management
• Boral Bricks is committed to maintaining a safe working environment • Safety Management procedures is implemented prior to commencement. • All workers are provided with site induction and necessary training prior to entering the site.

6.0 ENVIRONMENTAL IMPACTS AND MANAGEMENT

The likely environmental impacts are minimal on a well managed site.

6.1 BIODIVERSITY MANAGEMENT PLAN

6.1.1 Vegetation and Flora

The resource areas are parkland pasture. Clearing Permit CPS 2928/1 is current.

The protection of vegetation is discussed in the vegetation assessment of the site in Appendix 1. It should be noted that the vegetation study attached as Appendix 1 applies to the whole Lots 5 (WAMIA) and Lot 6 (Boral Bricks), and so much of the study is not relevant to this proposal.

Photographs of the vegetation are contained in Figures 1 and 2 of that report.

The relevant information contained in that assessment is;

1. The site consists of pasture with some *Eucalyptus calophylla - Eucalyptus wandoo - Eucalyptus accedens* Remnant Woodland. There is little or no understorey species within this remnant.

2. This vegetation is generally in Degraded to Completely Degraded Condition. Any reduction in this vegetation through operational demands can be offset by additional tree planting and revegetation.

3. No Declared Threatened or Priority species or Threatened Ecological Communities were recorded from the excavation site.

4. A total of 23 hectares of rehabilitation has already been undertaken along the southern and eastern portion of the northern creekline, to the north of the excavation area and along the southern creekine. This includes the Muchea East catchment to the south of the excavation area.

5. Boral Bricks will continue to work with the Chittering Landcare Group to ensure long term sustainability of the rehabilitation.

6. In later stages of excavation scattered *Eucalyptus (Corymbia) calophylla - Eucalyptus wandoo - Eucalyptus accedens* Remnant Woodland will be taken as part of the excavation program. This is restricted to isolated and scattered trees with pasture understory and ground cover.

7. Prior to any areas being cleared, a Clearing Permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* will be applied for. No clearing will take place until such a permit is in place when required by the legislation. Clearing Permit CPS 2928/1 is in place for the current excavation site. See Appendix 4. A new Clearing Permit will be required to clear ground outside the permitted area, and when excavation extends onto the ridge.

8. Also shown in Figures 2 and 3 are the areas of rehabilitation and watercourse restoration that Boral Bricks has already undertaken in

conjunction with the Chittering Landcare Group. In total across both this will amount to 23 hectares of revegetation. This revegetation was completed on land previously held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA.

9. A screening bund and trees has been planted along the eastern side of the pit, with a tree belt along the westernn side of the excavation.

10. This, combined with the commitment to return parkland pasture with the trees in clumps, will provide for a greater number of trees being present than currently exist on the proposed excavation area.

11. When combined with the WAMIA Livestock holding facility and the landcare activities on the whole site that have been undertaken in the past, and will be part of the rehabilitation of the site, a sustainable long term improvement to the habitat can be achieved, that complies with Government Policy.

6.1.1 Land Clearing

The resource areas are generally cleared. Whilst the excavation will approach some trees it is not anticipated that any will need to be removed and therefore a clearing permit will not be required.

Clearing Permit CPS 2928/1 is in place for the current excavation site. See Appendix 4. A new Clearing Permit will be required to clear ground outside the permitted area, and when excavation extends onto the ridge.

6.1.2 Fauna

As the site is currently pasture, impacts on native fauna are expected to continue be minimal.

The adjoining vegetation will not be impacted on by excavation.

6.1.4 Wetlands

There are no wetlands on the resource area.

Boral Bricks has worked with the local Landcare Group over a number of years and has rehabilitated and replanted the area of moist soils on the southern boundary. This revegetation was completed on land previously held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA.

The area now consists of rehabilitation on saline soils planted to local trees and shrubs, which serves as a wetland.

The excavation and disturbance is separated by 100 metres of pasture from the revegetation. It is proposed to retain that buffer apart from activities related to normal agricultural practices to maintain that pasture.

Biodiversity - Applicable Legislation / Policies
• None relevant.
Commitments to Biodiversity Management
• The excavation areas are cleared. • Boral Bricks will not impact on the adjoining remnant vegetation by the proposed excavation.

6.1.5 Dieback Management Plan

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

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

There are several guides to the management of Dieback.

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

The Department of Environment and Conservation generally recognises that Dieback is less likely to impact on vegetation on limestone and Spearwood/Cottesloe Land Systems, Podger F D and K R Vear, 1998, Management of Phytophthora and disease caused by it, IN Phytophthora cinnamomi and the disease caused by it - protocol for identifying protectable areas and their priority for management, EPA 2000. However recent research by Murdoch University shows that a species of Phytophthora can survive in alkaline soils.

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

On this site, with cleared land and only isolated to scattered trees, the potential dieback risk is minimal.

The site has operated as a farming property in a similar manner in the past and has been excavated for clay for the past 5 years. No adverse dieback conditions appear to have been introduced into local or adjoining vegetation.

The access roads are hard gravel sourced from on site.

However as a matter of good environmental management Boral Bricks will use practices that will minimise the introduction of weeds or plant pathogens.

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

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

The other management is to ensure that all excavation equipment and road transport vehicles are clean and free from soil and vegetable matter prior to entering the operations. This is normal practise by Boral Bricks who strive for high levels of resource hygiene to minimise any potential for dieback spread.

The following actions are taken on this site.

- Excavation is undertaken using practices recommended by DEC. See *CALM Dieback Hygiene Manual 1992* which is more practical and *CALM Best Practice Guidelines for the Management of Phytophthora cinamomi, draft 2004.* See also *Dieback Working Group 2005, Management of Phytophthora Dieback in Extractive Industries.*

- Vehicles are prohibited from entering remnant vegetation, apart from normal travel along made firebreaks and farm maintenance activities.

- The pit operates in cells that are internally draining to retain all surface water or drain to the sediment settlement and water storage dam in the south western corner.

- Contour banks and small drains are used to harvest water from upslope of the pits and direct it to storage dam.

- All vehicles and equipment to be used during land opening or land reinstatement, are clean and free from soil or plant material when arriving at site. This will occur at the previous site or at the Boral Bricks works site by using brushing and compressed air.

- Illegally dumped rubbish is to be removed promptly**.**

- No contaminated or suspect soil or plant material is or will be brought onto the site.

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

- Compliance with the Weed Management Policy.

Dieback - Applicable Legislation / Policies
• *DEC (CALM) Dieback Hygiene Manual 1992.* • *DEC (CALM) Best Practice Guidelines for the Management of Phytophthora cinamomi, draft 2004.* • Dieback Working Group 2005, *Management of Phytophthora Dieback in Extractive Industries.*
Commitments to Dieback Management
• Boral Bricks will not impact on the adjoining remnant vegetation by the proposed excavation. • Boral Bricks maintain the Dieback Management Policy to reduce the spread of *Phytophthora spp*

6.1.6 Weed Management Plan

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

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

Generally if the actions taken for Dieback are applied they will also control weeds.

The management of weeds use the following principles.

- The resource areas are cleared agricultural land with an edge of trees.
- All vehicles and equipment used during site preparation, excavation and closure are clean and free from soil or plant material when arriving at site. See 6.1.5 Dieback Management Plan.
- Vehicles are prohibited from entering remnant vegetation, apart from normal travel along made firebreaks and farm maintenance activities.
- Illegally dumped rubbish is the major source of weeds and is removed promptly.
- No weed contaminated or suspect soil or plant material is brought onto the site.

- When clearing land or firebreaks vehicles are to work in conjunction with dieback principles and push from areas of better vegetation towards areas of lower quality vegetation.
- Weed management is integrated with normal rural farm weed management already in place.
- Unwanted grasses are be sprayed with grass selective spray prior to seeding or rehabilitation.
- Weed management work from least affected areas to most affected.
- Declared weeds are treated promptly by digging out or spraying if present.
- Weeds will be treated promptly no matter how few there are.
- Ongoing monitoring of weeds should be undertaken at least annually in autumn, prior to winter rains.
- Compliance with the Dieback Management Policy.

Weed - Applicable Legislation / Policies
• *Agriculture and Related Resources Protection Act 1976.*
Commitments to Weed Management
• Boral Bricks will continue to use the weed policy to try and prevent the introduction of Declared, Environmental or other weeds to the site.

6.2 WATER MANAGEMENT PLAN

6.2.1 Protection of Water Quality

The extraction of clay is a chemically free operation with the only liquids used being lubricants for machinery.

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

Guidance on the quality of water can be found in;

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

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

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

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

- *Overview*
- *Minesite water quality monitoring*
- *Minesite stormwater*
- *Mechanical servicing and workshop facilities*
- *Mine dewatering*

6.2.2 Surface Hydrogeology

Surface water occurs along the water course to the south of the resource area. The water course in the south has elevated salinity and has been restored as part of a local landcare project.

One watercourse runs east to the west along the southern edge of the site. This has been rehabilitated and fenced as part of a landcare project in conjunction with the Chittering Landcare Group. This revegetation was completed on land previously held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA.

There are no water courses on the area proposed for excavation. The claypit and disturbances are 150 metres from this watercourse and 100 metres from the revegetation associated with it.

No alteration to drainage lines, and neither surface water nor ground water, is proposed or anticipated. The proposed excavation lies within the Muchea East Catchment.

Rehabilitated areas are to be formed to maximise infiltration and reduce surface runoff, with contour banks potentially being used in difficult areas.

The Chittering Landcare Group, worked with Boral Bricks to revegetate the southern drainage line, have previously proposed contour banks to reduce surface water runoff to the drainage line. This revegetation was completed on land previously held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA.

Surface water is contained and not allowed to flow to the watercourse unless part of a controlled dewatering program. See below.

Superficial and surficial aquifers are shallow surface aquifers that form in surface sands and sediments. On this site, these normally form in the surface sand or more permeable areas where the water runs along the top of the less permeable shale to emerge as seepages along the base of slopes and where more permeable interbeds outcrop, and adjacent to the water course; for example to the south of the clay resource. Drilling has revealed a small seepage to the south east of the resource which appears to flow from a more permeable bed at approximately 12 metres depth to the surface. Water quality on 11 May 2005 was 4 235 mg/L salt and a pH of 6.3.

Surface Water Collection - Dewatering

During excavation, all water collecting in the active area from rainfall is contained in the active pit by the slope of the wall and depth of excavation, as occurs in other clay pits operated by Boral Bricks in the local area, or is directed to the sediment settlement and storage dam in the south western corner of the operations.

There is no uncontrolled release or escape of surface water.

The pit void and sediment settlement and storage dam are sufficiently large to retain all water from 1 : 100 storm events as shown in other Boral Bricks pits in the area.

The sediment settlement dam is able to act as a contingency for dewatering excess water, prior to the summer excavation phase.

Contour banks will be designed into the final land surface to minimise runoff to the drainage line. Boral Bricks will continue to work with the Chittering Landcare Group to minimise environmental impacts and maximise the protection of the Muchea East Catchment.

The sediment settlement dam is located down slope to the south west from the main pit to enable a contingency of dewatering the sump in the base of the pit, prior to the summer excavation phase.

If required, dewatering is carried out using the water from the storage dam and pumping it to a small intermediate basin in which the water can be treated to improve water quality as required. The secondary basin contains limestone to neutralise any acidity. During any release monitoring of the water is regaulrly carried out to ensure that the water quality is equal or better than the water in the drainage line.

Currenly water is only released occasionally and only to the southern drainage line. In the future a similar facility may be constructed in the north.

6.2.3 Groundwater Protection and Water Use

Parsons Brinckerhoff 2006 found the groundwater elevation to be 116 – 117 metres AHD on the ridge, dropping to 97 metres AHD in the lower elevations in the south, that is below the base of the clay excavations.

The dam in the south west corner sits in the lowest elevation and does not have any water seepage into it, and is therefore above the groundwater elevation at that point. The separation to groundwater from the base of the pit varies from 5 – 10 metres.

The clay is impermeable with horizontally bedded aquicludes and will contain spills and prevent their entry to depth.

No seepages have been encountered in the excavation completed to date and, as excavation is to continue on the ridge in an elevated position, none are anticipated.

The groundwater is protected by the measures and management plans that follow relating to maintenance, refuelling and wastes.

The same procedures as used in all existing quarries will be used in the event of any fuel or hydrocarbon spill, including those in excess of 5 litres. Any spills are contained by the excavation. Soil and resource will quickly be placed around any spill to contain it in as small an area as possible. When adsorbed, the contaminated soil ise scooped up and removed to an approved landfill or other approved site. Where the spill is contained but not adsorbed overburden will be added to soak up the excess spill and then scooped up for removal.

6.2.4 Salinity

Clay with high salinity levels is not excavated. The water in clay pits is normally only affected by salts when fresh clay is being disturbed such as during excavation. Evidence from other pits shows that the water in the dams is only mildly elevated with salt and, on closure, the dams become fresher.

Boral Bricks do not excavate clay which is too saline. High levels of salt are not targeted because the salt can impact on the surface appearance of the bricks.

Drilling revealed a small seepage to the south east of the resource which appears to flow from a more permeable bed at approximately 12 metres depth to the surface. This provides an indication of water quality at depth. Water quality on 11 May 2005 was 4 235 mg/L salt and a pH of 6.3.

Surface water occurs along the water course to the south of the resource area. The water course in the south has elevated salinity and has been restored as part of a local landcare project.

Experience from other clay pits has shown that when a pit is closed and rehabilitated, the surface water quickly removes the salt from the surface clay and the water storage becomes fresher.

This is borne out on north eastern Location M1327 by the old clay pits which had a salinity of 880 mg/L and 110 mg/L for the two water bodies in October 2004. This water is suitable for stock. As a comparison humans can drink to 990 mg/L and stock to 12 000 mg/L.

6.2.5 Recharge and Water use

When the farm was first cleared the removal of the vegetation will likely have increased the recharge.

As the parkland pasture is to be returned there will be no significant changes to the current level of recharge on site as a result of excavation.

The water collecting in the base of the pit is used for dust suppression, as it is in all Boral Bricks clay pits. Being fresher than the existing surface water flowing in the creeks and streams, such water will be suitable for dust suppression.

At the end of excavation the site will be rehabilitated to a dam in the base of the void. Although the dam will hold water, the overall deep recharge of the land should not be significantly different to the pre-excavation condition.

With a total possible open area of say 15 hectares at any one time, and all water retained on site during and after excavation and a rainfall of 688 mm per year with no infiltration, a volume of 118 200 kL is likely to be retained on site annually. This volume is a significant volume to be used for dust suppression and as a farm dam at the end of excavation.

Potable water is to be brought to the site as needed.

6.2.6 Acid Sulfate Risk

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

The site is listed in WAPC Planning Bulletin 64 as having a low to no risk of ASS or PASS at depths of >3 metres. However mapping by WAPC did not recognise the potential for acidic conditions to occur in the grey carbonaceous shales of the Muchea Beds below the water table.

In general, however, the interest has been over reactive and conditions and risk applied in many areas where there is no geological risk or evidence of acid sulfate.

For acid sulfate conditions to be present the soils and rocks must be under reducing conditions, or have been under reducing conditions. The type of oxidation minerals present can be used to provide a highly definitive method of identifying materials at risk.

Acid Sulfate Soils can potentially form under reducing conditions when there is a source of carbon and a source of sulfur (normally from sea or saline water). Micro-organisms are thought to play an important role in reducing the sulfates within the sediments to form the iron sulfide. The other source of sulfides is natural sulfides that might occur in igneous or other rocks.

It is a natural phenomena, that can be exacerbated by disturbance.

The most definitive survey procedure is produced by the Acid Sulfate Soil Management Advisory Committee NSW, 1998, in their *Acid Sulfate Manual.* This Manual forms the basis for much of the assessment procedures in Australia, including those adopted by the Western Australian Planning Commission and the Department of Environment and Conservation. The *Acid Sulfate Manual* adopts the procedure of reviewing the published data followed up by field assessment, which has been completed for this site. If a geological risk is determined, then a Preliminary Acid Sulfate Assessment is conducted.

The clays on site are also tested for sulfur which would burn to sulfur dioxide during brickmaking. Boral Bricks therefore regularly tests the clay for sulfur as part of their quality control for firing bricks and the resulting gaseous emissions.

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

On site the shale beds are clay and silt, horizontally bedded and white in colour. At depth, below the water table, they turn into grey carbonaceous claystone and siltstones that carry pyrite. Above the carbonaceous beds the sediments consist of oxidised clays and silts of some 10 to 30 metres thickness.

Potential acid sulfate soils or rocks are tested under conditions which speed up the natural oxidation of the soils on exposure to the atmosphere. Natural oxidation can occur within hours and days of exposure and is normally

complete for small samples within a month. Laboratory testing speeds up this process with the use of H_2O_2 or other oxidising agent and then tries to quantify the amount of oxidation and acid development. One of the best methods of preliminary assessment is to collect samples and leave them exposed to the atmosphere for one month. The pH of the sample is to be tested immediately on exposure and at the end of one month for changes to pH.

As there are grey carbonaceous shales at depth below the excavations an acid sulphate investigation was commissioned by Boral Bricks from Parsons Brinkerhoff. That study found some evidence of acid sulphate below the base of the pit and as a *result, Parsons Brinkerhoff* prepared an Acid Sulfate Management Plan which has been used during the excavations on site.

An Acid Sulfate Management Procedure Plan was provided by Parsons Brinkerhoff and this is included as Appendix 3.

Boral Bricks Company Pty undertake routine testing for sulfur as part of their normal production procedures to gain knowledge of any sulfur within the firing process. If total sulfur levels exceed 0.03% the species of sulfur will be determined to see if the sulfide sulfur exceeds the trigger level at which further studies are recommended.

Boral Bricks Company Pty Ltd has standard management practices in place at all their clay pits if any acid sulfur conditions are detected, because acidic conditions can impact on clay processing and brick making.

A sediment and water trapping basin has been constructed in the south west of the operations. This collects the surface water from disturbed land on site. The water storage is used for wetting down and dust suppression. When excess water is present it is pumped to a small treatment basin to the east which is lined with limestone to ensure any acidity in the water is neutralised and then released to the creekine in the south. Boral Bricks regularly test the water and in particualar the waters released to the watercourse.

The limestone is high in $CaCO_3$ which neutralises any acid within the water. It is a standard acid sulfate management technique and is used to ensure that any potential acidic water quality is treated prior to release to the watercourse.

Water in the current operational pits of Boral Bricks is normally of moderate in salinity and little different to surface water in the drainage line at the south of the resource next to Muchea East Road. During excavation and on exposure to rainwater any salt is washed from the surface of the clay.

When a pit is closed and rehabilitated, the surface water quickly removes the salt from the surface clay and the water storage becomes fresh. This is borne out on Location M1327 by the old clay pits which have a salinity.

When dewatering water samples are collected regularly and show that the water is neutralized to slightly above neutral prior to release by contact with the limestone.

The proposal complies with all Department of Environment and Conservation Guidelines.

6.2.7 Waste Rock and Tailings Management

There is no washing of products. Subgrade materials are used for subsoil restoration or used for perimeter bunding and landform restoration.

There will be no waste rock or tailings.

6.2.8 Waste Materials

- **Unauthorised Access and Illegal Dumping**

The potential for rubbish to be dumped relates to unauthorised access to the site. Access is restricted by current farm fencing and locked gates. Fences are maintained and upgraded as required.

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

- **Solid Domestic and Light Industrial Wastes**

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

- **Wastewater Disposal**

Anapproved serviced portable toilet facility is located on site when the site is manned.

6.2. Refuelling and Maintenance

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

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

All spills are to be cleaned up in accordance with the summarised procedures following.

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

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

Boral Bricks have in place safety and pollution management procedures for all their operations. These are summarised below.

Refuelling - Fuel Spill Management Plan

Refuelling uses dedicated mobile fuel tankers. There will be no onsite fuel storage. This method is undertaken on most mine and construction sites as well as many farming properties and is the method used on all other Boral Bricks pits including those in the local area. Refuelling will occur in the active pit area to allow for containment if any spill did occur.

Clays such as this are normally impermeable. Clays usually have permeabilities of 10^{-11} - 10^{-5} cm/sec, (Hirschberg 1993) depending on their nature. The experience of Boral Bricks is that these clays, below the influence of roots and when compacted, have permeabilities in the order of 2×10^{-9} cm/sec.

The main risk of contamination is the minor drips that occur during the removal of hoses etc. Minor spills are quickly degraded by soil microbial matter. Any drips or minor fluid spills are scooped up with the clay resource and sent to the Middle Swan works site, where they are burnt with the clay during the firing process.

The only other risk is from a tank rupture, but tanks are designed to manage this eventuality. Soil contaminated by large spills will be removed from the site to an approved disposal area.

- Refuelling will be carried out in accordance with Boral Bricks Refuelling Procedures that are in accord with the DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing, *Mechanical servicing and workshop facilities* and *Above-ground fuel and chemical storage*. A copy of the Boral Bricks Refuelling Management procedures is attached as Appendix 7.

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

- The operators of the mobile refuelling facilities (SWP) are trained in re-fuelling duties including the management of any spills.

- Refuelling and lubricating activities are to occur in the base of the pit, and equipment for the containment and cleanup of spills is to be provided. The mobile facilities are equipped with adsorbent mats and products (attapulgite) to be used in the event of spills.

- Spillage will be contained in plant and working areas by shutting down plant or equipment if the plant or equipment is the source of the spill (provided it is safe to do so).

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

- All significant adverse incidents (such as a fuel spill of >5 litres) in one dump, are to be recorded, investigated and remediated. A record is to be kept of incidents, and DEC, DOW and Shire of Chittering notified within 24 hours of an incident.

- In the event of a spill or adverse incident, activities will be stopped in that area until the incident is resolved.

- Any spills will be contained by the excavation. Soil and resource will quickly be placed around the spill to contain it in as small an area as possible. When contained, the contaminated clay will be scooped up and removed to an approved landfill or other approved site.

Dangerous Goods and Hazardous Substances

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

Servicing and Maintenance

- All major servicing of vehicles will be conducted off site Minor maintenance is carried out with dedicated trucks equipped with oil and waste recovery systems.

- Waste oil and other fluids derived from the routine maintenance of mobile machinery, is transported off site and disposed off at an approved landfill site. Grease canisters, fuel filters, oil filters and top-up oils is stored in appropriate containers in a shed or brought to the site as required.

- The service truck collects all waste oils and lubricants and takes them back to the Middle Swan Works Site for correct disposal.

- Vehicle washdown is not used on site.

- Regular inspections and maintenance of fuel, oil and hydraulic fluids in storages and lines will be carried out for wear or faults.

- Servicing plant and equipment is in accordance with a maintenance schedule.

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

- Rubbish generated is to be recycled wherever possible and periodically disposed of at an approved landfill site.

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

6.2.10 Monitoring

Boral Brick has in place quarterly water sampling programs to ensure that the quality of water within the drainage line and water storage dam is environmentally acceptable to the local conditions.

Monitoring of any water dewatered from the sediment settlement dam is carried out regularly for acidity and relevant ions to ensure the quality of water discharged to the drainage line is equal or better than the existing water in the waterway.

Water Management - Applicable Legislation / Policies

DEC – DMP Water Quality Protection Guidelines for Mining and Mineral Processing

- *Overview*
- *Minesite water quality monitoring*
- *Minesite stormwater*
- *Mechanical servicing and workshop facilities*
- *Mine dewatering*

Commitments to Water Management

- Boral Bricks has in place a site code outlining requirements for operators and drivers.
- Boral Bricks conducts training programs on pollution minimisation practices.
- Boral Bricks conducts regular water sampling and maintains the water quality protection measures listed above.

6.3 ATMOSPHERIC POLLUTION MANAGEMENT PLAN

6.3.1 Visual Management

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

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

The site is zoned Agriculture Resource under the Shire of Chittering Town Planning Scheme. The zoning has objectives that provide for the maintenance of productive grazing land, protection of the landscape values and continued extraction of the basic raw materials. The proposed excavation has been designed to comply with these objectives.

The site is joined on the west by the Western Australian Meat Industry Authority livestock holding facility. The eastern boundary is Wandena Road.

The closest dwelling remains the dwelling in Wandena Road at a distance of 250 metres from the pit and stockpile area. Other dwellings appear to be 600 m to the south east and 800 m to the east.

The potential impact from this pit on dwellings to the east of Wandena Road, is reduced by the used of constructed bunding and tree planting along the Wandena Road boundary.

Tree belts have been planted along Powderbark Road, and strategically between the dwellings and that pit. See Figure 2.

The main potential for visual impact is the northern face from Muchea East Road and the eastern face from Great Northern Highway. The other potential impact is from the clay stockpiles that will have to be created on natural land surface early in the life of the excavation. In later years these can be located on excavated ground, but at this stage the south western pit has not yet been sufficiently excavated.

Great Northern Highway lies at a distance of 1.8 km from the eastern face of the quarry, with scattered trees of parkland pasture occurring on the intervening ground between the Highway and the excavation, which should assist in minimising visual impact. A drive along Great Northern Highway, and views west from the top of the resource, indicate that there is at least one area from which a glimpse of the northern face of the resource is visible from Great Northern Highway. This glimpse will be through trees at a distance of 1.8 km and from moving traffic. The impact should therefore not be significant.

As the land rises from Muchea East Road, from 90 metres AHD to 150 metres AHD, visual impact of the northern face from Muchea East Road is a consideration. Tree belts, as part of the landcare project, are already established along Muchea East Road, west of Wandena Road. Drives along

this section of road, and views from the resource area, indicate that the site is visually well protected with only isolated small glimpses of the resource visible from Muchea East Road.

However, east of Wandena Road and from the southern part of Powderbark Road, the site is partially visible even though there are clumps of trees in place along Wandena Road.

Trees have been planted along Wandena Road to increase the visual buffer.

A similar screening bund and trees will be planted along the western side of the pit, with a tree belt along the southern side of the excavation. This will be located on the overburden dump which will be installed with temporay vegetation cover of *Acacia Saligna* and other local *Acacia* species.

The existing trees provide screening of parts of the excavation. These will left in place and only cleared as required for each portion of the pit excavation.

The pit is worked inside out on the floor of the pit between 10 and 15 metres below natural ground level.

The final land surface will be formed to a sloping land surface with a dam in the base to the south west.

IDEAL OPERATIONAL PROCEDURES	**COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE**
• Locate exposed features behind natural barriers and landform.	• Constructed bunds are in place along Wandena Road. • The pit is worked from below natural ground level, using the land surface to provide screening. • The recommended 20 metre buffer zones are retained along other perimeter boundaries of the site, to the north, west and south, with a road buffer of 40 metres along Wandena Road. • The south western pit will be used to house stockpiles when excavation has been completed.
• Operate from the floor of the pit below natural ground level.	• This is used.
• Avoid breaks in the skyline due to workings and haul roads.	• The excavation areas are below the high natural ground features. They are located low in the landscape and are cut further in the ground. • The existing ridgeline has not been removed when viewed from Great Northern Highway.
• Push overburden and interburden into positions where they will not be seen or can form screening barriers.	• Perimeter bunds are in place in the east and west.
• Stage workings and progressive rehabilitation to provide visual protection of later activities.	• The excavation areas are being staged.

• Adopt good house keeping practices such as orderly storage and removal of disused equipment or waste.	• Boral Bricks maintains a tidy site.
• Provide progressive rehabilitation of all completed or disturbed areas.	• Rehabilitation to productive agricultural land is proposed. • The wet soil area in the south has been rehabilitated by Boral Bricks and the Chittering Landcare Group prior to the land being sold to WAMIA.
• Minimise the amount of ground used at any one time.	• This is used wherever possible. Only ground required for excavation will be prepared.
• Install fences and gates which are compatible with the style of the area.	• The resources lies on agricultural land that is farmed and fenced and set back from local roads. • Fences and locked gates are in place.
• Minimise offsite impacts of night lighting.	• Night operations are not used.
• Paint and maintain buildings exposed, plant and equipment with low impact colours.	• No permanent plant is used. • The temporary buildings are located behind vegetation and landform in the west of the operations.
• Locate roads and access to prevent direct views into the site	• No new roads are proposed. • The existing access roads will be used.
• Locate buildings, plant and stockpiles in areas of low visual impact and maintain appropriate size.	• No permanent plant will be used. • Mobile plant is located behind vegetation and landform in the west of the operations.
• Ensure transport vehicles do not spill material on public roads and ensure prompt cleanup if it occurs.	• Company practices and drive/operator training address the need to minimise spill by ensuring the trucks are not overloaded or material is not left on the outside of trays. • Collection of spills is carried out when reported. • Drivers are instructed to be responsible for their loads.

Excavated areas will be progressively rehabilitated to productive agricultural land as completed.

Visual Management - Applicable Legislation / Policies
• None applicable
Commitments to Visual Management
• Boral Bricks is committed to management of visual impact and will implement the measures outlined

6.3.2 Noise Management

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

The Environmental Protection (Noise) Regulations 1997, require that sensitive premises including dwellings in non industrial areas are not subjected to noise levels exceeding 45 dBA for more than 10% of the time, 55 dBA for more than 1% of the time and never exceeding 65 dBA during normal working hours. There are penalties for tonality of 5 dB, modulation 5 dB and 10 dB for impulsiveness, although impulsiveness is not likely to be relevant.

Occupational noise associated with the quarrying processes falls under the Mines Safety and Inspection Act 1994 and Regulations 1995. The management of occupational noise is normally handled by providing all necessary hearing protection, as well as conducting worker inductions, and educational programs for all staff. Regular site audits of quarry and mining operations are normally conducted by the Department of Mines and Petroleum.

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

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

Boral Bricks has noise management procedures in place. The main on ground management activities are summarised below. They are the same management procedures that are used by other clay excavators in the local area and within the past five years of operations.

The closest dwelling remains the dwelling in Wandena Road at a distance of 250 metres from the pit and stockpile area. Other dwellings appear to be 600 m to the south east and 800 m to the east.

Sound travels mostly in a “line of sight” manner. Sold barriers are very effective in attenuating or suppressing sound transmission.

Therefore all static and processing equipment are located to provide maximum noise screening, behind bunds if sufficient overburden is available. The overburden bunds are used to provide screening from that direction and the nearest dwelling where possible.

Not all equipment operates at the same time. Similarly not all resources will be worked at the same time.

The site is to be progressively rehabilitated by placement of the overburden followed by top soil and pasture.

IDEAL NORMAL OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE
• Comply with the *Environmental Protection (Noise) Regulations 1997.*	• Boral Bricks will comply with the Regulations.
• Maintain adequate buffers to sensitive premises.	• No changes are proposed to the previously applied footprint in terms of distances to the closest dwellings. • Excavation is moving west away from the closest dwelling.
• Locate exposed features behind natural barriers and landform.	• The existing pit is excavated from the west, behind the screening landform along the eastern boundary. • An earth bund has been constructed along the eastern boundary and overburden has been formed into s bund along the west of the proposed pit assist noise screening.
• Operate from the floor of the pit below natural ground level.	• This is used.
• Push overburden and interburden dumps into positions where they can form screening barriers.	• Perimeter bunding is used where overburden is available, to provide maximum noise screening.
• Design site operations to maximise the separation and protection from sensitive premises.	• See above.
• Maintain all plant in good condition with efficient mufflers and noise shielding.	• Boral Bricks has modern equipment that is maintained in good condition.
• Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	• No changes to the access roads are proposed. The existing roads will be maintained to minimise noise generation. • The first part of the access road is sealed.
• Implement a site code outlining requirements for operators and drivers.	• Boral Bricks has site induction and training for all personnel for all their operations.
• Use equipment that will minimise noise generation.	• The most efficient and environmentally suitable equipment is used.
• Shut down equipment when not in use.	• Boral Bricks use this policy to save fuel and maintenance costs in addition to noise minimisation.
• Scheduling activities to minimise the likelihood of noise nuisance.	• Operations are intermittent and take place in campaigns throughout the year.
• Fit warning lights, rather than audible sirens or beepers, on mobile equipment wherever possible.	• Lights or low frequency frog beepers are to be used rather than high pitched beepers to restrict noise intrusion.
• Use transport routes that minimise community disruption.	• Transport is along Muchea East Road to Great Northern Highway. All roads are sealed. • The first part of the access road and

	the transport route is sealed.
• Avoid the use of engine braking on product delivery trucks in built up areas.	• Truck drivers are instructed to minimise the use of engine braking.
• Minimise and conduct at the least disruptive times, non day to day activities such as vegetation, topsoil or overburden stripping on exposed ridgelines.	• Quarrying and processing operations are to be continued to be conducted during the approved working hours.
• Provide a complaints recording, investigation, action and reporting procedure.	• A complaints recording and investigation procedure is used. • No complains relating to noise have been recorded
• Conduct training programs on noise minimisation practices.	• Boral Bricks maintains site induction and training for all personnel.
• Provide all workers with efficient noise protection equipment.	• All personal noise protection equipment are provided to staff.
IDEAL BLASTING PROCEDURES	
• Blasting is conducted to the *Mines Safety and Inspection Act 1994 and Regulations 1995.*	• Blasting is not be used.

• **Noise Management - Applicable Legislation / Policies** • *Environmental Protection (Noise) Regulations 1997.* • *Mines Safety and Inspection Act 1994 and Regulations 1995.*
Commitments to Noise Management • Boral Bricks are committed to minimising noise emissions and will implement the measures outlined above. • Boral Bricks will comply with the *Environmental Protection (Noise) Regulations 1997.*

6.3.3 Dust Management Plan

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

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

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

A draft *Dust Management Guideline* on the development and implementation of a dust management program has just been released for comment by the Department of Environment and Conservation (May 2008). This mainly relates to monitoring but is used to guide this assessment

Occupational dust associated with the quarrying processes falls under the *Mines Safety and Inspection Act 1994 and Regulations 1995*.

There are no proposed changes to the operations or nearby dwellings. Over time the active face will move further away from the closest dwelling.

A Dust Management Plan has been prepared and is attached as Appendix 5.

The main potential for dust generation is from the movement of traffic on the access road and within the pit and active areas in summer. The first 50 metres of the access road is sealed.

Excavation on site is intermittent with several excavation campaigns through the year per year being typical. Transport of clay from the stockpiles occurs on other days and during excavation.

The only closest dwelling remains at 250 metres from the eastern edge of the excavation with separations of 600 metres and 800 metres to the next closest dwellings. Excavation is moving west away from those dwellings.

A water tanker is maintained on site during excavation in summer when the risk of generating dust is greater. The water will be used to settle dust on the pit floor and to reduce the dust emanating from any transport along Wandena Road. It will also be used to water any of the internal access roads as required.

A truck wet down bay is established as used in other pits. The loads on trucks are wetted down or covered as necessary although this has been found to not always be required because of the nature of the clay which is normally transported as lumps. New trucks have automatic tarpaulins fitted to cover the clay during transport.

Apart from the initial soil clearing and surface reinstatement, operations will be conducted 5 to 15 metres below natural ground level.

Bearing in mind the distances involved and the dust suppression methods in place, dust should not impact on any dwellings and this appears to be the case. There are no proposed changes to the excavation methods, or rate of excavation.

Only one complaint is recorded for the past five years. That complaint occurred in 2010. The complaint was investigated and found not to match the operations or the prevailing wind at that time.

See Dust Management Plan – Appendix 5.

Dust Management - Applicable Legislation / Policies

- *Guidance for the Assessment of Environmental Factors, EPA, March 2000.*
- *Land development sites and impacts on air quality, DEP, 1996.*
- Department of Environmental Protection Guidelines, November 1996 and *DEC 2008, A guideline for the development and implementation of a dust management plan*

Commitments to Dust Management

- Boral Bricks will take the necessary steps to manage and contain dust by implementing and maintaining the Dust Management Plan.

6.3.4 Fire Management

The excavation areas are relatively small and will form a natural fire break.

The machinery used on site is little different to farm machinery in terms of fire risk although there will be more of it. The risk will often be less than farm traffic because the Boral Bricks traffic will be restricted to hardstand and cleared areas.

Water available on site can be used for fire fighting.

> *The safety of workers is managed through a Safety Management Plan developed through the Mines Safety and Inspection Act 1994 and Regulations 1995.*
>
> *There are a number of management actions that can be taken in quarries to minimise fire risk and these will be used wherever possible. The general management actions are summarised below together with the potential issues that relate to this site. The actions will be used where applicable and as the opportunity presents to minimise fire risk.*

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

A Fire Management Plan was prepared by FirePlan WA for the clay excavations in this area. The plan has been updated for this site. See Appendix 6.

Fire Management - Applicable Legislation / Policies

- *Bush Fires Act 1954.*
- *Shire of Chittering Bylaws.*

Commitments to Fire Management

- Boral Bricks will ensure the quarry operates to the standards in the *Mines Safety and Inspection Act 1994 and Regulations 1995.*
- Boral Bricks will ensure the quarry complies with the local fire safety requirements and operates in compliance with normal rural fire practise and restrictions.

7.0 CLOSURE – REHABILITATION PLAN

7.1 Land Use Policies

The site is located on portion of Lot 6, Wandena Road in a rural area.

7.2 End Use

The extraction areas will be returned to agriculture production as a gentle swale of parkland pasture and with a farm dam in the base of the depression.

7.3 Mine Closure Considerations

There are no particular considerations apart from constructing soils that are capable of growing pasture.

Rehabilitation will contain Dieback and Weed Management actions as applicable.

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

The site is zoned Agriculture Resource under the Shire of Chittering Town Planning Scheme. The zoning has objectives that provide for the maintenance of productive grazing land, protection of the landscape values and continued extraction of the basic raw materials. The proposed excavation has been designed to comply with these objectives, by returning the land surface to a form that is similar to that currently existing, and rehabilitating the land to parkland pasture.

The current land surface is parkalnd pasture, with clumps of scattered trees. A significant number of tree belts have been planted to the north and south on land that was once held by Boral Bricks (Midland Brick) and subsequently sold to WAMIA in conjunction with landcare operations. In all some 23 hectares of revegetation has been established prior to the commencement of excavation.

The final surface will be returned to parkland pasture.

Critical aspects of the rehabilitation are;

- *All storm water running off from the site should be collected in contour drains and directed to sediment trapping dams.*
- *Contour drains should meet around the base of the filled area to collect any drainage from the site, and the water shall be directed to sediment trap dams.*
- *Compacted areas to be revegetated must be ripped and the ground surface cultivated.*

- *Final ground cover rehabilitation is to be carried out progressively during the first winter following surface restoration because delaying for one year will severely reduce the success rate of rehabilitation due to compaction of the ground. Each portion of the fill is to be progressively completed where possible and established with parkland pasture.*

- *Where available, overburden and topsoil will be used to provide a better planting base.*

- *Boral Bricks will liaise with the Chittering Landcare Group to ensure compatibility with the past and proposed landcare activities on site.*

7.4 Rehabilitation Objectives

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

Appropriate contour banks will be used to control and harvest surface water from the post mined landform.

Boral Bricks involves the site staff in the objectives of land restoration and revegetation to assist in providing an awareness of site ownership and a better rehabilitation outcome.

Completion criteria

- Stable post-mining landscape, and the minimisation of wind and water erosion. Match slopes and landform to those of the face of the ridge and local area.

- Provide for the protection of the local groundwater resource in terms of both quality and quantity.

- Provide a farm dam in the base of the void with bare water catchment slopes to increase water harvesting. Pasture will be used on the more gentle slopes of the void.

- Achieve weed species at levels not likely to threaten the pasture and land uses.

- Provide clumps of trees to create parkland pasture at rates of 20 per hectare

Vegetation Clearing

1. Clearing will be in accordance with the applicable Clearing Permit, currently CPS 2928/1.

2. The remaining vegetation will then be cleared by pushing to windrows for burning in winter.

3. Pasture will be taken with the topsoil.

Landform Reconstruction and Contouring

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

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

3. The land surface will be left as a sloping land surface to match the existing landform.

4. The land surface will be graded down to several dams in the base of the void. The slopes will be made as gentle as possible but, because of a lack of overburden, will need to be 1 : 3 and even to 1 : 2 vertical to horizontal, in the east. The existing land surface is already moderately steep and the reformed land surface will be designed to be compatible with those slopes. See Figure 5.

5. The steeper slopes will increase water harvesting from rainfall events and therefore will add to the productivity of the post excavation land surface.

6. Contour/interceptor banks will be constructed to prevent rain from causing excessive soil movement in susceptible areas of the reconstructed land surface.

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

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

Topsoil and Overburden Removal Replacement

1. Where possible topsoil and overburden will be directly transferred from an area being cleared to an area to be rehabilitated. Boral Bricks will spread any recovered topsoil to increase the total organic carbon fraction, improving soil properties such as resistance to water and wind erosion and moisture retention.

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

3. Overburden, if available from the excavations, will be pushed to assist with visual and noise screening to the west of the pit. From there it can be used for the rehabilitation process.

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

5. Where possible topsoil clearing and excavation will be undertaken in wetter months.

Pre-Planting/Seeding Weed Control

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

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

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

4. The Weed Management Plan will form the basis of weed treatment. Weed management will be integrated with the normal farm practise on site.

Revegetation

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

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

3. The sowing of pasture and crop will be integrated into the normal farming systems. Seeds of pasture species will be spread by normal farm practice at rates and species determined by the land holders/farm manager with advice from either a consultant or the Department of Agriculture and food if necessary.

4. Trees will be installed as tube plants during June - July in clumps on the rehabilitated land surface and will be provided with a 10 g tree fertiliser tablet placed beside the plant. The planting density will be 200 tube plants per hectare, planted in clumps.

5. The clumps of trees will be fenced to exclude stock, and rabbit guards installed if deemed necessary at the time of planting. If no stock are retained on site fencing will not be necessary.

Species list of local trees suitable for revegetation

Hardened tube plants from the following local species will be used for the revegetation.

Acacia acuminata
Acacia microbotrya
Eucalyptus accedens
Eucalyptus accedens

Eucalyptus calophylla
Eucalyptus loxophleba
Eucalyptus wandoo

Fertiliser

1. Fertiliser will be integrated with normal agricultural practice.

Irrigation

1. The land will be returned to normal non irrigated pasture.

Erosion Control

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

2. The soils are relatively permeable in the upper horizons. Therefore runoff is normally minimal apart from storm events and if any overlying sand becomes non-wetting.

3. Clay and the associated gravel and loam soils are not susceptible to wind erosion. Replacing the cover crops at the first opportunity is the best means of minimising wind erosion.

4. The surface will be internally draining to the dam in the south west. In areas not internally draining, several small contour banks will be established around the ridge to reduce the potential for erosion. See Concept Final Contour Plan.

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

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

Monitoring

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

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

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

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

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

5. Provide ongoing weed management to identify and treat significant environmental weeds or weeds likely to impact on the rehabilitation.

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

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

Rehabilitation - Applicable Legislation / Policies
• Nil
Commitments to Rehabilitation
• Boral Bricks will ensure the completed land surface is formed to the standards in the *Mines Safety and Inspection Act 1994 and Regulations 1995.* • Boral Bricks will rehabilitate the surface as outlined above and monitor the revegetation and parkland pasture.

8.0 References - Reading

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Appendix 1

Local Government Act 1960

Municipality of the Shire of Chittering

By-law Relating to Extractive Industries

Second Schedule

EXCAVATION LICENCE

Licence Holder:	**Midland Brick**
Address:	**102 Great Northern Highway, Middle Swan WA 6056**
Land Description:	**Lot 13 Wandena Road, Muchea**
Material to be excavated:	**Clay and Minor Gravel**
Term of Licence:	**5 Years**

Permitted Hours of Operation:

- Monday to Friday - 0600 - 1800 hours
- Saturday - 0730 - 1700 hours
- Sunday & Public Holidays - not permitted except with the written approval of Council

This licence is issued with the Shire of Chittering By-law relating to Extractive Industries upon and subject to the following conditions:

1. ***The extractive industry licence is for a period of five (5) years from the date of issue until the 30 June in the year specified as the year of expiration. The proponent may apply for an extension of the licence for a further period of up to five (5) years. This application is to be made no later than three (3) months prior to the expiry of the current licence;***
2. ***A guarantee/bond or other acceptable form of security shall be lodged with or paid to the Council in accordance with the amounts stipulated in Schedule 3 of the Extractive Industry Local Law;***
3. ***The development to comply with the provisions of Council's Town Planning Scheme No.6, the Health Act 1911, Building Code of Australia and any other relevant Acts, Regulations, Local Laws and Council Policies (except where varied by this approval).***
4. ***Prior to the commencement of each stage of excavation as shown on Figure 6 of the report:***
   (a). An assessment shall be conducted to determine whether acid sulphate soils are present on the land and, if present, their extent and severity;

(b). If the stage is found to contain acid sulphate soils, an Acid Sulphate Soils Management Plan (ASSMP) shall be submitted and approved by the Council in consultation with the Department of Environment; and
(c). Operations shall be carried out in accordance with the provisions of the approved management plan.

5 Prior to the commencement of each stage of excavation a Soil and Water Monitoring Program, including methodology, will be submitted and approved by Council (in consultation with the Department of Environment) incorporating:
- a) Monitoring of soils and water excavated within areas identified as 'high risk' of containing Acid Sulphate Soil material (in accordance with an approved ASSMP); and
- b) Periodic monitoring of water quality retained within on-site excavations.

6 No discharge of pit-water to waterways will occur without prior approval from Council.

7 An Annual Report will be submitted to Council that includes:
- a) The progress of excavation;
- b) Monitoring program results and findings;
- c) Progress of rehabilitation;
- d) Contingency actions and outcomes; and
- e) Community complaints and responses.

8 Rehabilitation of the pit to include surface water control measures on all pit faces to prevent gully erosion, and final batters to be graded to provide safe entry and exit slopes should access to standing water within the pit be required or accidentally occur.

9 A Close-out Plan will be submitted and approved by Council prior to the cessation of clay excavation works on each stage incorporating:
- a) Final revegetation and contouring plan;
- b) Demarcation of surface water catchments;
- c) Excavation pit hydrology, water balance and landscaping; and
- d) Ongoing monitoring requirements.

10 Internal access road to be constructed to a standard that minimises dust emission from machinery and traffic;

11 The operations to comply with the requirements of the Environmental Protection (Noise) Regulations 1997 in respect to noise but, not withstanding, the operations to have due regard to the health and amenity of any person in the vicinity;

12 Appropriate dust suppression measures being taken at all times where any operation on the site is likely to generate a dust nuisance to nearby residents to the satisfaction of Council's Engineering Services and Environmental Health Services;

13 Excavation for the extractive industry shall not occur in the following areas:
- Within 20 metres of a boundary of any land not owned by the proponent or Planning Consent holder;
- Within 20 metres of any land affected by a registered grant of easement;
- Within 40 metres of any designated water course; and
- Within 40 metres of any road or road reserve.

14 Upon decommissioning of each pit, rehabilitation shall take place in accordance with the approved plan using the stockpiled topsoil and

replanting of appropriate local native species as recommended by the Local Chittering Landcare Coordinator;

15 Prior to clay transport, water shall be applied to all clay loads to eliminate dust generation during transit.

16 Materials imported for rehabilitation or other purposes shall be certified free of dieback or other plant diseases;

17 Any amendments or variations to the any rehabilitation or land management plan associated with the excavation must be approved in writing by Council;

18 Top soil in the excavation area is to be stockpiled and used where applicable in the rehabilitation process;

19 The proponent shall protect all areas containing rare or endangered species of flora and fauna and no excavation shall be permitted in these areas;

20 All excavation areas shall strictly comply with any buffer areas designated by any statutory authority;

21 A suitability qualified consultant be engaged to conduct ethnographic and archaeological surveys of this area in accordance with Part 4 Aboriginal Heritage Act 1972.

22 All excavation/extraction shall be strictly in accordance with the Council's By-law Relating to Extractive Industries, conditions specified in the Planning Consent and conditions imposed by any other statutory authority;

23 The Excavation Licence shall only remain valid while there is the appropriate Planning Consent in place to support the extraction of materials;

24 The Excavation Licence is not transferable except with the written approval of Council and if required, the landowner;

25 The licensee is to be responsible for ensuring that the extractive operations are confined to those areas depicted in the plan accompanying the application to the Council and the approved Rehabilitation or Land Management Plan;

26 The licensee may not remove natural vegetation except with the written approval of Council and any other government department or agency controlling the clearing of land;

27 The licensee is required to take all reasonable and appropriate steps to prevent soil and water erosion and the emission of dust, noise and other forms of nuisance from the excavation site;

28 The licensee is to retain a water tanker on site for dust suppression of overburden storage, stockpile material, pit floors and access tracks;

29 The licensee is to strictly comply with the Refuelling Management Plan applicable to the site;

30 The licensee is to maintain the currency of the public liability insurance cover for the site, excavation and transport of material;

31 The licensee is to strictly comply with the Fire Management Plan applicable to the site;

32 The licensee is to strictly comply with the Dieback Management Plan applicable to the site;

33 *The licensee is to be responsible for the repair of any undue damage to Muchea East Road and Wandena Raod caused by the extraction*

34. *The licensee is to provide and maintain a safety barrier at the top of any excavated work face with a depth greater than 2m;*

35 *Breach of conditions may result in cancellation of this licence.*

Dated the 5 (insert) day of August (insert) 2007

Signed: _____

CHIEF EXECUTIVE OFFICER

Appendix 2

VEGETATION STUDY

LOCATIONS M1327 and M1499 WANDENA ROAD, MUCHEA

15 APRIL 2005

Landform Research

VEGETATION STUDY

LOCATIONS M1327 and M1499 WANDENA ROAD, MUCHEA

Landform Research
Land Systems - Quarries - Environment
ABN 29 841 445 694

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CONTENTS

1.0 INTRODUCTION

Portion of the study site is proposed to be a Western Australian Meat Industry Authority Livestock Centre. The site has recently been purchased from Midland Brick Company Pty Ltd.

The vegetation across the whole of the site has been surveyed, including the area to be retained by Midland Brick Company Pty Ltd and the areas to be used for dams and WAMIA facilities.

As part of an environmental assessment of the site a vegetation study has been completed to determine what constraints existing vegetation places on the location of the footprint of the livestock centre.

2.0 METHODOLOGY

Aims of the Surveys

Landform Research was asked to assess the vegetation in terms of its plant communities, vegetation condition, plant species and the potential for Rare and Priority Species to be present, with a view to how the vegetation fits in with the clearing principles in Schedule 5 of the Environmental Protection Act, 1986.

Initially the vegetation on the site was visited by Lindsay Stephens of Landform Research on 20 August 2004, to check all the areas that might be impacted on by the proposed development. On 1 November 2004 an additional flora surveys were conducted of the remaining areas to the north, which are proposed to be excluded from impact, and to recheck some of the other areas of remnant vegetation within the central southern portions of the site.

Prior to the inspections, a search was made of the CALM and WA Herbarium databases to determine the likely presence of Rare or Priority species. See attached databases. This is attached as Appendix 1. All species on that list were checked to ensure familiarity.

The areas of remnant vegetation across the whole site were traversed at approximately 50 metre intervals, either in a north south or east west pattern, depending which one provided the most detail of each remnant. In some areas more extensive searches were made at a closer interval of approximately 20 metre spacings.

All native plant species found were identified in the area where disturbance may occur. The remnant vegetation in the north western corner was extensively searched, but the result may still not be a definitive list. Rather this vegetation is regarded as significant and is proposed to be protected as a conservation zone. The species present in this corner are therefore to be protected. An additional survey is warranted in this north western corner, possibly including some 100m^2 plots, if this vegetation is to be disturbed at some stage in the future. Under past land activities the remnant was seasonally grazed.

The vegetation communities and vegetation condition were recorded.

Exotic species were uncommon and were not identified because of constraints on the survey and the fact that these species did not contribute to the aims. Pasture species were not identified.

The main reference works used were published texts, Florabase and the WA Herbarium Reference Collection. Specimens that showed similarities to those that are listed as Declared Rare or Priority species were checked in detail and against the WA Herbarium Reference Collection.

Following identification of the species, a comparison was made to the Declared Rare and Priority Flora database searches conducted by CALM.

3.0 PHYSICAL ENVIRONMENT

3.1 Site Description

The site is cleared and has been used for cropping and grazing for a number of years. Currently it consists of wide open areas with small parkland cleared areas. The land to the north is covered by remnant vegetation.

The site lies on the edge of the Yilgarn Shield in an area of Mesozoic sediments, bounded on the east by the Darling Scarp and on the west by the Gingin Scarp. The site drops generally from a ridge in the east at about 150 metres, down to approximately 65 metes in the lowest point on the western boundary.

The site is underlain by Mesozoic sediments, predominantly clays of Cretaceous age commonly ascribed to the Leederville Formation by the Department of Environment, although there may be part of the overlying Osborne Formation capping the site, which better fits the description of the sediments.

Overlying the shales are sheets of sand that could be Tertiary or Pleistocene in age. These deepen in hollows in the central south and along the northern boundary. The sands are earthy and yellow in the north western corner but grade to leached white sands in lower elevations, damp areas and adjacent to watercourses.

The shales and overlying sands have been subjected to laterite development in the late Tertiary to Pleistocene, to produce gravels, gravelly sands and duricrust.

Midland Brick Company Pty Ltd extracts clay from the local area and has previously extracted clay from the north of the site and has identified a new resource in the south. A number of landcare initiatives have been carried out across the site, through the rehabilitation and revegetation of watercourses and drainage lines, with the assistance of Midland Brick Company Pty Ltd.

3.2 Hydrology

The area generally has no surface drainage because of the permeable and porous nature of the overlying sands

However two watercourses run across the site, one along the southern boundary which has been rehabilitated and fenced as part of a landcare project. The other runs inside the northern boundary. Both watercourses run east west on a base of the underlying clays/shales.

4.0 VEGETATION

The site has been cleared and subjected to grazing and other rural activities for many years, as evidenced by the original presence of a dwelling located in the north east, the widespread pasture and the level of disturbance.

Remnant vegetation is restricted to laterite gravel and duricrust ridges. These remnants are parkland pasture with generally minor understorey and are dominated by *Eucalyptus calophylla* - *Eucalyptus wandoo* Remnant Woodland. *Eucalyptus accedens* is added to the community to the east on the higher more clayey slopes where *Eucalyptus calophylla* drops out of the community.

A small area of Open *Banksia* Woodland occurs on earthy yellow sand in the north western corner.

Minor wetland species occur along the two watercourses which have been extensively planted and rehabilitated as part of Landcare operations particularly in the east.

The Open *Banksia* Woodland in the west, of which the north western corner is a remnant, is classified as Regan Complex, as identified by Heddle et al, 1980, *Vegetation Complexes of the Darling System, Western Australia in Atlas of Natural Resources, Darling System, Western Australia*, Department of Conservation and Environment.

Heddle et al classifies the remainder of the original vegetation as part of Mogumber Complex - South, and this would apply to the vegetation on some of the cleared more sandy areas but does not apply to the laterite areas where *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland occurs. *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland is included in the of Mogumber Complex - South by Heddle et al, but does not match the description of the community because it occurs on gravelly clay soils.

4.1 Communities

Open Banksia Woodland

The Open Banksia Woodland Community is restricted to the earthy yellow sands in the north western corner.

It is typified by *Banksia attenuata* and *Eucalyptus todtiana* over *Xanthorrhoea preissii, Eremaea pauciflora, Jacksonia floribunda, Adenanthos cygnorum, Allocasuarina humilis, Petrophile linearis* and *Hibbertia hypericoides*. *Banksia attenuata* and *Eucalyptus todtiana* increase to the west.

The species listed are those predominantly restricted to the north western corner. A total of 70 species were noted. Included in this vegetation community are some species that were noted in adjoining vegetation to the north of the site or in the road verge as these are likely to have been part of the original vegetation communities.

The plant species tend to be increasingly sand related species to the west and more gravel liking to the east. Overall the vegetation contains a mixture of sand plain and Darling / Gingin Scarp species. This vegetation may have covered the western more sandy areas of the site originally and at that time may have been able to be divided into more than one vegetation community.

The vegetation condition is Good to Excellent and the remnant is worthy of retention. The vegetation of the north western corner is recommended for retention as a conservation area.

Eucalyptus calophylla - Eucalyptus wandoo Remnant Woodland

Eucalyptus calophylla - Eucalyptus wandoo Remnant Woodland occupies the laterite ridges. It is predominantly parkland cleared over pasture with scattered plants of a number of remnant understorey such as *Hakea lissocarpha, Desmocladus fasciculatus, Dryandra bipinnatifida, Phyllanthus calycinus, Bossiaea eriocarpa, Dryandra lindleyana* var *melliculata* and *Dryandra armata* var *armata*.

A total of only 17 species were recorded on the laterite remnants, indicating the high levels of disturbance in these remnants. In addition some species were represented by only a few individuals. For example in the gravelly remnant on the central southern boundary only two plants of *Hibbertia commutata* were observed.

Eucalyptus accedens is added to the community on the higher more clayey slopes in the east where *Eucalyptus calophylla* drops out of the community. *Eucalyptus marginata* subsp *thalissica* is also present to the west, particularly where the soil becomes more sandy and probably represents remnants of the Mogumber Complex - South.

***Melaleuca* Woodland**

A small stand of *Melaleuca preissiana* with associated *Juncus pallidus* and *Autos gracillima* and minor other dampland species occurs along the drainage line and in a seepage in the central north west. Associated with the *Melaleuca preissiana* are occasional *Melaleuca rhaphiophylla* and *Eucalyptus calophylla*.

The *Melaleuca* Woodland represents a remnant of creekline vegetation in Regan Complex.

Only nine species were recorded from this community with two of these *Juncus acutus** and *Typha* sp* being recorded from upstream.

Several other species such as *Juncus acutus* and *Typha* sp are present along the creek lines but are not necessarily associated with the *Melaleuca preissiana*.

4.2 Species list

The species recorded during the site investigation are listed below with the main plant community to which they were recorded. A total of 95 native species were recorded on 20 August and 1 November 2004.

The species list below shows the species identified on site during the various site inspections.

Table 1 Species List

Family	Genus Species	*Eucalyptus calophylla* - *E. wandoo* Woodland	*Melaleuca* Woodland and creekline	Open *Banksia* Woodland
Amaranthaceae	*Ptilotus manglesii*	x		
	Ptilotus polystachyus var *polystachyus*			x
Anthericeae	*Laxmannia squarrosa*			x
	Tricoryne eliator			x
	Thysanotus manglesianus			x
	Thysanotus s multiflorus			x
Apiaceae	*Xanthosia huegelii*			x
Asteraceae	*Brachyscome iberidifolia*			x
	Podotheca angustifolia			x
	Rodanthe corymbosa			x
	Trichocline spathulata			x
Casuarinaceae	*Allocasuarina humilis*			x
Colchicaceae	*Burchardia umbellata*			x
Cyperaceae	*Cyathochaeta avenacea*	x		x
	Lepidosperama squamatum	x		x
	Mesomelaena pseudostygia			x
	Mesomelaena tetragona			x
	Schoenus curvifolius		x	
Dasypogonaceae	*Calectasia cyanea*			x
Droseraceae	*Drosera erythorhiza*			x
Dilleniaceae	*Hibbertia commutata*	x		x
	Hibbertia hypericoides	x		

Epacridaceae	*Conostephium pendulum*			x
	Leucopogon propinquus			x
Euphorbiaceae	*Phyllanthus calycinus*	x		
Goodeniaceae	*Damperia trigona*		x	
	Scaevola pilosa			x
Halgoraceae	*Glischrocaryon aureum*			x
Haemodoraceae	*Anigozanthos manglesii*			x
	Conostylis aculeata			x
	Conostylis setigra			x
	Haemodorum loratum			x
Iridaceae	*Patersonia juncea*			x
Juncaceae	*Juncus acutus**		x	x
	Juncus pallidus		x	
Lauraceae	*Cassytha glabella*			x
Loranthaceae	*Nuytsis floribunda*			x
Mimosaceae	*Acacia lasiocarpha*			x
	Acacia pulchella	x		x
	Acacia saligna		x	
Myrtaceae	*Calothamnus hirsutus*			x
	Calectasia cyanea			x
	Eremaea pauciflora			x
	Eucalyptus accedens	x		
	Eucalyptus calophylla	x		
	Eucalyptus marginata subsp *thalassica*			x
	Eucalyptus todtiana			x
	Eucalyptus wandoo	x		
	Hypocalymma angustifolium		x	
	Leptospermum			
	Melaleuca preissiana		x	
	Melaleuca scabra			x
	Scholtzia involucrata			x
	Verticordia chrysantha			x
Orchidaceae	*Pyrorchis nigricans*			x
Papilionaceae	*Aotus gracillima*		x	
	Bossiaea eriocarpa	x		
	Daviesia divaricata			x
	Daviesia inflata			x
	Daviesia incrassata subsp *incrassata*			x
	Gompholobium knightianum			x
	Gompholobium tomentosum			x
	Hovea elliptica			x
	Kennedia prostrata			x
	Jacksonia floribunda			x
	Jacksonia sternbergiana			x
	Nemica acuta			x
Pittosporaceae	*Billardiera* sp			x
Poaceae	*Neurachne alopecuroidea*	x		
Proteaceae	*Adenanthos cygnorum* subsp *cygnorum*			x
	Banksia attenuata			x
	Dryandra armata var *armata*			
	Dryandra bipinnatifida			

	Dryandra lindleyana var mellicula			
	Hakea a lissocarpha	x		x
	Hakea ruscifolia			x
	Hakea stenoptera	x		
	Lambertia multiflora			x
	Petrophile linearis			x
	Petrophile serruriae			x
	Stirlingia latifolia			x
	Synaphea petiolaris			x
	Synaphea spinulosa?			x
Restionaceae	*Desmocladus fasciculatus*	x		
	Hypolaena exsulca			x
	Caustis dioica			x
Stylidiaceae	*Stylidium brunonianum*			x
Tremandraceae	*Tetratheca nuda*			x
Thymelaeceae	*Pimelia imbricata* var *major*			x
Typhaceae	*Typha orientalis?**		x	
Violaceae	*Hybanthus*			
Xanthorrhoeaceae	*Xanthorrhoea acanthostachya*	?		
	Xanthorrhoea gracils			x
	Xanthorrhoea preissii	x		x

4.3 Rare and Priority Flora

Prior to the site inspections, searches were made of the CALM and WA Herbarium databases to determine the likely presence of Rare or Priority species. The database search was quite wide and a significant number of species have been recorded some distance from the site. However as the site has not been investigated before a wider database search was requested because of the changes in habitat on site.

A description of (R) and (P) codes is shown in the printout of the databases attached.

Acacia anomala	R
Acacia drummondii	P3
Calytrix sylvana	P4
Chamaescilla gibsonii	P3
Cyathochaeta teretifolia	P3
Darwinia foetida	R
Grevillea curviloba	R
Leucopogon glaucifolius	P3
Synaphea grandis	P4
Verticordia lindleyi	P4
Verticordia serrata	P3
Adenanthos cygnorum subsp *chamaephyton*	P3
Darwinia sp A	
Baeckea sp Chittering	P4
Grevillea althoforrum	R
Guichenotia tuberculata	P3
Haemodorum loratum	P3
Platysace ramosissima	P3
Rodanthe pyrethum	P3

Rodanthe pyrethum	P3
Schoenus sp Bullsbrook	P2
Stenanthemum sublineare	P2
Stylidium longitubum	P3
Verticordia plumosa var *pleibotrya*	R

Most of these species are readily identified, although some are closely related to species recorded on site, such as *Cyathochaeta avenacea* and these species were checked against the WA Herbarium reference collection.

One Rare and Priority Species was recorded, *Haemodorum loratum* a Priority 3 species. This occurs in the north western Open Banksia Woodland Remnant which has the highest species richness and is recommended to be protected. The species also occurs to the north outside the northern boundary of the WAMIA land. With retention of the north western remnant the species will be protected unless any plants that were not observed occur in remnants on the northern boundary.

The specimens of Adenanthos *cygnorum* observed were not prostrate like *Adenanthos cygnorum* subsp *chamaephyton* and are therefore ascribed to *Adenanthos cygnorum* subsp *cygnorum*.

No other Declared Rare or Priority species were recorded. With the level of disturbance in the *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland, it is considered unlikely that they will be found in these remnants.

A copy of the CALM and WA Herbarium databases are attached.

4.5 Vegetation Condition

The *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland is the vegetation most likely to be impacted on by the proposed developments on site. This vegetation is generally in Degraded to Completely Degraded Condition.

The Open Banksia Woodland Community vegetation remnant in the north western corner is in Good to Excellent Condition even though it has been grazed by stock in the past. It is recommended to be retained.

The *Melaleuca* Woodland although small and obviously disturbed is also in Good condition. It straddles a seepage area to the north of the creekline and is recommended for protection with linkages to the creek and possibly to the north western remnant vegetation.

The vegetation condition scale used is the same as that used in Bush Forever 2000. Whilst this scale inflates the descriptors of condition in the middle of the scale when compared to earlier condition scales, in this case it does not significantly affect the interpretation of the vegetation condition. See Bush Forever 2000, Volume 2 Table 12 on page 48.

5.0 SIGNIFICANCE OF THE FLORA

The vegetation on site is is classified as Regan Complex, as identified by Heddle et al, 1980, *Vegetation Complexes of the Darling System, Western Australia in Atlas of Natural Resources, Darling System, Western Australia,* Department of Conservation and Environment.

This mainly applies to the Open Banksia Woodland in the north western corner.

Heddle et al classifies the remainder of the original vegetation on site as part of Mogumber Complex - South. This would apply to the vegetation on some of the cleared more sandy areas but does not apply to the laterite areas where *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland occurs. Its level of degradation is such that it has lower conservation significance, but should be protected, where possible, by locating developments outside the areas of remnant vegetation, and retaining the vegetation as buffers.

EPA Guidance 10 *Level of assessment for proposals affecting natural areas within the System 6 Region and Swan Coastal Plain portion of the System 1 Region* lists Regan Complex as having 38% of the pre-European area still occurring, but only 1.9% in secure tenure. It is therefore appropriate to retain the remnant vegetation in the north western corner as Conservation, particularly since it contains *Haemodorum loratum*.

EPA Guidance 10 lists Mogumber Complex - South as having 40% of the pre-European area still occurring, but only 1.1% in secure tenure. The *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland is in Degraded to Completely Degraded condition and is therefore less suitable for retention as conservation. However it does form useful remnants and where possible this vegetation is recommended to be retained as buffers.

These buffers could separate holding paddocks in the WAMIA stock holding facility or provide buffers to clay excavation.

The *Melaleuca* Woodland represents a remnant of creekline vegetation in Regan Complex. All creeklines are to be protected and enhanced and so the remnant will be protected.

6.0 LANDCARE ACTIVITIES

Extensive landcare activities have been undertaken along the southern creekline and the eastern portion of the northern creekline jointly between Midland Brick Company Pty Ltd and the Chittering Landcare Group.

The southern creekline, which forms part of the Muchea East Subcatchment, has been fenced and extensively planted. This area lies outside the clay resource area and the area required by WAMIA for the livestock facility. Figure 3.

Several contour banks, as drainage control, are proposed and these are recommended to be incorporated into site drainage to catchment dams that are proposed.

The northern drainage line is part of the Wandena 2 Subcatchment for which the Chittering Landcare Group has concept plans for rehabilitation and vegetation linkages. Some of this rehabilitation has already been undertaken, however the area proposed compromises some valuable clay resources and the WAMIA livestock holding facility and will require modification to enable the facilities and landcare activities to co-exist.

The *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland is shown on the Chittering Landcare Group Concept Plans as generally "Medium" with some "Light Vegetation"

The northern creekline will not be used by WAMIA and it is recommended that this creekline be revegetated and fenced in line with the Chittering Landcare Group proposals. Figure 3.

It is recommended that when the requirements of Midland Brick Company Pty Limited and WAMIA are accurately known negotiations be held with the Chittering Landcare Group to arrive at a compromise solution.

7.0 POTENTIAL IMPACTS OF WAIMA AND MIDLAND BRICK COMPANY PTY LTD OPERATIONS

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

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

Both the Regan Complex and Mogumber Complex South have greater than 30% of the original vegetation remaining, although less than 2% in secure tenure.

The recommendation to fence and retain the north western vegetation remnant will conserve 5.0 hectares of Regan Complex in a conservation area. A conservation covenant can be placed over this remnant to provide higher levels of protection.

The *Melaleuca* Woodland represents approximately 0.6 hectares which is recommended to be linked to the creekline and possibly the north western remnant vegetation, although a laneway may be required through that corridor. See Figure 3.

The existing tree planting areas represent 23 hectares (Land Assessment Pty Ltd 2005) of revegetation that is already in place to offset any changes to vegetation. Further offsets will be possible to act as buffers and linkages, and will be developed as part of a Vegetation Management Plan that is recommended to be developed for the WAMIA site. This Vegetation Management Plan could form part of a site management plan or landscape management plan. It should set out the required operational and infrastructure footprint areas as well as the areas to be to be disturbed and the proposed conservation and vegetation linkage areas.

Overall, with the remnant vegetation proposed to be retained, the existing landcare replanting and rehabilitation, further protection and rehabilitation of the northern creekline, the amount of vegetation on the final landscape can be greater than that currently existing.

As well as increases in vegetation cover the best remnant vegetation and the creeklines are to be retained, enhanced and linked to form biological corridors.

The revegetation and preservation activities can be used to provide a check against the Clearing Principles in Schedule 5 Environmental Protection Amendment Act, 1986.

8.0 CLEARING PRINCIPLES

	CLEARING PRINCIPLE (Schedule 5 Environmental Protection Amendment Act, 1986)	COMMENT
1a	High Level of diversity	• The site has been assessed in the flora surveys. The operational areas are generally totally cleared with minor impacts on *Eucalyptus calophylla - Eucalyptus wandoo* Remnant Woodland that does not now have a high level of species diversity and is classified as Degraded to Completely Degraded. • The five hectares of Open Banksia Woodland Community in the north western corner, which has high diversity and contains the Priority 3 *Haemodorum loratum,* is to be retained for conservation.
1b	Significant fauna habitat	• The level of disturbance across the site is very high with the site being predominantly pasture. The Open Banksia Woodland Community is to be retained, and past landcare activities have led to the rehabilitation of 23 hectares of vegetation. Additional revegetation and rehabilitation of the northern Creekline is recommended. The *Melaleuca* Woodland remnant is recommended for protection. • Even though some modification to the Chittering Landcare Group's concept revegetation plan will be required linkages between the vegetation are possible and are recommended.
1c	Necessary to existence of Rare flora	• No Declared Rare flora was found. The Priority 3 *Haemodorum loratum* is included in vegetation proposed to be retained for conservation
1d	Threatened Ecological Community	• No vegetation is listed as a Threatened Ecological Community.
1e	Significant area of vegetation in an area that has been extensively cleared	• The area of significant vegetation in the north western corner is to be retained. The existing landcare activities have already led to increased revegetation across the site and this together with additional rehabilitation will lead to even greater areas of vegetation to offset any impacts.
1f	Wetland or watercourse	• The southern creekline and the eastern portion of the northern creekline which were previously cleared are already included in the landcare activities on site and the remainder of the northern creekline will be rehabilitated. There is a constructed recycling pond in the south eastern corner that will not be impacted on by quarrying.
1g	Land degradation	• The proposed activities can be managed in a manner to prevent long term land degradation. Rehabilitation of the creeklines has already been carried out and will be extended to cover all of the two watercourses. This revegetation will provide for buffers to the watercourse which will assist in minimising the potential for further land degradation. • Existing remnant vegetation will be retained where possible to maintain landuse buffers, and other buffers will be planted. • Past degraded areas are undergoing existing rehabilitation.
1h	Impact on adjacent or nearby conservation areas	• There are no adjoining conservation areas. The remnant vegetation to the north will not be impacted on and the adjoining vegetation in the north western corner will be retained and fenced.

1i	Deterioration of underground water	• Quarrying is one of the few industries that are permitted in areas where groundwater is close to the surface. The proposed final land surface can comply with the Department of Environment guidelines for separations to the ground water. • Restoration of the land surface after excavation, including a surface water dam and revegetation, will be able to manage potential salinity impacts from clay excavation as shown by previously completed clay pits. For example the water quality of the dams in the existing clay pits on site is fresh. • The site is gravel or clay based at depth with some overlying surface sands. • It will be possible to design the WAMIA livestock facility using contour and tail drains to collect water and minimise loss of nutrients. WAMIA proposes to use extensive nutrient collection and management systems to collect and dispose of nutrients through lined, if necessary, settlement and treatment ponds. • Surface water will be harvested for use on site.
1j	Increase flooding	• There is no potential for flooding to increase on site. The watercourses will not be interfered with and water will be harvested for use on site.

9.0 CONCLUSIONS

1. The site is large enough for most activities to be undertaken with low impacts on the existing vegetation on site.

2. The site consists of pasture with some *Eucalyptus calophylla* - *Eucalyptus wandoo* Remnant Woodland. This vegetation is generally in Degraded to Completely Degraded Condition. This vegetation is described as being desirable to retain. Any reduction in this vegetation through operational demands can be offset by additional tree planting and revegetation.

3. The areas of *Eucalyptus calophylla* - *Eucalyptus wandoo* Remnant Woodland generally lend themselves to form land use buffers.

4. Open *Banksia* Woodland Community vegetation remnant in the north western corner is in Good to Excellent Condition. This vegetation species is rich and contains the Priority 3 *Haemodorum loratum* and is classified as significant. It is proposed to be protected.

5. The *Melaleuca* Woodland, although small and obviously disturbed, is also in Good condition and could be linked to the vegetation along the creekline.

6. 23 hectares (Land Assessment Pty Ltd) of rehabilitation have already been undertaken along the southern and eastern portion of the northern creekline.

7. The proposed land use activities can be modified to be compatible with the new requirements for the site and provide an opportunity to extend the area of vegetation on site.

8. The use of the site for WAMIA livestock holding facility and clay excavation can be undertaken in a manner that will minimise disturbance to vegetation and, with offsets, can ensure compliance with the Clearing Principles in Schedule 5, Environmental Protection Amendment Act, 1986.

9. The five hectares of significant Open *Banksia* Woodland Community in the north western corner will be provided with a much greater level of protection as a result of the WAIMA proposal.

10.0 RECOMMENDATIONS

1. Retain the Open *Banksia* Woodland Community vegetation remnant in the north western corner.

2. The Open *Banksia* Woodland Community remnant is recommended to be fenced and covered by a Conservation Covenant.

3. The *Melaleuca* Woodland should be fenced and linked to revegetation of the remaining portion of the northern creekline.

4. The design of the operations should seek to minimise impact on remnant vegetation or replace affected vegetation with offset planting.

5. WAMIA and the Chittering Landcare Group should discuss the modification and extension of the Chittering Landcare Concept Plan for the Wandena 2 Subcatchment to ensure long term compatibility between the livestock facility and the landcare needs.

6. Areas of remnant vegetation to be retained should be fenced.

7. Additional plantings of buffers and biological linkages, should be of local native species, where possible. Other planting such as windbreaks could consider the use of additional species to provide the correct form with trees and shrubs.

Lindsay Stephens

KEY	VEGETATION COMMUNITIES
BW	Open *Banksia* Woodland
EcEw	*Eucalyptus calophylla* - *Eucalyptus wandoo* Remnant Woodland
Mp	*Melaleuca* Woodland
LC	Landcare revegetation

KEY	VEGETATION CONDITION (Bush Forever 2000)
P	Pristine
E	Excellent
VG	Very Good
G	Good
D	Degraded
CD	Completely Degraded

0 200 400 600 800 METRES

VEGETATION COMMUNITIES and CONDITION	
LOCATIONS M1327 and M1499, WANDENA ROAD, MUCHEA	
Basemap DOLA Air Photo December 2004	Scale 1 : 12 000 at A3 Drawn April 2004

Figure 1

Remnant *Eucalyptus calophylla - Eucalyptus wandoo* over pasture in the north

Remnant *Eucalyptus calophylla - Eucalyptus wandoo* over pasture in the central northwest

Remnant *Eucalyptus calophylla - Eucalyptus wandoo* over pasture in the central east

Melaleuca preissiana Woodland in the north west

Landcare planting

Landcare planting

Landcare planting

PHOTOGRAPHS OF VEGETATION COMMUNITIES and CONDITION	
LOCATIONS M1327 and M1499, WANDENA ROAD, MUCHEA	
Landform Research	NOVEMBER 2004

Figure 2

Eucalyptus calophylla with *Xanthorrhoea preissii* in the north

Open *Banksia* Woo land Remnant in the north west

Open *Banksia* Woo land Remnant in the north west

Open *Banksia* Woo land Remnant in the north west

FIGURE 18. MUCHEA EAST SUBCATCHMENT - SITE FEATURES

Source: Chittering Landcare Group – mapping overlain on current aerial photo

FIGURE 19. MUCHEA EAST SUBCATCHMENT –

Landcare Group Proposed Earthworks and Drainage Control

Source: Chittering Landcare Group – mapping overlain on current aerial photo

Your Ref:
Our Ref: 2001F001173VO17
Enquiries: Kelly Poultney
Phone: (08) 9334 0123
Fax: (08) 9334 0278
Email:

DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

Lindsay Stephens
Landform Research
25 Heather Road
ROLYSTONE WA 6111

Dear Mr Stephens

REQUEST FOR RARE FLORA INFORMATION

I refer to your request of 4 August 2004 for information on rare flora in the following areas.

- Bullsbrook: The search co-ordinates used were 31^0 33' - 31^0 36' S and 115^0 58' - 116^0 02' E.
-

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) Flora* database (for results, *if any*, see "Summary of Threatened Flora Data" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for priority species opportunistically collected in the area of interest (for results, *if any*, see "WAHERB Specimen Database General Enquiry"- coordinates are AGD84) and **(3)**, the Department's *Declared Rare and Priority Flora List* [this list, which may also be used a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "Declared Rare and Priority Flora List"].

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the seventh point which refers to the requirement to undertake field investigations for the accurate determination of rare flora occurrence at a site. *The information supplied should be regarded as an indication only of the rare flora that may be present and may be used as a target list in any surveys undertaken.*

An invoice for $200 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of rare flora encountered by you in the area could be reported to this Department to ensure their ongoing management.

Please note there has been an increase in proponents requesting searches using GIS shapefiles, and the provision of information in electronic format that can be used in GIS applications. This form of search is more labour intensive than standard searches, while being more economical for more complex searches. Consequently, I wish to advise of a change in the fee structure for the provision of rare flora information from the CALM datasets whereby GIS-based searches will attract a standard fee of $300 (plus GST). The fee for other searches will remain unaltered. This fee structure will commence on 1 October 2004 to facilitate commercial budgeting requirements.

If you require any further details, or wish to discuss rare flora management, please contact my Principal Botanist, Dr Ken Atkins, on (08) 9334 0425.

Yours faithfully

for Keiran McNamara
EXECUTIVE DIRECTOR
9 August, 2004

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

RARE FLORA INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data to be made in writing to the Executive Director, Department of Conservation and Land Management, Attention: Administrative Officer Flora, Wildlife Branch.

2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the Executive Director, Department of Conservation and Land Management.

3. Specific locality information for Declared Rare Flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for DRF may not be used in public reports without the written permission of the Executive Director, Department of Conservation and Land Management. Publicly available reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Department is to be contacted for guidance on the presentation of rare flora information.

4. Note that the Department of Conservation and Land Management respects the privacy of private landowners who may have rare flora on their property. Rare flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Conservation and Land Management.

5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Conservation and Land Management accepts no responsibility for this.

6. Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

7. **It should be noted that the supplied data do not necessarily represent a comprehensive listing of the rare flora of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. The receiving organisation should employ a botanist, if required, to undertake a survey of the area under consideration.**

8. Acknowledgment of the Department of Conservation and Land Management as source of the data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Conservation and Land Management, Attention: Principal Botanist, Wildlife Branch.

THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

DECLARED RARE AND PRIORITY FLORA LIST

for Western Australia

CONSERVATION CODES

R: Declared Rare Flora - Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One - Poorly known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

ABBREVIATIONS USED IN THREATENED FLORA DATABASE PRINTOUTS

VESTING

AGR	Chief Exec Dept of Agriculture
ALT	Aboriginal Land Trust
BAP	Baptist Union of WA Inc
BSA	Boy Scouts Association
CC	Conservation Comission –NPNCA
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
DOL	Dept of Land Administration
DPU	Ministry for Planning
EXD	Exec Direc CALM
FRE	Freehold
HOW	Homeswest
ILD	Industrial Lands Develop. Auth
JOI	Joint Vesting-NPNCA & Shire
LAC	LandCorp
LFC	Lands and Forests Commission
MAG	Minister for Agriculture
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
NPN	NPNCA
OTH	Other
PRI	Private
RAI	Westrail
SEC	Western Power
SHI	Shire
SPC	State Planning Commission
TEL	Telstra
TGR	Timber Govt Requirement
TOW	TOWN
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
AER	Aerodrome
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CPK	Car Park
COM	Common
CON	Conservation Park
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes UWA
ENE	Enjoyment of Natural Environ.
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GRE	Green Belt
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes
HER	Heritage trail
HOS	Hospital
KEN	Kennels
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAC	Public access
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUT	Public Utility
QUA	Quarry
RAD	Radio Station
RAC	Racecourse
REC	Recreation
REH	Rehabilitation
RNP	Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHI	Shire Requirements
SHO	Showgrounds
SNN	Sanitary
STO	Stopping place
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
TVT	Television transmitting
UNK	Unknown
UTI	Utilities
VCL	Vacant Crown Land
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WCO	Water & Conservation of F & F
WOO	Firewood

9/08/2004

WAHERB SPECIMEN DATABASE
GENERAL ENQUIRY

Bullsbrook

Acacia anomala
Court (Mimosaceae)
CONSERVATION STATUS:R
Coll.: H. Kretchmar s.n. Date: 08 1965 (PERTH 723665)
LOCALITY Muchea WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Gravel.
Previous det.: Acacia anomala C. Gardner ex Court

Acacia anomala
Court (Mimosaceae)
CONSERVATION STATUS:R
Coll.: H. Kretchmar s.n. Date: (PERTH 723649)
LOCALITY Muchea area. WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Prints from slides supplied by H. Kretchmar.
Previous det.: Acacia anomala C. Gardner ex Court

Acacia drummondii
Lindl. subsp. affinis (Maslin)Maslin (Mimosaceae)
CONSERVATION STATUS:P3
Coll.: B.R. Maslin 3985 Date: 02 11 1975 (PERTH 00319163)
LOCALITY About 5 km due ENE [of] Muchea WA
LAT 31 Deg 33 Min 34.000 Sec S LONG 116 Deg 1 Min 15.000 Sec E
Previous det.: Acacia drummondii Lindl. subsp. affinis (Maslin)Maslin

Acacia drummondii
Lindl. subsp. affinis (Maslin)Maslin (Mimosaceae)
CONSERVATION STATUS:P3
Coll.: B.R. Maslin 3218 Date: 07 07 1973 (PERTH 00319260)
LOCALITY Ca 5 km due ENE of Muchea WA
LAT 31 Deg 33 Min 34.000 Sec S LONG 116 Deg 1 Min 15.000 Sec E
Erect shrub to 0.5 m tall; pinnae patent to more or less ascending; pinnules prominently recruved, dark green above, sub-glaucous below; flower heads light yellow.
Gravel.
Jarrah - Marri woodland.
Previous det.: Acacia drummondii Lindl. subsp. affinis (Maslin)Maslin

Calytrix sylvana
Craven (Myrtaceae)
CONSERVATION STATUS:P4
Coll.: S. Paust s.n. Date: 23 09 1969 (PERTH 04236157)
LOCALITY 36 mile peg Great Northern Highway WA
LAT 31 Deg 33 Min 0.000 Sec S LONG 116 Deg 0 Min 0.000 Sec E
Laterite.
Previous det.: Lhotzkya purpurea

Chamaescilla gibsonii
Keighery (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: A.S. George 6833 Date: 25 09 1965 (PERTH 1967509)
LOCALITY 36-37 mile peg, Great Northern Highway[c. 3 miles N of turnoff to Muchea] WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Flowers deep blue. Damp sandy clay.
Previous det.: Chamaescilla sp.Ellen Brook(G.J.Keighery 12501)

Chamaescilla gibsonii
Keighery (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: A.S. George 6833 Date: 25 09 1965 (PERTH 01967487)
LOCALITY 36 mile peg, Great Northern Highway [3 miles N of turnoff to Muchea] WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Flowers deep blue. Damp sandy clay.
Previous det.: Chamaescilla sp.Ellen Brook(G.J.Keighery 12501)

Chamaescilla gibsonii
Keighery (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: H. Steedman s.n. Date: 10 1928 (PERTH 1967592)
LOCALITY Muchea WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Previous det.: Chamaescilla sp.Ellen Brook(G.J.Keighery 12501)

Cyathochaeta teretifolia
W.Fitzg. (Cyperaceae)
CONSERVATION STATUS:P3
Coll.: B.J. Keighery 2495 Date: 17 11 1994 (PERTH 06427839)

LOCALITY Nature Reserve, Muchea (System 6 Area C25) in System 6 Update quadrat much05 WA
LAT 31 Deg 35 Min 54.420 Sec S LONG 115 Deg 58 Min 6.780 Sec E
Tufted perennial herb, sterile. Seasonal Wetland, flat ground, black sandy peaty clay, over ?clay, poor
drainage, wet during winter/spring. Low Forest A. Associated species: Melaleuca rhaphiophylla, Banksia littoralis.
Frequency:abundant.

Darwinia foetida
N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
Coll.: D. Papenfus & F. Hort DP 2002 Date: 09 09 2002 (PERTH 06407366)
LOCALITY 70 m from SE corner of Nature Reserve, just S of Muchea WA
LAT 31 Deg 35 Min 6.700 Sec S LONG 115 Deg 58 Min 27.000 Sec E
Compact, perennial shrub, 25 cm high x 40 cm wide. Flowers green/red.
Plain. Winter wet area. Dry/moist grey/brown soil.
Medium trees within dense shrub/sedge layer. Characteristic species: Banksia, Xanthorrhoea and Hakea.
1% in bud. Infestation area of this weed: 11-100 sq.m.
Previous det.: Darwinia sp.Muchea(B.J.Keighery 2458)
Frequency:300+ plants.

Darwinia foetida
N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
Coll.: R.J. Cranfield 5050 Date: 06 11 1984 (PERTH 1335448)
LOCALITY Muchea townsite, 0.5 km S along Carl street WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Compact shrub 27 cm high. Heads nodding. Floral bracts reddish green. Grey-white sand. In low heath.
Previous det.: Darwinia sp.Muchea(B.J.Keighery 2458)
Frequency:frequent.

Darwinia foetida
N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
TYPE STATUS: HOL
Coll.: G.J. Keighery 16158 Date: 01 10 2001 (PERTH 06059082)
LOCALITY Muchea Nature Reserve, Muchea WA
LAT 31 Deg 35 Min 6.000 Sec S LONG 115 Deg 58 Min 27.001 Sec E
Tangled domed shrub 60 x 60 cm; infl. bracts red in centre, outer green, flowers wet for smell.
Winter wet-damp flats, peaty sandy clay.
Assoc. vegn.: Regelia inops/Melaleuca incana/Kunzea recurva shrubland over Hypocalymma angustifolia over sedges.
Frequency:locally common.

Darwinia foetida
N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2458 Date: 17 11 1994 (PERTH 06019749)
LOCALITY Gnangara Water Reserve, Swan Location 1518 (leased to the Commonwealth Government for a bombing range, lease 37L 776) part System 6 Area C25, Muchea WA
LAT 31 Deg 35 Min 52.800 Sec S LONG 115 Deg 58 Min 8.400 Sec E
Domed shrub to 0.3 m by 0.3 m. Flowers green, bracts red-green.
Seasonally wet area alongside sumpland (depression). Grey sand.
Pericalymma ellipticum and Astartea aff. fascicularis Heathland adjacent to Melaleuca rhaphiophylla and Banksia littoralis Low Forest A.
Previous det.: Darwinia sp.Muchea(B.J.Keighery 2458)

Darwinia foetida
N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
Coll.: A.S. George 1693 Date: 28 10 1960 (PERTH 01333828)
LOCALITY 0.75 miles N of Muchea X-roads WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Small shrub; bracts red-green. In sandy soil. With Banksia, Adenanthos sericea association.
Previous det.: Darwinia sp.Muchea(B.J.Keighery 2458)

Darwinia foetida
N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
Coll.: H. Steedman s.n. Date: 12 1927 (PERTH 1333836)
LOCALITY Muchea WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Previous det.: Darwinia sp.Muchea(B.J.Keighery 2458)

Darwinia foetida

N.G.Marchant & Keighery ms (Myrtaceae)
CONSERVATION STATUS:R
Coll.: R.A. Saffrey 93 Date: 13 11 1963 (PERTH 01333801)
LOCALITY S of Muchea WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
In swampy sand.
Previous det.: Darwinia sp.Muchea(B.J.Keighery 2458)

Grevillea curviloba
subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2399 Date: 13 10 1994 (PERTH 06511732)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2397 Date: 13 10 1994 (PERTH 06511716)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2401 Date: 13 10 1994 (PERTH 06511600)
LOCALITY Muchea Nature Reserve, Muchea South Road, System 6 Area C25. Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2400 Date: 13 10 1994 (PERTH 06511740)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: G.J. Keighery 14886 Date: 18 10 1996 (PERTH 04832795)
LOCALITY Muchea Nature Reserve, Muchea, WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Shrub, much branched at base, flowering stems to 2 m. Largely post flowering. Sandy rises in wetland.
Regelia/Actinostrobus shrubland.
Previous det.: Grevillea curviloba McGill.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: G.J. Keighery 14884 Date: 18 10 1996 (PERTH 04832817)

LOCALITY Muchea Nature Reserve, Muchea, WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Shrub, much branched at base, flowering stems to 2 m. Flowers white, largely post flowering.
Sandy rises in wetland.
Regelia/Actinostrobus shrubland.
Previous det.: Grevillea curviloba McGill.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2398 Date: 13 10 1994 (PERTH 06511724)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: R.M. Evans, G. Stack & A.P. Brown RME 22 Date: 09 09 1998 (PERTH 05414156)
LOCALITY Maralla Road, Muchea, 7 km W from intersection with Railway Parade, S side of road, WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Open, erect shrub 3+ m high x 2+ m wide. Old mature plants, appeared heavily grazed. No lower branches. No pods.
Winter wet creek line. Moist, grey sand.
Open Scrub (very old). Associated species: Acacia saligna, Melaleuca
rhaphiophylla, sedges, Xanthorrhoea preissii, Banksia menziesii.
Frequency:common locally.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2396 Date: 13 10 1994 (PERTH 06511708)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2395 Date: 13 10 1994 (PERTH 06511694)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: B.J. Keighery 2394 Date: 13 10 1994 (PERTH 06511686)
LOCALITY Muchea Nature Reserve, Muchea South Road. System 6 Area C25; Muchea townsite (adjacent System 6 Update plot much 02) WA
LAT 31 Deg 35 Min 3.372 Sec S LONG 115 Deg 58 Min 27.552 Sec E
Prostrate shrub with erect flowering branches to 2 m by 2 m. Fruiting.
Wet Flat; grey sand over sand. Poor drainage, wet during winter/spring.
Open Scrub, Associated species: Xanthorrhoea preissii.
Previous det.: Grevillea curviloba McGill.
Frequency:abundance: 1 of 8 plants in 1 population.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R

Coll.: J.L. Robson s.n. Date: 26 09 1996 (PERTH 05383684)
LOCALITY Pop. 4A 2 km N along Brand Highway from junction of railway crossing at Muchea, E side of road, Pop. 4B 30 m E of railway line, WA
LAT 31 Deg 33 Min 48.000 Sec S LONG 115 Deg 58 Min 3.000 Sec E
Flat, grey sand, partialy inundated site. Very open with odd Paperbarks in inundated, degraded site. Associated species:
Acacia saligna, Blackboys, Stirlingia latifolia, Arum Lilies, Watsonia, Blue
Lupins and extremely dense weed and grass growth. Population No. 4A & 4B.
Frequency:7 plants, 5 seedlings.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.L. Robson s.n. Date: 26 09 1996 (PERTH 05383706)
LOCALITY Pop. 5A, 1.8 km N along Brand Highway from junction of railway crossing at Muchea and 20 m on E side of road, Pop.5B 25 m E of Pop.5A and or 5 m E of railway line, WA
LAT 31 Deg 34 Min 15.000 Sec S LONG 115 Deg 58 Min 16.000 Sec E
Flat. Completely open, previously disturbed/degraded site. Fringed by odd Marri and
Paperbarks. Acacia saligna, Hakea prostrata, H. varia, Blackboys, Capeweed
and other dense agricultural weeds and Kikuya grass growth - Hibbertia sp., Melaleuca sp., Stirlingia latifolia.
Population No. 5A & 5B.
Frequency:21 mature plants, 25 seedlings.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.L. Robson s.n. Date: 27 09 1996 (PERTH 05383749)
LOCALITY 1.68 km N along Brand Highway from junction of railway line crossing at Muchea and then 20 m E of the nearby railway line, WA
LAT 31 Deg 34 Min 4.000 Sec S LONG 115 Deg 58 Min 10.000 Sec E
Flat. Grey sand. Inundated. Open, inundated damp site. Banksia menziesii, Hakea prostrata, Acacia saligna,
Acacia sp., Blackboys, Jacksonia furcellata, Conostylis sp., Melaleuca sp., Dense grasse and weeds.
Population No. 6.
Frequency:49 mature plants, 30 seedlings.

Grevilléa curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
TYPE STATUS: ISO
Coll.: P.M. Olde 92 108 Date: 26 09 1992 (PERTH 04700139)
LOCALITY Steer Street, Muchea, 0.6 km from Brand Highway, WA
LAT 31 Deg 34 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Robust, multi-stemmed shrubs to 3 m. White flowers. Beside railway. Weedy low-lying reserve.
Abundance: several plants.
Previous det.: Grevillea curviloba subsp. incurva P.Olde & N.Marriott

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: H. Steedman s.n. Date: 09 1927 (PERTH 02415933)
LOCALITY Muchea WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Previous det.: Grevillea curviloba McGillivray

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: G.J. Keighery & J.J. Alford 83 Date: 27 08 1985 (PERTH 1112848)
LOCALITY Muchea Townsite Reserve. WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Spreading low shrub 1 m x 2.5 m wide, flowers white. Winter wet. Peaty sand over clay.
Melaleuca low woodland.
Abundance: common.
Previous det.: Grevillea ? curviloba McGillivray

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: K.L. Brown KLB 12 Date: 17 12 1996 (PERTH 04564278)
LOCALITY 2 km N of Muchea on Brand Highway, E side of road, both sides of railway line WA
LAT 31 Deg 33 Min 31.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E

Shrub to 2 m. Low lying area of sand plain. Grey peaty sand.
Open woodland with Eucalyptus calophylla, Acacia saligna, Hakea
prostrata, Grevillea obtusifolia, Melaleuca preissii, veldt grass and wild oats.
Abundance: 7 plants.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.L. Robson s.n. Date: 04 10 1996 (PERTH 05383676)
LOCALITY 2.45 km SSE down Muchea South Road from Muchea township, population
adjoins E side of road and W side of railway line, WA
LAT 31 Deg 35 Min 57.000 Sec S LONG 115 Deg 58 Min 55.000 Sec E
Flat, grey, moist sand. Open, semi-disturbed, degraded, scrubby site. Associated species: Acacia
saligna, Jacksonia furcellata, Melaleuca sp., Adenanthos cygnorum, Blackboys, Watsonia, Banksia littoralis, Cape Tulip, Anigozanthos manglesii and very dense grasses.
Population No. 14.
Frequency:41 mature plants, 20 seedlings.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: K.R. Newbey 1674 Date: 26 08 1964 (PERTH 02415895)
LOCALITY 1 mile N of Muchea WA
LAT 31 Deg 34 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
5 ft high. In sandy loam.
Previous det.: Grevillea curviloba McGillivray

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: R.M. Evans, G. Stack & A.P. Brown RME 21 Date: 09 09 1998 (PERTH 05414148)
LOCALITY Muchea Nature Reserve, corner of Railway Parade and Archibald Street, WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Open, erect shrub 2.5 m high x 1 m wide. Plant tends to be prostrate when young
then erect branches develop. Flowering profusely. Pods common. Low lying. Red sand-clay-gravel over ironstone.
Sparse vegetation, mainly veldt grasses.
Associated species: Acacia saligna, Corymbia calophylla, Viminaria juncea, Watsonia, grasses, etc.
Frequency:common.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.A. Cochrane JAC 3195 Date: 16 12 1998 (PERTH 05207010)
LOCALITY Corner of Archibald and Muchea South Road, Muchea townsite, in vacant block at edge of road WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 115 Deg 58 Min 0.000 Sec E
Spreading shrub with prostrate vegetative growth and flowering/fruiting growth to 2 m.
Bright green trifurcate foliage.
Low lying area of sandplain. Grey peaty sand over clay.
Open woodland with weeds, grasses, Hakea sp., Watsonia, Jacksonia furcellata.

Leucopogon glaucifolius
W.Fitzg. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: R.J. Cranfield 10696 Date: 16 01 1996 (PERTH 04414152)
LOCALITY NE corner of Barracea Reserve, Muchea WA
LAT 31 Deg 33 Min 0.000 Sec S LONG 116 Deg 1 Min 30.000 Sec E
Erect open pungent shrub 27 cm x 30 cm, flowers white. Grey -brown sandy clay, swamp. Open woodland.
Abundance: occasional.

Synaphea grandis
A.S.George (Proteaceae)
CONSERVATION STATUS:P4
TYPE STATUS: ISO
Coll.: A.S. George 11158 Date: 01 11 1971 (PERTH 04543602)
LOCALITY ca 1 mile E of Muchea crossroads WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 116 Deg 1 Min 0.000 Sec E
Shrub with many stems; scapes to 1 m; flowers yellow. On lateritic hill. In Wandoo woodland.

Synaphea grandis
A.S.George (Proteaceae)
CONSERVATION STATUS:P4
TYPE STATUS: HOL
Coll.: A.S. George 11158 Date: 01 11 1971 (PERTH 04543599)

LOCALITY ca 1 mile E of Muchea crossroads WA
LAT 31 Deg 35 Min 0.000 Sec S LONG 116 Deg 1 Min 0.000 Sec E
Shrub with many stems; scapes to 1 m; flowers yellow. On lateritic hill. In Wandoo woodland.
Previous det.: Synaphea sp.

Verticordia lindleyi Schauer subsp. lindleyi (Myrtaceae)
CONSERVATION STATUS:P4
Coll.: R.J. Cranfield 10695 Date: 16 01 1996 (PERTH 04414187)
LOCALITY NE corner of Barracea Reserve, Muchea WA
LAT 31 Deg 33 Min 0.000 Sec S LONG 116 Deg 1 Min 30.000 Sec E
Erect open shrub 40 cm x 50 cm, flowers pink. Grey - brown sandy clay, swamp. Open woodland.
Abundance: abundant.
Previous det.: Verticordia lindleyi Schauer subsp. lindleyi

Verticordia serrata (Lindl.)Schauer var. linearis A.S.George (Myrtaceae)
CONSERVATION STATUS:P3
Coll.: A.S. George & E.A. George ASG 16924 Date: 09 07 1988 (PERTH 01894544)
LOCALITY E of Muchea WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
Slender shrub to 80 cm. On sandy flat. In Jarrah-Marri open forest.

Verticordia serrata (Lindl.)Schauer var. linearis A.S.George (Myrtaceae)
CONSERVATION STATUS:P3
Coll.: F. Lullfitz 3137 Date: 18 12 1963 (PERTH 01557866)
LOCALITY Muchea WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
3 ft high, yellow flowers.
Previous det.: Verticordia serrata (Lindl.)Schauer.

Verticordia serrata (Lindl.)Schauer var. linearis A.S.George (Myrtaceae)
CONSERVATION STATUS:P3
Coll.: D. Mills 18 Date: 15 10 1981 (PERTH 02033739)
LOCALITY NE of Muchea WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
150 cm high, 30 cm wide. Flowers yellow. White sand.
Previous det.: Verticordia serrata

Verticordia serrata (Lindl.)Schauer var. linearis A.S.George (Myrtaceae)
CONSERVATION STATUS:P3
Coll.: L. Norton 16 Date: 15 10 1979 (PERTH 02033747)
LOCALITY Muchea WA
LAT 31 Deg 34 Min 36.000 Sec S LONG 115 Deg 58 Min 17.000 Sec E
To 90 cm high, to 45 cm wide. Flowers bright yellow. Erect shrubs with blooms in 4-8 cm heads. Gravelly soil.
Previous det.: Verticordia serrata

9-AUG-04 Summary of Threatened Flora Data P

Taxon Name	Cons.	Pop ID	Latitude	Longitude	Purpose
Adenanthos cygnorum subsp. chamaephyton	3	6	31^34'41.6"	116^01'53.3"	VER
Cyathochaeta teretifolia	3	4	31^35'49.6"	115^58'15.3"	DEF
Darwinia sp.A Perth Flora(A.S.George 16943) pn		1	31^35'01.6"	115^58'31.3"	CFF
Darwinia sp.A Perth Flora(A.S.George 16943) pn		2	31^35'15.6"	115^58'15.3"	WAT
Darwinia sp.Muchea(B.J.Keighery 2458) pn	R	1	31^35'02.1"	115^58'32.5"	CFF
Grevillea curviloba subsp. curviloba	R	6	31^34'31.6"	115^58'22.3"	CFF
Grevillea curviloba subsp. incurva	R	2A	31^34'44.6"	115^58'09.3"	VER
Grevillea curviloba subsp. incurva	R	2B	31^34'57.6"	115^58'33.3"	RRE
Grevillea curviloba subsp. incurva	R	3A	31^34'57.6"	115^58'32.3"	CFF
Grevillea curviloba subsp. incurva	R	3B	31^34'57.6"	115^58'32.3"	CFF
Grevillea curviloba subsp. incurva	R	3C	31^35'04.6"	115^58'29.3"	CFF
Grevillea curviloba subsp. incurva	R	3D	31^35'00.6"	115^58'23.3"	CFF
Grevillea curviloba subsp. incurva	R	4A	31^33'43.6"	115^58'08.3"	VER
Grevillea curviloba subsp. incurva	R	4B	31^33'43.6"	115^58'09.3"	RRE
Grevillea curviloba subsp. incurva	R	4C	31^33'59.6"	115^58'15.3"	RRE
Grevillea curviloba subsp. incurva	R	5A	31^34'11.6"	115^58'22.3"	VER
Grevillea curviloba subsp. incurva	R	5B	31^34'11.6"	115^58'23.3"	RRE
Grevillea curviloba subsp. incurva	R	12A	31^35'53.6"	115^59'00.3"	VER
Grevillea curviloba subsp. incurva	R	12B	31^35'53.6"	115^59'00.3"	RRE
Grevillea curviloba subsp. incurva	R	16	31^34'52.6"	115^58'33.3"	PAR
Verticordia serrata var. linearis	3	4	31^34'15.6"	116^00'07.3"	VER

A total of 21 records were printed.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
DECLARED RARE AND PRIORITY FLORA LIST
19 July 2004

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
Baeckea sp. Chittering (R Cranfield 1983)	4	SW	Chittering, Bullsbrook, Avon Valley	Dec,Jan
Grevillea althoferorum	R	MW,SW	Eneabba, Bullsbrook	
Grevillea curviloba subsp. curviloba	R	SW	Bullsbrook, Muchea	Oct
Guichenotia tuberculata ms	3	MW,SW	Mogumber, New Norcia, Gillingarra, Wannamal, Bullsbrook	Aug,Sep
Haemodorum loratum	3	MW,SW	Eneabba, Cockleshell Gully, Bullsbrook, Wattle Grove, Boonanaring	Sep-Nov
Platysace ramosissima	3	CF,SW, MW	Yalgorup, Boonanarring, Gingin, Lancelin, Bullsbrook Nature Reserve	
Rhodanthe pyrethrum	3	CF,SW	Bullsbrook, Boyanup, Kenwick, Waterloo, Harvey, Eaton, Denmark	Sep-Oct
Schoenus sp. Bullsbrook (JJ Alford 915)	2	SW	Bullsbrook	Oct-Nov
Stenanthemum sublineare	2	SW	Bullsbrook	Oct-Dec
Stylidium aceratum	2	SW	Bullsbrook	Oct-Nov
Stylidium longitubum	3	SW,WB, CF	Upper Swan, Bullsbrook, Bunbury, Midland, Busselton, Arthur River, Jandakot	Nov
Verticordia plumosa var. pleiobotrya	R	SW	Mundijong West Road, Bullsbrook NR	Nov

Appendix 3

Acid Sulphate Soil Investigation & Management Plan Lot 6 Wandena Road Muchea WA

December, 2006

Midland Brick Company

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited ABN 80 078 004 798

1 Alvan Street
Subiaco WA 6008
PO Box 1232
Subiaco WA 6904
Australia
Telephone +61 8 9489 9700
Facsimile +61 8 9380 4060
Email perth@pb.com.au

NCSI Certified Quality System ISO 9001

2145267A-PR2:17401 Rev C

8. Acid sulphate soil management plan

The following management practices are recommended to prevent potentially complete exposure pathways from occurring during Stage 1 and, therefore, minimise the risk of harm to identified receptors as a result of the site works defined in Section 1 of this report.

The overall objectives are to:

- minimise mobilisation of acidity from disturbed areas;
- retain stormwater runoff from disturbed areas in detention basins and excavation voids and treat as required with lime dosing to neutralise acidity prior to any release or re-use; and
- facilitate the re-establishment of a vegetative cover to prevent erosion as part of the longer term management of the site.

Groundwater management

- The depth of excavations should be limited to the unsaturated zone and not extend below permanent groundwater where PASS most likely occurs.
- Groundwater was not encountered across the northern half of Stage 1 to a maximum depth of 21m BGS. It was encountered at the south-western corner at 15 m BGS (PB borehole J300) and across the central southern portion of Stage 1 at approximately 17 m BGS (MBC borehole L5-400) and 12 m BGS (MBC borehole L-400).

Drainage management

- Prior to commencing earthworks stormwater diversion drains will be constructed at the up-gradient boundary to minimise stormwater migration across worked areas.
- Stormwater runoff from worked areas shall be retained in stormwater detention ponds e.g. pit voids.
- Water levels within detention ponds shall be monitored to prevent overtopping.
- Any stormwater released from the site shall be monitored and treated as required.
- Roadside drainage system designed for proper discharge of runoff. To avoid erosion of soil.

Rehabilitation of exposed soils

- All slopes that have been disturbed during earthworks are to be stabilised.
- Topsoil stripped from the site is to be respread across the site with lime if necessary for revegetation.

Management of stockpiles

- Stockpiles including overburden, topsoil and clay stored on-site should be managed in a manner that will retain any leachate by stormwater runoff and prevent erosion through being stored within an undercover enclosure.

8.1 Monitoring programme

The following monitoring program is proposed for the protection of identified sensitive environmental receptors:

8.1.1 Surface water

- The Wandena Creek and the Muchea East Road creek will be screened for baseline conditions prior to earthworks and monitored regularly for at least two years after cessation of excavations, to confirm surface water bodies have not been adversely impacted. Monitoring frequency will be monthly during periods of high stream flow.
- The pH of water in detention basins and excavation voids will be checked especially for re-use and when overtopping is more likely e.g. greater than 80% capacity.

8.1.2 Groundwater

- Baseline groundwater quality should be established prior to commencing operations.
- Groundwater monitoring should be undertaken from a network of suitable monitoring bores during the life of the operation and for a period of at least two years following cessation of operations to confirm that groundwater has not been adversely impacted.

8.2 Performance criteria

Table 8.1 summarises the performance criteria that will be adopted for evaluating the management plan. These criteria are for assessing impact on off-site/down-stream to the development site.

Table 8.1: Performance Criteria

Medium	Acceptable Threshold
Streams and Groundwater	Less than 10% or 0.05 pH variation from background With respect to heavy metals in groundwater these should not exceed acceptable thresholds by 10x or background concentrations by 15 % where background concentration already exceeds adopted threshold.

Appendix 4

Government of Western Australia
Department of Environment and Conservation

Your ref
Our ref CPS 2928/1
Enquiries Jessica Davis
Phone 9333 7537
Fax
Email jessica.davis@dec.wa.gov.au

Mr Garry Price
Midland Brick Company Pty Ltd
102 Great Northern Highway
MIDDLE SWAN WA 6058

Dear Mr Price

PERMIT TO CLEAR NATIVE VEGETATION UNDER THE *ENVIRONMENTAL PROTECTION ACT 1986*

Thank you for your amended application to clear 2 hectares of native vegetation, on Lot 6 on Plan 49665 Wandena Road, Muchea for the purpose of extractive industry (reference CPS 2928/1).

Please find enclosed your permit to clear native vegetation granted under s.51E of the *Environmental Protection Act 1986*. This authorisation gives you approval to clear, subject to certain terms, conditions or restrictions. A copy of your permit is now available for the public to view, as required by the regulations.

A copy of the Decision Report is attached for your information. The Decision Report is also available for the public to view.

Please read your permit carefully. If you do not understand your permit, contact the Department of Environment and Conservation (DEC) immediately. Be aware that there are penalties for failing to comply with the requirements of your permit.

If you are aggrieved by this decision an appeal may be lodged with the Minister for Environment. If you choose to appeal, it must be in writing, clearly set out the grounds of your appeal, and be received by the Minister within 28 days. More information on lodging an appeal is available from the Office of the Appeals Convenor on telephone 9221 8711. Completed appeals should be posted or delivered to:

Office of the Appeals Convenor
13th Floor, Allendale Square
77 St Georges Terrace, PERTH WA 6000
Tel: 9221 8711 Fax: 9221 8244
Email: admin@appealsconvenor.wa.gov.au
Web: http://www.appealsconvenor.wa.gov.au

Third parties may also appeal against the issue of this permit.

Department of Environment and Conservation
Native Vegetation Conservation Branch, Swan Region
B1-205 Davy Street Booragoon
Locked Bag 104, Bentley Delivery Centre WA 6983
www.dec.wa.gov.au/nvc

Please note that clearing must not commence until the date stated on the permit, or in the event of an appeal, after the appeal has been determined and you have been notified that you may proceed.

Be aware also that compliance with the terms, conditions or restrictions of this permit does not absolve the Permit Holder from responsibility for compliance with the requirements of all Commonwealth, State and Local Government legislation.

It has been noted that this permit covers an area in which there exists one registered Indigenous Heritage Site. It is the responsibility of the proponent to ensure that no Aboriginal Sites of Significance are damaged through the clearing process. In implementing this permit please liaise with the Department of Indigenous Affairs regarding your obligations under the *Aboriginal Heritage Act 1972*.

If you have any queries regarding this decision, please do not hesitate to contact Jessica Davis at DEC's Swan Region on 9333 7537.

Yours sincerely

Keith Claymore
A/ ASSISTANT DIRECTOR
NATURE CONSERVATION DIVISION

12 February 2009

Attached: Clearing Permit and Decision Report.
Fact Sheet: Complying with your Clearing Permit

GOVERNMENT OF WESTERN AUSTRALIA

CLEARING PERMIT
Granted under section 51E of the Environmental Protection Act 1986

PERMIT DETAILS

Area Permit Number: 2928 / 1
File Number: DEC10215
Duration of Permit: From 5 March 2009 to 5 March 2013

PERMIT HOLDER

Midland Brick Company Pty Ltd

LAND ON WHICH CLEARING IS TO BE DONE

Lot 6 on Plan 49665 Wandena Road, Muchea

AUTHORISED ACTIVITY

Clearing of up to 2.0 hectares of native vegetation within the area cross-hatched yellow on attached Plan 2928/1.

CONDITIONS

1. Revegetation

(a) The Permit Holder shall retain the vegetation material and topsoil removed by clearing authorised under this Permit.

(b) Within six months of any area no longer being required for the purpose of this Permit, the Permit Holder must *revegetate* the area by:

(i) laying vegetation material and topsoil retained in accordance with condition 1(a), on the area; and
(ii) deliberately planting and/or seeding native vegetation using local species from within 20km of the area cleared.

(c) Within one year of undertaking *revegetation* in accordance with condition 1(b), the Permit Holder must where, in the opinion of an *environmental specialist, revegetation* area does not provide adequate stabilisation of surface soils, undertake additional planting or seeding of native vegetation in accordance with the requirements of conditions 1(b)(ii).

2. Records must be kept

The Permit Holder must maintain the following records for activities done pursuant to this Permit, as relevant:

(a) In relation to the *revegetation* of areas pursuant to condition 1:

(i) the commencement date of the *revegetation*;
(ii) the location of any area *revegetated* recorded using Geocentric Datum Australia 1994
(iii) a description of the *revegetation* activities undertaken; and
(iv) the size of the area *revegetated* (in hectares).

3. **Reporting**

(a) The Permit Holder must provide to the CEO, on or before 30 June of each year, a written report of records required under condition 2 and activities done by the Permit Holder under this Permit between 1 January and 31 December of the preceding year.

(b) Prior to 30 March 2012, the permit holder must provide to the CEO a written report of records required under condition 2 where these records have not already been provided under condition 3(a).

Definitions

The following meanings are given to terms used in this Permit:

environmental specialist means a person who is engaged by the permit holder for the purpose of providing environmental advice, who holds a tertiary qualification in environmental science or equivalent, and has experience relevant to the type of environmental advice that an environmental specialist is required to provide under this Permit;

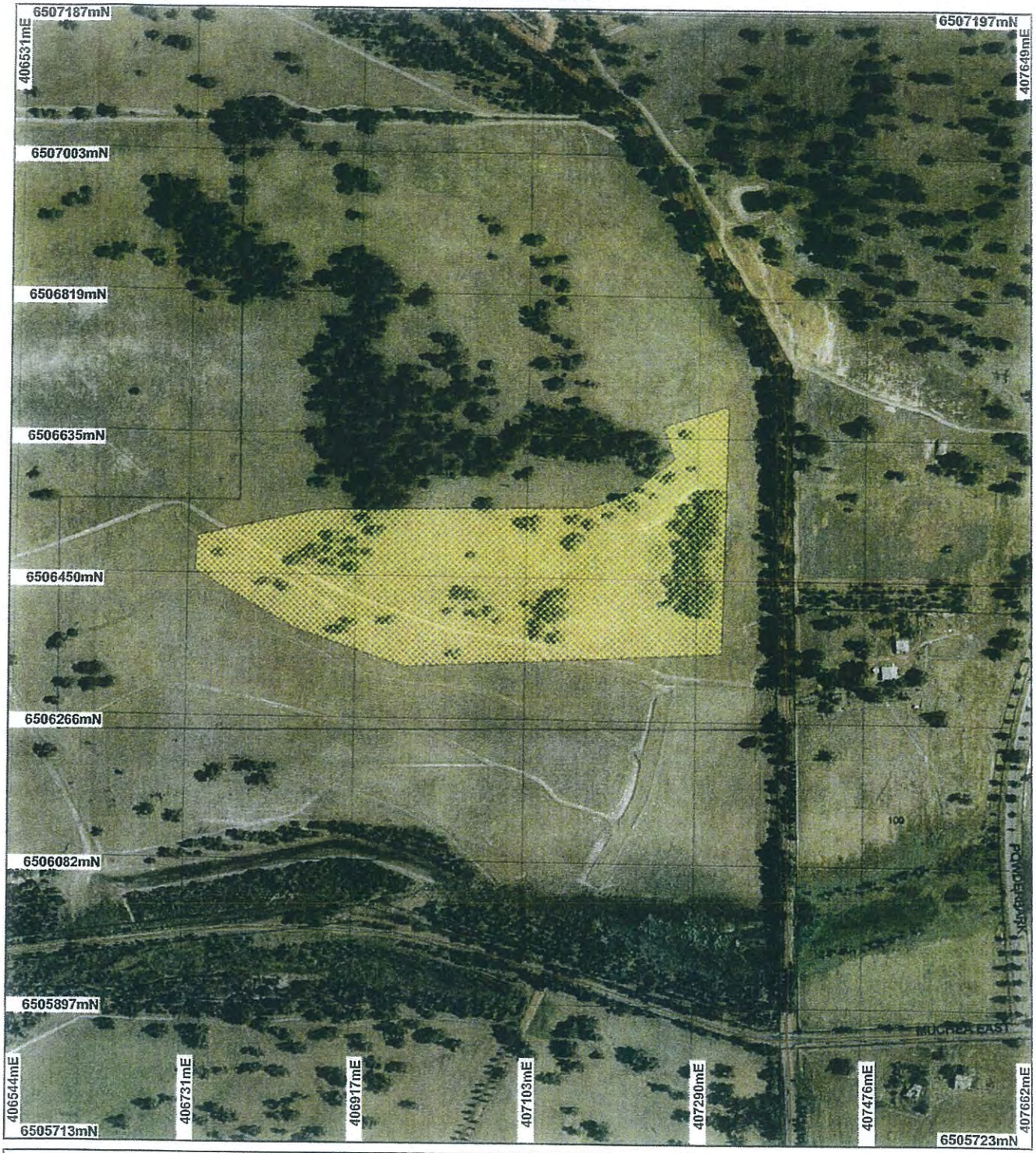
revegetate, revegetated **and** ***revegetation*** means the re-establishment of a cover of native vegetation in an area such that the species composition, structure and density is similar to pre-clearing vegetation types in that area, and can involve regeneration, direct seeding and/or planting.

Keith Claymore
A/ ASSISTANT DIRECTOR
NATURE CONSERVATION DIVISION

Officer delegated under Section 20
of the Environmental Protection Act 1986

12 February 2009

Plan 2928/1



LEGEND

- Cadastre for labelling
- Road Centrelines
- FW
- HY
- LRD (cont)
- LRS
- MR
- N
- TR

Swan Coastal Plain North
40cm Orthomosaic - Landgate
2005

Clearing Instruments
- Areas Approved to Clear

N

0 ~150 m

Scale 1:6533
(Approximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

Kath Claymore 12/2/09

K. Claymore Date

Officer with delegated authority under Section 20 of the Environmental Protection Act 1986

Information derived from this map should be confirmed with the data custodian acknowledged by the agency acronym in the legend.

Department of Environment and Conservation

* Project Data is denoted by asterisk. This data has not been quality assured. Please contact map author for details.

Appendix 5

DUST MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

May 2012

BORAL BRICKS

1.0 Site Description

The excavation are lies on Lot 6 Wandena Road, Muchea.

The site is generally cleared grassland with scattered parkland pasture, shade trees and some revegetation and landscaping belts.

Topsoil, overburden and targeted brick making clays can be extracted at random throughout the year using heavy earthmoving equipment. Some of this activity can occur during the dryer months of the year when the fire risk is at its peak.

Equipment utilised on site include scrapers, dozers, dump trucks, excavators, loaders, water tankers, service vehicles and drilling rigs. Some mobile plant will be available for cutting fire breaks.

Clay is either loaded directly to road trucks or stored in stockpiles for later recovery and transport.

There is a transportable site office and amenity building, and associated serviced portable toilet system.

A sediment settlement dam is located in the south western corner of the operations. The water in this dam is used for dust suppression and is available for fire fighting.

A wet down bay and water tanker are retained on site.

6.3.3 Dust Management Plan

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

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

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

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

Occupational dust associated with the quarrying processes falls under the Mines Safety and Inspection Act 1994 and Regulations 1995.

There are a number of management actions that can be taken in quarries to minimise dust generation or travel and these will be used wherever possible. The general management actions are summarised below together with the potential dust issues that

relate to this site. The actions will be used where applicable and as the opportunity presents to minimise dust on this site.

A Dust Management Plan has been prepared and is attached as Appendix 5.

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

The main potential for dust generation is from the movement of traffic on the access road and within the pit and active areas in summer. The first 50 metres of the access road is sealed.

Excavation on site is intermittent with several excavation campaigns through the year per year being typical. Transport of clay from the stockpiles occurs on other days and during excavation.

The only closest dwelling remains at 250 metres from the eastern edge of the excavation with separations of 600 metres and 800 metres to the next closest dwellings. Excavation is moving west away from those dwellings.

A water tanker is maintained on site during excavation in summer when the risk of generating dust is greater. The water will be used to settle dust on the pit floor and to reduce the dust emanating from any transport along Wandena Road. It will also be used to water any of the internal access roads as required.

A truck wet down bay is established as used in other pits. The loads on trucks are wetted down or covered as necessary although this has been found to not always be required because of the nature of the clay which is normally transported as lumps. New trucks have automatic tarpaulins fitted to cover the clay during transport.

Apart from the initial soil clearing and surface reinstatement, operations will be conducted 5 to 15 metres below natural ground level.

Bearing in mind the distances involved and the dust suppression methods in place, dust should not impact on any dwellings and this appears to be the case. There are no proposed changes to the excavation methods, or rate of excavation. No complaints are known from past operations.

When operating in the east of the pit near the dwelling in Wandena Road, care will be taken to operate from the floor behind the face to minimise dust generation and transmission. A low bund 2 - 3 metres high and tree belt will be established along the edge of the excavation in this area to minimise dust transmission.

Experience with excavation in other pits operated by Boral Bricks in the Muchea area shows that dust can be managed through operational procedures and watering during susceptible times such as during transport along unsealed internal roads. Clay has been found to have natural moisture content of 15 to 25% on excavation.

Any dust generated is fine clay, soil and organic matter that tends to be filtered out by perimeter vegetation. It is innocuous kaolin and similar clay is used to treat some medical conditions.

The climate data for Bullsbrook is shown in show that the predominant summer winds are from the east at 9.00 am and from the south west at 3.00 pm, making the summer afternoons potentially the worst time for dust impacting on the dwelling in Wandena Road.

The potential for dust to impinge on the closest dwelling to the east has been assessed using the Department of Environmental Protection Dust Control Guidelines (Sept 1990), taking into account the measures outlined for excavation. During the initial land clearing and reinstatement the risk would be expected to be higher if conducted in summer. However this would be proposed to occur in spring or autumn when the soil is moist.

The main methods of dust control are awareness of the issues on a day to day and hour to hour basis as activities on site change. The most appropriate dust management procedures are then chosen to minimise occupational dust and environmental dust. Ongoing site awareness will be combined with a commitment to take whatever action is appropriate.

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

Dust emissions fall under the *Guidance for the Assessment of Environmental Factors, EPA, March 2000*. However an assessment of the dust risk can be made using the *Land development sites and impacts on air quality*, Department of Environmental Protection Guidelines, November 1996 and *DEC 2008, A guideline for the development and implementation of a dust management plan*, which reveal that the risk of dust impacting on the closest dwellings is as listed below.

This guideline is not really appropriate for quarries. It was developed for subdivision earthworks at a time when dust management was a lower priority.

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

Activity	Calculated Score	Allocated Risk of Dust
Clay excavation, transport – with no water treatment	450	Medium
Clay excavation, transport – with effective dust suppression	288	Low

DUST MANAGEMENT ACTIONS

ACTIVITY	POSSIBLE RISK SEVERITY and FREQUENCY	IDEAL OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE	RISK AFTER MANAGEMENT
GENERAL				
Legislation	----	• Comply with the provisions of the Mines *Safety and Inspection Act 1994 and Regulations 1995.*	• Boral Bricks comply with the Act and Regulations at all their pits.	----
Buffers	----	• Maintain adequate buffers to sensitive premises.	• No changes are proposed to the buffers or excavation. • Excavation will continue to move further away from the closest residence.	----
Landform	----	• Locate activities behind natural barriers, landform and vegetation.	• The resources are located and selected to provide the best screening although there is little choice in the location. • The method of excavation is used to assist dust management and this has been used in the design of the pit.	----
Landform	----	• Work below natural ground level.	• This is used	----
		• Push overburden and interburden dumps into positions where they can form screening barriers.	• This is used by pushing the overburden to the west and east of the pit to form bunds. • The use of an overburden bund along the east of the excavations, combined with additional tree planting helps mitigate any dust escape. • The existing trees west of the current excavations are to be retained and only cleared progressively as required to maintain the best dust management. • See attached figures.	----
Staging	----	• Design operational procedures and staging, to maximise the separation to sensitive premises.	• The excavation areas will continue to be staged. • Progress of the pit is to the west away from dwellings.	----
Pit design	----	• Design the excavation to provide enhanced landform and constructed dust screening.	• See above.	----
Screening/ Vegetation	----	• Use landscape screening, wind	• The intermittent nature of the operations and a return to	----

		breaks and tree belts.	productive agriculture land do not make this generally possible in the time frames proposed. The existing vegetation and trees will assist. • Additional bunding and tree planting has been undertaken along Wandena Road.	
MANAGEMENT				
Occupation	----	• Provide air conditioned closed cabins on plant	• These are used for on site operational mobile plant.	----
Monitoring	----	• Provide monitoring and supervision of the processing and other practices on site.	• A monitoring system is proposed. see below "Trigger Conditions".	----
Trigger conditions	----	• Trigger conditions are used to determine when additional dust management is required.	• Most dust generated from excavation is visible. • The trigger for dust management is the generation of visual dust. • A site supervisor is present at all times when excavation is occurring. At other times if not present the supervisory duties are allocated to a mobile plant operator, who is in the best position to assess dust generation and to direct remediation. • A commitment is made that no visible dust will cross the lot boundaries as a result of activities conducted in the pit. There may be occasional drift of transport dust because of proximity to the western boundary. • All on site operators are to be instructed to visually monitor dust, report and treat any visible dust.	----
Adverse weather	Low - Uncommon in winter, more common in summer.	• When winds are sufficiently strong, or other weather conditions are unacceptable, to negate the effects of dust management, operations will cease until conditions improve and compliance can be achieved.	• This policy is implemented and is normal company policy to minimise impact on adjoining land holders.	Low
Equipment failure	Low to moderate - Uncommon	• In the event of dust management not being able to be achieved through equipment failure operations will cease until full capability	• This is committed to.	Low

		is restored.		
Training	----	• Conduct training programs on dust minimisation practices.	• Boral Bricks use on site induction and training to all personnel at all operations.	----
Complaints	----	• Provide a complaints recording, investigation, action and reporting procedure such as Appendix 3 of Land development sites and impacts on air quality, Department of Environmental Protection Guidelines, November 1996.	• A record of all dust complaints is to be maintained together with the mitigation measures to be used to reduce the dust impacts. • All complaints relating to dust are to be investigated immediately on receipt of a complaint. Appendix 3 of *Land development sites and impacts on air quality*, Department of Environmental Protection Guidelines, November 1996, will form the basis of the methods on which a complaint on dust is dealt with.	----
EARTHWORKS				
Land Clearing	Low - Unlikely to be required	• Schedule activities such as vegetation removal or topsoil stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	• Clearing is restricted to the scattered trees ahead of excavation. • A Clearing Permit is in place, and another will be applied for to cover future excavation to the west. • Trees will only be cleared when that immediate ground is required. • Substantial tree belts have been planted in the south along Muchea East Road.	Nil to Low
Overburden removal	Low - Once per year	• Schedule activities such as overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	• This is generally used. • Overburden removal will normally be conducted initially and then less than once per year. • The use of an overburden bund along the west and east of the excavations, combined with additional tree planting along the eastern edge of the resource, will help mitigate any dust escape. See attached figures.	Low
Land restoration	Moderate - < once per two years	• Schedule activities such as ripping, overburden and topsoil spreading on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions.	• This is proposed normally to occur only when each stage has been completed and no more frequently than once every two years.	Low
EXCAVATION				
Excavation	Low to Moderate -	• Excavate from the face using techniques that minimise the crushing of	• Excavation will normally be completed by excavator or scraper and will be intermittent	Low

	up to 90 days per year	dry matter.	and not normally more than 90 days per year. • The excavation of clay is not dusty in itself, it is the traffic on the floor of the pit and on the clay hard stand areas which are more likely to generate excessive dust.	
Loading at Face or from stockpiles	Low to Moderate - Few weeks per year	• Ensure that products to be loaded are moist and that the hardstand on which the loading occurs is wetted down or moist.	• These are intermittent operations. As noted above most dust is created by traffic on the floor of the pit.	Low
Haulage To create stockpiles etc	Moderate to Low - Intermittent	• Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	• Haul routes are made to be as short as possible.	Low
		• Reduce the length of the internal roads by maximising internal servicing efficiency.	• See above	
		• Providing speed management on hardstand and the road network.	• This is proposed.	
		• Provide air conditioned closed cabins on plant.	• All vehicles will be air conditioned.	
		• Limit speed on haul roads.	• Speed limits will be imposed on the haul and access roads as normal quarry practice.	
		• Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat.	• Even though excavation will be intermittent, water treatment of the access roads will be used during all operations. • The main access road has been sealed for approximately 50 metres from Wandena Road.	
PLANT - PROCESSING				
Hardstand traffic	Moderate - Occasional during year	• Maintain hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades.	• As noted above most dust is created by traffic on the floor of the pit. • A water truck is retained on site when operations are occurring.	Low
Processing	No onsite processing	• Treat processing areas with water sprays.	• There is no on site processing.	Nil
Mobile and static plant Operation	No onsite processing	• Maintain all plant in good condition.	• Boral Bricks has modern equipment that is maintained in good condition including the maintenance of dust minimisation measures.	Low to Nil

		• Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate.	• Operators are instructed to visually monitor dust, report and treat any visible dust. • Dust management and monitoring forms part of the site induction programs.	
Loading and Stockpile Creation	Low - Infrequent	• Shut down equipment when not in use.	• Boral Bricks uses this policy to save fuel and maintenance costs in addition to noise minimisation.	Low
		• Limit drop heights from conveyors and dump trucks.	• This is in place. It is a good safety and site management procedure.	
TRANSPORT				
Road condition	Moderate - Infrequent	• Maintain access roads in good condition (free of potholes, rills and product spillages).	• The internal farm roads will continue to be used. • The first 50 metres of the access road is sealed. • The access roads will be watered down as required.	Low
		• Water and/or treat access roads using a water tanker or sprinkler system.	• This is used to control the risk of dust generation from the movement of traffic on the floor of the pit.	
Road Transport	Moderate - Frequent	• Wet down or cover loads on trucks that are likely to blow during transport.	• This is used for road haulage trucks when the materials can blow. • All the new Boral trucks are fitted with covers for use during transport.	Low
		• Implement a site code outlining requirements for operators and drivers.	• A site code and induction system is proposed for the quarry.	
		• Maintain road trucks in a clean condition.	• Boral Bricks road trucks are maintained in a clean condition. • Individual contractors are required to do likewise.	
Road Transport		• Avoid spillages on roads and clean up promptly.	• Boral Bricks has a policy of covering or wetting down loads and instruct drivers to report and clean up spillages.	Low
		• Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport.	• This forms part of Boral Bricks normal operational procedures.	

		• Drivers are to inspect trucks prior to leaving site. Any product not correctly located and secured is to be removed prior to exit from the site.	• This forms part of Boral Bricks normal operational procedures.	
STOCKPILES				
Stockpiles	Low	• Wet down stockpiles using water canon or sprinklers as required.	• Clay stockpiles are stable. It is only the crushing of the clay by vehicles that causes dust. At other times the clay crusts and clumps.	Low

Dust Management - Applicable Legislation / Policies
• *Guidance for the Assessment of Environmental Factors, EPA, March 2000.* • *Land development sites and impacts on air quality, DEP, 1996.* • Department of Environmental Protection Guidelines, November 1996 and *DEC 2008, A guideline for the development and implementation of a dust management plan*
Commitments to Dust Management
• Boral Bricks will take the necessary steps to manage and contain dust by implementing and maintaining the Dust Management Plan.

Attached

Boral Bricks Standard Work Procedures.

Midland Brick

Standard Work Procedure

BORAL

Originated By: GARRY PRICE				
Written/Revised by: TREVOR HIGGINS	Checked by DAVE VELJACICH	SH&E: KYM CRAMER	Authorised by: GARRY PRICE	Supersedes: N/A
Signature:	Signature:	Signature:	Signature:	JSA Ref#:
Date:	Date:	Date:	Date:	Review Date:

PERSONS PERFORMING THIS STANDARD WORK PROCEDURE MUST BE COMPETENT AND HAVE SIGNED OFF ON THE TRAINING RECORD SWP No LOG 016-00

CHECKING FOR LOOSE MATERIAL AND WETTING DOWN OF LOADS

PPE REQUIRED:

ADDITIONAL PPE REQUIRED:

SAFETY / ENVIRONMENTAL EQUIPMENT REQUIRED:

ENVIRONMENTAL MANAGEMENT CONSIDERATIONS:

Waste Housekeeping

- **Reminder that the job is not complete until the housekeeping is**

Water Management

- **No scheme water to be used only collected pit operation water**

Dust Minimisation

- **Excess dust will be reduced by watering down your load creating less of an impact on other road users**

OTHER EQUIPMENT REQUIRED:

- SUITABLE WET DOWN STAND WITH COLLECTED SITE WATER USED
- EXTENDABLE POLE WITH HOOK ATTACHMENT

ALL ABOVE EQUIPMENT TO BE INSPECTED TO ENSURE IT IS SAFE & SUITABLE
PRIOR TO USE AT ALL TIMES

PROCEDURE:

1. PULL UP AT THE WET DOWN STAND ONLY WHEN AREA IS CLEAR

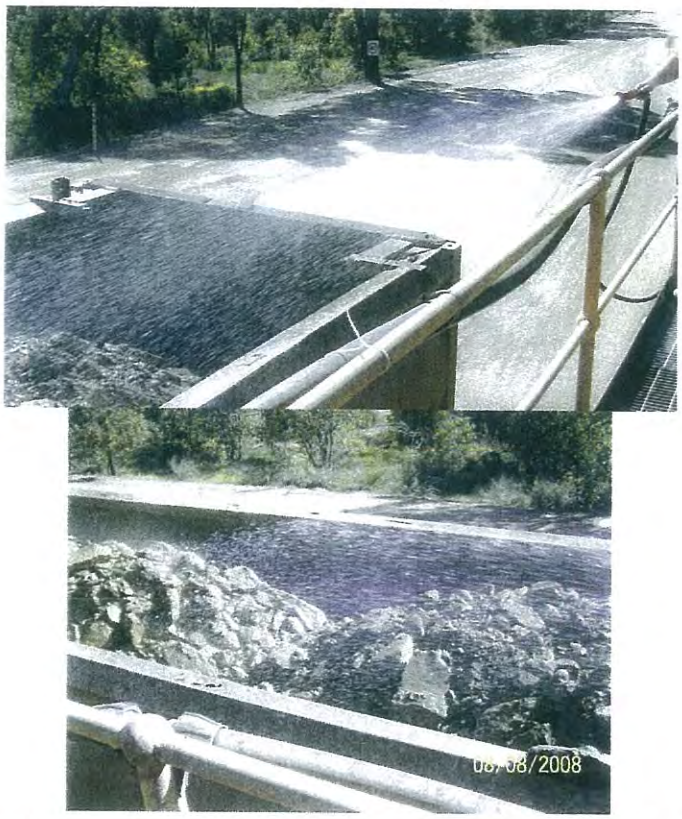
2. APPLY PARK BRAKE AND EGRESS USING 3 POINTS OF CONTACT

3. USING YOUR 3 POINTS OF CONTACT ACCESS THE WET DOWN STAND AND CHECK THE SIDES OF YOUR TRUCK / TRAILER FOR ANY LOOSE MATERIAL THAT MAY HAVE BECOME STUCK DURING THE LOADING PROCESS

4. USING THE EXTANDABLE POLE REMOVE THE LOOSE MATERIAL

NOTE: DO NOT LEAVE ANY LOOSE MATERIAL ON THE SIDE OF THE TRUCK / TRAILER

5. USING THE HOSES ATTACHED TO THE PLATFORM, WET DOWN YOUR LOAD SUFFICIENTLY AS TO CREATE A CRUST TO ELIMINATE ANY DUST THAT MAY BLOW DURING TRANSIT



6. WHEN LOAD IS WET DOWN ENOUGH AND ALL LOOSE MATERIALS HAVE BEEN REMOVED PACK AWAY EQUIPMENT AND EGRESS FROM THE PLATFORM

7. ACCESS YOUR VEHICLE USING 3 POINTS OF CONTACT AND MOVE AWAY FROM THE WET DOWN STAND WHEN SAFE TO DO SO

NOTE: DRIVERS ARE RESPONSIBLE FOR THERE LOAD

DUST CAN BE CLASSED AS LOOSE MATERIAL

SWP DEVELOPED IN CONSULTATION WITH:

CRAIG VIVIAN

END OF DOCUMENT

USING THE WET DOWN STANDS

FULL NAME:	SIGNATURE:	
POSITION:	DEPT:	DATE: / / 2008

1. When must this task be performed:
   (a) Every time you get loaded at one our mining operations.
   (b) Only when it's not raining.
   (c) During daylight hours only.

2. List 2 pieces of equipment to use when performing this task?

   1).....2).....

3. What must you use when Accessing or Egressing from the wet down stand.
   ..... Points of contact

4. Do **you** need too make sure there are no loose items that may fall from your vehicle.
   YES NO

5. Can you leave the hoses and the extendable pole laying in an unsafe manner as to cause a trip hazard.
   YES NO

SCORE...../ 5
PASS MARK 5 / 5

Once you complete the assessment, return it to the Trainer. If you have any questions, discuss them with the Trainer.

Remember: **NO JOB IS SO IMPORTANT THAT IT CANNOT BE DONE SAFELY OR ENVIRONMENTALLY FRIENDLY.**

Appendix 6

FIRE MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

May 2012

BORAL BRICKS

1.0 Site Description

The excavation are lies on Lot 6 Wandena Road, Muchea.

The site is generally cleared grassland with scattered parkland pasture, shade trees and some revegetation and landscaping belts.

Topsoil, overburden and targeted brick making clays can be extracted at random throughout the year using heavy earthmoving equipment. Some of this activity can occur during the dryer months of the year when the fire risk is at its peak.

Equipment utilised on site include scrapers, dozers, dump trucks, excavators, loaders, water tankers, service vehicles and drilling rigs. Some mobile plant will be available for cutting fire breaks.

Clay is either loaded directly to road trucks or stored in stockpiles for later recovery and transport.

There is a transportable site office and amenity building, and associated serviced portable toilet system.

A sediment settlement dam is located in the south western corner of the operations. The water in this dam is used for dust suppression and is available for fire fighting.

A wet down bay and water tanker are retained on site.

2.0 Purpose of the Plan

The Shire of Chittering normally requires the preparation of a Bushfire Management Plan for extractive industries.

The site operates to the *Mines Safety and Inspection Act 1994 and Regulations 1995,* which are administered by the Department of Mines and Petroleum. This legislation deals with occupational health and safety which includes vehicle fire and staff safety.

As fire management strategies may require altering to meet changing climate, weather patterns, environment and land use needs the Bush Fires Act 1954 may still be enforced in addition to requirements of the Shire of Chittering such as "vehicle movement bans", "fire risk," and this Fire Management Plan.

3.0 Fire Risk

The assessment of fire risk takes into account existing site conditions, which include: Topography with particular reference to ground slopes and accessibility;

- Vegetation cover — both remnant and likely revegetation;
- Relationship to surrounding development

The Bush Fire Hazard Assessment for the site is generally Low. The bush fire hazard assessment for the adjoining Lots is rated low.

The Mediterranean climate experienced by this area is such that the majority of rain falls in late autumn through to early spring. This rainfall supports substantial vegetation growth which dries off in Summer/Autumn.

Therefore fires in this general area can be very fast moving in unmanaged dry pasture, running at sufficient speed and spotting ahead at a pace that can make control very difficult. Smoke is also likely to inhibit activity and management.

Vehicle fire risk tends to be small. Normally this can start from a tyre fire or fire in a seized bearing. Management of such occurrences is handled through the safety provisions used by Boral Bricks and involves parking the affected vehicle in an isolated non flammable position where any water directed to it will be contained, leaving the vehicle and retreating to a safe distance. The normal place of parking is in the pit, hardstand or stockpile area.

4.0 Aim

The aim of the Fire Management Plan is to reduce the threat to workers and fire fighters in the event of bush fire within or near the site. It is generally recognized that bush fires are an inevitable occurrence in the spring, summer and autumn months in the south west.

The project will be designed so as to take into account the following fire protection measures:-

- Road Systems
- Firebreaks systems;
- Equipment on site;
- Water supplies;
- Fire contacts;
- Action in the event of a wildfire on site;
- Brigade familiarization of site.

5.0 Road System

The main access to the site is off Wandena Rd. An emergency access could be to WAMIA facility to the west and then to Much East Road. and Muchea East Road.

6.0 Firebreaks

The clay excavation and storage area is separate from the remainder of Lot 6 and distinguished by bare soils and clay.

6 metre wide firebreaks are to be installed around the boundary of the mine site.

Perimeter fire breaks to Lot 6.

The firebreaks are to have vertical clearance of a minimum of 5 metres high to allow access for fire appliances. The mine site and the remainder of Lot 6 is to comply with the Shire of Chittering Firebreak Notice.

7.0 Equipment on Site

When mining operations are carried out the following equipment can be utilized on site.

- Excavators
- Dozers
- Dump Trucks x 2
- Water Carts x 1 (20,000 litres capacity)
- Scrapers
- Drill Rig
- Service Vehicles
- Front end loader
- Water cart — dust suppression only
- Service vehicles

When day to day operations of carting clay from the stockpile the following equipment is on site when carting is taking place.

Boral Brick water tankers are equipped with 50mm camlock fittings for easy filling of local fire fighting appliances.

The 'mine site' is a registered mine with the Department of Mines and Petroleum and as such is restricted to MBC personnel only.

8.0 Water Supplies

The main dam is to be used for water supply under direct supervision of Boral Bricks personnel only.
The water tanker is available for fire fighting operations off site when wildfires are close by and availability is at the discretion of Boral Bricks Management and subject to safety.

9.0 Contacts

Quarry Manager:- David Veljacich 0401 895 725
Team leaders:- John Johansen 0401 897 768 & Jamie Evans 0401 895 586 General Manager Logistics — Garry Price 0401 897 993

10.0 Action Plans

1. Report fire to FESA Operation by ringing '000' and provide details of where the fire is, type of vegetation fire burning in eg. grass, bush land, vehicle fire, and personnel onsite;

2. Onsite personnel and equipment to take action to extinguish the fire by use of fire extinguishers, plant and equipment, water cart;

3. Relocate personnel and equipment to safe area;

4. Create a fire break around the fire if possible as is safe to do so not putting personnel or equipment at risk;

5. On arrival of Fire Brigade all personnel are to take direction from the most senior Brigade Officer on site (Incident Controller). Midland Brick personnel will operate through their own chain of command with the team leader taking directions from the Incident Controller;

6. Communications on all plant and equipment is UHF Radio Ch 19;

7. Mobile phones available to operators;

8. Fire extinguishers are fitted to all plant;

9. Water cart has fire hose facility.

10. Vehicle Fire

    Park the affected vehicle in an isolated non flammable position where any water directed to it will be contained, leaving the vehicle and retreating to a safe distance. The normal place of parking is in the pit, hardstand or stockpile area.

11.0 Brigade Familiarisation

Each year prior to summer wildfire season say September/October, Boral Bricks should familiarize the local Bush Fire Brigade of access, firebreak, water supplies, equipment available and contact details once a year.

This will give the Brigade an idea of what they will face if ever there is a fire on the site and will provide valuable information prior to a wildfire occurring on the site.

12.0 Boral Bricks Commitments

Boral Bricks commits to implement the Fire Protection Plan.

Appendix 7

REFUELLING MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

May 2012

BORAL BRICKS

Refuelling Management Plan

The extraction and transport of clay is a chemical free activity except for the consumption of hydrocarbons in the form fuel, oils and lubricants.

Over 90% of the hydrocarbons consumed on site are within earthmoving machinery and there are minor quantities used in small stationary engines which generate power or drive water pumps. The balance of approximately 10% is consumed by road transport vehicles which remove clay from the site.

- To minimise the risk of contamination, Midland Brick does not store any bulk fuel of lubricants on any clay extraction sites within the Shire.
- All fuels and lubricants are delivered to site on a purpose built service truck which dispenses fuel and oils to the earthmoving equipment on a demand. Diesel is dispensed to the machines via a "Wiggins" filling system which is designed to automatically shut off fuel delivery once the machine storage tanks are full. This prevents wastage of a valuable resource and ensure over filling does not occur during this procedure.

Various grades of oils are dispensed from dedicated tanks on the service truck via hand held volume metering pumps.

- Daily records are kept of quantities of fuel and oil consumed by each machine to monitor operational efficiency and early detection of excessive consumption or leakage of fluids.
- The service truck is also equipped with a vacuum pump and waste oil tank which is used to remove any spilt or used lubricants generated during routine servicing on site. All wastes collected by this method are returned to Midland Bricks Middle Swan workshop facility for storage and recycling by a licensed contractor.
- Wherever possible major mechanical repairs to earthmoving equipment is performed offsite at dedicated contractor's workshops or within Midlands Middle Swan workshops.
- Clay transport vehicles that visit the site are not serviced or refuelled at the clay pits.

Service trucks and the earthmoving machine operator are appropriately trained to insure compliance with the Companies standard working procedures and expectations in regard to refuelling equipment. This is covered within Midland Brick document SWP LOG 013 -01 document "Mobile Plant & Vehicle Prestart / Post –op of Service Truck" document as attached in appendix 2. Pages 7-10 cover dispensing of fuel of vehicles within the clay pits.

Spill Management

- If a spill should occur each site is equipped with a self contained oil & fuel spill absorbent kit. The fuel service truck, mechanics vehicle and several supervisors' utilities also carry spill kits to insure there is a rapid response capability.

- In the event of a large spill the area can be bunded off with low permeability clay to contain the flow. After collection of the spill with absorb bant granules, any remaining contaminated clays and bunding materials are scooped up and delivered to Midland Bricks clay shed for disposal.

Employees are trained to respond to such an event in accordance with the companies Safety Health and Environmental management System, specifically SHE-MP -003 "Dangerous Goods Management Plan" and SWP No: 042-01 "Using (Oil & Fuel) Spill Kit" which is attached in appendix 4 and 5 respectively.

- All significant spills of over 5 litres are recorded to Midland Brick environmental department the incident is investigated, before it is remediated. Midland Bricks environmental officers report the incident to Boral corporate office and to the revellent authorities within the appropriate regulated time frame.

Summary:

The protection of surface and ground water from contamination by hydrocarbons is viewed as a critically important issue in managing its environmental responsibilities at Muchea. The company has examined this risk and adopted a range policies and procedures to mitigate the impact of hydrocarbon spills on the environment. There is an internal and external audit system in place to ensure employees and contractors comply with SHE Management Plans and policies.

Refuelling will continue to be conducted on a defined part of the active pit area with low permeability clay base which has the ability to contain and manage any spill if it did occur. This procedure complies with DEC, DOIR Water Quality Protection Guidelines for Mining and Mineral Processing.

Midland Brick commit that it will ensure its personnel and any contractors employed on site adopt management practices and procedures to minimise any adverse environmental impacts at its Muchea clay operations which have been active since 1970.

DUST MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

May 2012

BORAL BRICKS

DUST MANAGEMENT PLAN

LOT 6, WANDENA ROAD, MUCHEA

May 2012

BORAL BRICKS

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Over 90% of the hydrocarbons consumed on site are within earthmoving machinery and there are minor quantities used in small stationary engines which generate power or drive water pumps. The balance of approximately 10% is consumed by road transport vehicles which remove clay from the site.

- To minimise the risk of contamination, Midland Brick does not store any bulk fuel of lubricants on any clay extraction sites within the Shire.
- All fuels and lubricants are delivered to site on a purpose built service truck which dispenses fuel and oils to the earthmoving equipment on a demand. Diesel is dispensed to the machines via a "Wiggins" filling system which is designed to automatically shut off fuel delivery once the machine storage tanks are full. This prevents wastage of a valuable resource and ensure over filling does not occur during this procedure.

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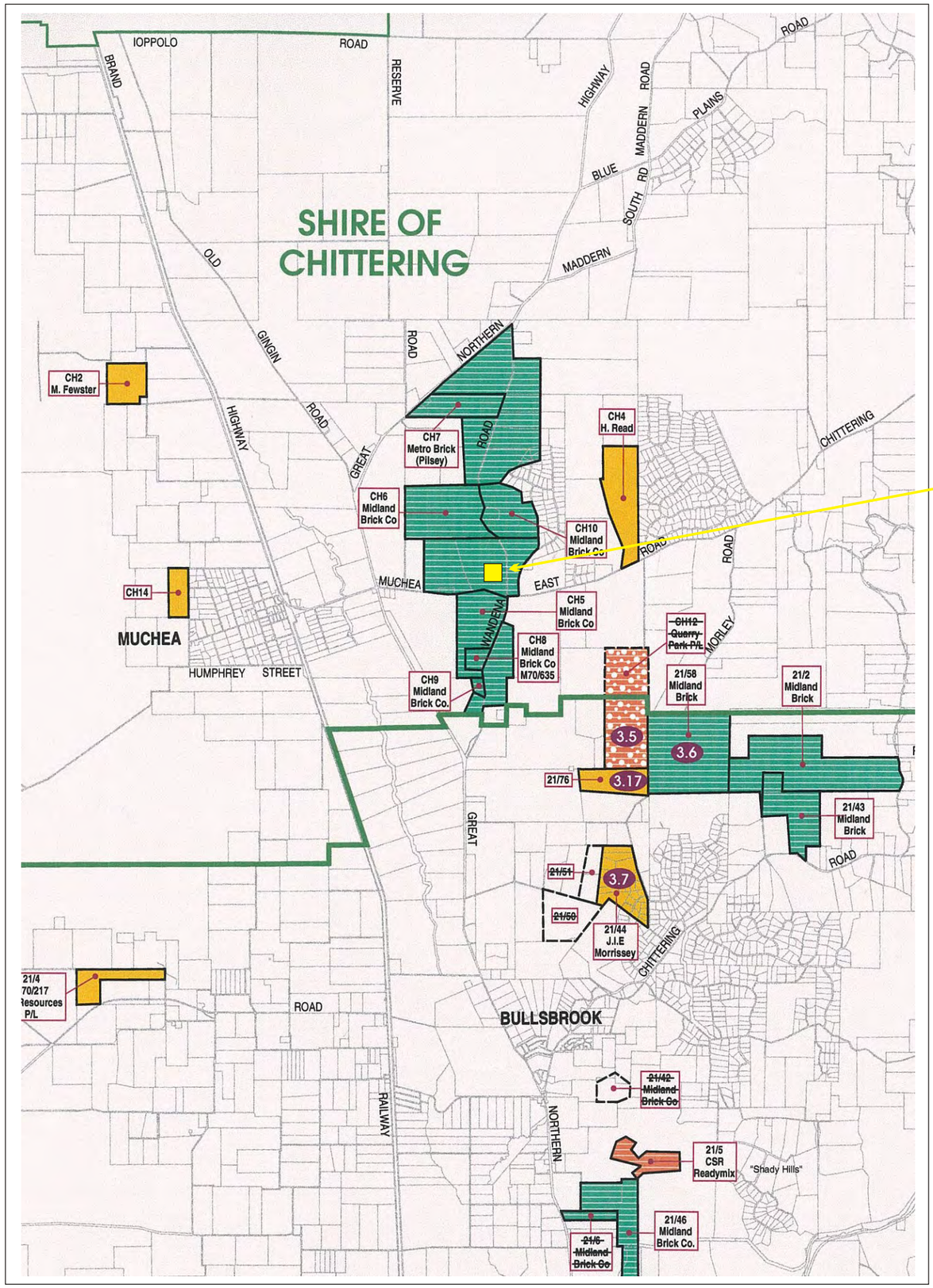


LOCATION OF THE RESOURCE ON MUCHEA LOT 6

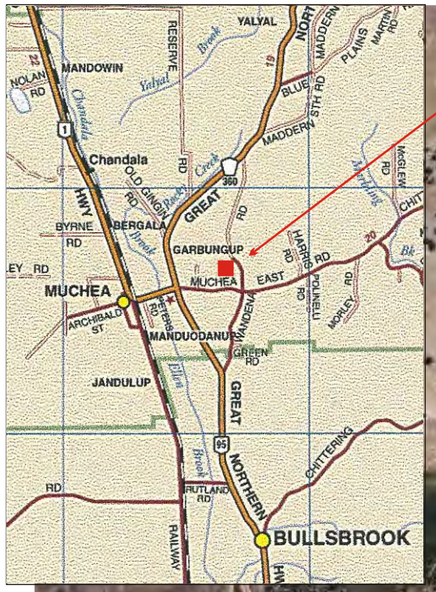
LEGEND

- Limestone / Limesand Resource
- Sand Resource
- Clay Resource
- Rock Resource
- Gravel Resource
- Key Extraction Area
  Extraction sites of regional significance.
  Key extraction areas are considered to be:
  - essential to the needs of the region.
  - of a long term nature.
  - strategically located in relation to transport links and manufacturing plant.
- Priority Resource Location
  Known areas of high resource potential which should be held available for current and future extraction
- Extraction Area
  Areas of existing extractive industry operation
- 27/5 — WAPC Reference No.
- ~~27/5~~ — Tenement expired
- M70/69 P70/81 — DMPR Reference No.
- (P) — Pending
- Work Processing Plant
- Local Government Boundary
- Metropolitan Region Boundary
- Policy Area Boundary

STATE PLANNING POLICY 2.4
BASIC RAW MATERIALS

BORAL

Figure 1



LOCATION

LOCATION 1327

Rehabilitated clay pits

Screening trees

Shire of Chittering Landfill

Screening trees

LANDCARE PLANTING

LANDCARE PLANTING

Rural living subdivision (not all dwellings shown)

Midland Brick claypit

CURRENT EXCAVATION

Lot 12

Intensive livestock

WAMIA livestock holding facility

Clay resource

LOT 6

600 m

250 m

Screening trees

Closest dwelling

POWDERBARK ROAD

MUCHEA EAST ROAD

LANDCARE PLANTING

LANDCARE PLANTING

MUCHEA EAST ROAD

Shire of Chittering gravel pit

1.4 km

GREAT NORTHERN HWY

Sheds at 800 m

Midland Brick Clay Pits

Figure 2

BORAL BRICKS	
LOT 6, WANDENA ROAD, MUCHEA	
LOCATION SURROUNDING LAND USE	
Landform Research	May 20012
Basemap NEARMAP	Scale 1 : 10 000

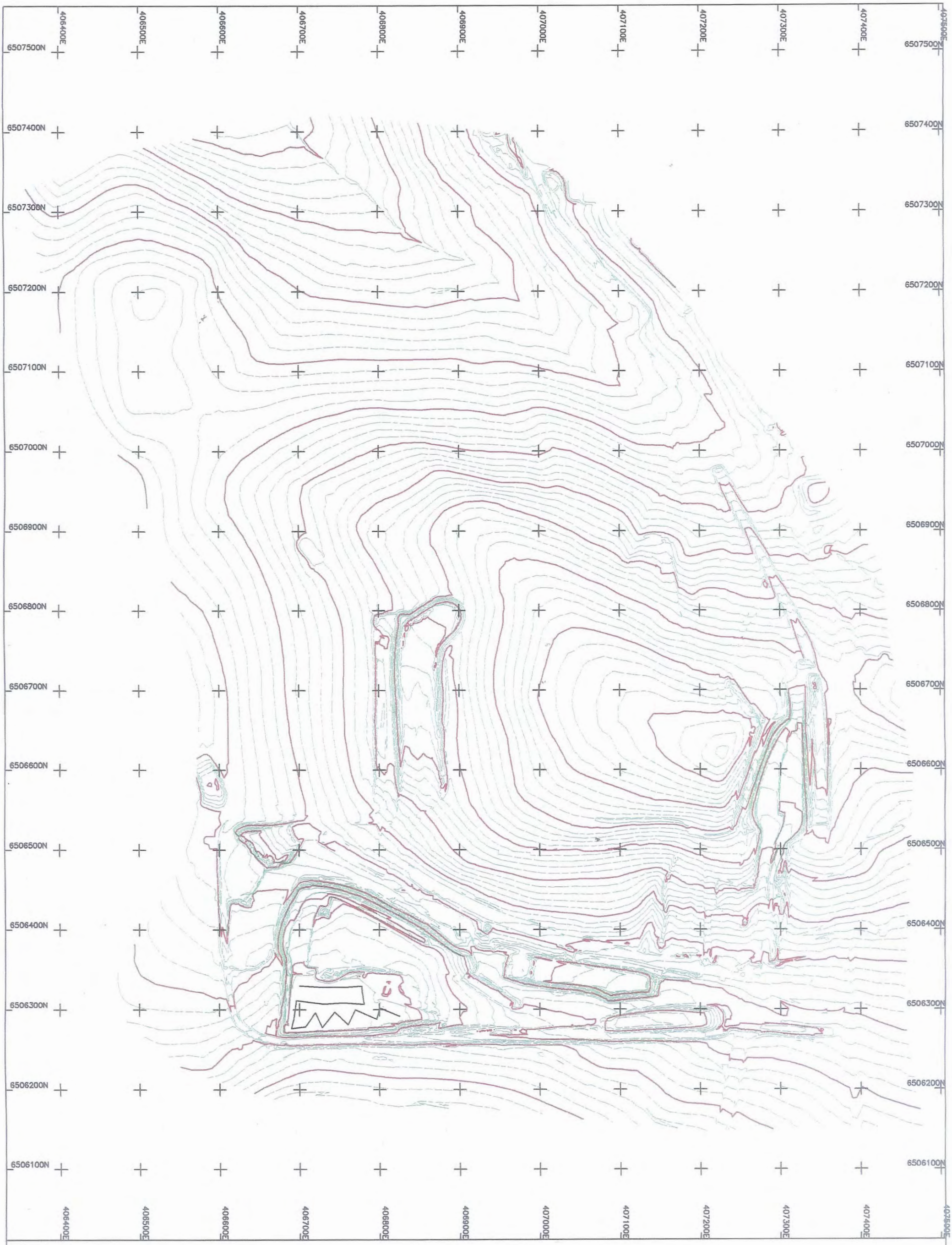
Dwelling
(note closest dwellings only are shown)

0 200 400 600 800 METRES

BORAL

BORAL BRICKS	
LOT 6, WANDENA ROAD, MUCHEA	
SITE LAYOUT	
Landform Research	May 20012
Basemap NEARMAP	Scale See Plan

Figure 3



Author wd

Scale 1:4242.2

Date 22 06 2012

Notes : 1m Contours

Boral Bricks Western Australia

Muchea 6 May 2011

Author	wd
Scale	1:3000.0
Date	21 06 2012

Boral Bricks Western Australia

Muchea 6 Conceptual Final Floor Levels

Sealed entrance, fences and gate, with signage.

Sire office - cribroom and serviced portable toilet

Road truck and trailer, being covered prior to leaving site

Excavators in the pit, view south. Note the eastern screening face.

Excavator digging clay in the pit

Recovering clay from stockpile

Dedicated water truck wetting down the onsite active areas.

Dedicated service and waste recovery vehicle.

Loading a road truck.

Figure 6

Clay resource ahead of excavation.

Sediment settlement dam and water source.

Clay resource with the eastern screening face.

Clay resource with western active face showing bedding.

View from south to north through the eastern pit.

View south across Muchea East Road showing Landcare planting - rehabilitation

View of the rehabilitation in the southern Boral Bricks Pit.s

View of the rehabilitation in the southern Boral Bricks Pits.

Figure 7

CLAY EXCAVATION (ONE BENCH)

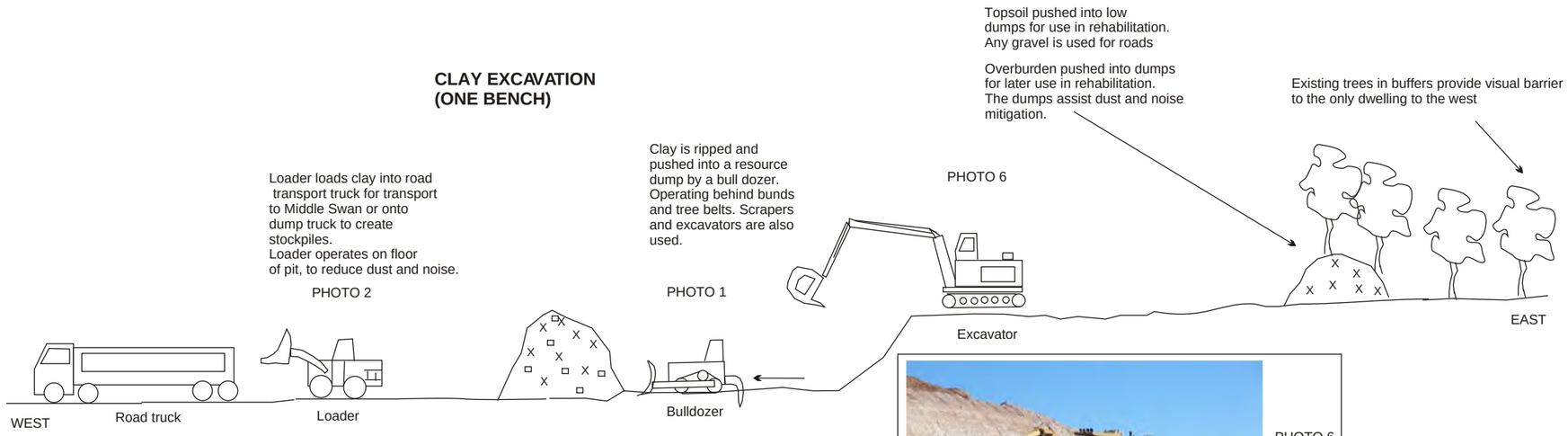


PHOTO 6
Excavator

PHOTO 5 Accessing water from the base of the pit as is normal practise in Boral Bricks pits. The water is being used for dust suppression.

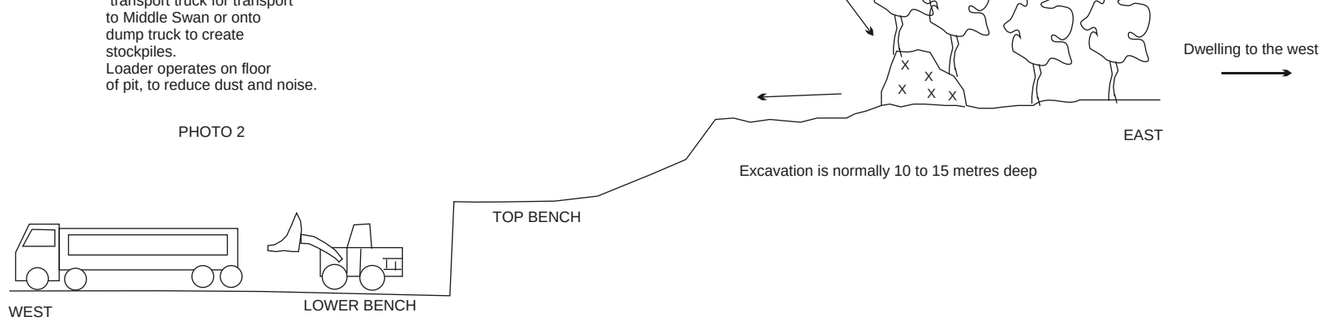
PHOTO 1 Removing overburden. Muchea

PHOTO 2 Loading road trucks, Muchea

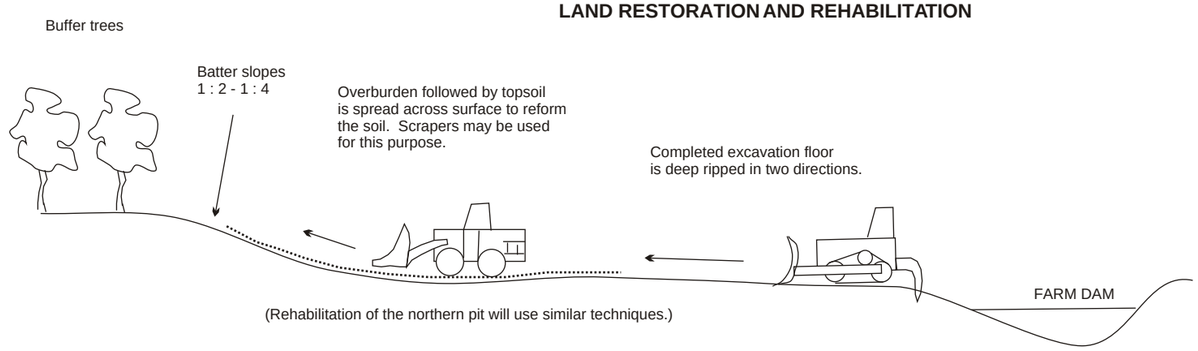
PHOTO 3 Typical clay resource of similar weathered schists at Morangup Road Toodyay.

PHOTO 4 Rehabilitation of clay pit to local native vegetation. Muchea

CLAY EXCAVATION (TWO BENCHES)



LAND RESTORATION AND REHABILITATION



Landform Research

TYPICAL CLAY EXCAVATION
BORAL BRICKS WESTERN AUSTRALIA PTY LTD

Figure 8

Figure 9

BORAL BRICKS	
LOT 6, WANDENA ROAD, MUCHEA	
OBLIQUE VIEW FROM THE WEST	
Landform Research	May 20012
Basemap NEARMAP	Scale See map

Name	Submission Comments	Applicant Response Comments	Officer Response Comments
Ellen Brockman Integrated Catchment Group (Chittering Landcare)	· Statements within the report indicate the Boral company is currently working with the Chittering Landcare Group which is not correct. No contact with Boral has been forthcoming for over six years.	We has met with CLG and have discussed at least one project on Boral Land to the south of Lot 6.	· Noted.
	· Rehabilitation undertaken on what is now WAMIA land occurred in 1999/2000 and on the Boral land in 1996/97 and was associated with a previous pit. No further revegetation has occurred on or adjacent to the site since that time.	Not sure what CLG means with this statement. The mine on Lot 6 only commenced operations in late 2008. There was no 'previous pi' on Lot 6 post the re-alignment of boundaries and the sale of land to WAMIA.	· Noted.
	· There has been no maintenance by Boral of this revegetation in the last twelve years.	As above – we are prepared to rehabilitate once an area is free of mining.	· Noted.
	· It is recommended in granting the extractive industry license Council need to be aware that no rehabilitation has taken place specific to this site and no association currently occurs between Boral Brick and the Chittering Landcare Centre.		· This is noted.
	· "There has been an increased interest in acid sulphate soils since the release of WAPC Planning Bulletin 64. However the interest has been over reactive and conditions and risk applied in many areas where there is no geological risk or evidence of acid sulphate". This statement is the author's opinion. Contamination by acidic water has occurred as the Ellen Brockman Water Quality Monitoring indicates.	Boral is prepared to be proactive with Acid Sulphate soil management is employing an Environmental Scientist to work with all stakeholders going forward.	· Noted.
	· Results from the Ellen Brook Water Quality Snapshot indicates that something has occurred between 2005 and 2006 in the catchment to precipitate a dramatic drop in pH (acidity). This site is EBN 10 (identifier) a small creekline that arises just east of the site. It runs alongside the pit and is the waterway into which excess water from the dam is released. It crosses Great Northern Highway approximately 250 metres south of the Brand Highway intersection.	Stripping of Lot 6 commenced in 2008	· Noted.
	· Earthworks were commenced on this site in 2006. Since this time this waterway has been consistently acidic. Neutral (normally pure water) is 7.0. Lemon juice has a pH of 2. The 5.19 pH level on 30/07/07 followed a significant rainfall event which would have diluted the sample. Boral have indicated that the overflow dam is lined with limestone. This will need maintaining to ensure that the surface does not become blocked with clay particles.	Stripping of Lot 6 commenced in 2008	· Noted.
	· It is recommended an assessment of the effectiveness of the limestone based overflow dam be conducted. Any release of storm water into the creekline should be monitored and a sample taken prior to release (as indicated in report), which should be used to inform the Council.	This is monitored and the Shire of Chittering are informed of the results prior to release of any buffered water.	· Noted.
	· The dam wall in the south west of the site was breached in		· Noted. The Excavation and Rehabilitation

	2009. This allowed significant flow of water into the creekline. This was bought to the attention of WAMIA during a site visit by Rosanna Hindmarsh when she identified the erosion and flow across the Boral and the WAMIA land. Rosanna also bought to the attention of Dave Saunders from WAMIA that a breach of the pit wall in the north west caused extensive erosion across the WAMIA site. It is recommended that any further "unplanned" escape of water from the dam be prevented. · Clay mining has been an industry in the Chittering Shire for many years. This will continue and it is very important that companies do consider the impact they have on the waterways of the area. The Chittering Landcare Centre would be willing to work with Boral Brick to resolve rehabilitation issues and to ensure that acidic water does not escape from site.	Boral is not aware of any breach of the dam wall. Boral look forward to working with the CLG on rehab matters.	Management Plan makes note that there is no uncontrolled release or escape of surface water. · Noted. It is advised that applicant's liaise with the Chittering Landcare Group for environmental advice.
Department of Planning	· Site is zoned 'Agricultural Resource'. Council should be satisfied the proposal is consistent with the zone objectives as well as the development requirements for Basic Raw Materials under Part 5 of the Scheme. · Proposal should be assessed against clauses 4.2.3, 5.16 and any potential impact on nearby Rural Residential land uses. · It is recommended that if approved all elements associated with this proposal that can be measured and quantified be specifically outlined as planning conditions such as hours of operation, site areas, staging, stockpiling etc. · Management Plan should be used to guide matters that cannot be reasonably determined at the time of the application. · If supported, the approval should be subject to a condition that development occurs with an approved plan, rather than a range of plans/diagrams. Approved plan should show (but not limited to): - Location, number and size of each pit within excavation areas; - Location of buildings, equipment and other incidental site works; - Staging or works; - Size and location of stockpiles within excavation areas; - Indication of nominal buffer distances from each pit, guided by EPA Guidance Statement 3; - Location of dwellings and other sensitive land uses adjacent to or on the site; - Proposed access to, from and within site, including indication of road standard; - Major site conditions including environmental	No comment from DoP about Lot 6 being within the boundary of Basic Raw Materials Planning 2.14. Boral believes these elements are covered in the EMP submission	· Noted. Assessment of the proposal against the zone objectives has been undertaken and conveyed in the Agenda Report. · This is noted and is conveyed in the Agenda Report. Impact on nearby Rural Residential land uses is considered based on submissions received and assessment of the Scheme and Strategy. · Noted. · Noted. The Officer's Recommendation acknowledges this point by imposing condition that development be in accordance with the Management Plan unless otherwise specified in a condition of approval. · This is noted. It is considered Figure 2 details this.

	attributes. · It is recommended that the site be surveyed to assist Council with monitoring and compliance if required. · It is recommended that Council be guided by EPA Guidance Statement 3 however be first satisfied the proposal could achieve appropriate separation distances so as to meet the zone and Special Control Area requirements of TPS 6. · Dust and noise suppression be dealt with via a management plan, however Council be first satisfied the proposal could achieve appropriate dust and noise suppression so as to meet the zone and Special Control Area requirements of TPS 6. · If Council determines road upgrading is necessary, it is recommended the requirement is imposed as a condition of planning approval, prior to commencement of site works to avoid potential dust impacts. Internal site roads should also be considered. · Consideration should be given to traffic that may be generated by proposal and whether existing access to Great Northern Highway is adequate. · Council could consider imposing conditions on type of plant and equipment that is to be used on site in order to address social and environmental requirements outlined in Scheme. This could reduce a potential future risk if needing to manage community expectations of how site will operate. · Council could consider issuing an advice note with any approval that outlines additional approvals that may be required i.e. Extractive Industry Licence, Works Approval etc.	What type of survey? Who by? This mine site has been operating since late 2008 and has had very few complaints from the public with regards to noise, dust etc. This should not be necessary as a major upgrade to Wandena Rd has occurred in the last 3 years. Traffic movements will not exceed the current levels as indicate in the EMP This should not be considered and would be out of the expertise of the council officers.	· Noted. A site survey of the excavation areas is required by the proponent prior to excavation. This ensures area and depths of excavation are consistent to what has been provided. · Noted. This has been conveyed in the Agenda Report. · Noted. It is considered the dust management plan provided and noise measures to reduce noise pollution have been addressed in the application and can be monitored by Council. · Noted. Advice from the Shire's Technical Services has been incorporated into the Officer's Recommendation. · Noted. Advice from the Shire's Technical Services has been incorporated into the Officer's Recommendation. · Noted. It is not considered to be out of the expertise of Council or Council Officers to impose restrictions on types of equipment used for the operations. · Noted. Advice Notes outlining additional approvals have been incorporated in the Recommendation to Council.
Department of Water	· Proposal is located within a Proclaimed Groundwater Area – Gingin. In accordance with the *Rights in Water and Irrigation Act 1914*, the extraction of groundwater requires a Ground Water Licence. · From the information provided it appears there is a dewatering requirement and a water resource is needed for dust suppression. It is recommended that the proponent contact the Department of Water to discuss their licencing requirements.		· Noted. This has been included as an Advice Note. · Noted, as per comment above.
Department of Mines and Petroleum	· Geological Survey of WA supports this application for extractive industry renewal for this important clay resource. · DMP has a Memorandum of Understanding with WAPC		· Noted. · Noted.

	and DoP and provides advice and recommendations under the MOU. · Further we draw the Shire's attention to the fact that this is a Priority Clay Resource in the State Planning Policy No 2.4 Basic Raw Materials. GSWA has also identified the area as regionally significant for clay.		· Noted. This has been outlined in the Agenda Report.
Main Roads WA	· No objection provided no change to current vehicle movements.		· Noted
Public 1	· No problems with this sort of mining. Hardly hear it from our place.		· Noted
Public 2	Council to consider the following points: · A screening and noise bund to be constructed on the north end to prevent sound travel to some degree across the hill toward my property. · I currently hear truck beepers constantly going at various times, usually early in the morning. · We hate to see the landscape of the hill destroyed/changed as it constitutes a big proportion of our view, so we would like to see nice appropriately high revegetation of the area to the north/north west end of the area mined. · Ideally do not want it mined but feel we have no choice in the matter.	Reversing beeper and horns to be modified to reduce potential impact on neighbours. This area has been zoned for Clay Extraction for many years and new residents to the area knew that eventually this land would be mined for clay. Boral will abide by the EMP plans that have submitted to protect our impact on neighbours regardless of when they purchased their land.	· Noted. · Noted. The Officer's Recommendation imposes a condition limiting operations hours from 7am weekdays and 7:30am on Saturdays. · Noted. The Rehabilitation Plan notes that once an area is exhausted, rehabilitation will commence. · Noted.

WAMIA
LIVESTOCK
FACILITY

Screening and noise bund formed from overburden

Tree belt along Wandena Road

Overburden Storage

Site office and serviced toilet

Screening and noise bund formed from overburden

Active pit

Wandena Road

Stockpile

Sediment settlement dam and water storage

Screening and noise bund formed from overburden

Water treatment dam

Sealed entrance road

LANDCARE PLANTING

LANDCARE PLANTING

Muchea East Road

LANDCARE PLANTING

LANDCARE PLANTING

LANDCARE PLANTING

Showing 17 Jan 2012
100 m
300 ft
Legal

BORAL

BORAL BRICKS
LOT 6, WANDENA ROAD, MUCHEA

SITE LAYOUT

Landform Research	May 20012
Basemap NEARMAP	Scale See Plan

Figure 3